ZOE
ENERGY STORAGE

User Manual

P5015L2H – A - EU Liquid Cooling Containerized ESS

P 5000

104 PACK

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About This Manual

Applicable Product

This user manual primarily covers the methods for the transportation and storage, mechanical installation, electrical connections, power-up and shutdown procedures, fault handling, and maintenance of the battery energy storage system. This manual is specifically applicable to the container-type liquid-cooling energy storage products developed by ZOE Energy Storage Technology Co., Ltd., with the product model: P 5000-2H.

NOTE：

For any matters not covered in this user manual, please contact our after-sales support team.

For detailed operations related to systems such as air conditioning, fire protection, UPS, BMS, liquid cooling units, etc., please refer to the respective product user manuals or contact the after-sales support team of the equipment manufacturer.

Target Audience

This manual is intended for personnel involved in the installation, operation, maintenance, and other related tasks of this product. Readers should possess certain electrical and related professional knowledge and qualifications.

All installation and operational tasks must only be performed by qualified technical personnel. Qualified personnel must meet the following requirements:

- Have undergone specialized training and received certification
- Have thoroughly read this manual and understood the related safety precautions
- Be familiar with local standards and safety regulations for electrical systems

Symbol Usage

To ensure the safety of users and property, and to enable more efficient and accurate use of this product, the manual provides relevant information, with key points highlighted using the following symbols.

The symbols used in this manual are listed below. Please read them carefully to enhance your understanding and proper usage of the manual.

The following symbols may appear throughout this document, and their meanings are as follows:

Symbol	Symbol Meaning
DANGER	Warning Symbol Used to alert to emergency hazardous situations. Failure to avoid these situations may result in death or serious personal injury
WARNING	Caution Symbol Used to alert to potential hazardous situations. Failure to avoid these situations could result in death or serious personal injury
CAUTION	Attention Symbol Used to alert to potential hazardous situations. Failure to avoid these situations could result in moderate or minor personal injury
NOTICE	Safety Information Symbol Used to convey safety warnings regarding equipment or the environment. Failure to observe these warnings may result in equipment damage, data loss, reduced equipment performance, or other unforeseen consequences
NOTE	Note Symbol Used to highlight important or key information, best practices, and tips. "Note" is not a safety warning and does not pertain to personal, equipment, or environmental hazards

Symbol Usage on the Product

When performing installation, operation, maintenance, or other tasks, please pay attention to the warning symbols on the product, including but not limited to the following:

Symbol	Symbol Meaning
	This symbol indicates the presence of high voltage or live electrical parts. Touching it may result in the risk of electric shock
	Used to warn of potential hazardous situations Failure to avoid them may result in moderate or minor personal injury
	This symbol indicates the protective earth (PE) terminal. It must be securely grounded to ensure the safety of operators.
	Functional Grounding
	Risk of Tripping
	No Entry for People with Pacemakers
	No Smoking
	No Open Flames
	No Climbing
	Do Not Touch
	Do Not Step On
	No Entry
	Do Not Lean
	Read the User Manual Before Use Failure to comply may result in danger
E-Stop	Emergency Stop

Acronyms

The following acronyms may appear in this document. Unless otherwise specified, their meanings are as follows:

NO.	Acronyms	Full Form
1	BMS	Battery Management System
2	BAMU	Battery Array Management Unit
3	BCMU	Battery Cluster Management Unit
4	BMU	Battery Management Unit
5	PCS	Power Conversion System
6	EMS	Energy Manage System
7	ESS	Energy Storage System
8	EMU	Energy Management Unit
9	BESS	Battery Energy Storage System
10	PE	Protective Conductor
11	SOC	State of Charge
12	SOH	State of Health

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1. Safety Information

1.1 General Safety Precautions

Before transporting, storing, installing, operating, using, and maintaining the equipment, please carefully read this manual and strictly follow the instructions. Always comply with the safety precautions indicated on the equipment and in the manual.

The "Notes," "Cautions," "Warnings," and "Danger" sections in the manual do not represent all the safety measures that should be followed but serve as supplements to the overall safety guidelines. You must also adhere to relevant international, national, or regional standards, as well as industry best practices. The company assumes no responsibility for any issues arising from violations of general safety operating procedures or failure to meet design, manufacturing, and usage safety standards.

The equipment should be used in environments that meet the design specifications. Failure to do so may result in equipment malfunction or damage to components, which will not be covered under the warranty. Additionally, the company is not liable for any personal injury, property damage, or other losses resulting from non-compliance with design specifications.

When transporting, storing, installing, operating, using, or maintaining the equipment, local laws, regulations, and standards must be followed. The safety precautions in the manual are intended to complement, not replace, local laws and regulations.

The company shall not be held responsible in the following situations:

1) Damage caused by installation and usage environments that do not comply with the relevant international, national, or regional standards.

2) Operating the equipment under conditions not specified in this manual.

3) Unauthorized disassembly, modification of the product, or alteration of software code.

4) Operating the equipment in ways that do not follow the operational instructions and safety warnings provided in this manual.

5) Damage to the equipment caused by abnormal natural environments (earthquakes, floods, volcanic eruptions, landslides, lightning strikes, fires, wars, armed conflicts, typhoons,

hurricanes, tornadoes, extreme weather, or force majeure events).

6) Damage caused during transportation due to your actions or those of a third party you have entrusted with the transportation.

7) Damage caused by failure to meet the product storage conditions outlined in the documentation.

8) Damage to the equipment's hardware or data caused by your or a third party's negligence, improper operation, or intentional damage.

9) System damage caused by you or a third party, including damage resulting from system relocation or installation that does not meet the requirements of this manual, as well as adjustments, modifications, or removal of identification labels that do not comply with the manual's guidelines.

10) Defects, malfunctions, or damages caused by events beyond the seller’s reasonable control, including power outages, electrical failures, theft, war, riots, civil disturbances, terrorism, or willful malicious damage.

NOTE:

Reverse engineering, decompiling, disassembling, dissection, adaptation, implantation, or any other derivative operations on the equipment software are prohibited. It is not allowed to study the internal implementation of the equipment in any way, to obtain the source code of the equipment software, to steal intellectual property, or to disclose any results of performance testing of the equipment software.

1.2 Personal Safety

⚠ DANGER	1) During installation, electrical operations are strictly prohibited. Do not install or remove cables while the system is live, as the moment the cable core comes into contact with conductors, it may cause electric arcs, sparks, or even fire or explosion, leading to potential fires or personal injury. 2) Improper or incorrect operation while the equipment is energized can result in fire, electric shock, or explosion, causing injury or property damage. 3) Do not wear watches, bracelets, bangles, rings, necklaces, or any other conductive items during operations to prevent the risk of electric shock or burns. 4) Specialized insulated tools must be used during operations to avoid electric shock or short-circuit hazards. The insulation and voltage rating of the tools must meet local laws, regulations, standards, and specifications.
⚠ WARNING	Special protective equipment must be used during operations, such as wearing protective clothing, insulated shoes, safety goggles, safety helmets, insulated gloves, etc.

1.2.1 General Requirements

1) Do not disable the equipment's protective devices or ignore the warnings, cautions, and preventive measures in the manual and on the equipment.

2) If a malfunction occurs during operation that may cause personal injury or equipment damage, immediately stop the operation, report it to the responsible person, and take effective protective measures.

3) Do not power on the equipment if installation is not complete or if it has not been verified by a qualified professional.

4) Do not directly contact or use other conductors to touch the power supply equipment, and avoid indirect contact through wet objects. Before touching any conductor surface or terminal, measure the contact point voltage to ensure there is no electric shock hazard.

5) The external casing may be hot during operation, posing a burn hazard. Do not touch the casing.

6) Do not touch running fans with fingers, parts, screws, tools, or circuit boards to avoid injury or equipment damage.

7) In case of fire, evacuate the building or equipment area and activate the fire alarm, or call the fire department. Under no circumstances should you re-enter a burning building or equipment area.

1.2.2 Personnel Requirements

The lifting, transportation, installation, wiring, operation, and maintenance of the equipment must be carried out by qualified electrical technicians who comply with local standards and regulations. When operating the equipment, personnel are required to wear personal protective equipment (PPE) that meets local safety requirements.

Figure 1-1 Personnel Protective Equipment Requirements

Operators must meet the following requirements:

1) When installing, operating, and maintaining the equipment, it is strictly prohibited to wear conductive items such as watches, bracelets, rings, necklaces, or other jewelry, to prevent electric shock and burns.

2) During transportation, transfer, installation, wiring, and maintenance operations, operators must comply with the laws, regulations, and relevant standards of the respective country or region.

3) Operators must be familiar with the entire energy storage system's structure and working principles and follow the operating procedures described in the manual.

4) Operators should have received professional training related to the installation and commissioning of electrical equipment, possess knowledge of electronics, electrical wiring, and mechanical principles, and be familiar with electrical and mechanical schematics.

5) Operators should be capable of responding to emergencies or unforeseen situations that may arise during installation or commissioning.

1.3 Electrical Safety

⚠ DANGER	1) Before making electrical connections, ensure that the equipment is undamaged; otherwise, it may result in electric shock or fire hazards. 2) Improper or incorrect operation could lead to accidents such as fires or electric shocks. 3) During operation, prevent foreign objects from entering the equipment, as this could cause short circuits, equipment failure, reduced load power supply, power loss, or personal injury.
⚠ WARNING	For equipment that requires grounding, the protective grounding wire must be installed first during installation. When dismantling the equipment, the protective grounding wire must be removed last.
NOTICE	Cables are not allowed to pass through the equipment's air inlet or outlet.

1.3.1 General Requirements

1) Installation, operation, and maintenance must follow the steps outlined in the manual. Unauthorized modifications, additions, or changes are prohibited.

2) Do not change the installation sequence or other settings of the equipment without proper authorization.

3) Permission from the local power authority is required before connecting to the grid.

4) Comply with power station safety regulations, including the implementation of operation permits and work permits.

5) Set up temporary barriers or warning ropes in the work area and post "No Entry" signs. Unauthorized personnel are prohibited from entering.

6) Before installing or removing power cables, disconnect the equipment and its upstream and downstream switches.

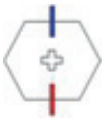
7) If liquid is found inside the equipment, immediately disconnect the power supply and prohibit further use.

8) Before operating the equipment, carefully check that the tools used are in compliance with requirements and are registered. After use, return them as per the inventory to prevent leaving tools inside the equipment.

9) Before installing power cables, confirm that the cable labels are correct, and the cable terminals are properly insulated.

10) Use a torque tool with the appropriate range to tighten screws during installation. When using a wrench, ensure it is properly aligned, and the torque deviation does not exceed the specified 10%.

11) Torque tools should be used to secure screws, and red and blue markings should be used for double-checking. The installer confirms the screw is tightened and marks it with a blue mark; the inspector verifies the tightening and applies a red mark (the marking should extend over the edge of the screw).



12) After installation, ensure that all electrical component protective covers, insulating sleeves, and other devices are in place to prevent electric shock hazards.

13) If the equipment has multiple inputs, disconnect all inputs before operating the equipment, ensuring that the device is completely powered off.

14) When maintaining downstream electrical or distribution equipment, disconnect the corresponding output switch of the power supply device.

15) During equipment maintenance, hang "Do Not Close" signs on the upstream and downstream switches or circuit breakers, and post warning signs to prevent accidental reconnection. Only re-energize the system after addressing the fault.

16) When diagnosing and troubleshooting faults that require power shutdown, the following safety measures must be implemented: power off > verify absence of voltage > install

grounding wire > hang warning signs and set up barriers.

17) Regularly check the terminal screws of the equipment connections to ensure they are tight and not loose.

18) If cables are damaged, they must be replaced by qualified personnel to prevent risks.

19) It is strictly prohibited to alter, damage, or obscure labels and nameplates on the equipment. Promptly replace labels that have become unclear due to long-term use.

20) Do not use water, alcohol, oil, or other solvents to clean the internal or external electrical components of the equipment.

1.3.2 Grounding Requirements

1) The equipment's grounding impedance must meet local electrical standards.

2) The equipment should be permanently grounded to a protective earth. Before operating the equipment, check the electrical connections to ensure the equipment is reliably grounded.

3) Operating the equipment without installing a grounding conductor is prohibited.

4) It is prohibited to damage the grounding conductor.

5) For equipment using a three-prong outlet, ensure that the grounding terminal of the outlet is properly connected to the protective earth.

6) For equipment with high contact current, the protective grounding terminal of the equipment's casing must be grounded before connecting the input power supply to prevent electric shock hazards from the equipment's contact current.

1.3.3 Wiring Requirements

1) The selection, installation, and routing of cables must comply with local laws, regulations, and standards.

2) During the installation of power cables, it is strictly prohibited to form loops or twists. If the cable length is insufficient, the cable must be replaced; it is forbidden to create joints or solder points in the power cable.

3) All cables must be securely connected, well-insulated, and of the correct specification.

4) Cable trays and cable entry holes must have no sharp edges, and cables passing through conduits or entry holes must be protected to prevent damage from sharp edges, burrs, etc.

5) If the cables enter the container from the top, they should bend in a U-shape outside the

container before entering.

6) Cables of the same type should be bundled together, with a neat and straight appearance, and free from damage to the outer insulation. Cables of different types should be routed at least 30mm apart, and must not be twisted or crossed.

7) After completing the wiring or leaving during wiring work, the cable openings must be immediately sealed with sealing compound to prevent water, moisture, or small animals from entering.

8) Cables buried underground must be securely fixed using cable supports and clamps. Ensure that cables are in close contact with the ground in areas filled with soil to prevent deformation or damage during backfilling.

9) When external conditions (such as laying methods or ambient temperature) change, cable selection must be verified according to IEC-60364-5-52 or local regulations and standards to ensure that the current carrying capacity meets the requirements.

10) Cables used in high-temperature environments may suffer from insulation aging and damage. The distance between the cable and heating devices or hot zones should be at least 30mm.

11) In extremely low temperatures, severe impacts or vibrations may cause the plastic outer casing of cables to become brittle and crack. To ensure construction safety, the following requirements should be followed:

– All cables should be installed at temperatures above 0°C. When handling cables, especially in low-temperature environments, they should be handled with care.

– If cables are stored at temperatures below 0°C, they must be placed in a room-temperature environment for at least 24 hours before installation.

12) It is prohibited to improperly drop cables from vehicles or engage in other non-standard practices that could damage the cables and affect their performance, including current-carrying capacity and temperature rise.

1.3.4 Anti-static Requirements

⚠ CAUTION	Static electricity generated by the human body can damage electrostatic-sensitive components on the circuit boards, such as the BMU board. 1) Before touching the equipment or handling circuit boards, anti-static gloves must be worn. 2) When holding a circuit board, it must be held by the edges where there are no components, and it is forbidden to touch the components with hands. 3) Disassembled circuit boards must be packaged using anti-static materials for storage or transportation.

1.4 Environmental Requirements

Symbol	Symbol Meaning
DANGER	1) It is strictly prohibited to place the equipment in environments with flammable, explosive gases, or smoke. No operations should be performed in such environments. 2) Flammable or explosive materials must not be stored in the equipment area. 3) The equipment must not be placed near heat sources or fire sources, such as fireworks, candles, heaters, or other heating devices. Exposure to heat may cause equipment damage or trigger a fire.
WARNING	1) The equipment should be installed in an area away from liquids and must not be installed below water pipes, air outlets, or other areas prone to condensation. It is strictly prohibited to install the equipment below air conditioning vents, ventilation openings, or windows in the equipment room that are susceptible to leaks, to prevent liquids from entering the equipment and causing malfunctions or short circuits. 2) While the equipment is operating, do not block air vents, cooling systems, or cover the equipment with any other objects to prevent overheating, equipment damage, or fire hazards.

