PA-3.0EU
Energy Storage System
User Manual

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Introduction

Overview

This document provides guidance on the installation, electrical connection, commissioning, and troubleshooting methods for the PA-3.0EU energy storage system (hereinafter referred to as the "ESS "). Prior to installation, operation of the energy storage system (ESS), please read this manual carefully, ensuring comprehension of the safety information and familiarity with the system's functions and features.

Users

This manual applies to operators of the energy storage power station and qualified electrical technical personnel.

All installation and related operations must only be carried out by professional technical personnel. Professional technical personnel shall meet the following requirements:

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

Symbol Convention

In this document, the following symbols may be used with the meanings described below.

Symbol	Description
DANGER	It indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.
WARNING	It indicates a hazard with a moderate level of risk that, if not avoided, could result in death or serious injury.
CAUTION	It indicates a hazard with a low level of risk that, if not avoided, could cause minor or moderate injury.
BEWARE	It is used to convey warning information related to equipment or environmental safety. If not avoided, it may result in damage to equipment, loss of data, degradation of equipment performance, or other unpredictable consequences. The "BEWARE" symbol does not refer to personal injury.
NOTE	It is used to emphasize important/critical information, best practices, and tips. The "NOTE" symbol is not a safety warning and

	does not refer to personal injury, equipment damage, or environmental hazards.

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1 Safety Precautions

1.1 General Safety

Declaration

Please thoroughly read this manual before installing, operating, and maintaining the equipment, and follow the markings present on the equipment, as well as all safety precautions outlined in this manual.

The "BEWARE", "CAUTION", "WARNING", and "DANGER" instructions contained in this manual do not cover all safety considerations that need to be observed, but are only intended to supplement all safety precautions. WHES disclaims any liability for damages resulting from failure to comply with general safe operation requirements or from violation of safety standards applicable to the design, production, and use of the equipment.

This equipment must be used in an environment that meets the design specifications, otherwise the equipment may fail, resulting in equipment malfunctions, component damage, personal safety accidents, property losses, etc., which are not covered by the quality warranty.

Be sure to install, operate and maintain the equipment in accordance with local laws, regulations, and specifications. The safety precautions contained in this manual are intended only to supplement local laws and regulations.

WHES shall not be held liable in any of the following circumstances:

- Installing or operating the equipment in an environment that exceeds applicable international, national, or local standards;
- Failure to operate the equipment under the conditions specified in this manual;
- Unauthorized disassembly, modification of the product or alteration of the software codes;
- Failure to operate the equipment in accordance with the operating instructions and safety warnings present on the product or outlined in the document;
- Damage to the equipment caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, mudslide);
- Damage caused by the customer's failure to comply with transport and installation requirements;

- Damage caused by storage conditions not meeting the requirements specified in the product document;
- Damage to the hardware or data of the equipment due to customer negligence, improper operation or intentional damage;
- Damage to the system caused by third parties or customers, including relocation and installation of the system not in accordance with the requirements of this manual, and adjustment, modification, or removal of identification marks not in accordance with the requirements of this manual;
- Defects, failures or damage caused by acts, events, negligence or accidents beyond the reasonable control of the Seller, including power outages or electrical failures, theft, war, riots, civil commotion, terrorism, intentional or malicious damage, etc.

General Requirements

DANGER

The equipment operates at high voltages and improper handling poses a risk of electric shock or fire, which may cause death, serious injury, or substantial property damage. Always operate according to instructions:

- Follow the operating procedures and safety precautions described in this manual and other relevant documents.
- Follow warning labels, cautions, and protective measures affixed to the equipment.
- Use the correct tools as specified in this manual and be proficient in their proper use.
- Comply with the safety regulations of the power plant, such as implementing the operation ticket and work ticket system.
- No one except the operator is allowed to access the equipment. Temporary warning signs or fencing must be erected to isolate the area during operation of the equipment.
- All warning labels, cautions, and protective measures affixed to the equipment shall remain legible. Unauthorized alteration, damage, or obstruction of such safety information is strictly prohibited. Any illegible markings shall be replaced in a timely manner.
- Do not perform installation, wiring, maintenance and replacement operations while the equipment is powered on.
- Do not clean the electrical components inside the equipment with water.
- Check the equipment for damage, such as holes, dents or other signs of possible internal damage.
- Check that the pre-installed cables of the equipment are securely connected.

- Check that the equipment is free from displacement of internal components, or unauthorized modification of internal structure and installation procedures.
- Do not power on the equipment until it has been installed or approved by qualified personnel.
- Measure the voltage at the contact point before touching any conductor surface or terminal, and ensure that the protective grounding conductor of the equipment or parts to be repaired is securely grounded to eliminate electric shock risk
- Immediately press the EMERGENCY STOP switch and notify the on-site management if any liquid ingress is detected in the equipment.
- Do not open the cabinet door while the system is operating.
- It is recommended to wear Level 1 arc-resistant clothing when powering on the equipment for the first time or working in the live main-circuit area.

⚠CAUTION

- Do not perform arc welding, drilling, or cutting operations on the equipment. Such operations may compromise enclosure sealing, electromagnetic shielding, and internal components or cables. Metal debris generated during these operations may cause short circuits, impairing equipment functionality or leading to damage.
- The casing temperature is elevated during operation of the equipment, posing a risk of burns. Avoid physical contact with the equipment.
- If, during operation of the equipment, a fault is detected that may cause personal injury or damage to the equipment, stop operation immediately, notify the person in charge, and take effective protective measures.
- Evacuate the area immediately if an audible/visual fire alarm is activated.
- Close and lock the cabinet door if the equipment has to be left temporarily unattended during the maintenance procedure.

BEWARE

- All transport, transit, installation, wiring, and maintenance activities must comply with the applicable laws, regulations, and standards of the country/region where the work is performed.
- The materials to be prepared by the user and the tools required during operation must comply with the applicable laws, regulations, and standards of the country/region where the work is performed.
- Permission from the local power authority must be obtained before the equipment is connected to the grid.
- Before opening the cabinet door during installation, operation, and maintenance, be sure to remove any accumulated water, snow, or other debris from the top of the enclosure to prevent debris from falling into the enclosure.

NOTE

- It is prohibited to reverse engineer, decompile, disassemble, dismantle, adapt, implant, or perform other derivative operations on the equipment software. It is not allowed to research the internal implementation of the equipment, obtain the source code of the equipment software, or steal intellectual property rights in any way, nor is it allowed to disclose the results of any performance tests of the equipment software.
- It is recommended that users prepare video recording devices to document the detailed process of installation, operation, and maintenance of the equipment.

1.2 Personnel Requirements

All operations related to hoisting and transportation, installation and wiring, operation, and maintenance of the ESS must be performed by professional technical personnel in compliance with local regulations. Operating personnel shall meet the following requirements:

- Possess basic knowledge of electronics, electrical wiring, and mechanical systems, and be familiar with electrical and mechanical schematics.
- Be familiar with the structure and working principles of the ESS, as well as the structure and working principles of the cabinet and its upstream and downstream equipment.
- Have received professional training related to electrical equipment installation and commissioning.
- Have the ability to respond to emergencies and hazardous situations during installation or commissioning.
- Be familiar with the relevant standards and regulations of the country/region where the project is located.
- Wear personal protective equipment (PPE) in compliance with local safety protection requirements when operating the equipment.

NOTE

Local regulations and industry standards shall be consulted for specific qualification requirements.

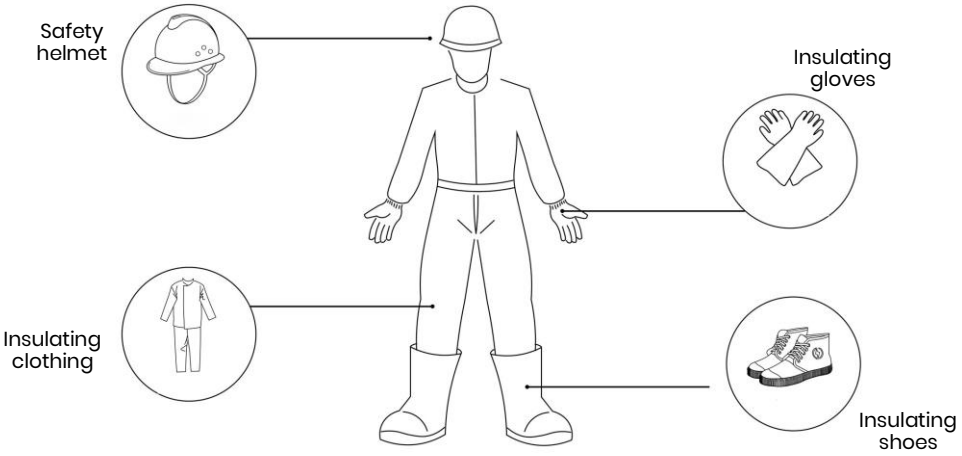


Figure 1-1 Illustration of PPE

- Do not wear watches, bracelets, bangles, rings, necklaces, or other conductive items during installation, operation, or maintenance to prevent electric shock and burns.
- All transport, transit, installation, wiring, and maintenance activities must comply with the applicable laws, regulations, and standards of the country/region where the work is performed.
- It is important to ensure a comprehensive understanding of the construction and working principles of the entire ESS, and conduct all activities in accordance with the instructions provided in this manual.

1.3 Storage and Installation Environment Requirements

General requirements

NOTE

- To prevent condensation inside the energy storage system cabinet or water immersion at the bottom of the cabinet during rainy seasons, the system base must be elevated. The specific elevation height should be determined reasonably according to site geology, weather conditions, and other factors.
- Store the energy storage system on a dry, level, sturdy platform with sufficient load-bearing capacity and free of any vegetation. The storage surface must be flat, free of standing water, bumps, or unevenness. The top surface of the foundation should be on the same horizontal plane, with a level deviation of 0–10 mm.
- Before storage, ensure that all cabinet doors and internal equipment doors of the energy storage system are securely locked.
- System storage ambient temperature: -25℃ to +55℃; recommended storage ambient temperature: average temperature ≤25℃.
- Long-term storage of batteries can lead to capacity degradation, so prolonged storage of batteries is not recommended. Even when stored at the recommended optimal temperature, batteries will experience irreversible capacity loss over time due to calendar aging. The longer the storage period, the greater the irreversible degradation. Refer to the technical agreement for specific degradation values.
- Storage environment relative humidity: 5%RH–95%RH, without condensation.
- Ensure effective protection of the system's air inlet and outlet, and take measures to prevent rainwater, dust, and other contaminants from entering the system.
- Conduct regular inspections at least once every two weeks. Check that packaging is intact and free of damage, and prevent damage from insects or rodents. Replace any damaged packaging immediately. Inspect the cabinet and all internal equipment for integrity.
- Before installing long-term stored energy storage systems, visually inspect the cabinet and internal equipment by opening the doors to ensure they are undamaged. Additionally, power on and start the system for verification. If necessary, testing by qualified personnel should be performed before installation.
- Battery modules must be stored in a clean, dry place, away from direct sunlight and rain. Storage locations must be free from harmful gases, flammable or

explosive materials, and corrosive chemicals. Avoid mechanical shocks, heavy loads, strong magnetic fields, and direct sunlight.

- The combined storage and transportation time of battery modules must not exceed 5 months (counted from the date of shipment). For periods exceeding 5 months, batteries must be recharged and SOC calibrated to 30%–40%, and the SOC must be maintained consistently after recharging. Failure to recharge as required may affect battery module performance and lifespan.
- Take precautions against harsh environmental conditions such as sudden cold, sudden heat, or collisions to prevent damage to the battery modules.
- Packaging boxes must not be tilted or placed upside down.

Installation Environment Requirements

For site selection, please refer to 3.2 Installation Environment Requirements The following requirements must also be met during on-site installation:

- The installation layout of the ESS must meet the local standard requirements for fire protection distance or fire walls, including but not limited to the requirements of GB 51048-2014: Design Code for Electrochemical Energy Storage Power Station and NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.
- It is prohibited to place the equipment in an environment with flammable, explosive gases, or smoke, and to operate the equipment in such an environment.
- The installation, use, and operation of outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, plugging and unplugging outdoor signal interfaces, working at heights, and outdoor installation) is prohibited during thunderstorms, rain, snow, and winds of level 6 or above.
- It is recommended to install fences, walls, and other protective measures around the ESS, and erect safety warning signs to isolate the area and prevent unauthorized personnel from accessing the equipment during operation, which may result in personal injury or property damage.
- Do not block the vents and the cooling system during operation of the equipment to prevent fires caused by high temperatures.
- The equipment shall be installed in an area free from liquids and away from locations prone to condensation (such as under water pipes, air outlets) or prone to potential water leakage (such as under air conditioners, vents, machine room cable exit windows) to prevent liquid from entering the equipment and causing faults or short circuits.
- The installation site must be located away from sources of ignition, and no flammable or explosive materials shall be placed in the vicinity of the equipment.
- If the equipment is installed in an area with lush vegetation, periodic weeding and hardening of the soil beneath the equipment is required to prevent weed growth.

Elevated Work Requirements

- Implement proper safety protection measures, including using safety helmets, safety harnesses, waist safety belts, and attaching them to robust and reliable structural members. Do not hang them on moving unstable objects or sharp-edged metals, to prevent the hook from slipping and causing a fall accident.
- The elevated work site must be clearly designated as a restricted, hazardous area with prominent markings to deter unauthorized access.
- The ground area directly beneath the elevated work zone must be kept clear of any stacked scaffolding, planks, or other debris. Ground personnel are prohibited from staying or passing directly below the high-altitude operation area.
- Do not throw objects from a high place to the ground or vice versa. All items must be transported using appropriate methods such as ropes, hanging baskets, overhead vehicles, or cranes.
- All scaffolding, planks, and work platforms utilized for elevated work must undergo a thorough safety inspection and certification prior to use, ensuring structural reliability and preventing scaffold overloading.
- Elevated work must be immediately suspended during rain or other potentially hazardous conditions. Thereafter, WHES's safety supervisor and relevant technicians must inspect all equipment and give approval before elevated work can be safely resumed.
- All edges and openings within the elevated work zone shall be outfitted with guardrails and markings to prevent the risks of accidental falls or step-through incidents.
- Securely carry all necessary apparatus and tools during operations to prevent accidental falls.
- If an elevated worker is found to be violating safety protocols and performing construction work improperly, the site supervisor or safety officer must immediately issue a warning and instruct the worker to make corrections. Work may not be resumed until the elevated worker is in full compliance with established operating specifications.

1.4 Loading/Unloading and Transport Requirements

BEWARE

This product has been certified to comply with UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria) and SN/T 0370.2-2009 Rules for the Inspection of Packing for Export Dangerous Goods - Part 2: Performance Test, and is consequently classified as a Class 9 Dangerous Good.

Shipment conditions:
Energy storage system must be inspected prior to shipment to ensure that the enclosure is intact and undamaged, the cabinet doors are properly closed and locked, no foreign objects are protruding from the interior, and no indications of smoke or burning are present. Failure to meet any of these criteria will result in the shipment being prohibited.

In most cases, when transported by truck, the total weight of the truck will exceed the limits allowed on standard roads, and an overweight permit from the local transportation authority may be required.

NOTE

Most of the equipment inside the energy storage cabinet is pre-installed and secured within the outdoor cabinet before leaving the factory. During transportation, the cabinet can be lifted and transported as a whole.

- All cabinet doors must be securely locked.
- Select an appropriate crane or lifting tool based on the site conditions. The chosen equipment must have sufficient load capacity, boom length, and rotation radius.
- Additional traction equipment may be required when moving on slopes or similar conditions.
- Remove any existing or potential obstacles during movement, such as trees, cables, and other obstructions.
- Whenever possible, transport and move the cabinet under favorable weather conditions.
- Warning signs or barrier tape must be set up to prevent unauthorized personnel from entering the lifting and transport area to avoid accidents.
- During land transportation, always secure the cabinet's top lifting hooks to the transport vehicle using ropes to prevent excessive tilting of the cabinet.

WARNING

Throughout the entire loading, unloading, and transportation process, the outdoor cabinet operation safety regulations of the country or region where the project is located must be strictly followed!

- The energy storage cabinet and all equipment used during the operation must be properly maintained.
- All personnel involved in loading, unloading, and securing the cabinet must receive appropriate training, with a particular emphasis on safety training.

1.5 Electrical Safety

Wiring Requirements

- Do not push cables directly off the vehicle or otherwise mishandle them.
- Do not route cables through the air inlet/outlet of the equipment.
- Cables of the same type shall be bundled together, while cables of different types shall be spaced at least 30 mm apart without intertwining or crossing.
- If the site has to be left unattended temporarily after or during the wiring process, the cable openings must be immediately sealed using sealing mud to prevent the ingress of small animals.
- Cables used in high-temperature environments are susceptible to insulation aging and damage. A minimum clearance of 30 mm must be maintained between cables and heat-generating components or heat source peripheries.
- Select cables that are in compliance with local laws and regulations.
- Cable troughs and openings must be free of sharp edges and provided with appropriate protection.
- Cable conduits or openings shall be protected against damage from sharp edges or burrs.
- Cables used in the ESS must be firmly connected, well-insulated, and comply with the appropriate specifications.
- After wiring, the cables must be securely fixed using cable supports and clamps. For cables in backfilled soil areas, ensure they are in close contact with the ground to prevent deformation or damage during backfilling.
- At low temperatures, violent impact and vibration may cause the outer plastic sheath of the cables to become brittle and crack. To ensure construction safety, the following requirements shall be followed:

✧ All cables must be laid and installed at temperatures above 0°C. Care should be taken when handling cables, especially in low-temperature environments.

✧ If cables are stored at temperatures below 0°C, they must be placed at room temperature for at least 24 h prior to installation.

Grounding Requirements

- Do not damage grounding conductors.
- Do not operate the equipment without installed grounding conductors.
- For equipment requiring grounding, always install the protective ground wire first and remove it last.
- The main grounding body of the equipment must be permanently connected to the protective grounding network. Before operating the equipment, the electrical connection must be checked to ensure reliable grounding.
- The grounding impedance of the equipment shall meet the requirements applicable to local electrical standards

AC/DC Operation Requirements

- Before installing or removing the power cord, turn off the power switch first.
- Prior to connecting the power cord, verify that the label on the power cord is correct.
- If the equipment has multiple inputs, all inputs shall be disconnected and the equipment shall be completely de-energized before any work is performed.

Operation, Maintenance and Repair Safety Requirements

1. Turn off the circuit breaker before connecting or disconnecting any cables.
2. Place a "Do Not Close" warning sign on the open switch.
3. Use a voltage tester of the appropriate rating to verify the equipment is completely de-energized.
4. Cover or wrap any nearby live parts with insulating sheeting or tape.
5. Before performing any operation, maintenance or repair activities, connect the circuit to be repaired securely to the grounding circuit using a grounding wire.
6. After the repair is completed, remove the grounding wire between the repaired circuit and the grounding circuit.

BEWARE

- Prior to connecting cables, verify that the label on the cable is correct.
- If the equipment has multiple inputs, all inputs shall be disconnected and the equipment shall be completely de-energized before any work is performed.

1.6 Mechanical Safety

Lifting Safety

BEWARE

- Lift the unit from the top, and ensure on-site safety during the lifting process.
- Check all tools and equipment used for lifting operations; they must be properly maintained and within their service life.
- All personnel engaged in loading, unloading, and securing operations must be trained professionals with the required expertise.
- Provide safety training to all on-site operators before lifting begins.
- Before hoisting the equipment, carefully check that the cabinet door is securely locked.
- A qualified professional must supervise and direct the entire lifting and installation process.
- Select suitable lifting equipment based on site conditions. The lifting slings must be strong enough to fully bear the equipment weight. It is recommended to use a crane with a lifting capacity ≥ 100,000 kg.
- Ensure that the strength of the slings meets the required load capacity. The sling connections must be secure and reliable, and all sling sections connected to the corner fittings must be of equal length.
- Adjust the sling length as needed based on actual site conditions.
- Ensure the ESS remains stable and does not tilt during lifting.
- Take all necessary auxiliary measures to ensure the ESS is lifted safely and smoothly.

WARNING

- Throughout the entire lifting process of the ESS, all operations must strictly follow the crane's safety operating procedures.
- No personnel are allowed within a 5–10 m radius of the operating area. In particular, standing under the boom or beneath the lifted or moving equipment is strictly prohibited to prevent injury or fatal accidents.
- Lifting operations must be suspended in adverse weather conditions such as heavy rain, dense fog, or strong winds.
- Warning signs or caution tape must be placed around the lifting work area to prevent unauthorized personnel from entering the lifting and transport zone.

Safety Instructions for Ladder Use

- Using straight ladders is prohibited.
- Before using a ladder, ensure it is in good condition and the load capacity meets the requirements. Overloading is strictly prohibited.
- Use wooden or fiberglass ladders when working overhead where electricity may be involved.
- When working overhead, it is preferable to use platform ladders with guardrails, where all four feet are securely fixed and the ladder is held by one person.

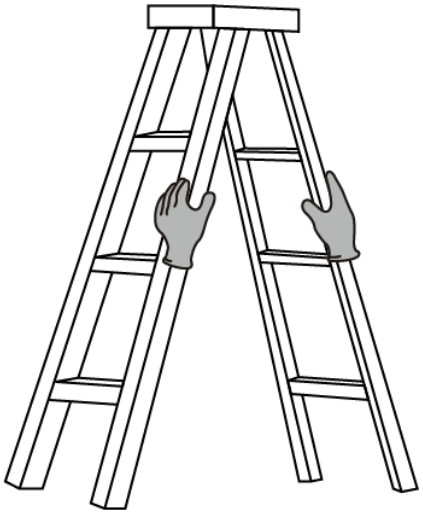


Figure 1-2 Holding Ladder

- For herringbone ladders, the rope must be secured and a person must hold the ladder during use.
- When climbing a ladder, please pay attention to the following actions to reduce danger and ensure safety.

⚠CAUTION

- Maintain a stable body posture.
- Stand on the ladder without exceeding the 4th rung from the top.
- Ensure your center of gravity remains within the ladder frame.

Equipment Exterior Drilling Safety

- Before drilling, carefully select the drilling location to avoid short circuits or other adverse effects.
- Wear safety goggles, gloves and other personal protective equipment when drilling.
- Effectively shield the equipment during drilling to prevent ingress of debris, and clean and remove debris promptly afterward.

Safety Instructions for Handling Heavy Objects

- When handling heavy objects, arrange for the number of people recommended in the diagram to ensure collaborative operation and load sharing.

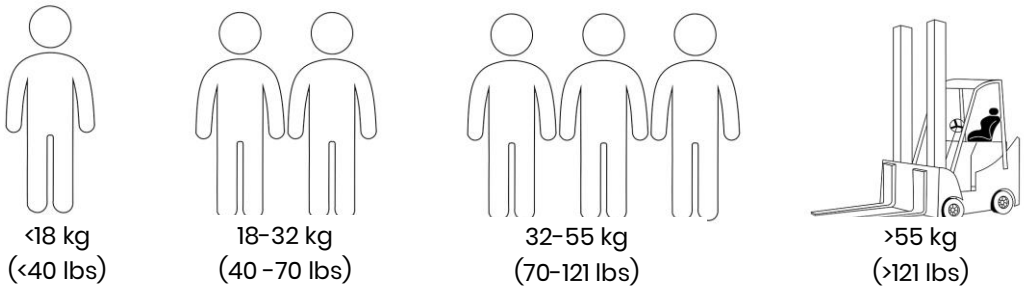


Figure 1-3 Installation Personnel Requirements

- Wear protective gloves, anti-smash anti-puncture safety shoes and other personal protective equipment when handling the equipment by hand.
- Protect the equipment from surface scratches or damage to internal components/cables during handling.
- For forklift handling, ensure the forks are centered under the load to prevent tipping. Secure the equipment to the forklift with ropes before moving, and assign a dedicated person to monitor during movement.
- Move the equipment carefully to avoid collisions or falls.

1.7 Battery Safety

Declaration

WHES will not be liable for damage to the battery supplied by WHES due to the following reasons:

- Battery capacity loss or irreversible damage caused by the customer's failure to charge the battery in a timely manner, resulting in expired storage.
- Damage to the battery caused by the customer's failure to accept the battery in a timely manner;
- Failure by the customer to properly set the system operation and management strategy, resulting in battery performance degradation;
- Unauthorized changes to the battery pack application scenario by the customer or a third party without prior notification to WHES, such as unauthorized connection of additional loads to the battery pack, and mixing the original battery pack with others, including different brands or varying rated capacities;
- Damage to the battery pack caused by the equipment operating environment or external power parameters failing to meet the normal operating requirements, including excessively high or low actual temperatures;
- Improper maintenance by the customer resulting in frequent over-discharge of the battery, capacity extension on site by the customer or long-term inability to fully charge the battery, etc.
- Failure by the customer to properly maintain the battery in accordance with the supplied equipment operating manual, including but not limited to ensuring the integrity of the cooling system, and addressing any loose or damaged HV cable harness or loose or missing structural fixing bolts;
- Theft of battery packs;
- Battery packs beyond the warranty period.

Basic Requirements

DANGER

- Do not expose the battery pack to high temperatures or near heating devices, such as direct sunlight, fire sources, transformers, heaters, etc. Overheating of the battery pack may cause fire or explosion hazards.
- Do not disassemble, modify, or damage the battery pack in any way (e.g. by inserting foreign objects, immersing in water or other liquids) to prevent battery pack leakage, overheating, fire or explosion.

- Lithium-ion battery ESS pose a high risk of fire. Before performing any battery-related operations, it is essential to thoroughly consider the following safety risks:
  1. The electrolyte in the battery pack is flammable, toxic, and volatile.
  2. Thermal runaway of the battery pack may generate flammable and harmful gases such as carbon monoxide and hydrogen fluoride.
  3. The accumulation of flammable gases from thermal runaway of the battery pack poses a risk of combustion and explosion.
- The battery pack shall be stored with its original outer packaging in a dedicated warehouse, separated from other materials. Outdoor storage is prohibited. The stacking height must be maintained within safe limits. Fire fighting facilities, such as fire sand and fire extinguishers, must be provided on site in accordance with regulations.
- For outdoor applications, it is recommended to charge an unpacked battery pack within 24 h. If timely charging is not possible, the battery pack shall be stored in a dry, indoor environment free of non-corrosive gases.

  Under normal circumstances, do not remove the outer packaging of the battery pack. Recharging, if necessary, must be performed by qualified personnel as per the specified requirements. The battery pack must be properly repackaged upon completion of recharging.
- The battery pack shall be properly oriented according to the anti-inversion label or marking on the packaging to prevent cell leakage from prolonged inverted storage.
- The ESS shall be subject to regular fire safety inspections, at least once a month.
- Use the battery pack only within the temperature range specified in this manual. Do not charge the battery pack when the ambient temperature is below the lower operating limit to prevent crystallization and internal short circuits.
- The battery pack must be protected from impacts.
- The storage location for damaged battery packs must be free of flammable materials, with access restricted to unauthorized personnel. During storage, damaged battery packs shall be monitored for signs of smoke, flames, electrolyte leakage, or heating.
- The battery pack that has been accidentally exposed to water must not be installed, but must be transported to a safe, isolated location for timely replacement with spare parts.
- The storage area must be protected from direct sunlight and rain, and must be dry, well ventilated, clean, and free from excessive infrared/ionizing radiation, organic solvents, and corrosive gases.

- Dispose of used battery packs in accordance with local laws and regulations. Do not treat them as household waste to prevent environmental contamination.
- Do not use damaged battery packs (such as dents or other damage on the casing), as damaged battery packs may release flammable gases and shall not be stored near undamaged products.

Recharging Requirements

WHES will not be liable for damage to the battery supplied by WHES due to the following reasons:

- Recharging is mandatory if the ESS has not been charged for more than 5-12 months. Failure to adhere to the recharging schedule may compromise the performance and lifetime of the ESS.
- The production completion date of the ESS can be determined by querying the shipment records using the ESS serial number (SN) or by consulting WHES's service engineers.