1) The storage environment for the equipment should be suitable, kept in a clean, dry, and well-ventilated area, and protected from dust and condensation.

2) It is strictly prohibited to install or operate the equipment beyond the specified technical limits, as this may affect its performance and safety.

3) It is strictly prohibited to install, use, or operate outdoor equipment or cables during adverse weather conditions such as thunderstorms, rain, snow, or winds above level six (including but not limited to moving equipment, operating cables, connecting/disconnecting outdoor signal interfaces, working at heights, outdoor installations, or opening doors).

4) The equipment must not be installed in environments with dust, smoke, volatile gases, corrosive gases, infrared radiation, or excessive organic solvents or salts.

5) The equipment must not be installed in areas with conductive metal dust or ferromagnetic dust.

6) The equipment must not be installed in areas prone to fungal, mold, or other microbial growth.

7) The equipment must not be installed in areas with strong vibrations, loud noise, or high electromagnetic interference.

8) The site selection must comply with local laws, regulations, and relevant standards.

9) The installation site should have a solid floor, free from rubber soils, soft soils, or sinking ground. Low-lying areas or areas prone to water accumulation are strictly prohibited. The site should be above the historical highest water level in the region.

10) It is strictly prohibited to install the equipment in areas prone to flooding.

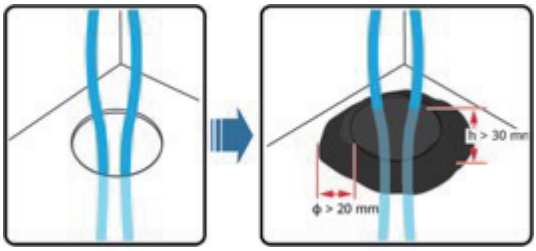
11) If the equipment is installed in areas with dense vegetation, in addition to regular weeding, the ground under the equipment should be hardened, such as with cement or

gravel.

12) Before opening doors during installation, operation, or maintenance, ensure that any accumulated water, snow, or debris on the top is cleaned off to prevent debris from falling into the equipment.

13) When installing the equipment, ensure the installation surface is sturdy and meets the weight-bearing requirements of the equipment.

14) All cable entry holes must be sealed. Seal the cable entry holes that have cables passing through with sealing compound, and use the equipment's own covers to seal the unoccupied cable entry holes. The proper sealing standard is shown in the following Figure.



1.5 Mechanical Safety

⚠ DANGER	When working at heights, wear a helmet, safety belt, or lanyard, securely fastened to a stable, solid structural component. It is strictly prohibited to hang from unstable or moving objects or sharp-edged metal to prevent accidental falls due to hook disengagement.
⚠ WARNING	1) Tools must be fully prepared and inspected by a qualified professional institution. Tools with damage, those that are uninspected or have expired inspection certifications, are strictly prohibited. Ensure that the tools are secure and not overloaded. 2) Before installing equipment into the container, ensure that the container is securely fixed. This is to avoid the risk of tilting or collapsing due to an unstable center of gravity, which could cause injury to personnel or damage to the equipment. 3) When pulling equipment out of the container, exercise caution to avoid unstable or heavy equipment that may be improperly installed, to prevent injury from being crushed or pinned. 4) Drilling holes in the equipment is strictly prohibited. Drilling will compromise the equipment's sealing, electromagnetic shielding, internal components, and cables. Metal shavings produced during drilling may enter the equipment and cause short circuits on the circuit board.

1.6 Handling and Transportation Requirements

1.6.1 General Requirements

1) Any paint scratches that occur during transportation or installation of the equipment must be promptly repaired. It is strictly prohibited to leave scratched areas exposed for extended periods.

2) It is prohibited to perform arc welding, cutting, or similar operations on the equipment without prior evaluation by the company.

3) It is prohibited to install any other equipment on top of the device without prior evaluation by the company.

4) When working in the space above the equipment, additional protection should be added to the top of the equipment to prevent damage.

5) Always use the correct tools and ensure that you are familiar with the proper usage of those tools.

1.6.2 Heavy Lifting Safety

1) When handling heavy objects, select appropriate lifting tools and coordinate with the correct number of people based on the weight of the items. Ensure safe packaging and handling of the goods.

Figure 1-2 Coordinating Tasks During Heavy Lifting

W<18kg | 18kg≤W<32kg | 32kg≤W<55kg | W≥55kg

2) When manually handling equipment, wear safety gloves, protective footwear (e.g., safety shoes), and other necessary protective gear.

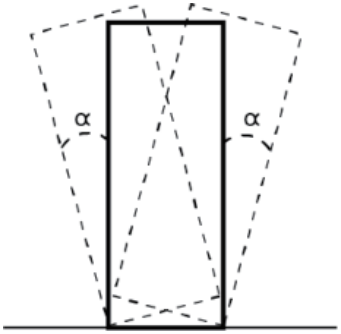
3) During the transportation of equipment, avoid scratching the surface, damaging components, or cables.

4) When using a forklift, position the forks centrally to prevent tipping. Before moving, secure the equipment with ropes to the forklift, and designate a person to supervise the operation.

5) Handle equipment with care to prevent impact or accidental drops.

6) For transportation, sea freight or well-maintained highways should be chosen, and rail and air transport are not supported. During transportation, it is essential to minimize vibrations and inclinations.

7) The inclination angle of the container should comply with the following Figure requirements: with packaging, the inclination angle α ≤15°; without packaging, the inclination angle α ≤10°.



1.6.3 High-altitude Work Safety

1) Any work conducted more than 2 meters above the ground is considered high-altitude work, and a supervisor must be assigned for such tasks.

2) Individuals must undergo relevant training and obtain the necessary qualifications before they can be employed for high-altitude work.

3) High-altitude work should be halted if the steel pipes are wet from rain or other hazardous conditions are present. After such conditions have passed, the safety officer and relevant technical personnel must inspect all work equipment to confirm safety before resuming work.

4) At the high-altitude work site, a danger zone should be demarcated with clear signs, and unauthorized personnel are strictly prohibited from entering.

5) Guardrails and signs should be installed at the edges and holes of high-altitude work areas to prevent accidental falls.

6) The ground directly below high-altitude work areas must not have scaffolding, planks, or other debris. Ground personnel are strictly prohibited from staying or passing directly under high-altitude work areas.

7) Carry all operational tools and instruments to prevent tool drops that could cause equipment damage or personal injury.

8) It is strictly forbidden for high-altitude workers to throw objects from above to the ground, and vice versa. Objects should be transferred using slings, baskets, elevated work platforms, or cranes.

9) Simultaneous work on multiple levels should be avoided. If it is unavoidable, dedicated protective shelters or other safety measures must be in place between levels, and tools and materials must not be stored on the upper levels.

10) When dismantling scaffolding after work is completed, it should be done from top to bottom in layers, and simultaneous dismantling on multiple levels is strictly prohibited. When removing a section, prevent the collapse of other parts.

11) High-altitude workers must strictly follow high-altitude safety regulations. The company will not be responsible for accidents caused by violations of these regulations.

12) Horseplay and resting in high-altitude work areas are strictly prohibited.

1.6.4 Ladder Safety

1) When there is a possibility of electrical exposure during elevated operations, wooden ladders or insulating ladders should be used.

2) For elevated operations, platform ladders with safety rails are preferred, and the use of straight ladders is prohibited.

3) Before using a ladder, ensure that it is in good condition, and that its load-bearing capacity meets the requirements. Overloading is strictly forbidden.

4) Ladders must be placed on a stable surface, and someone must hold the ladder during use.

5) When climbing a ladder, maintain body stability and ensure that your center of gravity does not deviate from the edge of the ladder to reduce risk and ensure safety.

6) When using a stepladder, the safety strap must be securely fastened.

1.6.5 Lifting Operation Safety

1) Personnel conducting lifting operations must undergo relevant training and be certified before they can be employed.

2) The lifting area must be marked with temporary warning signs or barriers to ensure segregation.

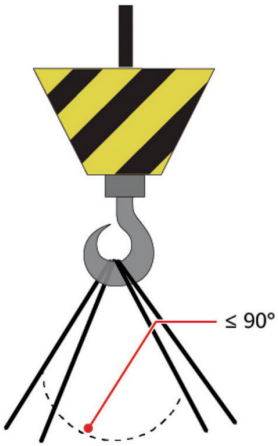
3) The ground where lifting operations are performed must meet the load-bearing requirements for crane work.

4) Before lifting, ensure that lifting tools are securely fastened to a fixed object or wall that complies with load-bearing standards.

5) During lifting, it is strictly forbidden to walk under the crane arm or the suspended load.

6) During lifting, dragging of steel wires or lifting equipment is prohibited, and striking with hard objects is not allowed.

7) Throughout the lifting process, ensure that the angle between the two cables is not greater than 90°, as shown in the figure below.



1.6.6 Drilling Operation Safety

1) Before commencing drilling operations, it is essential to obtain consent from both the client and the contractor.

2) During drilling, it is mandatory to wear safety goggles and protective gloves, along with other required personal protective equipment.

3) When drilling, take care to avoid any pre-embedded pipes or electrical lines to prevent the risk of short circuits or other potential hazards.

4) Protect the equipment with covers during drilling to prevent debris from entering the interior of the device, and ensure that all debris is promptly cleared away after the drilling is completed.

1.7 Equipment Safety

1.7.1 Energy Storage System Safety

DANGER	1) During system operation, opening the container doors is prohibited. 2) In the event of an energy storage system malfunction, avoid standing near the container doors (including the area within the range of the open door).
NOTICE	Energy storage systems must be equipped with protective measures such as fences or walls, and safety warning signs should be erected to isolate the area. This is to prevent unauthorized personnel from entering during the operation of the equipment, which could lead to personal injury or property damage.

1) The installation and layout of the energy storage system must comply with local standards for fire separation distances or firewall requirements, including but not limited to the "GB 51048-2014Design code for electrochemical energy storage station "GB 51048-2014Design code for electrochemical energy storage station" and the "NFPA 855 Standard for the Installation of Stationary Energy Storage Systems".

2) The energy storage system should undergo regular fire safety inspections, with no fewer than 1 inspection per month.

3) During live inspections of the system, attention should be paid to danger warning signs on the equipment to avoid standing near container doors.

4) After replacing power components or changing wiring in the energy storage system, manual initiation of wiring detection and topology recognition is required to prevent abnormal system operation.

5) It is recommended that users equip themselves with video recording devices to document the detailed processes of installing, operating, and maintaining the equipment.

1.7.2 Battery Safety

DANGER

1) It is strictly forbidden to short-circuit the positive and negative terminals of the battery, as this can cause a short circuit. A short circuit can instantly generate a large current and release a significant amount of energy, leading to battery leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion. To avoid short circuits, batteries should not be maintained while energized.
2) Do not expose batteries to high-temperature environments or heat-generating devices, such as intense sunlight, fire sources, transformers, heaters, etc. Overheating of batteries may cause leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion.
3) It is strictly forbidden to subject batteries to mechanical vibration, dropping, collision, puncture by hard objects, or impact pressure, as this may lead to battery damage or fire.
4) It is strictly forbidden to disassemble, modify, or damage batteries (such as inserting foreign objects, applying external pressure, immersing in water or other liquids), to avoid battery leakage, smoking, release of flammable gases, thermal runaway, fire, or explosion.
5) It is strictly forbidden for battery terminals to come into contact with other metal objects, as this may cause heating or electrolyte leakage.
6) Using or replacing batteries with incorrect models can be dangerous and may cause fires or explosions. Please use the specified model of batteries recommended by the manufacturer.
7) Battery electrolyte is toxic and volatile. In case of electrolyte leakage or abnormal odors, avoid contact with the leaked liquid or gases. Non-professionals should not approach; contact professionals immediately for handling. Professionals should wear safety goggles, rubber gloves, gas masks, protective clothing, etc., to de-energize the equipment promptly, remove the leaking battery, and contact a technical engineer for further handling.
8) Batteries are a closed system, and under normal operating conditions, no gases are released. In extreme abuse cases, such as fire, puncture, crushing, lightning strikes, overcharging, or other severe conditions that may cause thermal runaway, the battery may be damaged or undergo abnormal chemical reactions internally, leading to electrolyte leakage or the production of gases like CO, H2, etc. Ensure that flammable gas emission measures are in place to avoid combustion or corrosion of equipment.
9) Gases produced by burning batteries can irritate the eyes, skin, and throat; take necessary precautions.

WARNING

1) Batteries should be installed in areas away from liquids. It is strictly prohibited to install them under locations prone to water leakage, such as air conditioning vents, ventilation outlets, computer room outlet windows, and water pipes, to prevent liquids from entering the equipment and causing equipment failure or short circuits.
2) During battery installation and commissioning, fire-fighting facilities must be provided in accordance with construction standard specifications, such as fire-fighting sand and carbon dioxide fire extinguishers. Before going into operation, ensure that fire-fighting facilities are in place that meet local laws, regulations, and specification requirements.
3) Before removing the packaging of batteries, ensure that the outer packaging boxes are intact and undamaged during storage and transportation. Place them correctly according to the packaging box markings, strictly prohibiting upside-down, side, vertical, or inclined placement. When stacking, comply with the stacking requirements on the outer packaging to avoid any impact or drops that could damage or scrap the batteries.
4) After removing the packaging of batteries, place them in the required direction, strictly prohibiting upside-down, side, vertical, inclined, or stacked placement to avoid any impact or drops that could damage or scrap the batteries.
5) Tighten the fastening screws of busbars or cables to the specified torque as per the document, and regularly inspect them to ensure they remain tightened, checking for rust, corrosion, or other foreign objects and cleaning them thoroughly. Failure to do so may result in poor connections, excessive voltage drop, and potentially cause the battery to overheat and be damaged or destroyed under high current conditions.
6) After the battery is discharged, it should be recharged in a timely manner; otherwise, the battery may be damaged due to over-discharge.

Disclaimer: The company shall not be held responsible for damages to the batteries provided by us due to the following reasons:

1) Damage caused by earthquakes, floods, volcanic eruptions, landslides, mudslides, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, extreme weather, or force majeure events;

2) Direct damage to the batteries caused by the operating environment of the site equipment or external electrical parameters that do not meet the requirements for normal operation, including but not limited to excessively high or low operating temperatures of the batteries, and unstable power grid conditions with frequent power outages;

3) Battery damage, falls, leakage, rupture, etc., caused by improper operation or failure to connect the batteries as required;

4) Damage caused by over-discharge of the batteries due to your failure to timely power up after installation and connection to the system;

5) Battery damage resulting from your failure to inspect and accept the batteries in a timely manner;

6) Incorrect setting of battery operation and management parameters by you;

7) Accelerated capacity decay caused by mixing our batteries with others, including but not limited to: mixing with batteries of other brands, mixing with batteries of different rated capacities;

8) Frequent over-discharge of the batteries due to improper maintenance by you, on-site expansion, or long-term inability to fully charge;

9) Failure to properly maintain and service the batteries according to the accompanying equipment manual, including but not limited to: not regularly checking whether the battery terminal screws are tightened;

10) Battery damage caused by your failure to store them according to storage requirements, such as storing in damp or easily rain-exposed environments;

11) Capacity loss or irreversible damage to the batteries due to your failure to charge them in a timely manner, leading to prolonged storage;

12) Battery damage caused by you or a third party, including but not limited to: unauthorized relocation or installation of the batteries without our company's requirements;

13) Changes in battery usage scenarios by you without notifying our company;

14) Connection of additional loads to the batteries by you;

15) The batteries have exceeded the maximum storage period;

16) The batteries have exceeded the warranty period.