NOTE

- Use only the specified battery pack model. Use of non-specified models may result in damage to the ESS.
- Before installing the battery pack, check whether the packaging is intact. Battery packs with damaged packaging must not be used.
- The battery pack must be placed horizontally and secured.
- Do not place any installation tools or debris on the battery pack during installation.
- When installing the battery pack, it is important to properly connect the positive and negative terminals. Short-circuiting the positive and negative terminals of the battery pack is strictly prohibited.
- When installing the battery pack, use a torque wrench to ensure that the terminals are tightened securely. Check the terminals on a regular basis for signs of loosening.

Battery Pack Short-Circuit Protection

DANGER

A short circuit in the battery pack may generate a large current surge and release significant energy, posing a serious risk of personal injury and property damage.

- When installing and maintaining the battery pack, use insulating tape to wrap the exposed wire terminals on the battery pack.
- Prevent foreign objects (such as conductive objects, screws, liquids) from entering the battery pack and causing short circuits.

Hazard and Toxicity Information

DANGER

- Hazard: A damaged battery pack may cause overheating or electrolyte leakage. Electrolyte is flammable. If leakage occurs, immediately move the ESS away from any heat source.
- Toxicity: Vapors from a burning battery pack may cause irritation to the eyes, skin, and throat.

C Countermeasures for Abnormal Battery Packs

DANGER

- In case of electrolyte leakage or an unusual odor, avoid contact with the leaking liquid or gas. Access shall be restricted to unauthorized personnel. Contact qualified personnel immediately for proper handling. Professionals must wear personal protective equipment, including goggles, rubber gloves, a gas mask, and protective clothing to protect against possible hazards caused by electrolyte spillage.
- Electrolyte is corrosive and may cause skin irritation and chemical burns. In case of exposure to electrolyte, the following measures must be taken:
- Inhalation: Evacuate the contaminated area, provide fresh air, and seek medical attention immediately.
- Eye contact: Immediately flush eyes with plenty of water for at least 15 min, without rubbing the eyes, and seek medical attention.
- Skin contact: Immediately wash the affected area with soap and water, and seek medical attention.
- Ingestion: Seek medical attention immediately.

Battery Pack Drop Incident

- If the battery pack falls (with or without packaging) but shows no visible deformation or damage, and no noticeable odor, smoke, or fire, proceed with caution and safety in mind as follows:

  Warehouse: Evacuate personnel, use mechanical tools to transfer the battery pack to a safe, open area by qualified personnel, and contact WHES's service engineers. Allow the battery pack to rest for 1 h and monitor the temperature to ensure it remains within ambient temperature ±10°C before further proceeding.

  ESS site: Evacuate personnel, close the ESS door, use mechanical tools to transfer the battery pack to a safe, open area by qualified personnel, and contact WHES's service engineers. Allow the battery pack to rest for 1 h before further proceeding.
- If the battery pack exhibits a noticeable odor, damage, smoke, or fire after a drop, immediately evacuate personnel, contact professionals, and promptly call emergency services. Professionals should use firefighting equipment to extinguish the fire while ensuring safety.
- Do not continue to use a dropped battery pack. Contact WHES's service engineers for evaluation.

1.8 Maintenance

CAUTION

Before removing any component from the ESS, verify that all other components are securely fastened.

- A minimum of two people is required on site during ESS maintenance.
- During equipment maintenance, always use insulating materials to cover nearby live components.
- Do not open the cabinet door in severe weather conditions such as rain, snow, lightning, sandstorms, or heavy fog.
- Never allow objects (such as fingers, components, screws, or tools) to come into contact with a running fan before it is powered off or stops rotating.
- Do not power on the equipment before troubleshooting.
- During live system patrol inspections, observe hazard warnings on the equipment and avoid standing near the cabinet door.
- After shutting down the equipment other than the battery packs, wait 15 min to ensure complete de-energization before proceeding with any operation on the equipment.
- A "Do Not Close" warning sign must be displayed on any switch that is disconnected for maintenance.
- After replacing power components or changing wiring in the ESS, manually initiate wiring detection and topology identification to prevent system malfunctions.
- Lock the cabinet door, secure the safety cable, and keep the key in a safe location immediately after completing maintenance and replacement.

1.9 Emergency Procedures

In the event of an incident, including but not limited to those listed below, immediately take appropriate measures to ensure the safety of all personnel on site, and contact WHES's service engineers.

In Case of Fire

DANGER

Recommendations for on-site operation and maintenance personnel:

1. In case of fire, evacuate the building or equipment area and activate the fire alarm bell. Call the fire department and provide them with relevant product information, including but not limited to battery pack type, ESS capacity, and battery pack distribution.
2. Never re-enter the burning building or equipment area, or open the ESS door. Isolate and monitor the site, and restrict access to unauthorized personnel.
3. After contacting the fire department, remotely shut down the system while prioritizing your own safety.
4. Upon the arrival of professional firefighters, provide them with relevant product information, including but not limited to battery pack type, ESS capacity, battery pack distribution, and user manual.
5. Once professional firefighters confirm the fire is extinguished, allow qualified personnel to handle the situation according to local regulations. Do not open the ESS door without authorization.
6. Post-disaster product maintenance: Contact WHES's service engineers for evaluation.

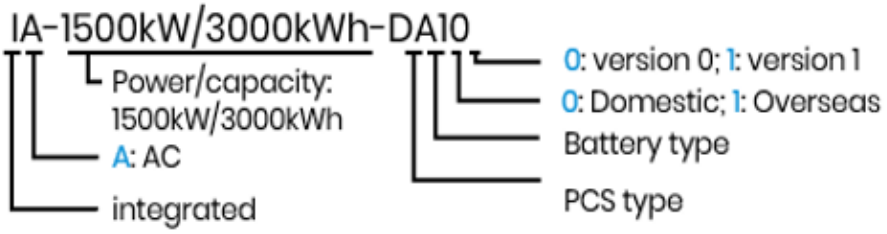
Recommendations for fire professionals:

1. Review the product information provided by operation and maintenance personnel, including but not limited to battery pack type, ESS capacity, battery pack distribution, and the user manual.
2. Do not open the ESS door if the internal safety of the system cannot be guaranteed.
3. Please follow local fire regulations for fire extinguishing operations.

2 Product Introduction

2.1 Model Description

Product Model Description:



This document primarily focuses on the following product models:

IA-1488 kW/2980kWh-DA10

IA-1302 kW/2600kWh-DA10

IA-1116 kW/2230kWh-DA10

IA-930 kW/1860kWh-DA10

IA-744 kW/1490kWh-DA10

IA-744 kW/2980kWh-DA10

2.2 Functions and Features

Function

The ESS integrates a large-capacity battery pack, EMS, monitoring system, liquid cooling system and fire protection system. The ESS system supports self-consumption, peak shaving, and voltage/frequency modes, making it an ideal solution for various industrial and commercial scenarios.

Features

1. **Enhanced Performance**

- This system adopts a string-based architecture, which effectively eliminates the “barrel effect,” reduces capacity waste, and extends the overall service life of the system.
- 50°C Full Performance, without Derating.

2. **Efficient & Flexible**

- Flexible cluster reduction, 2/4 Hours adaptable solutions.
- Flexible capacity expasion for large-scale applications.

3. **Safe & Reliable**

- IP66 (Battery) / IP65 (PCS).
- Four-level active and passive fire protection.

4. **User Friendly**

- All-in-one design, quick installation.
- Pre-commissioned at factory to minimize on-site wiring errors and commissioning costs while ensuring fast delivery.
- Automatic fluid refill and replacement, reducing maintenance time by 50%.

2.3. External Design

2.3.1 ESS External Design

Figure 2-1 Appearance and Dimensions

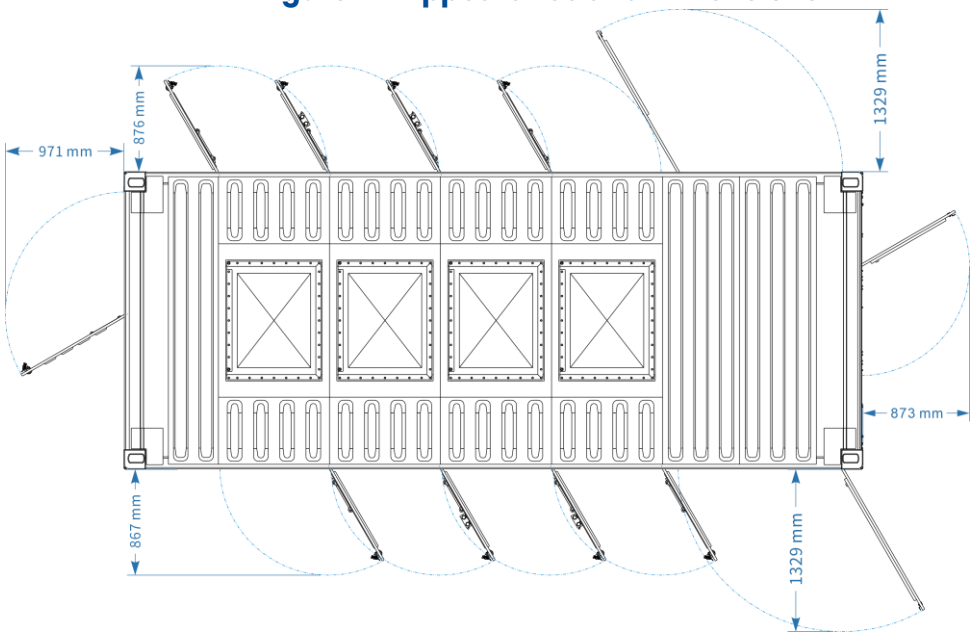


Figure 2-2 Maximum Door Opening Size

2.3.2 Ventilation Design

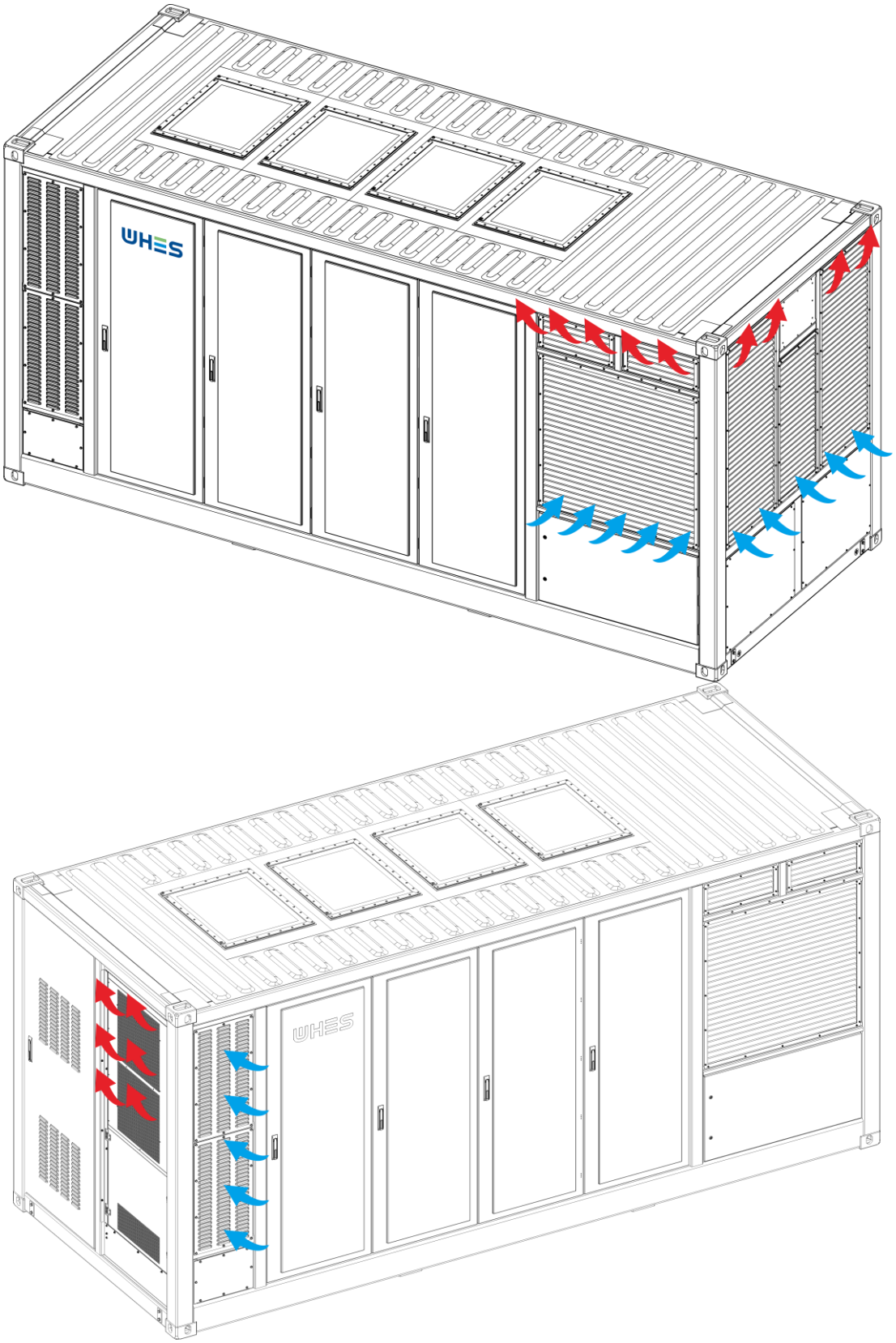


Figure 2-3 Ventilation Design

2.3.3 Product Symbol Description

Symbol	Name	Description
	CE Mark	Indicates that the product complies with the applicable EU directives.
	Grounding	Indicates the grounding point of the product. Ensures that fault current can be safely discharged through the grounding system to protect electrical safety.
	Dangerous Voltage	The product operates under HV conditions. All operations must be performed by qualified technical personnel only.
	Hazardous Area	This warning symbol indicates a hazardous area. Exercise extra caution when operating the product.
	Hot Surface	The product becomes hot during operation. Do not touch while in operation. Allow sufficient cooling before performing any operation. Wear appropriate PPE, such as safety gloves.
	Hearing Protection	The product generates high noise levels. Wear hearing protection when operating the product.
	Refer to Documentation	Follow all instructions provided in the accompanying product documentation.
	Environmental Protection	Certain items must not be disposed of in general waste and must be handled according to specific regulations.
	Electric Shock Hazard After Power-Off	High voltage may remain present after power-off. Wait at least 15 min after disconnecting power before proceeding with any operations.

2.4 Internal Design

2.4.1 Internal Components

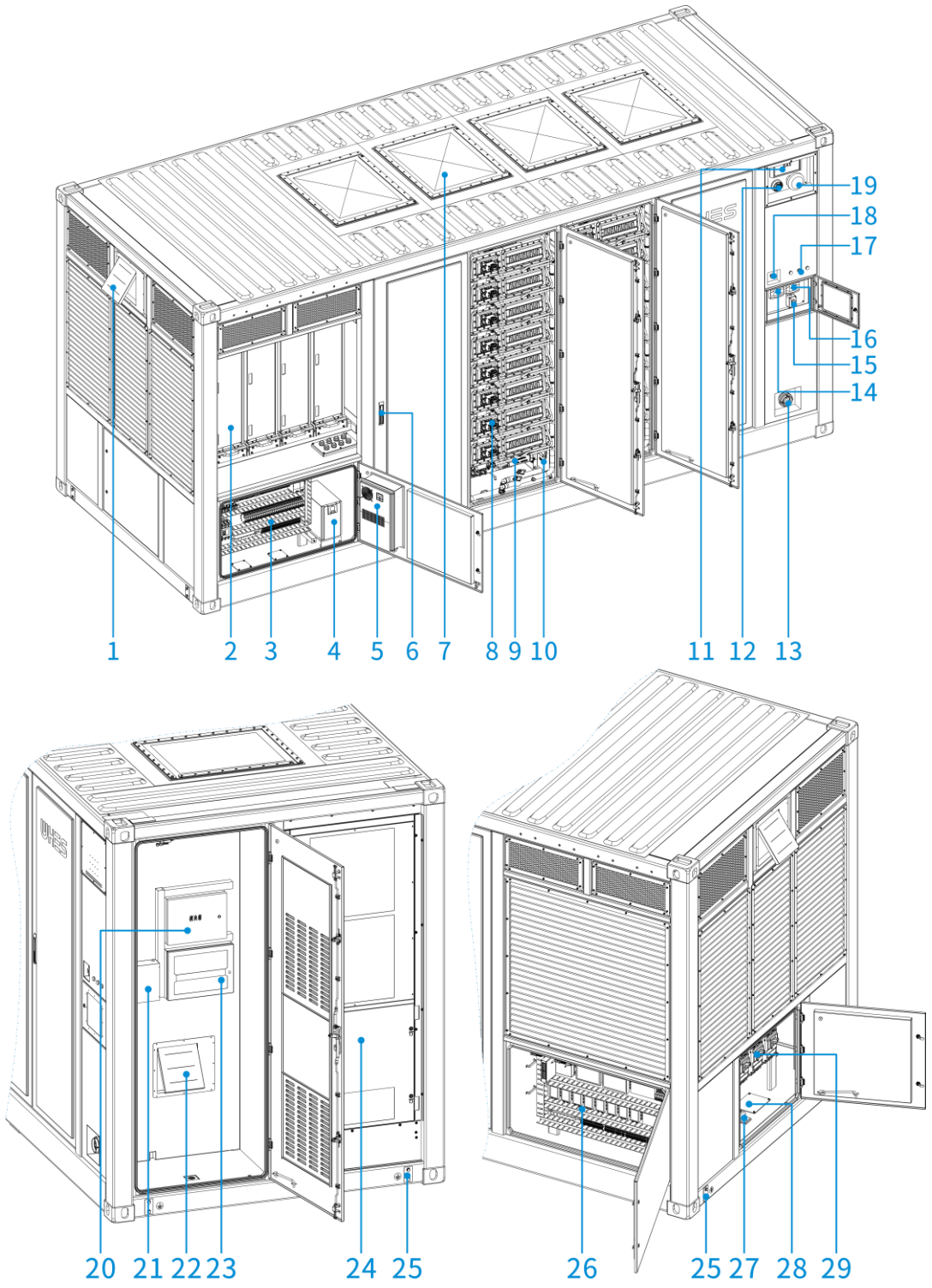


Figure 2-4 Component Overview

Table 2-1 Component Configuration

No.	Name	Description
1	Fire Exhaust Fan	The exhaust unit discharges harmful gases to ensure safe operation.
2	PCS	Enable and control the bidirectional energy conversion between the battery and the grid/load.
3	System Distribution Box A	A core electrical device used for centralized distribution, protection, and control of power in each circuit.
4	UPS	Provide stable auxiliary power output.
5	Power Distribution Compartment Air Conditioner	Regulate the temperature and humidity within the power distribution compartment.
6	Door Lock	Ensure the safety of the ESS system.
7	Explosion Venting Plate	A safety device designed to rapidly release pressure and gases in the event of internal overpressure or thermal runaway in the battery or equipment, preventing structural damage or fire spread.
8	Battery Cluster	A modular unit formed by combining multiple individual batteries in a specific configuration, used for centralized energy storage and output in the energy storage system.
9	HV Box	A key component used to connect, distribute, and protect HV circuits, ensuring a safe and reliable electrical connection between the battery and the PCS.
10	Dehumidifier	A device used to reduce air humidity in the equipment room or battery compartment, preventing condensation and corrosion, and ensuring safe and stable operation of the equipment.
11	Gas Release Indicator Light	An indicator device used to display the gas release status of the battery or equipment, alerting operators to potential safety risks.
12	Audible and Visual Alarm	A safety device that provides timely warnings to personnel through sound and light signals during abnormal conditions such as fire, leakage, or equipment failure.
13	Water Fire Protection System Interface	An interface device used to connect to a sprinkler or fire hydrant system, enabling automatic or manual fire suppression during a fire.
14	Emergency Fire System Activation Button	A device used to manually activate the fire protection system during a sudden fire or hazardous situation, immediately initiating emergency actions such as fire suppression or smoke extraction.
15	Fire Ventilation Fan Start/Stop Button	A device used to manually start or stop the fire ventilation and supply fans, assisting in smoke extraction, air supply, and maintaining a safe environment during a fire.
16	Fire Protection System Emergency Stop Button	A safety device used to immediately cut off the power supply to the fire protection system in emergencies, stopping equipment operation to prevent misuse or escalation of accidents, ensuring the safety of personnel and equipment.

17	System Status Indicator Light	A visual indicator device used to intuitively display the operating status of the equipment (e.g., normal, fault, or warning), enabling operators and maintenance personnel to quickly assess the system condition.
18	System Emergency Stop Button	An emergency control device used to immediately cut off the system power and stop all operating equipment in urgent situations, ensuring the safety of personnel and equipment.
19	Fire Alarm Bell	An alarm device that emits a loud warning sound during a fire or abnormal situation, alerting personnel to evacuate promptly and take emergency measures.
20	Fire Protection System Module Box	A control box used for centralized installation, management, and control of various fire protection system modules (such as alarms, sensors, and actuators), ensuring coordinated operation of the fire protection system.
21	Fire Protection System Backup Power Box	A device that provides emergency backup power to fire protection equipment, ensuring the continuous and reliable operation of the fire protection system during a fire or power outage.
22	Fire Supply Fan	A ventilation device used to supply fresh air to fire-protected areas or smoke extraction systems during a fire or smoke event, maintaining positive pressure and improving visibility.
23	Fire Control Panel	A core control device used for centralized monitoring, management, and coordination of various fire protection equipment, enabling functions such as fire alarm, smoke extraction, and sprinkler activation.
24	Liquid Cooling Unit	A cooling device that regulates the temperature of batteries or power equipment by circulating coolant, ensuring they operate within a safe and efficient temperature range.
25	Grounding Point	A safety point used to reliably ground the electrical system of the equipment, preventing electric shock, static buildup, and equipment damage.
26	System Distribution Box A	A core electrical device used for centralized distribution, protection, and control of power in each circuit.
27	Internal Grounding Busbar	Provides a unified low-impedance grounding point for the equipment.
28	AC Inlet Port	An interface channel on the distribution device used to introduce AC power lines, facilitating power input and system wiring.
29	Main System Circuit Breaker	A core switching device used for centralized control of the entire system's power supply, providing overload and short-circuit protection.

2.4.2 PCS

The ESS is equipped with eight TAA-186 kW PCS units, used for monitoring battery clusters, managing energy transfer, and enabling signal communication.

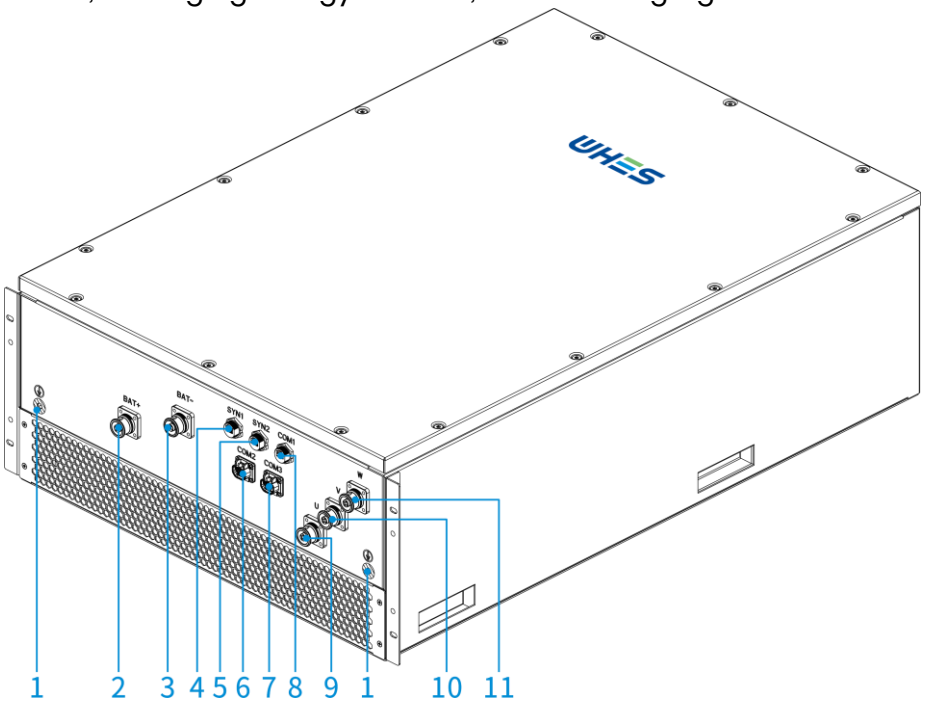


Figure 2-5 PCS Appearance

Table 2-2 Panel Overview

No.	Name
1	Enclosure Grounding Point
2	DC Terminal ~ Positive
3	DC Terminal ~ Negative
4	Communication Port ~ SYN1
5	Communication Port ~ SYN2
6	Communication Port ~ COM2
7	Communication Port ~ COM3
8	Communication Port ~ COM1
9	AC Terminal ~ U
10	AC Terminal ~ V
11	AC Terminal ~ W

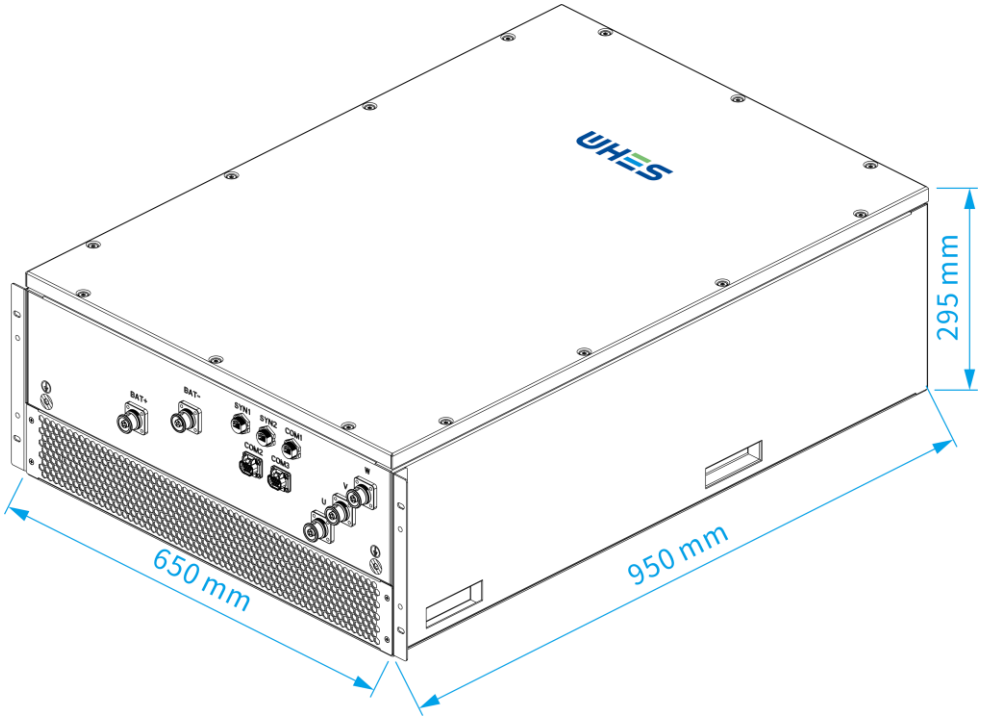


Figure 2-6 PCS Dimensions

Table 2-3 Performance Specifications

Parameter Name	Parameters
Maximum DC Voltage	1500 V
Operating DC Voltage Range	1000~1500 V
Max. Charging/Discharging Current	166/174 A
Rated Output Power	186 kW
Rated Grid Voltage	690 VAC, 3W+PE
Rated Frequency	50/60 HZ
Rated Output Current	172 A
Max. Apparent Output Power	205 kVA
Power Factor	-1~+1
Ingress Protection	IP65
Operating Temperature Range	-25°C ...+60°C (derating @>55°C)
Weight	135 kg

2.4.3 HV Box

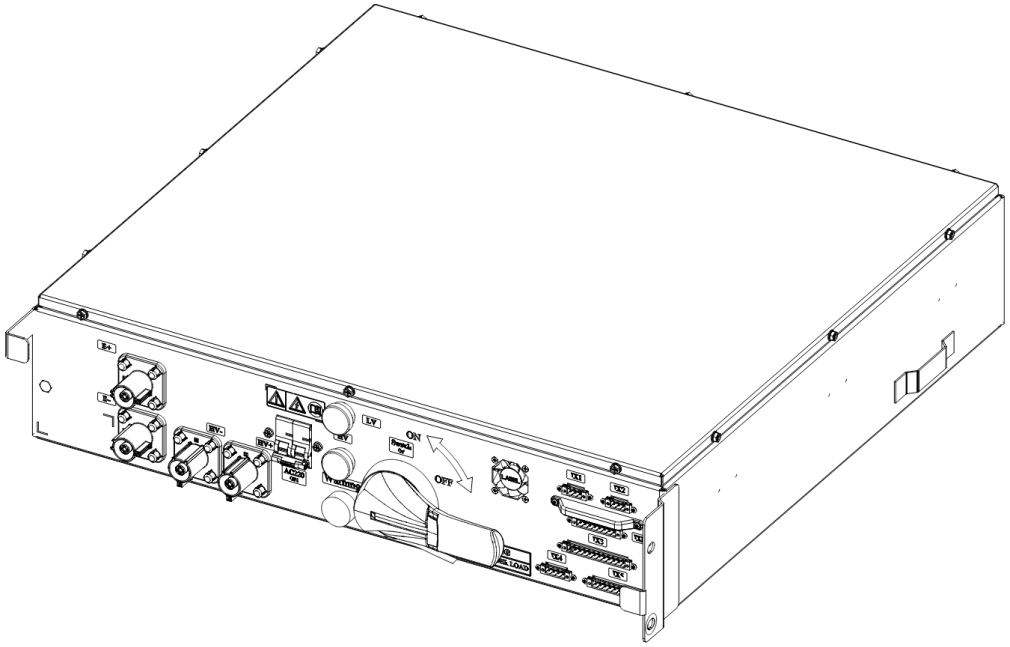


Figure 2-7 HV Box Appearance

Module Description: Integrates SBMU, DC fans, circuit breakers, fuses, 24V power supply and other components.