1.7.2.1 General Requirements

1) Do not expose the battery to high-temperature environments or place it near heat sources such as direct sunlight, flames, transformers, or heaters. Overheating the battery may lead to fire or explosion.

2) Do not disassemble, modify, or damage the battery (e.g., inserting foreign objects, submerging it in water or other liquids) to avoid leakage, overheating, fire, or explosion.

DANGER

3) Lithium-ion/sodium-ion battery energy storage systems have a higher fire risk. Before performing any work on the battery, fully consider the following safety hazards:

a. The battery electrolyte is flammable, toxic, and volatile.

b. Thermal runaway of the battery can produce combustible gases, as well as harmful gases such as CO and HF.

c. Combustible gases produced during thermal runaway may accumulate, posing a risk of flash fire or explosion. The energy storage system must be loaded and unloaded according to the local laws, regulations, and industry standards. Rough handling can cause short circuits or damage inside the battery enclosure, potentially leading to leakage, rupture, explosion, or fire.

1) Batteries must be stored in a separate storage room, within their original packaging, to avoid mixing with other materials. Do not store them outdoors or stack them too high. The site must be equipped with proper fire safety equipment, such as fire sand and fire extinguishers.

2) Under normal circumstances, do not remove the battery's outer packaging. If the battery requires recharging, it must be done by qualified personnel following the proper procedures. After recharging, the battery must be placed back into its packaging.

3) For outdoor storage, it is recommended to power on the battery within 24 hours after unpacking. If it cannot be powered on promptly, the battery should be placed in an indoor, dry, and non-corrosive environment.

4) The battery should be stored according to the "Do Not Invert" markings or labels on the packaging to prevent electrolyte leakage due to long-term storage in an inverted position.

5) Avoid physical impacts to the battery.

6) When transporting the battery, follow the required orientation. Do not invert or tilt the battery during handling.

7) Use the battery within the temperature range specified in the manual. Do not charge the battery when the ambient temperature is below the lower limit of the operating temperature range, to prevent crystal formation and internal short circuits due to low-temperature charging.

8) Dispose of used batteries according to local laws and regulations. Do not treat batteries as household waste. Improper disposal of batteries may lead to environmental pollution.

9) Do not use damaged batteries (e.g., battery casing dents or other damage). Damaged batteries may release flammable gases. Do not store damaged batteries near undamaged products.

10) The storage location for damaged batteries should not contain flammable materials. Non-professional personnel should not approach the damaged battery.

11) During the storage of damaged batteries, monitor the battery for signs of smoke, flames, electrolyte leakage, or overheating.

12) If the battery pack is accidentally exposed to water, do not continue with installation. Transport it to a safe isolation area and promptly request replacement parts.

13) The storage environment should be free from direct sunlight or rain. It should be dry, well-ventilated, clean, and free from excessive infrared radiation, organic solvents, or corrosive gases.

1.7.2.2 Recharging Requirements

1) If the battery has not been charged for more than 8 months, a recharge operation is required. Failing to recharge the battery as specified may affect its performance and lifespan.

2) The production completion date of the battery can be obtained by consulting the company's after-sales personnel.

NOTE:

Before installing the battery pack, check for any abnormalities in the pack.

Abnormalities include any of the following phenomena:

1) The battery pack casing is noticeably deformed or damaged;

2) The voltage from the total positive to the total negative of the battery pack is approximately 0V;

3) The impedance of the battery pack's positive or negative terminal to ground is less than 50kΩ.

1.7.2.3 Battery Installation Requirements

1) Use only the specified battery models. Using non-specified models may damage the battery.

2) Before installation, check if the packaging is intact. Do not use batteries with damaged packaging.

3) The battery should be placed horizontally and securely fixed.

4) During installation, do not place tools, debris, or other objects on the battery.

5) During installation, pay attention to the correct polarity. Do not short-circuit the battery's positive and negative terminals.

6) Use a torque wrench during installation to ensure the terminal connections are tightened. Regularly check the connections to ensure they are not loose.

1.7.2.4 Battery Short-Circuit Protection

⚠ DANGER	Battery short-circuits can cause a large current to flow instantly, releasing a significant amount of energy, which can lead to personal injury and property damage.

1) When installing or maintaining the battery, use insulating tape to cover any exposed terminal connections.

2) Prevent foreign objects (such as conductive materials, screws, liquids, etc.) from entering the battery, as they can cause short circuits.

1.7.2.5 Hazard and Toxicity Information

⚠ DANGER	**1) Hazard:** Contact between the battery terminals and other metals may cause heating or electrolyte leakage. The electrolyte is flammable. If leakage occurs, immediately remove the battery from any fire source. **2) Toxicity:** The fumes generated when the battery burns may irritate the eyes, skin, and throat.

1.7.2.6 Battery Abnormality Handling Measures

⚠ DANGER	1) In case of electrolyte leakage or unusual odor, avoid contact with the leaked liquid or gas. Non-professional personnel should not approach. Immediately contact professional personnel for handling. Professionals should wear protective equipment such as goggles, rubber gloves, gas masks, and protective clothing to prevent harm from electrolyte spillage. 2) Electrolyte is corrosive and can cause skin irritation or chemical burns. If contact with the battery electrolyte occurs, take the following actions: a. Inhalation: Evacuate the contaminated area, immediately breathe in fresh air, and seek medical help. b. Eye Contact: Immediately rinse the eyes with a large amount of water for at least 15 minutes, do not rub the eyes, and seek medical help immediately. c. Skin Contact: Immediately wash the affected area with plenty of water and soap, and seek medical help immediately. d. Ingestion: Seek medical help immediately.

1.7.2.7 Handling Battery Drops

1) If the battery is dropped (whether or not it is in its packaging) but shows no visible deformation, damage, or signs of unusual odor, smoke, or fire, proceed with operation only if safety is ensured.

2) In the warehouse: Evacuate personnel, and use mechanical tools by qualified personnel to move the battery to an open, safe location. Contact the company's after-sales service. Allow the battery to rest for 1 hour, ensuring its temperature remains within ±10°C of room temperature, before proceeding with further handling.

3) At the energy storage system site: Evacuate personnel, close the energy storage system door, and use mechanical tools by qualified personnel to move the battery to an open, safe location. Contact the company's after-sales service. Allow the battery to rest for 1 hour before proceeding with further handling.

4) If the battery shows any obvious signs of odor, damage, smoke, or fire after falling, immediately evacuate personnel, contact professional personnel, and alert emergency services. Only qualified personnel should use fire safety equipment to extinguish the fire, ensuring safety during the process.

5) After a battery drop, it is prohibited to continue using it. Contact the company's after-sales service for evaluation.

1.8 Maintenance and Replacement

NOTICE Before removing components from the container, ensure that other components in the container are not loose or pose any safety risks.

1) When performing maintenance on the energy storage system, there must be at least two personnel on-site.

2) During equipment maintenance, use insulating materials to cover nearby live parts.

3) Do not open the container doors during weather conditions such as rain, snow, lightning, sandstorms, or heavy fog.

4) Before the fan has powered off and stopped spinning, do not allow fingers, components, screws, tools, or boards to come into contact with the operating fan.

5) Do not power on the equipment before troubleshooting is completed.

6) When conducting live inspections of the system, pay attention to hazard warning labels on the equipment and avoid standing near the battery container doors.

7) For equipment other than the battery pack, after disconnecting the power, wait for 15 minutes to ensure that the equipment is fully powered down before proceeding with any operations.

8) Switches that need to be disconnected for maintenance should have clearly visible labels placed on them.

9) After replacing or modifying the wiring of the energy storage system's power components, it is necessary to manually initiate wiring checks and topology recognition to prevent system operation anomalies.

10) After completing maintenance and replacement operations, promptly lock the battery container doors and securely store the keys.

2. Product Introduction

2.1 System Configuration Overview

This product is a container-type liquid-cooling energy storage system, housed in a 20HQ container. The system primarily comprises battery PACKs, high-voltage control boxes, a main control cabinet, a thermal management system, a fire protection system, an environmental monitoring system, and auxiliary power distribution. The system's nominal capacity is 5015 kWh.The system uses 314Ah lithium iron phosphate (LiFePO4) batteries, with each PACK configured as 1P104S. Each battery cluster consists of four PACKs connected in series, with a total of 12 clusters in the system. Two battery clusters are managed by one high-voltage control box, and every six clusters are connected to a 1250 kW PCS.The thermal management system adopts liquid cooling and includes a 60 kW liquid cooling unit and an independent pipeline system. The container is equipped with an automated fire detection and suppression system, featuring cluster-level automatic detection and PACK-level in-box fire suppression, enabling precise detection and targeted fire extinguishing.The battery container design is non-walk-in, with external maintenance capabilities.

Figure 2-1 Exterior Rendering of the Battery Container

2.2 Appearance and Structural Layout

(1) Structural Introduction

Figure 2-2 Front View of Battery Container

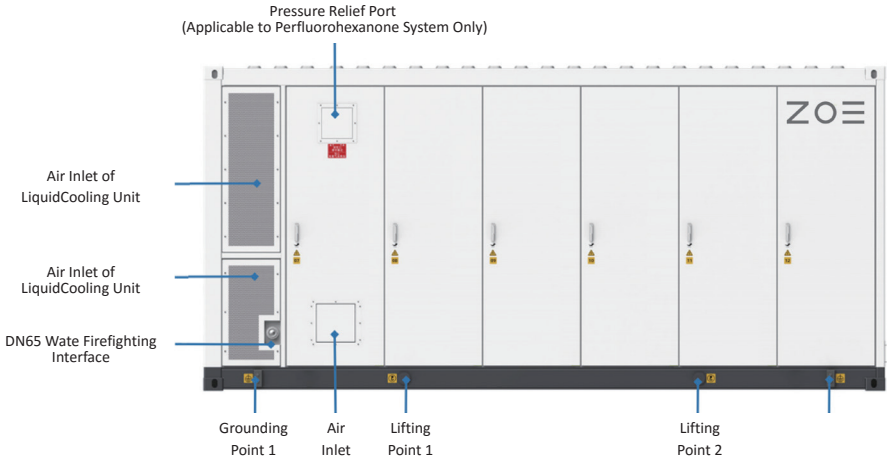


Figure 2-3 Rear View of Battery Container

NOTE:

The container door configuration, number of doors, pressure relief ports, and air intake/exhaust vents are subject to their actual positions.

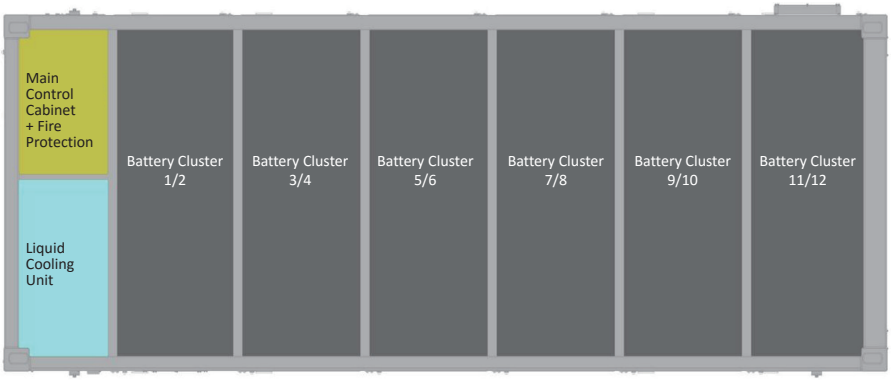
(2) Appearance Dimension

Figure 2-4 Battery Container Dimensions Figure

(3) Structural Layout

The schematic Figure of the internal layout of the battery box is shown in the figure below:

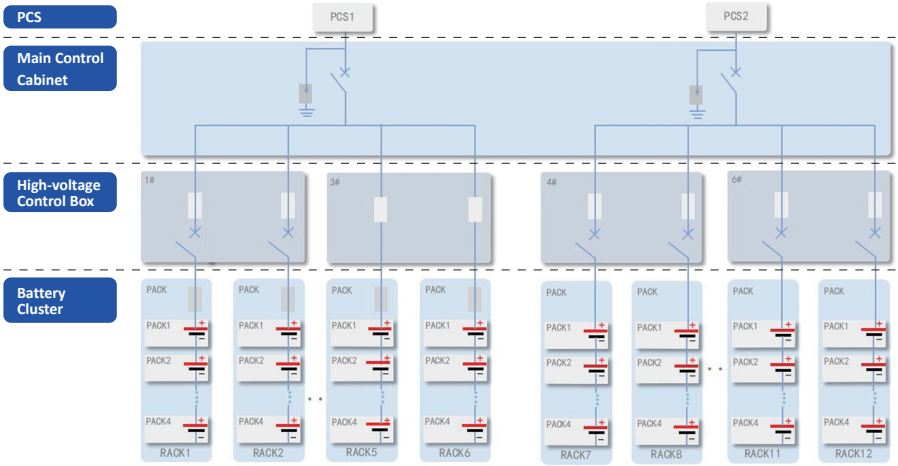
Figure 2-5 The schematic figure of the internal layout of the battery container



2.3 Primary Circuit Topology

The unified primary power circuit equipment mainly includes battery PACKs, high-voltage control boxes, and the main control cabinet. Every 4 battery PACKs are connected in series to form 1 cluster, with every 2 clusters connected to 1 high-voltage control box. Subsequently, every 6 clusters converge into 1 PCS rated at 1250 kW. The topology is shown in the figure below:

Figure 2-6 Primary Circuit Topology Figure



2.4 System Parameters

Table 2-1 System Specification Parameters Table

No.	Name	Parameter	Remark
1	Cell Type	LFP-3.2V-314Ah	
2	Nominal System Capacity	5015kWh	
3	Nominal Voltage	1331.2Vdc	
4	Voltage Range	1164.8~1497.6Vdc	
5	Charge and discharge rate	≤0.5CP	
6	Cooling Method	Smart Liquid Cooling	
7	Auxiliary Electrical Parameter	50kVA-400V/50Hz	~3N+PE
8	Firefighting System	Aerosol gas fire suppression + water fire suppression	Novec 1230 (C6-fluoroketone) optional
9	Corrosion Protection Level	C4	
10	Lightning Protection Level	II Level	
11	IP Level	IP55	
12	Working Temperature	-30℃ ~+50℃	>45 Derating
13	Storage Temperature	-20℃ ~+45℃	
14	Working Humidity Range	0~95%RH	No Condensation
15	Installation Method	Outdoor Installation	
16	Operating Conditions	Maximum 2 charge and 2 discharge cycles per day	
17	System Communication Interface	Ethernet/RS485/CAN	
18	External Communication Protocol	Modbus TCP/IEC61850/IEC104/ Modbus RTU	IEC61850 or IEC104, choose one
19	Altitude	3000m	
20	Dimension（D*W*H）	6058*2438*2896mm	
21	Weight	Approximately 42000kg	

3. Structure Fixing and Installation

3.1 Installation Environment Requirements

3.1.1 Site Selection Requirements

⚠ WARNING

The site selection must comply with the requirements of GB 51048: Design Code for Electrochemical Energy Storage Stations, NFPA 855: Standard for the Installation of Stationary Energy Storage Systems, and local regulations.

Energy storage systems are only suitable for outdoor installations and should not be installed indoors. General site selection requirements are as follows:

1) The installation site should not be in low-lying areas, and the installation surface must be above the historical highest water level of the region.

2) The distance from the site to airports, landfills, riverbanks, or dams should be at least 2000 meters.

3) Choose an open area to ensure that there are no obstacles within a 10-meter radius around the site.

4) The site should be at least 50 meters away from residential areas to avoid noise pollution.

5) The site should have convenient transportation access and reliable fire suppression equipment.

6) The site should meet the immediate land area requirements and allow space for future expansion based on the system's entire lifecycle needs.

7) The location should have good ventilation.

8) Energy storage systems should not be installed in areas affected by salt corrosion, as this could lead to fire hazards. Specifically, avoid installation in outdoor areas within 2000 meters of the coastline or in regions influenced by seawind. Areas affected by seawind vary based on local climatic conditions (e.g., typhoons, seasonal winds) or topographical features (such as embankments or hills).

NOTE

1) If the safety clearance requirements for site selection cannot meet the relevant national standards, it is recommended to relocate the site.

2) If no more suitable alternative site is available, it is recommended to install a firewall with at least 3-hour fire resistance for safety protection. Additionally, consider the space requirements for equipment transportation, installation, and maintenance.

3) It is recommended to refer to NFPA 855-2023 "Standard for the Installation of Stationary Energy Storage Systems": When there is a fire wall with a fire resistance of 1 hour, the length and height of the fire wall should extend 1.5 meters beyond the physical boundary of the prefabricated cabin, and the spacing can be reduced to 3 inches (914mm).

Site selection should avoid locations and scenarios not recommended by industry standards and regulations, including but not limited to the following:

1) Areas with strong vibrations, loud noise, and strong electromagnetic interference.

2) Locations that generate or contain dust, oil fumes, harmful gases, or corrosive gases.

3) Sites involved in the production or storage of corrosive, flammable, or explosive materials.

4) Sites with existing underground facilities.

5) Areas with poor geological conditions, such as rubber soil, soft soil layers, areas prone to water accumulation, or areas with ground subsidence risks.

6) Earthquake fault zones and regions with seismic intensity greater than 9 degrees.

7) Areas directly threatened by landslides, mudslides, quicksand, sinkholes, or other similar hazards.

8) Within mining subsidence (displacement) zones.

9) Within explosive hazard zones.

10) Areas that could be flooded following dam or levee failure.

11) Important water source protection areas.

12) Historical or cultural heritage protection zones.

13) Locations with dense populations, high-rise buildings, or underground structures.

3.1.2 Spatial Requirements

To ensure proper maintenance of the equipment inside the Container and facilitate the movement of transport tools and machinery, it is recommended to leave sufficient space around the Container installation site. The minimum reserved space should not be less than the minimum dimensions shown in the figures below.

1) For the long side of the energy storage system, a clearance of ≥3000mm should be maintained. For the short side, a clearance of ≥4000mm is required (if the side includes heat-generating components such as PCS or air conditioners, a clearance of ≥4000mm is required).

2) A maintenance passage should be provided around or on one side of the Container, with a minimum clear width of ≥1200mm.

3) The energy storage equipment area is recommended to be isolated by a solid wall or a fence for protection. A firewall may replace part or all of the fence; the design should consider this comprehensively.

4) The spacing design above only considers installation and maintenance requirements. The final spacing must also comply with local fire safety regulations.

Figure 3-1 Installation Space for Single Container

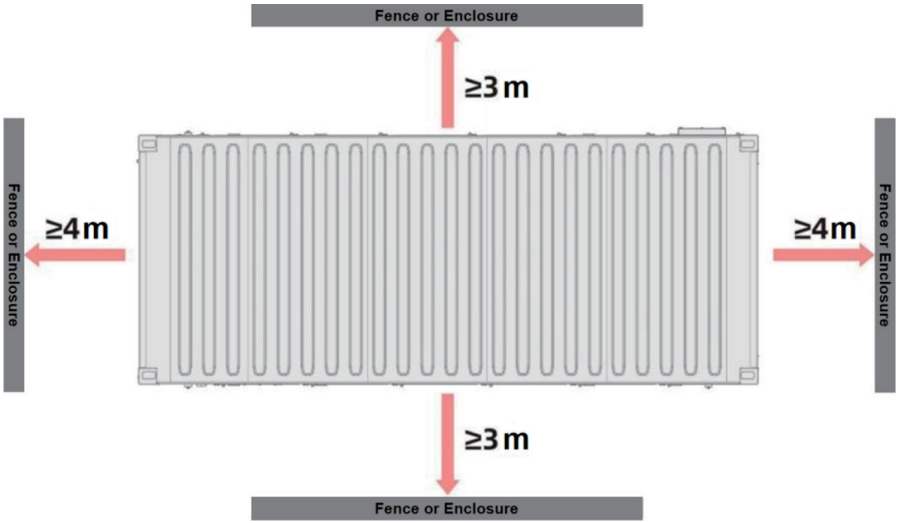
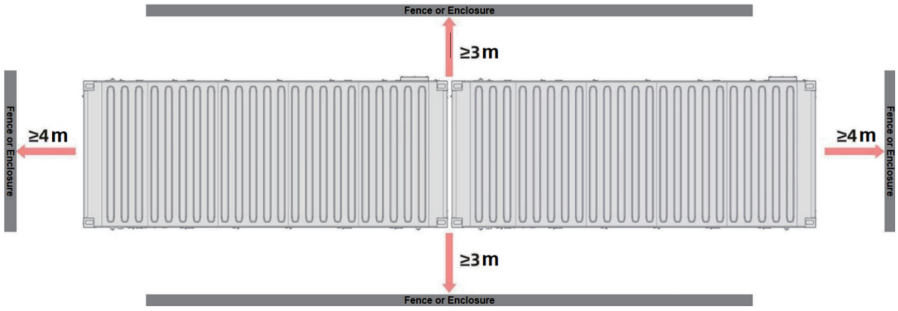


Figure 3-2 Installation Space for Parallel Containers



3.1.3 Installation Foundation and Positioning Requirements

⚠ DANGER	The battery container is relatively heavy, so before constructing the foundation, a thorough assessment of the installation site conditions (primarily geological and environmental conditions) should be conducted. Only after this assessment can the foundation design and construction work begin.

The storage location for the battery container must be pre-prepared by a professional construction team, ensuring enough space is left around the Container for installation and maintenance. If the power cables are routed through a bottom cable trench, foundation preparation should be done in advance. The overall foundation should meet the requirements for lightning protection, waterproofing, rodent and insect prevention, and ventilation. The installation foundation of the battery container must first be designed and constructed to meet the requirements for mechanical support, cable routing, and later maintenance, while complying with local electrical facility construction standards. The foundation design should be tailored to the actual terrain, as shown in Figure 3-2, which illustrates a typical battery container foundation design.

When constructing the foundation, at least the following requirements must be met:

1) The soil at the installation site must have a certain degree of compaction. It is recommended that the relative compaction of the soil be ≥98%. If the soil is loose, measures must be taken to ensure the foundation's stability.

2) The bottom of the foundation pit must be compacted and leveled to provide adequate and effective support for the Container.

3) The foundation of the battery container should be constructed according to the foundation plan provided by the supplier or the foundation plan confirmed by the company, with a surface tolerance requirement of ±5mm.

4) The foundation should elevate the battery container to prevent rainwater from eroding the base and the interior of the Container.

5) The cross-sectional area and height of the foundation must meet the requirements. The foundation design should consider local geological conditions and incorporate appropriate drainage measures.

6) A cement foundation with sufficient cross-sectional area and height should be constructed. The height of the foundation should be determined by the contractor based on the site’s geological conditions.

7) The foundation construction should account for cable routing.

8) A maintenance platform should be constructed around the foundation to facilitate later maintenance.

9) Based on the cable entry and exit locations and dimensions on the battery container,

sufficient space should be reserved for AC/DC cable channels during the foundation construction, and cable conduits should be embedded in advance.

10) The specifications and number of embedded conduits should be determined based on the cable type and the number of cable entries and exits.

11) A drainage system should be installed to prevent flooding of the Container's bottom or internal equipment during rainy seasons or heavy precipitation.

12) Both ends of all embedded conduits should be temporarily sealed to prevent debris from entering, avoiding complications during later wiring installation.

13) After all cables are connected, the cable entries and exits of the embedded conduits, as well as the junctions, should be sealed with fireproof sealing compound or other suitable materials to prevent rodents from entering.

Figure 3-3 Schematic Figure of Single Container Installation Foundation

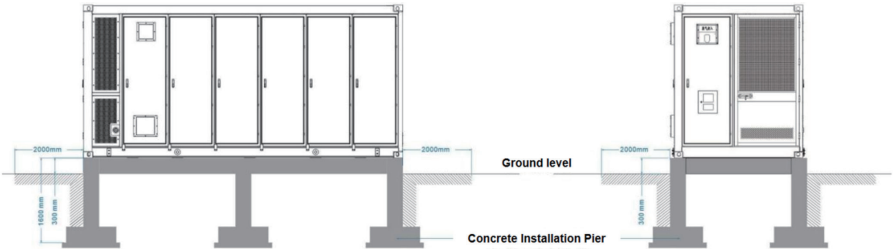
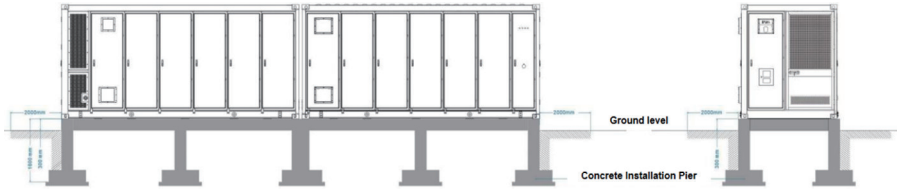


Figure 3-4 Schematic Figurem of Parallel Containers Installation Foundation



3.2 Pre-installation Inspection

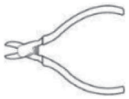
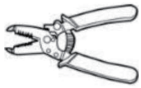
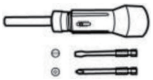
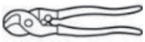
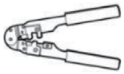
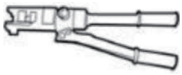
3.2.1 Tool Preparation

Tools required for equipment installation include installation tools and personal protective equipment as listed below.

⚠ WARNING	All tools, including socket wrenches, torque wrenches, and screwdrivers, must be insulated or treated for insulation purposes. Alternatively, fully insulated tools should be used.

1) Installation Tools

Table 3-1 Common Installation Tools List

			
Impact Drill (Φ14mm, Φ16mm, Φ20mm)	Complete Set of Socket Wrenches	Torque Wrench	Diagonal Pliers
			
Wire Strippers	Phillips/Flathead Screwdriver	Rubber Mallet	Utility Knife
			
Cable Cutters	RJ45 Crimping Tool	Vacuum Cleaner	Multimeter DC voltage range ≥ 1500V DC
			
Marker Pen	Steel Tape Measure	Digital or Bubble Level	Hydraulic Crimping Tool
			
Heat Shrink Tubing	Hot Air Gun	Cable Ties	Insulated Ladder
			
Crane	Lifting Ropes		

2) Personal Protective Equipment

			
Safety Gloves	Protective Goggles	Dust Mask	Safety Shoes
			
Reflective Vest	Safety Helmet	First Aid Kit	

3.2.2 Installation Environment Inspection

Conduct a check against the site requirements item by item, and proceed with the installation only after meeting the requirements. Our company will not assume any responsibility for any losses caused by forced installation when the requirements are not met.

⚠ WARNING	Marking the Safety Area: Mark the safety area with red construction tape to delineate the zone. Clear any obstacles within the safety area, and place construction markers and safety warning signs in prominent locations.

3.3 Energy Storage System Installation

3.3.1 Lifting Precautions

⚠ DANGER	1) During the entire process of lifting the battery container, strict adherence to the safety operation procedures for cranes is required. 2) No personnel are allowed within the 5m to 10m operational range. Particularly, standing is prohibited directly under the lifting arm or beneath the lifted or moving machinery to avoid accidents and injuries. 3) Weather Conditions: Lifting should cease in the event of adverse weather conditions such as heavy rain, fog, or strong winds.

When lifting the battery container, the following requirements must be met:

1) The lifting operation must be carried out based on a lifting plan provided by a professional lifting company, which should be evaluated and confirmed before implementation.

2) Lifting should be performed from the bottom of the battery container, ensuring safety on-site during the process.

3) Before lifting, ensure all doors on the battery container are closed, the locking rods are secure, and the transport fastening bolts are tightened.

4) Prior to lifting, remove all potential obstacles from the movement path, such as trees, cables, etc.

5) For outdoor lifting, it is recommended to conduct the operation in clear weather with no wind to ensure optimal conditions for lifting the energy storage system.

6) Set up warning signs or caution tape at the lifting site to prevent unauthorized personnel from entering the lifting area.

7) The lifting process must comply with the local or national safety regulations for battery container lifting operations.

8) All equipment or tools used for the lifting must be properly maintained and serviced. The use of unmaintained or unserviced equipment is strictly prohibited.

9) Personnel involved in loading, unloading, and securing the battery container should

receive proper training, particularly in safety protocols. Professional personnel must be on-site to supervise the lifting and installation throughout the process.

10) Based on site conditions, choose appropriate lifting machinery and tools. The lifting equipment should have a weight capacity of at least 150 tons (sufficient to handle the load of the item being lifted), with an arm length and rotation radius suitable for the lifting requirements. The lifting tools must meet the equipment's weight-bearing specifications.

11) The strength of the slings used must be sufficient to support the total weight of the energy storage system.

12) Ensure that all sling connections are secure and reliable. The slings connected to the corner pieces should be of equal length. After the slings are taut, the horizontal angle between the slings and the top of the container should be 60°.

13) The length of each sling should be ≥9 m, although it can be adjusted based on actual site requirements.

14) Throughout the lifting process, the battery container must remain steady and level, without tilting. The lifting should be smooth and at a constant speed. Rapid lifting or lowering is strictly prohibited to avoid causing impact on the internal equipment.

15) Take all necessary auxiliary measures to ensure the safe and smooth lifting of the battery container.

3.3.2 Installation of the Energy Storage System

Select the appropriate crane based on the weight of the energy storage container and develop a lifting plan. During lifting operations, no personnel should be within the working area.

Figure 3-5 Crane Operations

I. Lifting Sling Connection Tightening

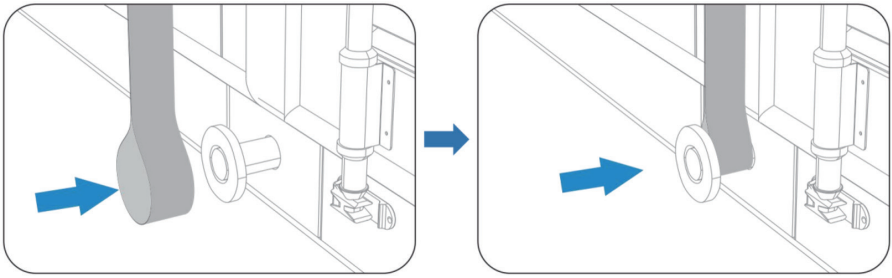
Considering the weight distribution of the integrated unit, the logistics company must provide specialized lifting equipment and slings. When lifting, the slings should be securely fixed at the lifting points as shown in Figure 3-6, with the lifting points being firmly anchored,

and the slings supported by beams.

The contractor must strictly follow the requirements outlined in this section for lifting operations.

The company will not be responsible for any tipping damage caused by the use of non-specialized lifting equipment or improper securing of slings. Please consult the company's after-sales team before lifting.