Main Functions：

- Collect battery cluster current and total voltage.
- Provide power cut protection in case of abnormal battery status.
- Perform capacity and SOC calibrations independently under BMS management. These calibrations serve as the basis for subsequent charge and discharge management.
- Collect CSC information downstream via CCAN and directly send the feedback to the EMS.

Table 2-4 Technical Specifications

Model	HVBX-A-140-01
Applicable Scenario	Outdoor
Rated DC Voltage	1500 V
Rated DC Current	140 A
Maximum Auxiliary Power	150 W
Rated Auxiliary Voltage	220V, 50Hz
Communication Protocol	CAN
Dimensions (W × D × H)	664.54*749.49*221.5mm
Weight (Approx.)	30kg

2.4.4 Battery Pack

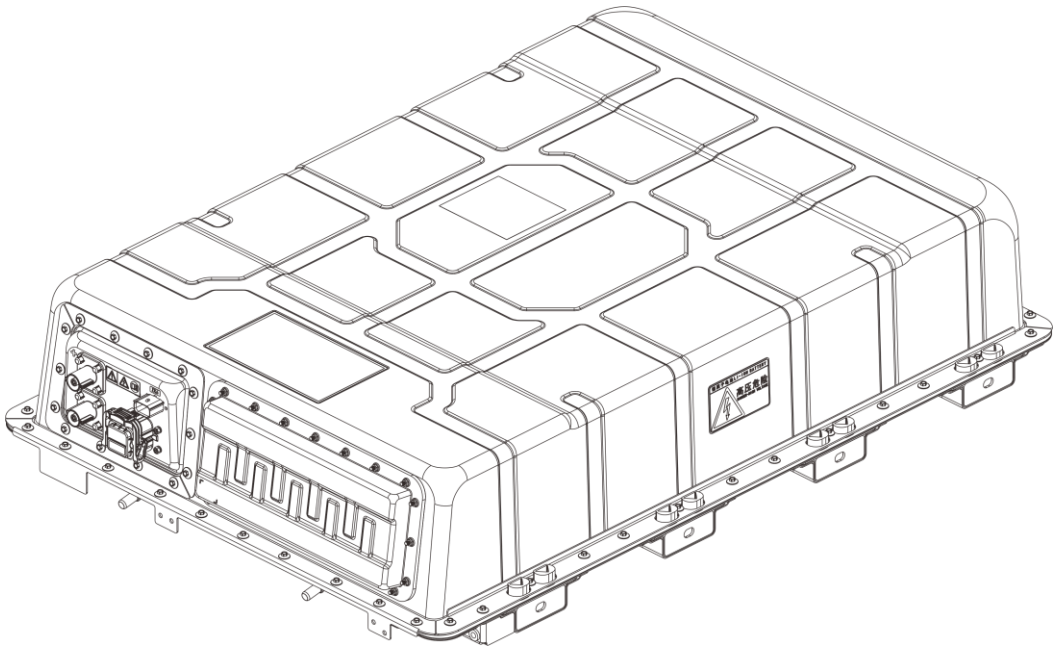


Figure 2-8 Battery Pack Appearance

Module Description: The battery pack contains 52 cells and a CSC (Battery Monitoring Unit). Each cell includes 8 NTC temperature sensors, and the CSC collects the voltage, current, and temperature of the cells within the battery pack.

Table 2-5 Technical Specifications

No.	Item		Specification	Notes
1	Basic Parameter	Nominal Capacity	46.59kWh	
2		Cell Number	52	
3		Cell Self-discharge Rate/month	≤3.5%	25°C, 40% SOC, 3 months after new battery produced
4		Voltage Range	145.6~187.2 V	CELL:2.8V~3.6V
5		Nominal Voltage	166.4 V	
6		Rated Charging Rate	0.5P	
7		Rated Discharging Rate	0.5P	
8		Maximum Continuous Current	160 A (1 min)	
9		Equalization way	Passive equalization	
10	Working Environment	Charge/Discharge Temperature	Charging:0~55°C Discharging:-20~55°C	

11		Storage Temperature	-30~60°C	
12		Recommended Operating Temperature	21±3°C	
13	Auxiliary Power Supply	Voltage range	20~26 VDC	
14		Power (CSC)	2W	
15	General parameter	Dimension (W*D*H)	810mm(W)*1152mm(D)*243.4mm(H)	
16		Weight	320±10 kg	
17		IP code	IP66	
18		Cooling Mode	Liquid cooling	
19		Communication	CAN	
20	Test & Certification	Battery Module	UN38.3	
21			UL9540A(V3)	

2.4.5 Battery Cluster

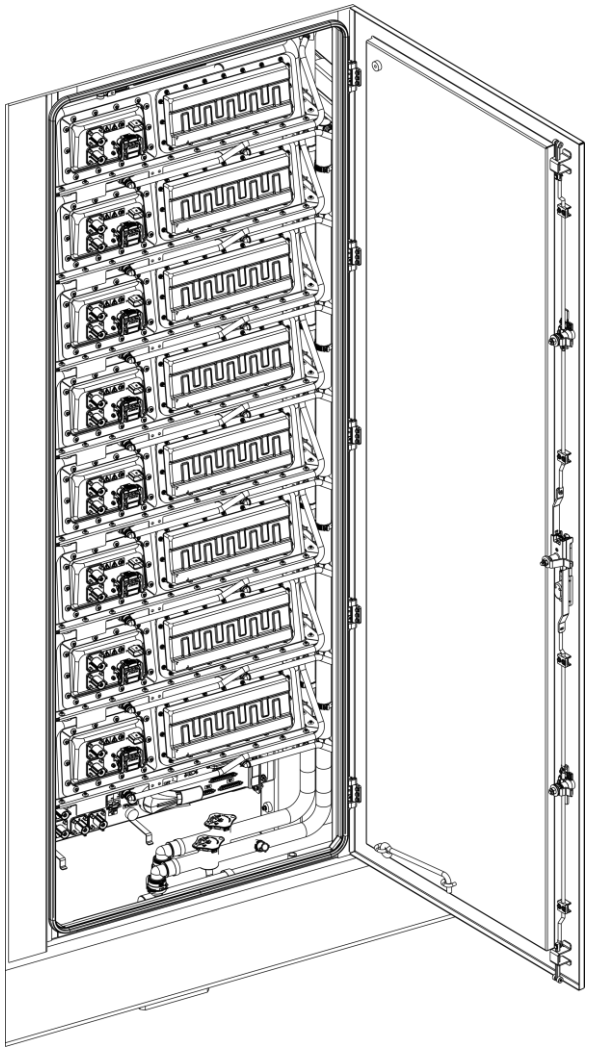


Figure 2-9 Battery Cluster

Each battery cluster is formed by connecting eight packs in series. The HV box is equipped with an isolation switch, independent positive and negative fuses, a sensing unit, sampling cables, a battery management system, and a control unit. The HV box also provides functions such as HV detection and pre-charging.

Table 2-6 Technical Specifications

Parameter Name	Parameter Value
Configuration	1P416S
Key Components	8 modules, 1 HV box
Rated Capacity	280 Ah
Rated Energy	372.74 kWh
Rated Voltage	1331.2 V
Voltage Range	1164.8~1497.6 V

2.4.6 Liquid Cooling Unit

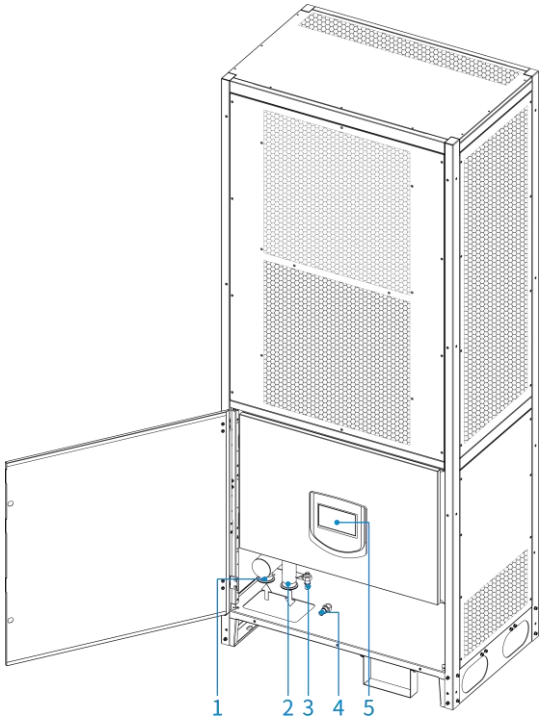


Figure 2-10 Liquid Cooling Unit Appearance

Table 2-7 Component Configuration

No	Name	Description
1	Main Return Port	The primary return interface used to send the heated coolant back to the liquid cooling unit for recooling, ensuring smooth coolant circulation and maintaining stable system heat dissipation.
2	Main Supply Port	The main output interface that delivers cooled coolant to the battery, ensuring stable coolant flow into the thermal dissipation loop to maintain proper equipment temperature.
3	Drain Port	The interface used to drain the coolant from the system during maintenance or servicing, facilitating coolant replacement or piping cleaning and maintenance.
4	Filling Port	The interface used to fill the cooling circuit with coolant or to replenish fluid, enabling convenient initial filling during maintenance.
5	Control Panel	The operation interface used to monitor and regulate the operating status of the liquid cooling unit (such as temperature, flow rate, and pressure), as well as to configure parameters and manage faults.

The liquid cooling unit adopts an integrated structure, with all components enclosed in a single chassis for easy installation. Its modular design offers a compact form factor, enabling embedded installation and space savings. The liquid cooling unit regulates the temperature of the battery system inside the ESS, ensuring it always operates within the appropriate temperature range to maintain optimal system performance.

Table 2-8 Liquid Cooling Unit Technical Specifications Table

Parameter Name	Parameter Value
Operating Voltage Range	3~380 VAC ±15%, 50/60 Hz
Operating Ambient Temperature Range	-30°C ~ +55°C
Operating Relative Humidity Range	5% ~ 95%
Storage Temperature Range	-40°C ~ +70°C
Storage Humidity Range	5% ~ 95%
Transportation Performance	Suitable for land, air, and sea transport
Operating Altitude	0 m ~ 4000 m
Altitude Derating	From 1000 m to 4000 m, performance decreases by 3% for every additional 1000 m
Dimensions (W × D × H)	980 × 630 × 2400 mm
Electrical Control Box Protection Rating	IP55
Coolant Operating Temperature Range	5°C ~ 35°C
Coolant Operating Pressure Range	0.3 bar ~ 3.0 bar

2.4.7 Liquid Cooling Piping Assembly

The liquid cooling piping features a three-level structure: the primary piping connects to the inlet and outlet of the liquid cooling unit; the secondary piping is equipped with control valves to regulate the coolant flow to the battery strings; and the tertiary piping connects directly to the battery pack.

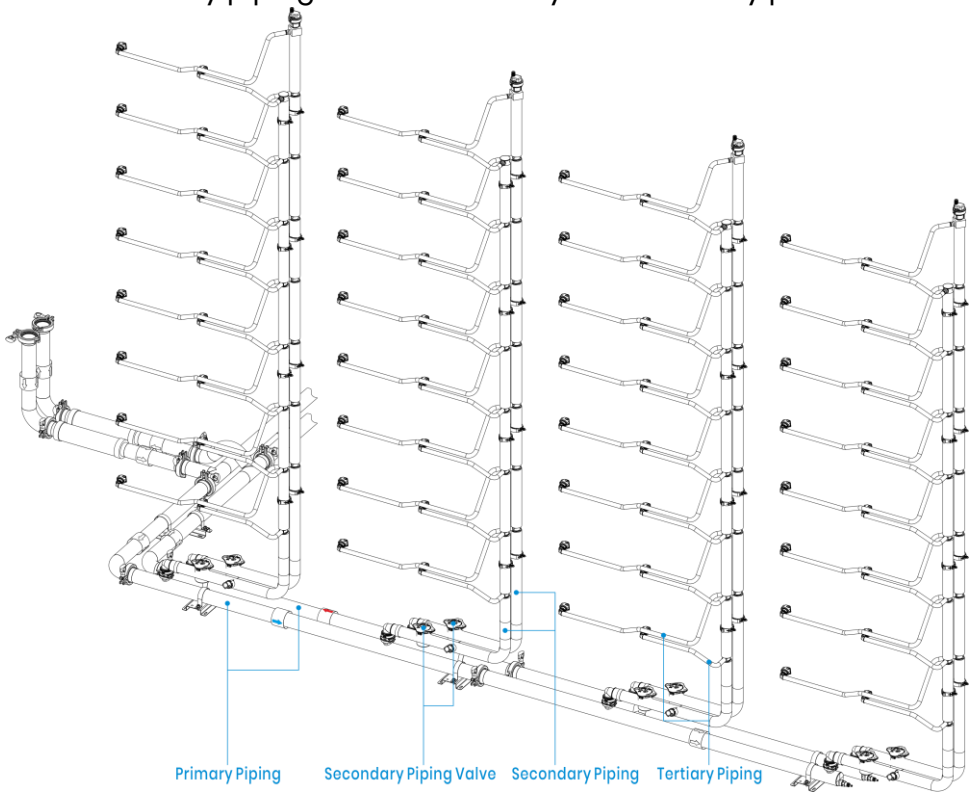


Figure 2-11 Liquid Cooling Piping

CAUTION

- When the equipment leaves the factory, the secondary piping valves are in the closed position. Before operating the equipment, be sure to open all secondary piping valves to the open position.