Figure 3-6 Lifting Sling Connection Figure



II. Lifting Operations

The recommended method for lifting the battery container is bottom lifting, using the four steel rings at the bottom of the container as lifting points. The following steps should be followed during the lifting process:

1) The battery container should be lifted according to the requirements, and no dragging should occur on the ground or on the top of the lower container. The container should not be dragged across any surface.

2) The crane should lift the container very slowly at first, maintaining a smooth and uniform lifting speed thereafter.

3) Once the battery container has been lifted 300mm from the support surface, the operation should pause, and the connection between the lifting equipment and the container should be checked. Lifting should only proceed after confirming the connection is secure.

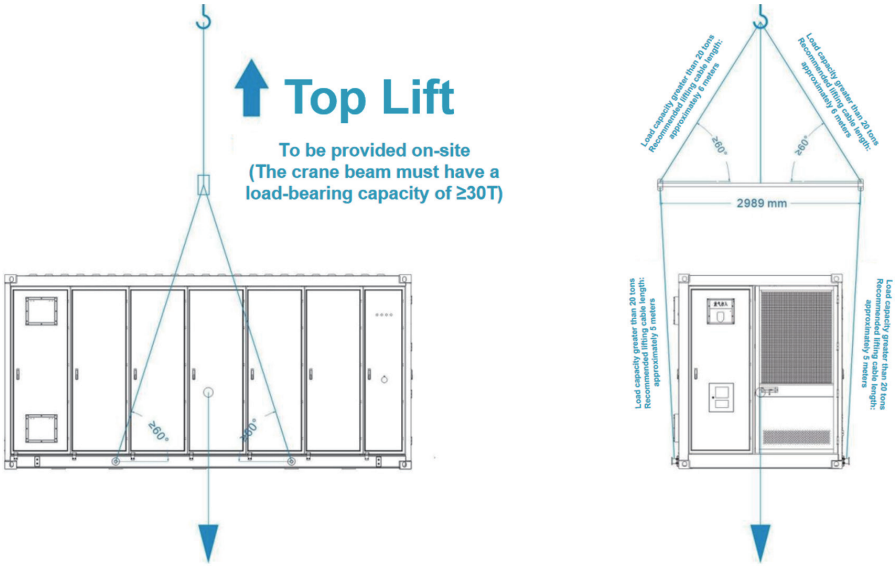
4) Once the battery container reaches the designated location, it should be lowered gently and placed carefully. It is prohibited to swing the lifting equipment and place the container outside the intended vertical landing area.

5) The ground where the battery container is placed must be firm, level, and well-drained, with no obstructions or protrusions. The container should only be supported by the six

bottom corner steel supports.

Refer to the figure below for the lifting sling connection setup:

Figure 3-7 Lifting Sling Connection Figure



DANGER

1) When lifting the battery container, ensure that it is raised and lowered horizontally to avoid tilting. Maintain a uniform speed during both ascent and descent to prevent damage to the internal equipment.
2) The company will not be held responsible for any safety accidents or equipment damage caused by non-compliance with these instructions or improper lifting practices.
3) When lifting the energy storage system, it is essential to ensure that the six corner steel supports of the system align with the marked corner steel positions on the concrete support platform.
4) Dragging the steel cables or lifting equipment is prohibited, and the use of hard objects to strike the equipment is also prohibited.

3.3.3 Energy Storage System Fixing

1) Preparation of Installation Tools

The following tools may be required when installing L-shaped angle steel:

Table 3-2 Preparation of Installation Tools

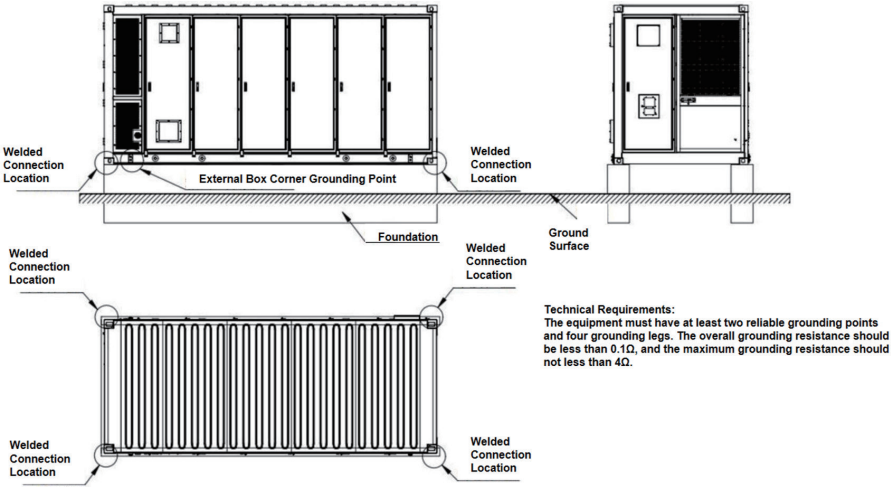
No.	Name	Component Source
1	Marker Pen	Not included in the supply range
2	Impact Drill	Not included in the supply range
3	Angle Steel	Not included by default. If needed, please contact our sales personnel.
4	M16×150 Expansion Bolt	Not included by default. If needed, please contact our sales personnel.
5	M16×50 Screw	Not included by default. If needed, please contact our sales personnel.

2) Installation Steps

Open the front door of the accessory storage box and retrieve the angle steel from the packaging box. Use the 6 angle steel pieces to secure the battery container.

NOTE	The flatness of the concrete support platform is crucial for the installation of the battery container. Ensure that the concrete platform meets the required specifications before proceeding with the installation and securing of the battery container.

Figure 3-8 Securing the Battery Container



4 Electrical Installation

4.1 Grounding Connection

4.1.1 Prerequisites

⚠ DANGER	It is strictly prohibited to install fuses, switches, or other devices on the protective earth conductor.
⚠ WARNING	The grounding system must comply with local electrical safety regulations.

1) The installation of the energy storage system has been completed.

2) Grounding requirements have been clearly defined.

4.1.2 Background Information

The specific requirements for the protective earth conductor are as follows:

Table 4-1 Protective Earth Conductor Requirements

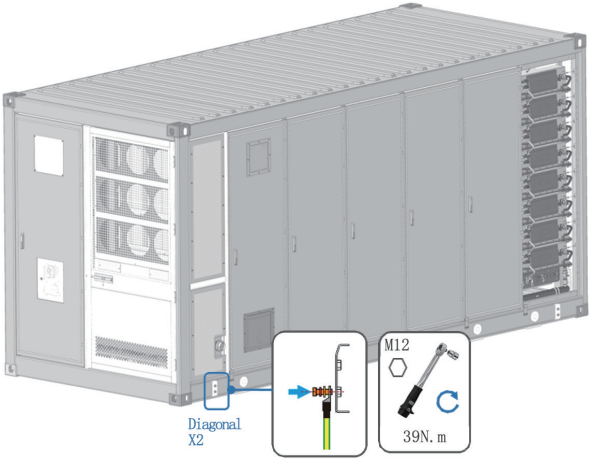
Cable	Cable Type	Recommended Cable Cross-sectional Area	Source
Protective Earth Conductor	1) Single-core outdoor copper conductor cable 2) Matching OT/DT terminal	≥ 200 mm² (Recommended: 2 wires of 185 mm²)	User-supplied

4.1.3 Connecting the Protective Earth Conductor

⚠ WARNING	1) The external grounding of the battery container needs to be connected to the grounding wire on the diagonal grounding bar. 2) The tightening torque for the grounding bolts (M12) should be 39 N·m ± 10%.

The battery container has four grounding points set up externally, as shown in the Figure below:

Figure 4-1 Grounding Connections for the Container



4.2 DC Circuit Wiring

⚠ WARNING	1) Ensure that the energy storage system is powered off. 2) The installation personnel should take the necessary safety precautions, such as wearing insulating gloves and insulating shoes. 3) The DC cables should have been pre-installed according to the standards. 4) The OT/DT terminals should be crimped according to the standards. For details, refer to Appendix A for crimping OT/DT terminals.

1) Open the DC cabinet of the main control cabinet.

2) Connect the DC cable that links to the positive terminal of PCS1 to the copper busbar PCS1+, and connect the DC cable that links to the negative terminal of PCS1 to the copper busbar PCS1-. Ensure the proper torque is applied as per the specified requirements and mark the anti-loosening lines.

3) Connect the DC cable that links to the positive terminal of PCS2 to the copper busbar PCS2+, and connect the DC cable that links to the negative terminal of PCS2 to the copper busbar PCS2-. Ensure the proper torque is applied as per the specified requirements and mark the anti-loosening lines.

Table 4-2 PCS and Main Control Cabinet Power Cable Connections

Cable Name	Function Definition	Cable Specification	Bolt Specification
PCS1 Positive DC Cable	PCS1+	Recommended cable: 4xZC-YJV22-1.8/3kV 1x185/Red	M12×30mm
PCS1 Negative DC Cable	PCS1-	Recommended cable: 4xZC-YJV22-1.8/3kV 1x185/Black	M12×30mm
PCS2 Positive DC Cable	PCS2+	Recommended cable: 4xZC-YJV22-1.8/3kV 1x185/Red	M12×30mm
PCS2 Negative DC Cable	PCS2-	Recommended cable: 4xZC-YJV22-1.8/3kV 1x185/Black	M12×30mm
⚠ WARNING	1) The recommended OT terminal is a double-hole terminal, CL180-2H-12. After connecting the DC cables, ensure that the OT terminal is fully attached to the copper busbar with good contact (it is recommended to apply a small amount of conductive paste), and that the DC cables are directed straight down. 2) Use a marker to make a line on the nut that has been checked for torque value. 3) After connecting the negative cable, promptly verify the torque before proceeding to connect the positive cable.		
NOTE	When using armored cables, it is recommended that the armor layer grounding be completed with a single-end grounding on the opposite side.		

4.3 AC Auxiliary Power Wiring

⚠ WARNING	1) Ensure that the energy storage system is powered off. 2) The installation personnel should take the necessary safety precautions, such as wearing insulating gloves and insulating shoes. 3) The cables should have been pre-installed according to the standards. 4) The OT/DT terminals should be crimped according to the standards. For details, refer to Appendix A for crimping OT/DT terminals.

1) Open the AC cabinet in the main control cabinet.

2) Connect the power supply wires sequentially to the AC distribution switch (QF1) L1/L2/L3, and connect the N wire to the N busbar in the AC cabinet. Ensure that the torque is applied

as required, and secure the anti-loosening wire.

Table 4-3 AC Side Incoming Cable Reference

Name	Function Definition	Cable Specification	Securing Bolt Specification
AC Side Incoming Cable	L1	Single multi-core cable 4×25mm²Recommended cable: ZC-YJV22- 0.6/1kV 4x25	M8×20mm
	L2		M8×20mm
	L3		M8×20mm
	N		M8×20mm

WARNING

1) When connecting the AC cables, ensure that no cables are damaged or disconnected. It is essential to ensure the reliable connection of the ground wire (connected to PE2) and the N wire; otherwise, it may lead to damage of AC equipment in the system or cause safety incidents such as electric shocks.
2) After completing the AC cable connections, ensure that the OT terminal is fully fitted and in good contact with the copper busbar, and that the AC input cable is directed vertically downward.
3) Bolts need to be pre-installed according to the recommended torque values: M6 (2 N·m), M8 (5 N·m).
4) Confirm the torque wrench is set to the correct torque values: M6 (7 N·m), M8 (14 N·m), and verify the torque on the installed bolts.
5) Mark the nuts that have been checked for torque with a marker.
6) When using armored cables for the AC incoming line, the armor type should be selected as 6: (Double) non-magnetic metal strip armor.
7) The AC incoming line grounding protection has been completed inside the battery container, and the battery container is grounded to the nearest grounding network.

4.4 Communication Cable Wiring

WARNING

If the communication cable has a shielding layer, ensure that the shielding layer is reliably grounded.

1) For details on the communication cable wiring, refer to the table below.

Table 4-4 Communication Cable Reference

Cable Name	Function Definition	Wire Gauge Requirement	Terminal Specification
Cat5e Shielded Patch Cable	EMS Ethernet Communication	8×0.5mm²	RJ45 8P8C with Shielded Housing
Shielded Twisted Pair(STP)	PCS CAN Communication	2×2×2.5mm²	Tubular E2512
Shielded Twisted Pair(STP)	BMS Emergency Stop PCS	12×2×2.5mm²	Tubular E2512
Cat5e Shielded Patch Cable	Video Surveillance	8×0.5mm²	RJ45 8P8C with Shielded Housing
Shielded Twisted Pair(STP)	Fire Protection Communication	2×2.5mm²	Tubular E2512

5 System Power-On/Off

5.1 System Power-On

DANGER	1) Only after confirmation by professional personnel and obtaining permission from the local power department can the energy storage system be put into grid-connected operation. 2) For systems that have been shut down for a long time, a comprehensive and detailed inspection and safety tests must be conducted before power-on to ensure that all indicators meet the requirements before proceeding with the power-on.

5.1.1 Pre-Power-On Inspection

Before powering up, please carefully check the following items to ensure they are correct:

1) Check that the wiring is correct and not loose.

2) Ensure that the protective covers inside the equipment are securely installed.

3) Confirm that the emergency stop button is in the released state.

4) Check to ensure there are no grounding faults.

5) Use a multi-meter to check that both AC and DC voltages meet the startup conditions and that there is no risk of over-voltage.

6) Check to ensure no tools or parts have been left inside the equipment.

7) Conduct safety testing on the equipment to confirm that it is in a safe state.

5.1.2 Power-On Procedure

DANGER	If any circuit breaker trips during the power-on process, stop closing other circuit breakers and immediately check whether there is a short circuit or other issue with the downstream load of the tripped breaker.

Powering on the Energy Storage System:

Step 1: Power-on the Battery Container Auxiliary Power Supply:

1) Visually confirm that the AC surge protector is functioning normally (green indicator visible in the observation window), and that the AC surge protection switch is in the closed position.

2) Confirm whether the auxiliary power incoming line is live and whether the incoming line indicator light on the main control cabinet is illuminated.

3) Close the main distribution switch between the main control cabinet and the AC cabinet, and check if the power indicator lights on the container and the main control cabinet are lit.

4) Close the UPS input switch between the main control cabinet and the AC cabinet. Press and hold the UPS power-on button (left side ON) and the combination button (center position) for 10 seconds until the UPS powers on, then check if the uninterruptible power

supply indicator light on the main control cabinet is lit.

5) Close the UPS output switch between the main control cabinet and the AC cabinet.

6) Close the power supply switch for the liquid cooling unit (located at the bottom of the unit), and observe if the liquid cooling unit is powered on (indicated by the display screen lighting up).

7) Close the air conditioning power supply switch in the main control cabinet- AC cabinet (only required for the first power-on), and observe if the air conditioning system is powered on.

8) Close the lighting power supply switch in the main control cabinet - AC cabinet (if required).

9) Close the emergency lighting power supply switch in the main control cabinet- AC cabinet, ensuring that the emergency lights remain online.

10) Press the button switches on the panel of the battery cluster 1 to battery cluster 12 in the battery compartment (only required for the first power-on), ensuring the 24V supply is energized and the indicator lights on the panel are illuminated.

11) Complete the power-on of the auxiliary power supply.

Step 2: Close the circuit breakers for all high-Voltage control boxes (only required for the first startup, and then they should remain in the closed position). For the first power-on, manually close the breakers one by one.

Step 3: Close the isolation switches 1 and 2 in the main control cabinet.

Step 4: Observe and confirm that the battery system parameters are in a normal state.

The battery system power-on is complete.

⚠ WARNING	Before closing the circuit breakers for each battery cluster in the battery container, the PCS should be in standby mode.

5.2 Normal Power-Off

Powering down the Energy Storage System:

Step 1: Reduce the PCS power to 0. Verify on the BAMU or upper-level computer that both power and current are at 0, and confirm that the main positive and negative contactors are in the open state.

Step 2: Open isolation switches 1 and 2 in the main control cabinet.

Step 3: Manually open the circuit breakers of all high-Voltage control boxes in the battery compartment, one by one (if necessary), and press the button switches (if required) to confirm that the indicator lights are off.

Step 4: Power-off the battery container auxiliary power supply:

1) Open the UPS output switch between the main control cabinet and the AC cabinet, and confirm that the indicator light is off.

2) Press and hold the UPS (right side OFF) and the combination button (center position) for 10 seconds. After the UPS powers off, open the UPS input switch between the main control cabinet and the AC cabinet, and confirm that the indicator light is off.

3) Open the power supply switch for the liquid cooling unit (if necessary; normally it should remain closed), and confirm that the liquid cooling unit is powered off.

4) Open the air conditioning power supply switch in the main control cabinet - AC cabinet (if necessary; it can remain closed under normal conditions), and confirm that the air conditioning system is powered off.

5) Open the lighting power supply switch in the main control cabinet - AC cabinet.

6) Open the emergency lighting power supply switch in the main control cabinet - AC cabinet, and observe whether the emergency lights are lit (emergency lights being on is the normal state).

7) Open the main switch in the main control cabinet - AC cabinet, and confirm that the indicator light is off.

8) Complete the power-down of the auxiliary power supply.

The system power-off is complete.

5.3 Emergency Power-Off

5.3.1 Power-Off in Case of Fire Emergency

In the event of a fire, ensure the safety of personnel and equipment, then press the emergency stop button on the battery container door panel (as shown in the attached figure). Immediately contact the local fire department and the equipment manufacturer for professional assistance.

5.3.2 Emergency Power-Off Due to Fault

If a fault causes the need for an emergency shutdown, please contact our after-sales personnel promptly.

6 Fault List Description

DANGER

1) Personnel responsible for fault handling must be professionally trained, certified, and qualified to perform the tasks.
2) Unauthorized wiring measurements or equipment disassembly without prior permission from the company are strictly prohibited. Any resulting irreversible damage will not be covered under warranty conditions.

6.1 Alarm Information Page Common Fault List

Table6-1 Alarm Information Page Fault List

No.	Alarm Name	Alarm Level	Possible Cause	Recommended Action
1	High-voltage control box Over-temperature	Alarm Protection	1) High-voltage control box fan failure. 2) Abnormal 24V power supply.	1) Check if the fan power supply is normal. 2) Replace the fan.
2	Fire Alarm Host Fault	Alarm Display	1) Composite detector sensor failure. 2) Combustible gas detector sensor failure. 3) Composite detector sub-control valve failure.	1) Inspect the composite detector sensor in the fire protection system. 2) Check the combustible gas detector. 3) Inspect the sub-control valve of the composite detector. 4) Inspect the wiring.
3	1) Over-temperature during charging. 2) Over-temperature during discharging. 3) Excessive temperature difference.	Alarm Protection	1) Liquid cooling system not started. 2) Loose connection of aluminum busbar or copper bus joint. 3) NTC sensor failure. 4) Pipe leakage or insufficient coolant.	1) Inspect the cooling system. 2) Check connections of aluminum busbar and copper bus joint. 3) Troubleshoot teh NTC sensor. 4) Check pipelines and replenish coolant.
4	1) Under-temperature during charging. 2) Under-temperature during discharging.	Alarm Protection	1) Liquid cooling system heating not started. 2) NTC sensor failure.	1)Inspect the heating system 2) Troubleshoot the NTC sensor.
5	1) Over-current during charging. 2) Over-current during discharging.	Alarm Protection	1) Dispatch power too high, 2) Device aging or current sensing unit failure.	1) Set appropriate dispatch power. 2) Inspect the current sensing unit.
6	1) Cell over-voltage. 2) Module over-voltage. 3) Cluster over-voltage	Alarm Protection	Over-discharging.	1) Let stand for over 30 minutes. 2) Charge until voltage returns to normal.
7	1) Cell under-voltage. 2) Module under-voltage. 3) Cluster under-voltage.	Alarm Protection	Over-discharging.	1) Let stand for over 30minutes. 2) Charge until voltage returns to normal.
8	1) PCS communication fault. 2) EMS communication fault.	Alarm Protection	1) Communication line disconnection. 2) Incorrect wiring. 3) Incorrect address setting.	1) Inspect ports. 2) Reconnect communication lines. 3) Verify address settings.
9	PCS control fault	Alarm Protection	1) Communication line disconnection. 2) Incorrect wiring. 3) Communication interference.	1) Reconnect communication lines. 2) Replace communication lines. 3) Replace with shielded lines.
10	1) BMU communication fault 2) BAMU communication fault 3) BCMU overview fault	Alarm Protection	1) Communication line disconnection. 2) Incorrect wiring. 3) Control board failure. 4) Incorrect address setting.	1) Reconnect communication lines. 2) Replace communication lines. 3) Replace control board. 4) Verify address settings.
11	Leak Detection Controller Communication	Warning Display	1) Communication cable disconnected. 2) Incorrect wiring connection.	1) Reconnect the communication cable. 2) Replace the communication cable.
12	Contactor Adhesion	Alarm Protection	1) Mismatch between feedback voltage and detected voltage. 2) Contactor stuck in closed position.	1) Restart the BCMU or update the firmware. 2) Replace the contactor.
13	NTC Fault	Alarm Protection	Sampling Abnormality	1) Replace the BMU (Battery Management Unit). 2) Inspect, disassemble, and reassemble as needed. 3) Return for factory repair.

14	Main Controller Initialization Failure	Alarm Protection	Hardware fault.	1) Restart. 2) Replace BCMU.
15	Combustible Gas Low-Level Alarm	Alarm Protection	1) Incorrect threshold configuration. 2) Sensor malfunction.	1) Adjust the threshold settings. 2) Replace the gas sensor.
16	Combustible Gas High-Level Alarm	Alarm Protection	1) Incorrect threshold configuration. 2) Sensor malfunction. 3) Presence of gas leakage.	1) Adjust the threshold settings. 2) Replace the gas sensor. 3) Contact technical support.
17	System Water Shortage Warning	Warning Display	Coolant leakage detected.	Inspect the coolant circulation system for leaks, repair the leaks, and replenish the coolant.
18	1)1#Condenser High Pressure Alarm 2) 2#Condenser High Pressure Alarm	Warning Display	1) Severe condenser blockage due to dirt accumulation. 2) Excessively high ambient temperature. 3) Overcharging of refrigerant.	1) Flush the condenser until water discharge is clean. 2) Monitor and adjust the ambient temperature. 3) Release excess refrigerant.
19	Outlet Temperature Warning	Warning Display	1) Compressor, electronic expansion valve, circulating pump, or fan malfunction. 2) Operating fault. 3) Coolant leakage.	1) Inspect the compressor, electronic expansion valve, circulating pump, or fan condition. 2) Check for leaks, repair them, and replenish coolant.
20	Liquid Cooling Unit Communication Fault	Warning Display	1) Communication line disconnected. 2) Incorrect connection.	1) Check communication lines. 2) Replace the lines.
21	UPS Communication Fault	Warning Display	1) Communication line disconnected. 2) Incorrect connection. 3) UPS device or interface card damaged.	1) Check communication lines. 2) Replace the lines. 3) Replace the device or interface card.
22	Temperature and Humidity Sensor Communication Fault	Warning Display	1) Communication line disconnected. 2) Incorrect connection.	1) Check communication lines. 2) Replace the lines.
23	Fire Protection Communication Fault	Warning Display	1) Communication line disconnected. 2) Incorrect connection.	1) Check communication lines. 2) Replace the lines.
24	EMS Communication Fault	Alarm Protection	1) Incorrect IP address. 2) Misconnection at the communication port.	1) Verify the IP address. 2) Check the communication port.
25	BAMU Communication Fault	Warning Display	1) Communication line disconnected. 2) Incorrect connection.	1) Check communication lines. 2) Replace the lines.
26	Single Fire Alarm Signal	Warning Display	1) Terminal block wiring error. 2) Dust accumulation in smoke detector. 3) Airflow disturbance around the smoke detector. 4) Smoke/thermal detector damaged.	1) Check terminal block wiring. 2) Clean dust from the detector. 3) Adjust the installation position. 4) Replace the detector.
27	Water Immersion Alarm	Warning Display	Water Ingress in the Enclosure	Inspect for the Source of Water Ingress

6.2 Common Operational Faults List

Table 6-2 Operational Faults List

No.	Fault Description	Possible Cause	Recommend Action
1	Main Contactor Not Engaged After Power-On	1) Pre-charge relay is open. 2) Pre-charge resistor is open. 3) Feedback signal line is loose.	1) Check the bus voltage on the display screen and ensure the load bus voltage is normal. 2) Verify if the load bus voltage rises during the pre-charge process. 3) Inspect the feedback signal line for proper connection.
2	BMS Cannot Communicate with PCS	1) Abnormal power supply to the device. 2) BAMU (Battery Management Unit) is not operational, or the signal line is disconnected. 3) PCS module failure.	1) Check whether the BAMU 24V power supply is functioning properly. 2) Verify that the signal transmission line is fully inserted and undamaged. 3) Check PCS data and operational status for abnormalities. 4) Inspect the PCS module for faults.
3	Unstable Communication Between BMS and PCS	1) Poor contact in external communication lines. 2) Communication lines placed too close to power lines. 3) Improper matching of terminating resistors.	1) Verify the integrity of the signal transmission lines. 2) Check for communication interference and implement shielding measures. 3) Inspect and replace the terminating resistor for proper matching.

4	Unstable Internal Communication in BMS	1) Loose communication cable connectors. 2) Duplicate BCMU (Battery Cluster Management Unit) addresses. 3) Incorrect terminating resistor.	1) Check for loose cable connections. 2) Verify BCMU addresses for duplication. 3) Inspect the bus terminating resistor (CAN bus resistance of 120Ω) for correctness.
5	System Does Not Operate After Power-On	1) Power supply circuit malfunction. 2) Wiring harness short circuit or open circuit. 3) No voltage output from UPS. 4) BMS system malfunction. 5) Emergency stop switch not reset.	1) Confirm that the external power supply meets the system's requirements for power, voltage, and frequency. 2) Check if the incoming power protection switch has tripped. 3) Verify if the UPS starts up normally. 4) Look for existing alarm states. 5) Ensure the emergency stop switch is reset to its initial position. 6) Use the display screen to verify if the BMS system is operational.
6	Incorrect Battery Current Data	1) Loose shunt sampling lines. 2) Shunt failure. 3) Data acquisition module malfunction.	1) Reconnect the shunt sampling signal lines. 2) Inspect the shunt for abnormalities. 3) Replace the data acquisition module.
7	System Reports Error After Relay Action	1)Disconnection of relay auxiliary contacts. 2) Relay contact sticking.	1) Re-plug the wiring harness. 2) Listen for relay operation sounds; replace the relay if necessary.
8	PCS Unable to Adjust Power for Charge/ Discharge	1) Abnormal communication between PCS and BMS. 2) Fault in the BMS system. 3) Power adjustment program not uploaded. 4) Unresolved alarm states.	1) Verify that the port and IP address are correct. 2) Check the communication line for faults. 3) Diagnose the BMS system for issues. 4) Re-upload the power adjustment program. 5) Restart the system after power off.
9	No BMS Data Displayed on the Screen	1)Abnormal connection between display and BMS communication line. 2) Display screen malfunction.	1) Ensure the display harness is connected properly and securely. 2) Check the operational status of the display screen. 3) Replace the display if needed.
10	Data Loss in Partial Battery Clusters	1) CAN bus connection is unreliable. 2) BCMU (Battery Cluster Management Unit) is not operating stably. 3) Interference sources are present.	1) Inspect connectors and wiring. 2) Replace the BCMU module. 3) Implement anti-interference measures.
11	Abnormal SOC Phenomenon: 1) SOC fluctuates significantly during system operation or alternates between specific values. 2) SOC deviates significantly during charging/ discharging. 3) SOC remains constant at a fixed value.	1) Current is not calibrated, or the current sensor is incompatible with the BCMU program. 2) The battery has not undergone deep charge/discharge cycles for an extended period. 3) Current sensor connection is incorrect. 4) Data acquisition module exhibits signal jumps, triggering SOC auto-calibration. Note: SOC calibration occurs under two conditions: ① Overcharge protection is triggered. ② Average cell voltage exceeds 3.4V. Poor battery consistency may prevent the second condition.	1) Update the main program or replace the current sensor. 2) Perform a deep charge/discharge cycle. 3) Replace the data acquisition module and manually calibrate the SOC. Recommend weekly deep charge/ discharge cycles. 4) Modify the main program to set accurate battery capacity and remaining capacity.
12	Over-voltage Shutdown Protection	1) Threshold parameters are improperly configured. 2) Sampling connector connection is unreliable. 3) BCMU/BMU operation is abnormal. 4) Signal jumps due to poor soldering of cells.	1) Verify and adjust threshold parameters. 2) Reconnect or reset connectors. 3) Monitor voltage data and allow system/cell voltage to drop to alarm recovery values. 4) Check BCMU/BMU operation. 5) Replace BCMU/BMU as needed.
13	Under-voltage Shutdown Protection (System/Cell Level)	1) Threshold parameters are improperly configured. 2) Battery sampling cable is disconnected. 3) Sampling connector connection is unreliable. 4) BCMU/BMU operation is abnormal. 5) Battery is over-discharged.	1) Verify and adjust threshold parameters. 2) Inspect and repair wiring harnesses. 3) Reconnect or reset connectors. 4) Monitor voltage data and charge the system/cells to alarm recovery values. 5) Reset BMU sampling and power connectors. 6) Check BCMU/BMU operation. 7) Recharge the battery.

14	Over-temperature Shutdown Protection During Charge/ Discharge	1) Threshold parameters are improperly configured. 2) System temperature exceeds protection limits. 3) Sampling connector connection is unreliable. 4) BMU operation is abnormal. 5) Poor soldering or loose connections in battery cells.	1) Adjust the threshold parameters. 2) Verify proper operation of the thermal management system. 3) Reset BMU sampling and power connectors. 4) Replace the BMU module. 5) Perform factory repair if necessary.
15	Under-temperature Shutdown Protection During Charge/ Discharge	1) System temperature is below protection limits. 2) Temperature sampling cable is disconnected or connector is unreliable. 3) BMU operation is abnormal.	1) Verify and adjust threshold parameters. 2) Reset BMU sampling and power connectors. 3) Verify the thermal management system operation. 4) Replace the BMU module.
16	Over-current Shutdown Protection During Charge/ Discharge	1) Threshold parameters are improperly configured. 2) Faulty acquisition device. 3) Excessive power dispatching.	1) Verify and adjust threshold parameters. 2) Replace the acquisition device. 3) Investigate and mitigate abnormal power conditions, then restart the system.
17	System Insulation Failure	1) Insulation monitoring is malfunctioning. 2) System leakage is detected.	Shut down the PCS and BMS remotely through the back-end and contact after-sales service.
18	SOC Display Abnormalities	1) SOC is uncalibrated. 2) SOC error has accumulated.	1) Re-calibrate the SOC. 2) Update the software program.