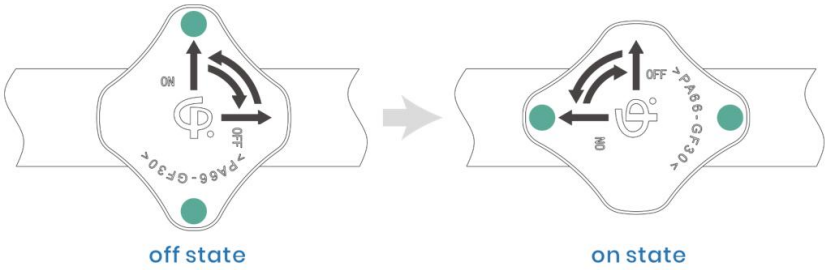


Figure 2-12: Secondary Pipeline Valve Positions

3 Equipment Installation

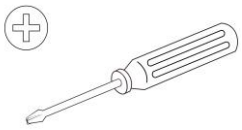
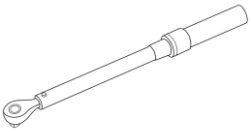
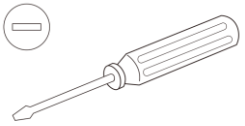
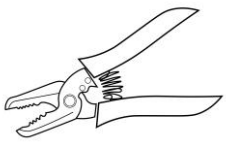
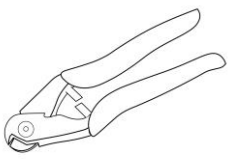
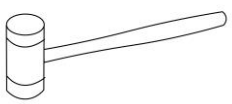
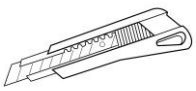
3.1 Preparations Before Installation

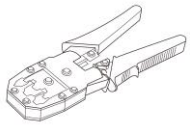
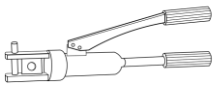
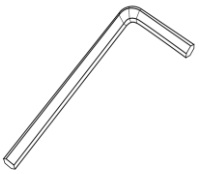
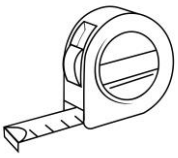
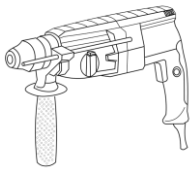
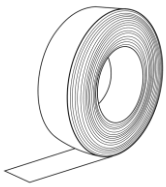
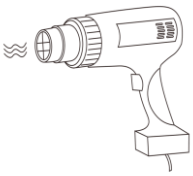
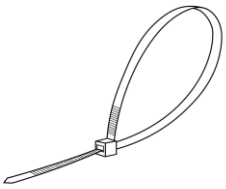
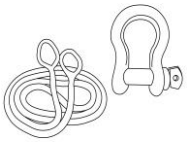
3.1.1 Tool Preparation

NOTE

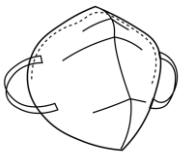
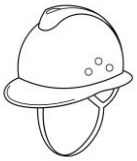
- The illustrated tools are for reference only and may differ from actual tools.
- Due to varying site conditions, this tool list may not be exhaustive. On-site installers and users are responsible for preparing unlisted tools based on actual needs.

Installation Tools

 Phillips Insulated Torque Screwdriver	 Insulated Torque Socket Wrench (including extension rod) ● Socket size: 7mm~19mm ● Socket depth: ≥32mm ● Socket interface compatible with torque wrench ● Torque range: 1.2N·m~45N·m	 Flathead Insulated Torque Screwdriver Driver	 Diagonal Pliers
 Wire Strippers	 Wire Cutters	 Rubber Hammer	 Utility Knife

 Crimping Tool	 Hydraulic Pliers	 Hex Wrench: 5mm~12mm	 Multimeter DC Voltage range ≥1500V DC
 Steel Tape Measure	 Spirit Level	 Vacuum Cleaner	 Impact Drill
 Impact Drill Bit Φ16mm	 Heat Shrink Tubing	 Heat Gun	 Cable Tie
 Insulated Ladder	 Crowbar	 Lifting Rope & Shackle Rope	

Personal Protective Equipment

 Insulating Gloves	 Protective Gloves	 Goggles	 Dust Mask
 Insulating Shoes	 Reflective Vest	 Safety Helmet	 Safety Harness

3.1.2 Inspect The Deliverables

Outer Packaging Inspection

Before unpacking the equipment, inspect the outer packaging for visible damage such as holes, cracks, or other signs of possible internal damage, and verify that the product model is correct. If the packaging appears abnormal or the equipment mode does not match, do not open the packaging and contact your dealer immediately.

NOTE

- It is recommended to remove the outer packaging within 24 h before preparing to install the ESS.

Deliverable Inspection

WARNING

- Check whether the actual ESS received is consistent with the ordered model.
- Check the ESS and its internal equipment to ensure there is no damage.
- If you find any problems or have any questions, please contact the carrier or WHES in a timely manner.

3.2 Installation Environment Requirements

3.2.1 Site Selection Requirements

BEWARE

- When selecting the installation site, carefully consider climatic conditions, geological features (e.g., stress wave activity and groundwater level), and other relevant characteristics.
- Ensure that the surrounding environment is dry and well-ventilated.
- Ensure that there are no trees near the installation site to prevent branches or leaves from being blown by strong winds, which could block the doors or air inlets of the ESS.
- The site should be located away from areas with concentrated toxic or hazardous gases, as well as away from flammable, explosive, or corrosive substances.
- To minimize noise impact, the equipment should be installed away from residential areas.

CAUTION

- The product must not be installed in environments with strong vibrations or strong electromagnetic fields. A strong magnetic field environment is defined as one where the magnetic field strength exceeds 30 A/m.

3.2.2 Foundation Requirements

Given the significant weight of the equipment, a thorough site assessment—particularly regarding geological and climatic conditions—must be completed before proceeding with foundation design and construction.
Improper foundation design may lead to significant challenges in equipment placement, door operation, or future operation. Therefore, the installation foundation must be designed and constructed in advance according to established standards to ensure proper mechanical support, cable routing, and ease of future maintenance and inspection.

WARNING

The foundation construction must meet at least the following requirements:

- The soil at the installation site must be sufficiently compacted, with a minimum recommended relative soil compaction of 98%. For loose soil, appropriate measures should be taken to ensure foundation stability.
- The bottom of the foundation pit must be compacted and leveled to provide

adequate and effective support for the ESS.

- The foundation must meet uniform settlement requirements, meaning that the settlement should be relatively consistent at all measurement points, with no significant deviation.
- The top surface of the ESS foundation must be on the same horizontal plane, with a leveling deviation of 0–10 mm.

CAUTION

- If the leveling deviation exceeds the specified limit, the equipment must be leveled with welded shims before being hoisted onto the foundation.
- After positioning the ESS, verify that the doors open and close smoothly prior to securing the equipment to the foundation.
- The foundation height must comply with local design codes. It is recommended that the foundation be elevated above the historical highest water level to prevent rainwater from eroding the ESS base or entering the interior.
- Appropriate drainage measures should be implemented based on local geological conditions to prevent water from submerging the ESS base or internal equipment during rainy seasons or heavy precipitation.
- Cable routing considerations must be incorporated during foundation construction.

NOTE

- Excavated soil during foundation construction should be cleared immediately to avoid affecting subsequent equipment hoisting.
- Ensure sufficient door clearance around the equipment and maintain adequate space for air inlet/outlet openings. For specific dimensions, refer to Figure 2-2 Maximum Door Opening Size.
- If welded fixation is used, embed 20# C-channel steel and apply proper anti-corrosion treatment.
- Provide embedded conduits for all incoming and outgoing cables. Conduit size and quantity must be based on the selected cable types and the total number of circuits.
- The foundation should include provisions for a grounding busbar (flat steel), which must be securely welded to the grounding terminal of the outdoor ESS.
- Temporarily seal both ends of all embedded conduits to prevent debris entry, ensuring easier cable routing later.
- After all cables are connected, seal all cable entry/exit points and joints with fireproof putty or other suitable materials to deter rodent ingress.
- Install grounding systems in accordance with the applicable standards of the country/region where the project is located.

3.2.3 Foundation Leveling Plan

The foundation levelness must be measured and inspected before hoisting and

securing the equipment. The unit should be installed on eight column bases, positioned as shown in the diagram below..

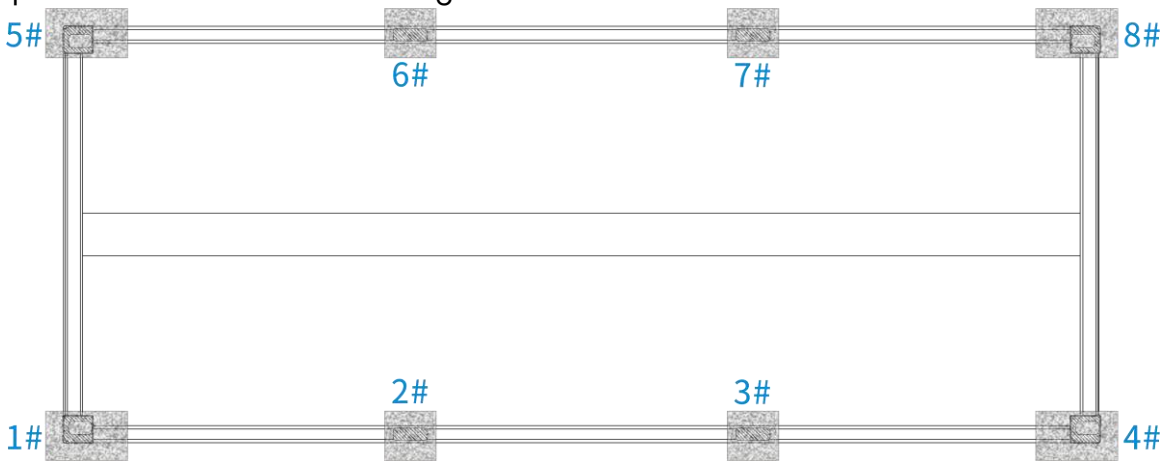


Figure 3-1: Typical Foundation Design (Top View)

For foundation points #1–#8, a height variation within 0–10 mm is acceptable for equipment installation. If the variation exceeds 10 mm, leveling is required prior to hoisting. The leveling procedure is as follows:

Step 1: Identify the highest foundation surface based on the foundation inspection results. Establish this point as the reference datum, and measure the height deviation of all other points relative to it.

Step 2: Weld shims of corresponding thickness at each foundation support point (except the highest point) so that the top surfaces of all foundations are on the same horizontal plane.

Step 3: After leveling the foundation, hoist the equipment and secure it to the foundation.

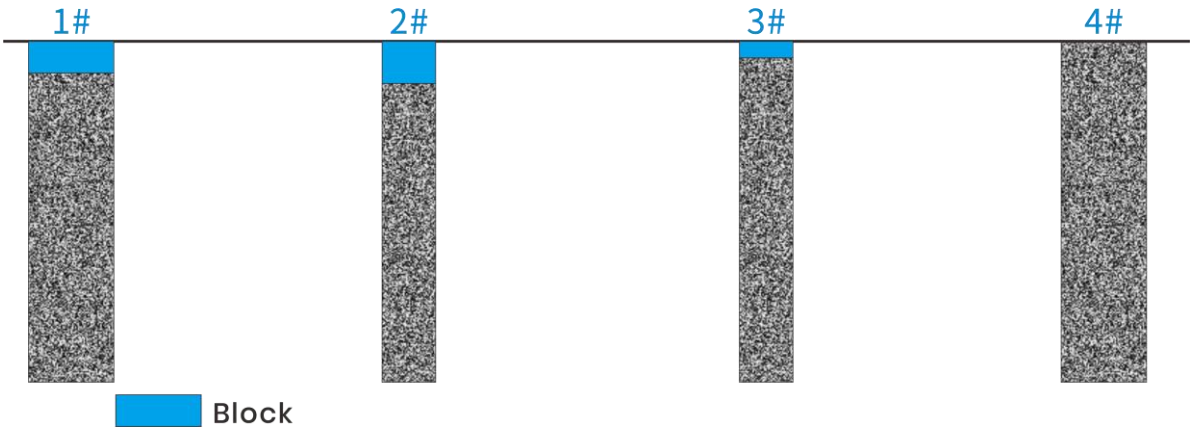


Figure 3-2 Leveling

3.2.4 Installation Space Requirements

CAUTION

- The following layout distances specify the minimum clearance between ESS units, not between their foundations.

- The layout requirements outline herein are based on a maximum ambient temperature of 45°C. For environments exceeding this temperature, consult WHES for revised layout specifications.
- Firewalls require no minimum separation distance. However, they shall extend at least 1 m beyond the overall demensions (length and height) of the outdoor ESS.

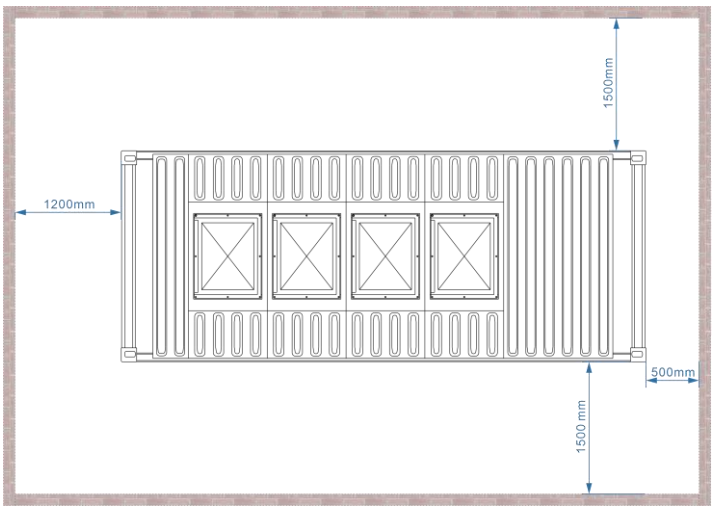


Figure 3-3 Installation Distance Requirements for Single ESS Unit

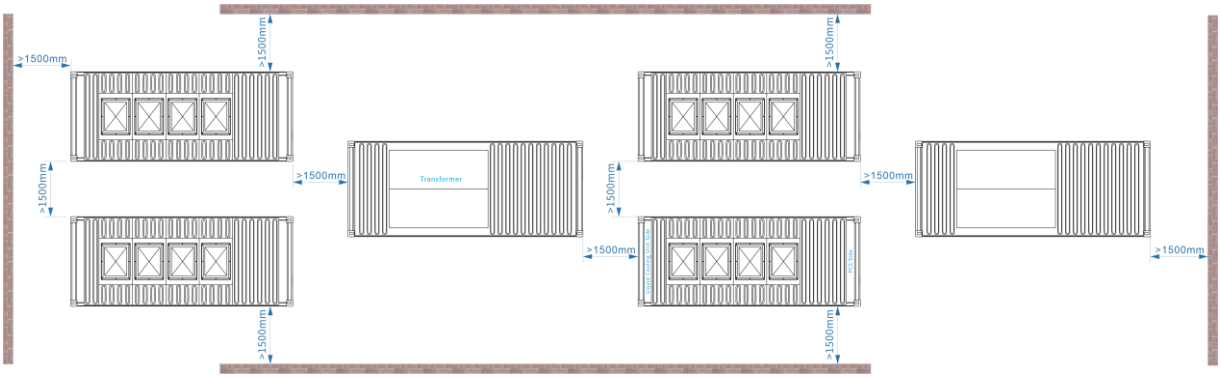


Figure 3-4 Installation Distance Requirements for Multiple ESS Units

3.3 Equipment Hoisting

CAUTION

Follow the requirements below when lifting the ESS:

- Lift from the top, ensuring on-site safety during the operation.
- Inspect all tools and equipment used for lifting operations to confirm that they are properly maintained and within their service life.
- Only trained and qualified personnel shall perform loading, unloading, and securing operations.
- Conduct safety training for on-site personnel before lifting operations.
- Before lifting, carefully check that all cabinet doors are securely closed.
- During lifting and installation, qualified personnel must supervise the entire operation.
- Select a suitable crane based on site conditions. All slings must be rated for the full equipment weight. It is recommended to use a crane with a minimum lifting capacity of 100 t.
- Ensure the sling strength meets the required load capacity. Sling connections must be secure and reliable. All slings attached to corner fittings must be of equal length.
- Rope lengths can be appropriately adjusted according to site requirements.
- Ensure that the ESS remains stable and upright throughout the lifting process.
- Take all necessary auxiliary measures to ensure the safe and smooth lifting of the outdoor cabinet.
- Throughout the entire lifting process of the energy storage system, operations must strictly follow the crane's safety operating procedures.
- No personnel are allowed within a 5–10 m radius of the operation area. In particular, standing under the crane boom or beneath the lifted or moving ESS is strictly prohibited to prevent injury or accidents.
- Lifting operations must be suspended in adverse weather conditions, such as heavy rain, dense fog, or strong winds.
- Warning signs or barrier tape must be installed around the lifting area to prevent unauthorized personnel from entering the lifting and transport zone.
- Only professional cranes should be used. Otherwise, there is a risk of personnel injury or product damage.

All steps during the ESS lifting operation shall comply with the requirements below:

- The ESS must be lifted vertically. Dragging the equipment on the ground or along the top of lower cabinets during lifting is strictly prohibited.
- Start crane operation slowly at first and then maintain a uniform speed.
- Once the ESS is in position, it should be gently and smoothly lowered. Under no circumstances should the system be swung or placed outside the vertical drop zone.

- The placement surface must be solid, level, well-drained, and free of obstacles or protrusions.
- Care must be taken during lifting to avoid scratching or damaging the product.

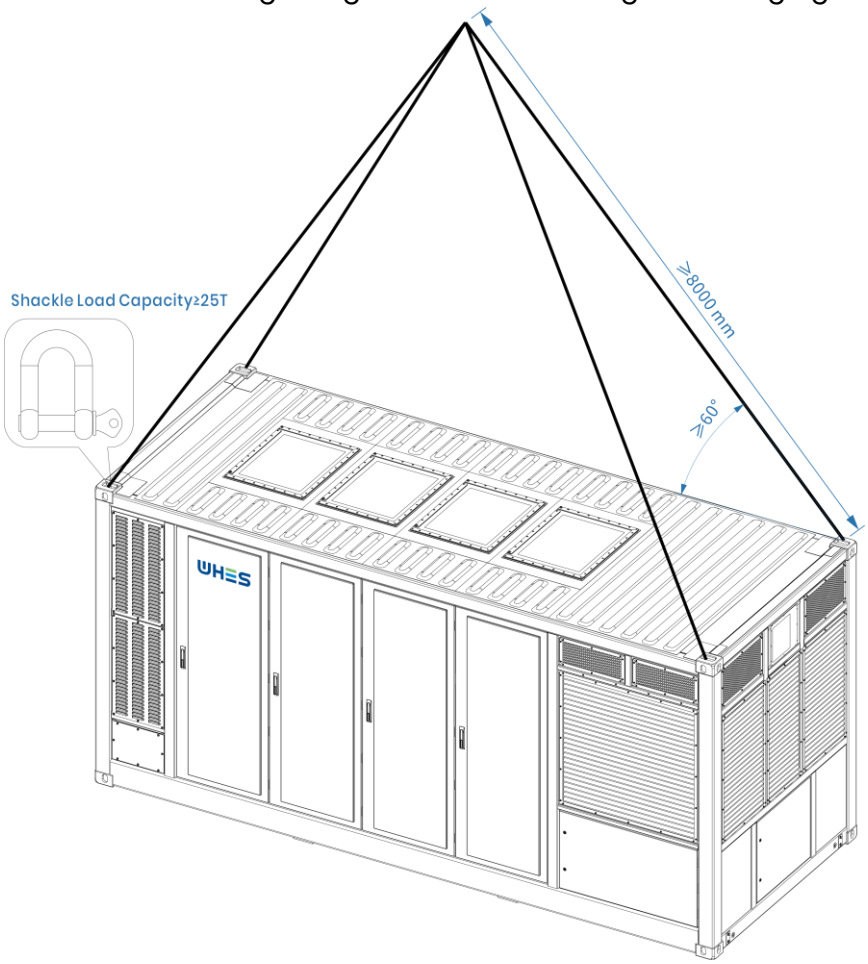


Figure 3-5 Lifting Diagram

Table 3-1 Requirements for Slings and Shackles

Name	Requirement
Sling	Length ≥ 8,000 mm, single lifting rope load capacity ≥ 25 t, safety factor ≥ 6.
Angle Between Lifting Rope and Horizontal Plane	≥ 60°
Shackle	Single shackle load capacity ≥ 25 T, safety factor ≥ 4

NOTE

- Guide ropes may be attached to the lower corners of the ESS to control its orientation during hoisting. All guiding maneuvers must be performed within a designated safe zone.

WARNING

- It is strictly forbidden to lift the ESS from the bottom.
- During hoisting and transportation, all relevant safety operation standards and regulations of the country/region where the project is located must be strictly followed.
- WHES disclaims all liability for personal injury or property damage resulting from the violation of these safety requirements or any applicable regulations.

3.4 Equipment Securing

After transporting the ESS to the installation site, it must be secured. For welded fixation, 20# C-channel steel should be pre-embedded in the foundation to allow welding and secure attachment of the ESS. The positions of the C-channels are shown in the diagram below.

Figure 3-6 Welding Positions

Use full-penetration welding for all permanent joints, followed by the application of anti-corrosion protection to all weld seams.

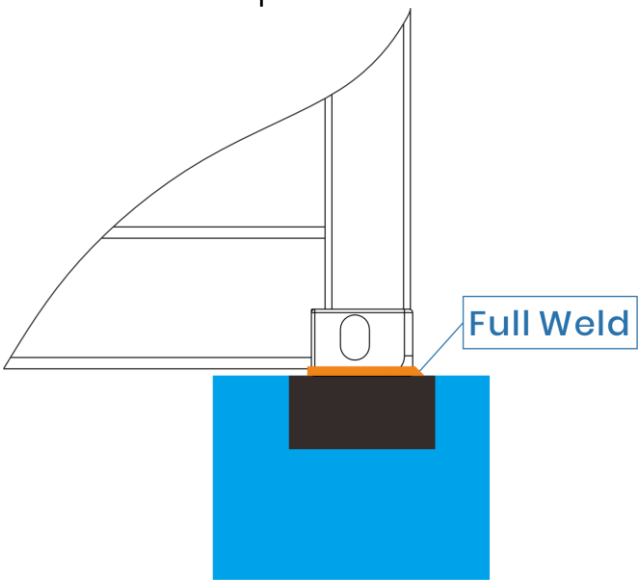


Figure 3-7 Full-Penetration Welding

4 Electrical Connection

4.1 System Schematic Diagram

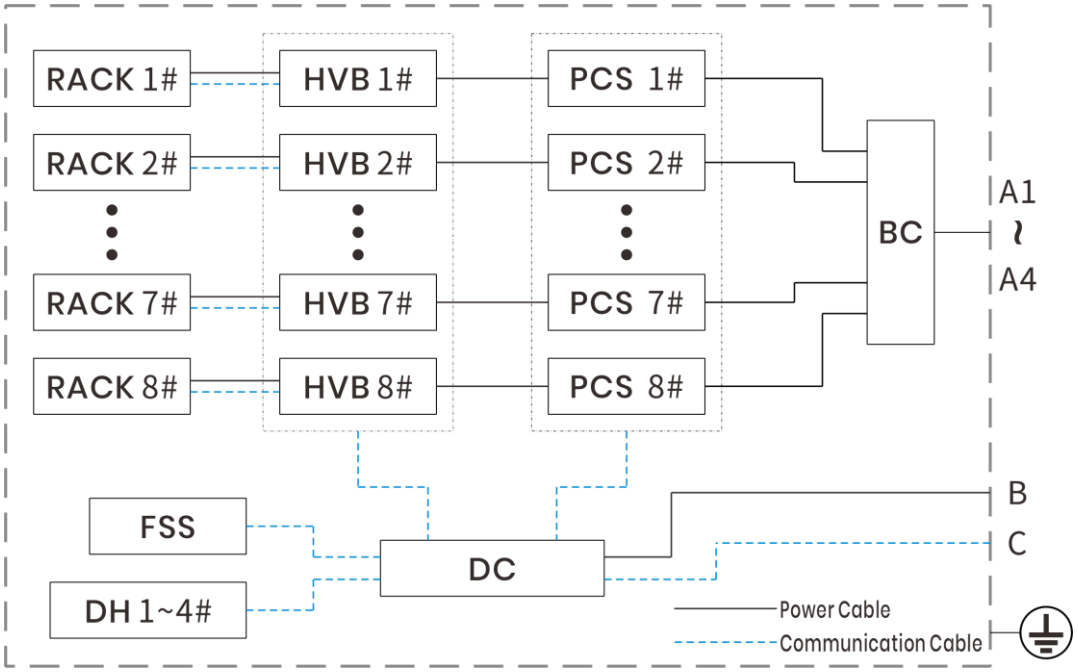


Figure 4-1 System Schematic Diagram

Table 4-1 Port Description

No.	Description	Grid Voltage	Recommended Cable Specification	Terminal	Remarks
A1~A4	Main power circuit connection ports	4-core outdoor copper cable; 690 V	YJV22-0.6/1KV-3*185mm²+1*95mm²	M10; DTterminal	Supplied by user
B	Auxiliary power supply port	5-core outdoor copper cable; 380 V	ZC-YJV22-0.6/1kV-4*16mm2+10mm2	M8, OTterminal	Supplied by user
C	Communication port	\	CAT-5e	Shielded RJ45 connector	Supplied by user

CAUTION

The above cable selection is based on current-carrying capacity in free air only. In actual applications, excessive cable length may cause voltage drop and efficiency loss. Final cable selection should be determined based on the specific conditions at the site.

4.2 Preparations before Wiring

4.2.1 Cable Preparation

CAUTION

- The cables used must comply with local laws and regulations.
- The cable colors shown in this manual are for reference only. Please select cables according to local standards.

BEWARE

The selected cables must meet the following requirements:

- Have sufficient current-carrying capacity. Factors affecting the conductor current-carrying capacity include, but are not limited to:
  - Environmental conditions
  - Type of conductor insulation material
  - Cable installation method
  - Cable material and cross-sectional area
- The cable diameter must be selected based on the maximum current-carrying capacity. A sufficient length margin should be reserved.
- All three-phase AC output cables shall be identical in specifications and materials.
- Flame-retardant cables must be used.

The OT/DT terminal crimping procedure is detailed in Appendix A.

4.2.2 Cable Entry

All external cables shall enter or exit through the bottom of the ESS. Cables must be properly protected (e.g., within conduits) to prevent damage from rodents. After completing the wiring, the entry and exit holes must be tightly sealed with fireproof putty or other suitable materials. The design of the cable entry and exit holes at the bottom of the ESS is shown in the diagram below.