7 Routine Maintenance

7.1 Precautions Before Maintenance

DANGER

1) Do not perform battery box maintenance or open the battery box doors during rainy, humid, windy, or lightning weather conditions. Any damages caused under such circumstances will not be the responsibility of the company.
2) Avoid opening the battery box doors in rainy, snowy, or foggy weather with high humidity. After closing the doors, ensure the sealing strips around the battery box doors are not twisted or rolled.
3) To reduce the risk of electric shock, do not perform any maintenance or repairs outside the scope of this manual. For any additional maintenance or repair needs, please contact the company's after-sales service team.

7.2 Container Maintenance Items and Cycles

The following are recommended maintenance cycles; actual cycles should be adjusted based on the specific installation environment of the product.

Factors such as station size, installation location, and on-site conditions can all influence the maintenance schedule. If the operating environment is prone to heavy wind and sand or excessive dust, it is necessary to shorten the maintenance cycle and increase the frequency of maintenance.

WARNING

During maintenance or shutdown,the following conditions persisting for more than 120 consecutive hours will result in capacity loss that is no covered under the warranty:
1) The battery discharge voltage falls below the minimum battery voltage of 2.7V.
2) The State of Charge of any battery cluster drops to 5%

7.2.1 Daily Inspection

Table 7-1 Daily Inspection Items and Requirement

No.	Inspection Items	Requirement
1	External Inspection Batteries and Battery Management System	1. Check if there are any flammable materials on top of the container, whether there is debris accumulation, and whether there are any blockages in the door openings, ventilation, and heat dissipation areas around the container. 2. Ensure that the welding points between the container and the foundation steel plate are secure and free from corrosion. 3. Inspect for any damage, paint peeling, or oxidation on the container. 4. Ensure that the container doors and locks open and close smoothly. 5. Check for any cracks or settlement issues in the foundation of the container. 6. Equipment operation labels and cable markings should be clear and identifiable; the factory nameplates should be complete and legible. 7. No abnormal salt mist, vibration, or noise. 8. Ensure that the main and secondary circuit connections in the battery system are secure, free from corrosion, dust, or condensation. 9. Inspect batteries for physical damage, swelling, deformation, or leakage. 10. Ensure the battery rack grounding is intact, and that grounding flat bars are free from rust and looseness. 11. Verify that the batteries are not short-circuited and that the grounding and fuses are normal. 12. Ensure that the battery voltage and temperature collection lines are securely connected, and the inspection collection units are operating normally. 13. The Battery Management System (BMS) parameters should display correctly, with battery voltage and temperature within acceptable ranges, no alarm signals, and normal indicator lights. 14. Verify that the connecting cables and wiring between equipment are secure, with no looseness, damage, or signs of burning.

2	Battery Room or Battery Compartment	1. The appearance and structure of the battery room or compartment should be intact. 2. The temperature and humidity inside the battery room or compartment should be within the normal operating range for the batteries. Air conditioning/liquid cooling systems, ventilation, and other temperature control equipment should be functioning properly. 3. Lighting equipment should be in good condition, and there should be no unpleasant odors inside the room. 4. Ensure that measures to prevent small animals from entering the battery room or compartment are intact. 5. The video surveillance system should display normally. 6. The camera lights should be functioning correctly, and the cameras should rotate properly. 7. Signal and power cables should be securely installed, with no looseness. 8. Check for any aging or damage to the door seals. 9. All internal equipment must be reliably grounded. 10. Ensure there is no rust, water leakage, or corrosion inside the equipment.
3	Fire Protection System	1. Fire alarm control panel indicators should display normally, without abnormal alarms. Backup power supply must be operational. 2. Fire safety signage must be clear and intact. 3. Emergency evacuation indicators must be clear, evacuation pathways must remain unobstructed, and emergency lighting must function properly. 4. Fire extinguishing equipment must be in good condition, with normal pressure, and pass testing. 5. Firefighting boxes, buckets, shovels, and axes must be intact, clean, and free from rust or damage. 6. Fire alarm system triggering devices must be securely installed, appear intact, and have operational status indicators functioning properly. 7. Fireproof barriers within cable trenches must be intact, walls undamaged, and tightly sealed. 8. Water-based fire protection interfaces must be free from rust and blockage.
4	Temperature Control System	1. Temperature control system must operate normally without abnormal noise or vibration, and maintain indoor temperature and humidity within the set range. 2. Air filters (internal and external) should be clean and intact. 3. Pressure and coolant temperatures within the system must be normal. 4. Pipe connections and joints must be secure, with no looseness, leakage, or water shortage alarms.

7.2.2 Routine Maintenance Cycle

Table 7-2 Storage System Maintenance Items and Recommendations

No	Maintenance Items	Requirement	Suggested Maintenance Cycle
1	Container	1)Perform comprehensive cleaning of the container's roof and surrounding areas.	≤ 6 months
		2)Inspect door panel seals for aging and replace if necessary.	≤ 12 months
		3)Sand and repaint areas with peeling paint or corrosion.	≤ 6 months
2	Battery and Battery Management System	1)Thoroughly clean battery packs and battery racks.	≤ 12 months
		2)Inspect and tighten bolts at all connection points.	≤ 12 months
		3)Verify operation of smoke and temperature detectors inside battery PACKs or containers.	≤ 6 months
		4)Perform periodic balancing maintenance for lithium-ion batteries.	≤ 12 months
		5)Charge and discharge batteries stored at low charge regularly.	≤ 6 months
		6)Inspect electrolyte circulation systems, thermal management systems, and stacks of flow batteries for corrosion or leaks.	≤ 6 months
		7)Regularly read, save, and update the software for battery management system data.	≤ 6 months
		8)Check fiber optic connections and address any issues promptly.	≤ 12 months
3	Air Conditioning System	1)Regularly inspect and replenish air conditioning coolant.	≤ 6 months
		2)Clean air conditioning filters.	≤ 12 months
4	Fire Protection System	Conduct annual inspections by qualified professionals in coordination with equipment manufacturers.	≤ 12 months

7.2.3 Battery Maintenance

1) Maintenance Precautions

To safely and effectively maintain the system, personnel must carefully review and adhere to the following safety requirements:

a.Personnel must possess an electrician certificate issued by the safety supervision bureau and undergo professional training before performing maintenance tasks.

b. Comply with relevant safety precautions, use necessary tools, and wear personal protective equipment (PPE).

c. Do not wear metal accessories such as jewelry or watches during maintenance work.

d. Under no circumstances should both hands simultaneously touch the high-voltage positive and negative terminals of the energy storage system.

e. Before performing maintenance on the energy storage system, disconnect all high-voltage and low-voltage switches.

f. During cleaning operations, direct water washing is strictly prohibited. Use a vacuum cleaner for cleaning if necessary.

g. When connecting or disconnecting cables, handle them carefully and avoid brute force or violent actions.

h. After maintenance, promptly clean up tools and materials, and check for any metallic objects left inside or on top of the equipment.

i. If there are any doubts about the operation or maintenance of the equipment, contact the company’s after-sales personnel. Unauthorized operations are strictly prohibited.

2) Equipment Maintenance

To ensure the safe and effective maintenance of the system, maintenance personnel must carefully read and adhere to the following safety requirements:

a. Maintain an ambient temperature between 0°C and 45°C.During charge/discharge operations, the temperature should ideally be controlled between 15°C and 30°C, with 25°C as a typical value.

b. Avoid high-rate charge/discharge operations for battery packs (PACKs). The continuous charge/discharge current for individual PACK should not exceed the rated value.

c. For long-term idle systems, perform a charge/discharge cycle every 6 months to adjust the system's SOC to 50%-60%. Ensure SOC consistency across the system after recharging.

d. Before first use after prolonged storage, fully charge the system at least once to restore

the battery's optimal performance.

e. Regularly check the ventilation system for blockages, and clean the system, especially the air inlet and outlet of the fans. Use a vacuum cleaner for cleaning if necessary. Power must be turned off before cleaning. Water washing is strictly prohibited.

f. Periodically check the fastening bolts of the high-voltage cables and connection rows of the battery storage system for looseness, good contact, and serious rust or oxidation on the terminal surfaces.

g. Check PACK positive and negative connectors regularly for aging or damage.

h. Inspect cables periodically for looseness, aging, damage, breaks, or poor insulation.

i. Check for any pungent odors inside the container and any signs of burning smells at high-voltage connection points.

j. Regularly monitor system voltage, temperature, and other data through the monitoring system. Check for abnormal alarms.

k. Ensure that system status and alarm indicator lights are functioning properly during inspections.

l. Test the emergency stop switch regularly to ensure it is effective and can quickly stop the system in emergencies.

m. Inspect fire extinguishing devices to ensure they are in good condition and within their valid period.

n. The use of different types of battery modules in series or parallel is strictly prohibited.

7.2.4 Firefighting Equipment Regular Maintenance Schedule

Table 7-3 Firefighting Equipment Regular Maintenance Schedule

No.	Item List	Maintenance Cycle
1	Controller Product	1) Check the fire control main unit power supply monthly. 2) Monthly inspection of the fire control main unit. 3) Perform 1-2 charge/discharge tests on the backup power supply quarterly and 1-3 automatic switch-over tests between main and backup power.
2	Composite Detector	1) To maintain the fire detectors' performance, clean all detectors every three years after they have been in operation for two years. 2) Test all fire detectors quarterly through sampling.
3	Input/Output Modules	At least one test per year after installation or during usage.
4	Gas Release Alarm	At least one test per year.
5	Fire Alarm Horns and Lights	At least one test per year.
6	Emergency Start/Stop Button	At least one test per year during use.
7	Smoke,Temperature, and Fire Detectors	1) Clean detectors at least once every two years to ensure proper system operation. 2) Perform a simulated fire test every six months to check if detectors are functioning correctly.

8	Combustible Gas Detectors	1) Inspect detectors weekly to ensure normal display, secure installation, and proper ventilation at the inlet. 2) Clean intake vents quarterly (turn off power before cleaning). If vents are severely blocked, contact the company's after-sales service. 3) Calibrate or test detectors annually through a certified organization. Note: Hydrogen gas detectors should be replaced every three years.
9	FM-200 Fire Suppression System	1) Regular maintenance is required; maintenance personnel should be familiar with the system's principles and performance, and keep records. 2) Inspect weekly, ensuring the pressure drop does not exceed 10% of the working pressure. 3) Inspect components quarterly. 4) Perform a comprehensive system inspection and maintenance annually. For detailed procedures, refer to the fire system maintenance manual.

Note: For detailed procedures, please refer to the Fire System Maintenance Manual.

7.3 Liquid Cooling System Maintenance

The following are recommended maintenance cycles. Actual cycles should be adjusted according to the specific installation environment.

Factors such as plant size, installation location, and site conditions will affect the maintenance schedule. If the environment is dusty or prone to heavy wind and sand, it is necessary to shorten the maintenance cycle and increase frequency.

Table 7-4 Liquid Cooling System Maintenance

Maintenance Item	Maintenance Content	Inspection Method	Maintenance Tools
Fan	1) Check if the fan blades rotate normally. 2) Check if the blades are damaged.	1) Ensure the fan blades rotate smoothly without abnormal noise. 2) Check that the blades are undamaged.	Long-handle screwdriver
Water Pump	1) Check if the heat dissipation intake holes are clogged more than 5%. Clean with a brush if necessary. 2) Visually inspect the pump body (excluding the pipe connections) for any leakage (except condensation). If leakage occurs, replace the pump seal.	1) Ensure the pump operates smoothly without abnormal noise. 2) Check that there are no visible leaks (except condensation).	Brush
Water System	Check high and low pressure values through BAMU: High pressure 2.8 bar, Low pressure 0.2 bar. 1) If high pressure exceeds 2.8 bar, check if the water system filter is clogged. 2) If low pressure is below 0.2 bar, refill the water system.	1) High pressure > 2.8 bar. 2) Low pressure < 0.2 bar.	Water pump Water pipe Clamp Flathead screwdriver Phillips screwdriver

Table 7-5 Liquid Cooling System Maintenance Items and Cycles

Item to be Replaced	Replacement Standard	Cycle	Tools
Coolant	1) Presence of visible impurities in the coolant. 2) Color of coolant changes from pink to dark red. Note: Contact the company's after-sales service for coolant selection.	5-6 years	Water pump Hose Hose clamp Flathead screwdriver
Pipeline pressure retention to prevent leakage	1)In the shutdown state of the liquid cooling unit, close all exhaust valves, liquid injection ports, water tank inlet ports, drainage ports, and fill ports. Open the ball valve for the primary water inlet and outlet pipelines. 2) Open the inlet valve, connect the pressure gauge, and use the air compressor to perform pressure retention on the primary pipeline at 350 kPa for 60 minutes, and on the secondary pipeline at 250 kPa for 60 minutes. A pressure drop of ±10 kPa will indicate successful air-tightness testing.	Pre-fluid replacement pressure retention	Pressure Gauge Air Compressor

Pipeline Vacuuming	In the shutdown state of the liquid cooling unit, open the inlet valve, connect the pressure gauge and vacuum gauge, and use a vacuum pump to evacuate the pipeline. When the vacuum gauge shows a negative pressure of ≤-900 kPa and the pressure gauge shows a pressure of ≤-50 kPa, the vacuum process is complete.	Pre-liquid change vacuuming	Vacuum pump, pressure gauge, pressure meter
Refilling	1)In the shutdown state of the liquid cooling unit, connect the water pipe to the filling port and the glycol container, open the filling port valve, and allow the coolant to be drawn into the pipeline by negative pressure. Stop filling when there is no negative pressure in the pipeline. 2)Replace the filling pump in the filling pipe, open the cluster exhaust valves (7 in total), open the main exhaust valve (1 in total), and open the pressure relief valve to inject coolant into the internal box. After the injection pressure reaches 1.0–1.2 kPa, stop the filling pump. 3)Open the inlet valve of the replenishment tank, turn the red knob of the filling port counterclockwise. When the sound of water is heard, it confirms that the replenishment tank is being filled. Stop filling when the transparent measuring tube reaches half full. 4)Start the exhaust for the liquid cooling unit. Once the outlet pressure drops below 1.8 kPa, stop the liquid cooling unit operation. Then, reapply pressure through the filling pump and stop when the static pressure reaches 1.1–1.2 kPa. Repeat the above steps. 5)Open the inlet valve of the replenishment tank again, turn the red knob of the filling port counterclockwise. When the sound of water is heard, it confirms that the replenishment tank is being filled. Stop when the transparent measuring tube is filled to two-thirds of its capacity. 6)When the operating outlet pressure remains between 1.8–2.5 kPa and the static outlet pressure is between 1.1–1.2 kPa, close the filling valve, stop the filling, and remove the pipeline and filling equipment. 4o mini	Refilling during fluid replacement	Filling pump

Note: For details, please refer to the Liquid Cooling Unit Operation and Maintenance Manual.

7.4 Maintenance of the Container

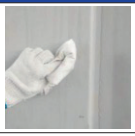
7.4.1 Cleaning the External Surface of the Container

It is recommended to clean the top first, followed by the sides. Cleaning can be done directly or by rinsing with water.

Situation 1: Surface dirt caused by water stains and dust can be cleaned thoroughly.

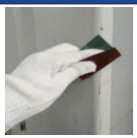
Maintenance Materials: Cloth, water, alcohol, or other non-corrosive cleaning agents.

Table 7-6 Steps for Cleaning the Exterior Surface of the Container

Illustration	Maintenance Step
	1) Use a cloth (or other cleaning tool) dipped in water to wipe the soiled areas on the surface. 2) If water alone cannot clean the surface adequately, use 97% alcohol to scrub until the surface cleanliness reaches an acceptable level (non-corrosive cleaning agents commonly used locally can also be considered).

Scenario 2: Surface dirt and paint damage, leaving marks that cannot be cleaned completely.

Table 7-7 Maintenance Steps for Irremovable Dirt on the Exterior Surface of the Container

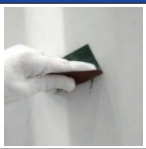
Illustration	Maintenance Step
	1) Use sandpaper to sand the areas with peeling paint or scratches, ensuring the surface is smooth.
	2) Use a cloth dampened with water or 97% alcohol to clean the damaged areas and remove surface stains.
	3) Once the surface is dry, use a soft-bristle brush to touch up the scratched areas with paint, ensuring the coating is applied evenly and consistently.

Maintenance Materials:Sandpaper, cloth, water, alcohol, brush, paint.

Case 3: Primer Damage with Exposed Substrate.

Maintenance Materials:Sandpaper, cloth, water, alcohol, zinc-rich primer, brush, paint.

Table 7-8 Maintenance Steps for Exposed Substrate Due to Damaged Primer

Illustration	Maintenance Step
	1) Use sandpaper to polish the damaged areas of the paint, removing rust and other burrs from the surface to make it smooth.
	2) Use a cloth dampened with water or 97% alcohol to clean the damaged areas, removing dirt and dust from the surface.
	3) After the surface is dry, apply zinc-rich primer to the exposed base material for protection. Ensure the primer fully covers the exposed material.
	4) Once the primer is dry, use a soft brush to repaint the damaged areas. The paint application should be uniform and consistent.

NOTE	It is necessary to inspect the protective paint coating on the shell of the energy storage integration system for signs of peeling or chipping. If such issues are identified, promptly repair them. The entire exterior of the energy storage integration system should be re-coated with specialized protective paint every 5 years.

7.4.2 Check Door Locks and Hinges

After cleaning, the door locks, hinges, and other components of the battery box should be checked for proper functionality and condition.

If necessary, lubricate the lock holes, hinges, and other parts appropriately.

7.4.3 Check Seals

Seals in good condition are crucial for preventing water ingress into the container. They should be thoroughly checked, and if damaged, they should be replaced immediately.

7.5 Electrical Maintenance

7.5.1 Environmental Conditions

Energy storage products should be installed and stored in environments that avoid high corrosive, high dust, high temperature, or high humidity conditions. Particularly, avoid the entry of metals or small animals into the main control cabinet, high-voltage control box, or battery packs.

7.5.2 Cable Connections

Regularly check the insulation of connection cables for signs of aging. Inspect cable connection points for looseness, corrosion, blackening, or other issues.

7.5.3 Check Electrical Components

The cabinet and electrical component surfaces inside the container should remain clean, or a professional electrical dusting service should be applied.

Switch devices should function properly to open or close as needed.

Warning labels and signal indicators should display correctly.

Appendix

A Crimping OT/DT Terminal

A.1 OT/DT Terminal Requirement

1)When using copper core cables, please use copper terminals.

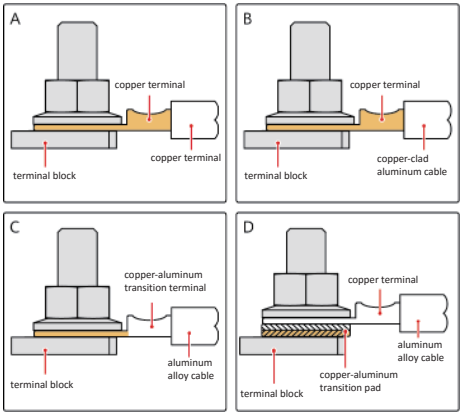
2)When using copper-clad aluminum cables, please use copper terminals.

3)When using aluminum alloy cables, please use copper-aluminum transition terminals or aluminum terminals with copper-aluminum transition pads.

NOTE

1)It is strictly prohibited to connect aluminum terminals directly to terminal blocks, as this can cause galvanic corrosion, affecting the reliability of cable connections.
2)When using copper-aluminum transition terminals or aluminum terminals with copper-aluminum transition pads, they must comply with IEC 61238-1 requirements.
3) When using copper-aluminum transition pads, pay attention to their orientation. Ensure that the aluminum side contacts the aluminum terminal, while the copper side contacts the terminal block.

Figure A1.1 OT/DT Terminal Requirement

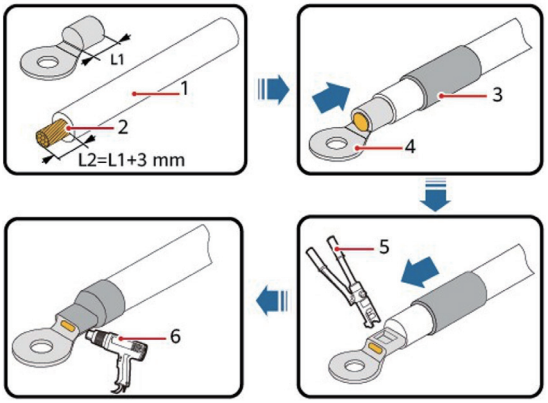


A.2 OT/DT Terminal Crimping

NOTE

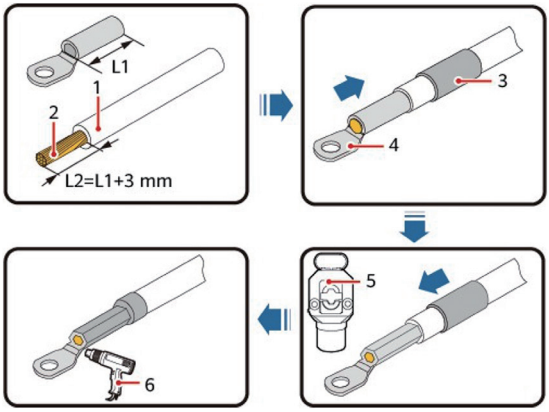
1)When stripping the wire, avoid damaging the conductor strands.
2)The cavity formed by crimping the conductor section of OT/DT terminals should fully enclose the conductor strands, ensuring a tight and secure connection without looseness.
3)The crimped section can be covered with heat shrink tubing or insulated tape.
4)During the use of a heat gun, take protective measures to prevent equipment from being scorched.
5)For cables larger than 50 mm², consider applying electrical conductive grease on the contact surface between the terminal block and the copper terminal to reduce contact resistance and enhance oxidation and corrosion resistance.
6)Use a hydraulic crimping tool with undamaged, defect-free jaws, ensuring a standard crimping height. The crimp shape should be hexagonal, and the crimping strength should meet the pull-out force standard specified in Table A2.1.

Figure A2.1 Crimping OT Terminal



(1)→Cable
(2)→Conductor
(3)→Heat Shrink Tubing
(4)→OT Terminal
(5)→Hydraulic Crimping Tool
(6)→Hot Air Gun

Figure A2.2 Crimping DT Terminal



(1)→Cable
(2)→Conductor
(3)→Heat Shrink Tubing
(4)→OT Terminal
(5)→Hydraulic Crimping Tool
(6)→Hot Air Gun

Table A2.1 Pulling Force Standards

No.	Conductor Size		Pull-out Force Standard
	AWG	mm²	N
1	26	0.13	13
2	24	0.2	22
3	22	0.324	35
4	20	0.519	50
5	18	0.823	80
6	16	1.31	150
7	14	2.08	180
8	12	3.31	270
9	10	5.261	400
10	8	8.367	500
11	6	13.3	550
12	4	21.15	1500
13	3	26.67	1650

No.	Conductor Size		Pull-out Force Standard
	AWG	mm²	N
14	2	33.62	2050
15	1	42.41	2200
16	1/0	53.49	2700
17	2/0	67.43	2700
18	3/0	85.01	2700
19	4/0	107.2	2700
20	250kcmil	127	2700
21	300kcmil	156	5000
22	350kcmil	177	5000
23	400kcmil	203	5000
24	500kcmil	253	5000
25	600kcmil	304	5000

Note: For national standard cables, choose the closest conductor size value, and the use of the difference method is allowed.

B How to Touch Up Paint

B.1 Precondition

1) It is strictly prohibited to perform touch-up painting in adverse weather conditions such as rain, snow, strong winds, or sandstorms, especially when outdoors without shelter.

2) Paint that meets the required specifications has been prepared according to the color sample provided at the time of shipment.

B.2 Touch-Up Painting Instruction

The appearance of the equipment should remain intact. If there is any paint loss, touch-up painting should be performed immediately.

NOTE	Note Symbol Used to highlight important or key information, best practices, and tips. "Note" is not a safety warning and does not pertain to personal, equipment, or environmental hazards

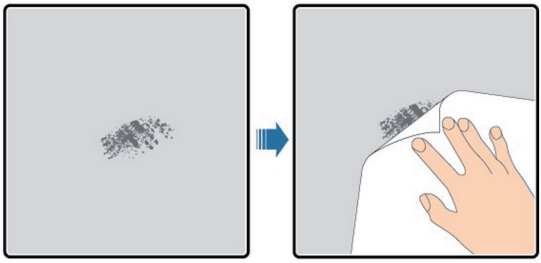
Appendix B2.1 Touch-Up Instructions

Paint Damage Level	Tools and Materials	Operation Step	Note
Light Scratches (Without exposing the steel base material)	1)Cotton Cloth 2)Fine Sandpaper 3)Anhydrous Ethanol 4)Hand Spray Paint or Paint 5)Paintbrush (for small areas) 6)Spray Gun (for large areas)	Reference B.3 Operation Steps	1) The topcoat (acrylic paint) color should match the color sample provided at the time of shipment, along with the Pantone number specified on the sample. 2) For minor scratches, small stains, or rust, hand spray paint or brushing is recommended. 3) For large scratches or large stains/rust, a paint spray gun should be used for spraying. 4) The paint film should be as thin and even as possible, avoiding liquid droplets, and ensuring a smooth surface. 5) The touch-up surface can be further processed after approximately 30 minutes of drying.
Stains, Rust (Unable to wipe off)			
Deep Scratches (Exposing the steel base material)	1)Cotton cloth 2)Fine Sandpaper 3)Anhydrous Ethanol 4)Zinc-rich primer 5)Hand Spray Paint or Paint 6)Paintbrush (for small areas) 7)Spray Gun (for large areas)	Reference B.3 Operation Steps	
Logo and Pattern Damage	For logo and pattern damage, provide the logo size and color code, and consult a local advertiser to develop a repair plan based on the logo size, color, and extent of damage.		
Impact Dents	1)If the impact area is less than 100mm² and the depth is less than 3mm, use unsaturated polyester resin putty (Poly-Putty base, "atom gray") to fill it in, then follow the deep scratch touch-up procedure. 2) If the impact area is larger than 100mm² or the depth is greater than 3mm, consult a local supplier for a tailored repair plan.		

B.3 Operation Step

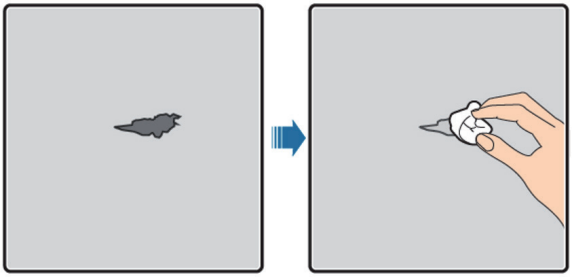
Step 1: Lightly sand the damaged area with fine sandpaper to remove dirt or rust.

Figure B3.1 Sanding the coating damage with fine sandpaper



Step 2: Moisten a cotton cloth with anhydrous ethanol and wipe the sanded or repair area to remove surface dirt and dust, then dry with a clean cotton cloth.

Figure B3.2 Treating the coating damage with anhydrous ethanol



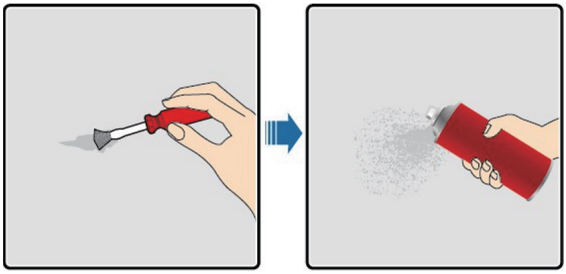
Step 3: Apply a zinc-rich primer to the damaged coating area using a paintbrush or spray gun.

NOTE	1) If the repair area has exposed the substrate, first apply an epoxy zinc-rich primer until the paint dries and the substrate is no longer visible, then apply the acrylic topcoat. 2) Choose an epoxy zinc-rich primer or, depending on the color of the equipment's surface coating, select the corresponding color of the acrylic topcoat.

Step 4: Depending on the extent of the paint damage, choose one of the following methods—spray paint, brush paint, or spray gun—to evenly touch up the damaged coating until no trace of the coating damage is visible.

NOTE	1) Ensure that the brush-applied paint film is as thin and even as possible, avoiding liquid droplets, and keeping the surface smooth. 2) For equipment with different colored patterns, cover the areas with other colors using tape and white paper before touch-up painting to prevent contamination of other colored areas during the touch-up process.

Figure B3.3 Touching up the coating damage on the equipment.



Step 5: After brushing the paint, leave it for approximately 30 minutes, then observe whether the touch-up area meets the requirements.

NOTE

1) The touch-up area should match the color of the surrounding area. Use a colorimeter to measure the color difference, ensuring that the color difference ΔE ≤ 3. If a colorimeter is not available, ensure that there are no obvious edges between the repainted area and the surrounding area, and that the paint is free from bumps, scratches, peeling, or cracks.
2) For spray painting, it is recommended to apply three coats first, then assess whether the result meets the requirements. If it does not, repeat the spraying process until the requirements are met.

B.4 Paint Resource

Appendix B4.1 Equipment Paint Requirement

Type	Paint Requirement	Specific Requirement
1	Primer Thickness	60μm
2	Intermediate Coat	120μm
3	Topcoat Thickness	60μm
4	Primer Type	Epoxy Zinc-rich Paint
5	Intermediate Coat Type	Zinc-rich Paint
6	Topcoat Color Code	Obtain the color code from the color sample provided with the shipment

NOTE

The following is a list of available paint models. This list may be updated periodically and is for reference only. Paint prices and technical services are subject to local pricing standards.

Appendix B4.2 Paint Model Reference List

Supplier	Location	Paint Model
Hempel	Equipment Exterior Coating	Pre-treatment Zinc-rich Primer: HEMPADUR ZINC (shopprimer) 1536C/19830 Full Zinc-rich Primer: HEMPADUR ZINC (on line) 1536C/19830 Intermediate Coat: HEMPADUR FAST DRY 15560/12170 Topcoat: HEMPATHANE 55210/17630 (RAL9003)
	Marking Paint	Red: HEMPATHANE 55210/57200 (RAL3020) Black: HEMPATHANE 55210-19990 (RAL9005)
CMP		Pre-treatment Zinc-rich Primer: EPICON ZINC SC B-2 M (SHOP PRIMER) Full Zinc-rich Primer: EPICON ZINC SC B-2 M (ON LINE ZINC) Intermediate Coat: EPICON SC PRIMER GREY CSC-9107 Topcoat: UNYMARINE SC FINISH WHITE CSC-9205 (RAL9003)
	Marking Paint	Red: UNYMARINE SC MARKING RAL-3020 Black: UNYMARINE SC MARKING RAL-9005

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