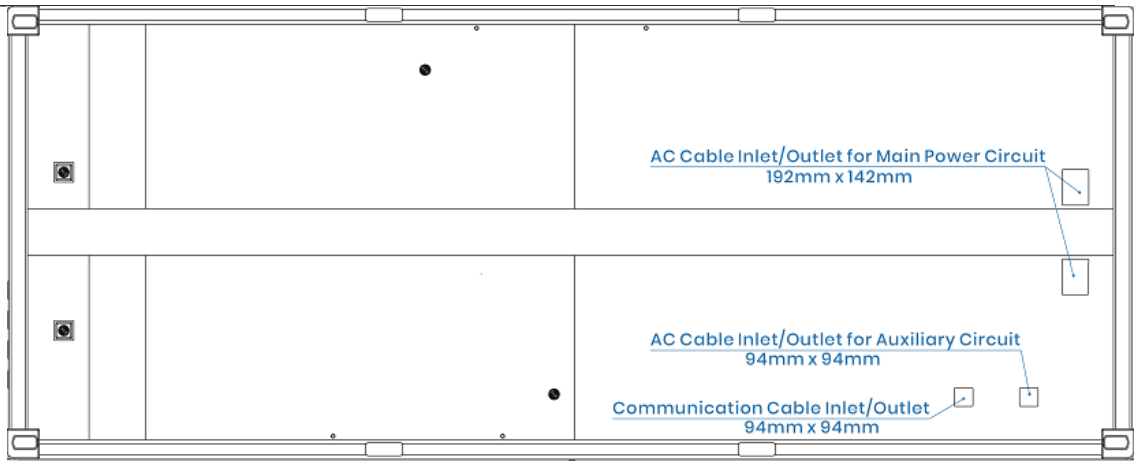


Figure 4-2 Bottom Cable Entry/Exit

4.3 Grounding Wire Connection

The internal grounding of the ESS is completed prior to shipment, while the external grounding of the ESS must be performed on-site. The ESS is grounded via external points and feature two grounding terminals on its exterior to facilitate on-site connections.

⚠CAUTION

- The ESS requires two-point grounding by securely connecting both external grounding terminals.
- The grounding method must comply with the standards and regulatory requirements of the installation site.

Two grounding methods are available as follows:

Method 1: Welded Flat Steel Grounding

Weld hot-dip galvanized flat steel to the grounding point (contact area between flat steel and cabinet: 60 mm × 110 mm). After welding, the entire contact surface should be coated.

Method 2: Cable Grounding

It is recommended to use a grounding cable with a conductor cross-section of 70 mm^2 to 95 mm^2. The grounding conductor shall be made of the same material as the phase conductors. Reliably connect the external cabinet grounding point to the system grounding point.

⚠WARNING

- Irrespective of the grounding method (flat steel or cable), all exposed metal surfaces—except for the grounding points themselves—must be treated for corrosion protection after grounding.
- Install the external grounding system according to actual site conditions and under the guidance of the power station personnel.
- After completing the grounding connection, measure the grounding resistance, which must not exceed 4 Ω. The specific grounding resistance should comply with national or local standards and regulations.
- If any doubts arise during the grounding process, promptly contact the relevant personnel. Failure to follow installation guidelines, or unauthorized installation or modification, may lead to safety incidents or equipment damage. WHES assumes no liability for any losses resulting from such actions.

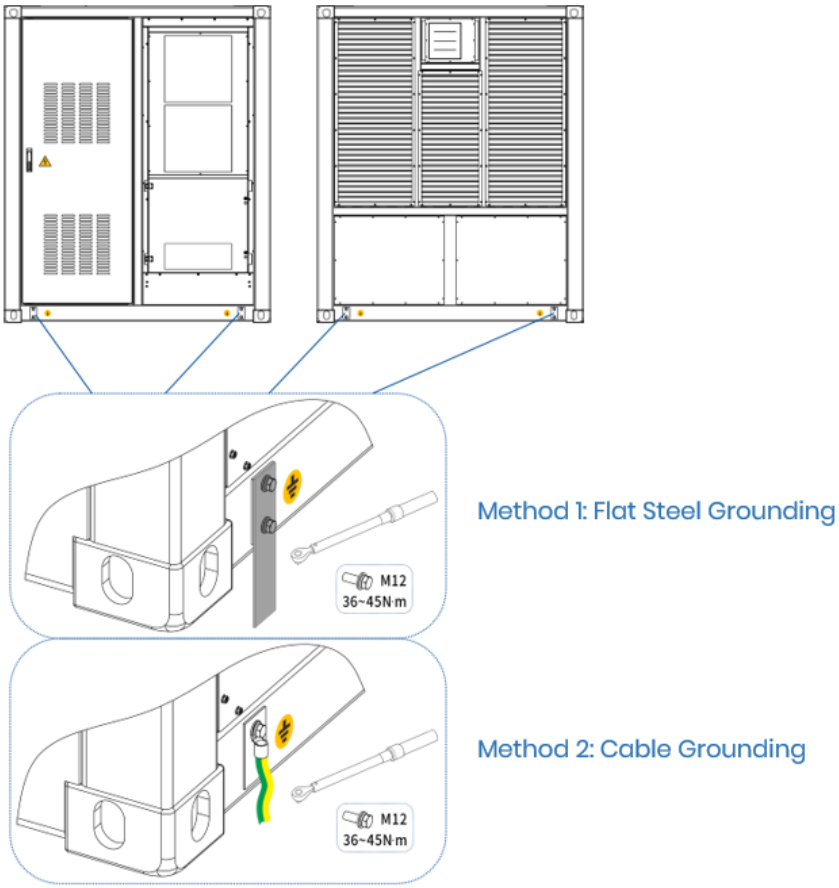


Figure 4-3 System Grounding

4.4 AC Side Connection

Operation Steps:

Step 1: Remove the inlet cover plate, route the cables through the entry holes into the wiring area, and mark the cable phases as U, V, W.

Step 2: Use a wire stripper to remove the cable insulation and expose the copper conductor.

Step 3: Crimp the DT terminals.

Step 4: Secure the DT terminals to the wiring holes using M10 bolts, tightening to a torque of 34–40 N·m.

Step 5: After completing the wiring, gently pull the cables to ensure sufficient slack.

Step 6: Seal all entry/exit holes and surrounding gaps with fireproof and waterproof materials.

WARNING

- Improper sealing may allow moisture to enter.
- Improper sealing may allow rodents to enter.

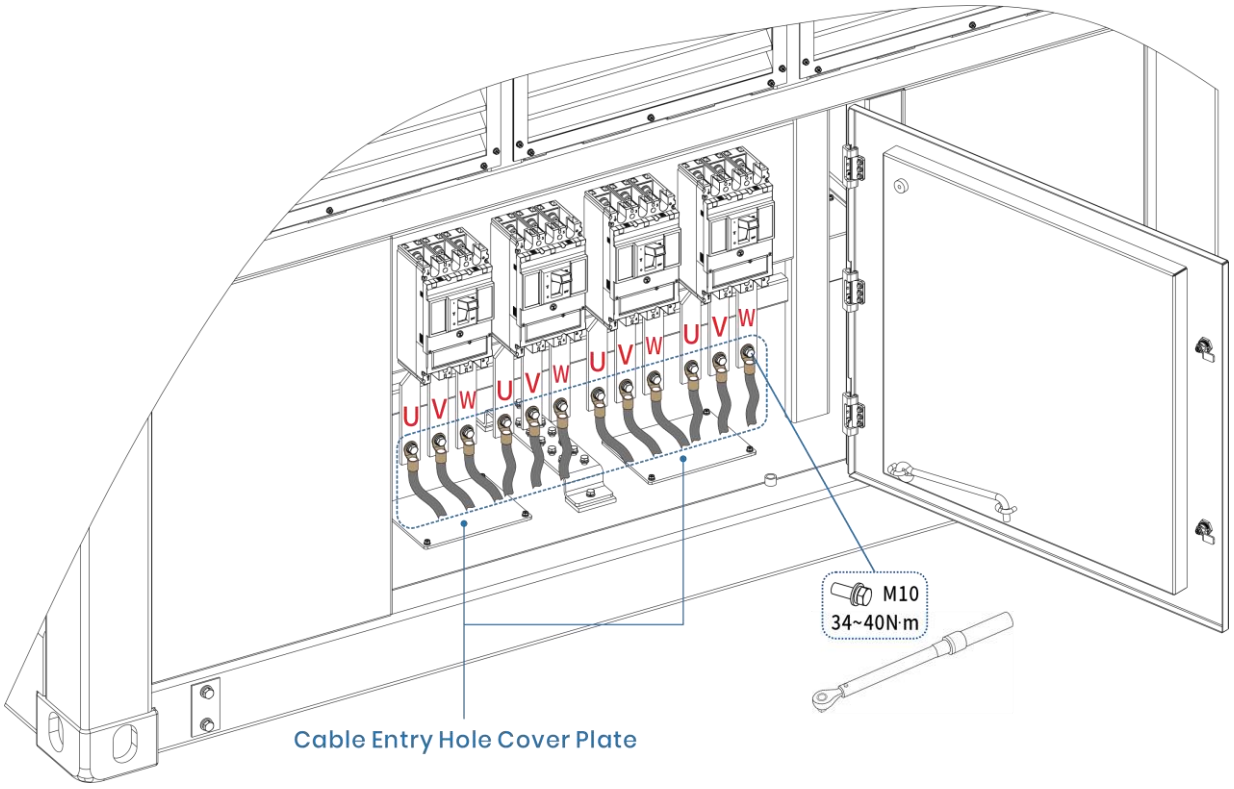


Figure 4-4 Primary Circuit Wiring

4.5 Auxiliary Power Supply &Communication Wiring

Operation Steps:

Step 1: Remove the inlet cover plate, route the cables through the entry holes into the wiring area, and mark the cable phases as U1, V1, W1, N1.

Step 2: Use a wire stripper to remove the cable insulation and expose the copper conductor.

Step 3: Crimp the OT terminals.

Step 4: Secure the OT terminals to the wiring holes using M8 bolts, tightening to a torque of 18–23 N·m.

Step 5: After completing the wiring, gently pull the cables to ensure sufficient slack.

Step 6: Seal all entry/exit holes and surrounding gaps with fireproof and waterproof materials.

Step 7: Connect the network cable by routing a CAT-5e cable through the entry hole and connecting it to any NET2 port.

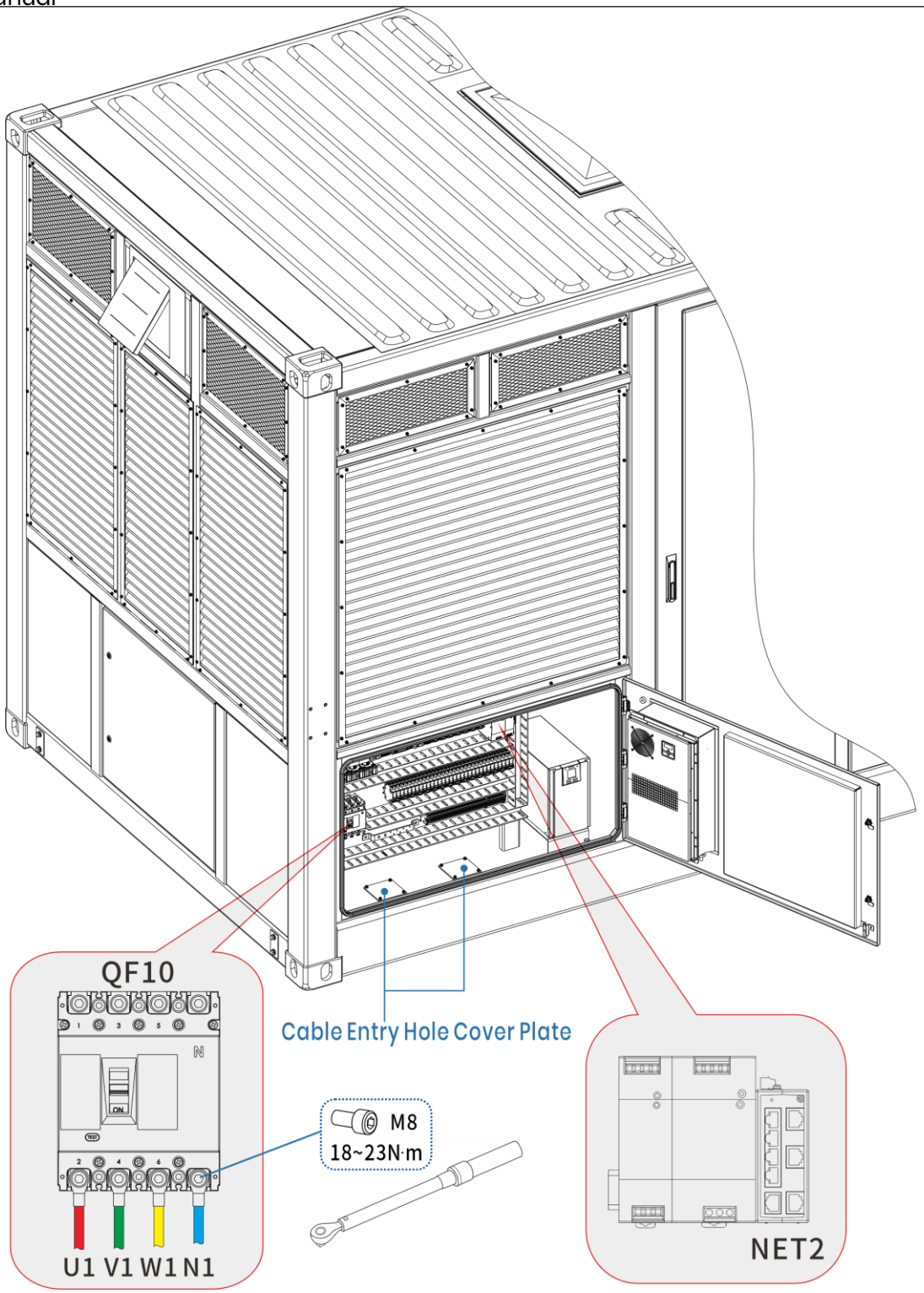


Figure 4-5 Secondary Circuit Wiring

4.6 Installing the MSD Maintenance Switch

WARNING

- Before powering on, the MSD must be installed on each pack, following the installation sequence from Pack 1 to Pack 8.

The MSD is equipped with a fuse to protect against short circuits outside the pack.

Operation Steps:

Step 1: Align the handle of the maintenance switch cover vertically with the guide slot on the base and push it in.

Step 2: Rotate the handle.

Step 3: Once a "click" sound is heard, engage the secondary lock.

Step 4: Check the MSD to ensure it is securely locked.

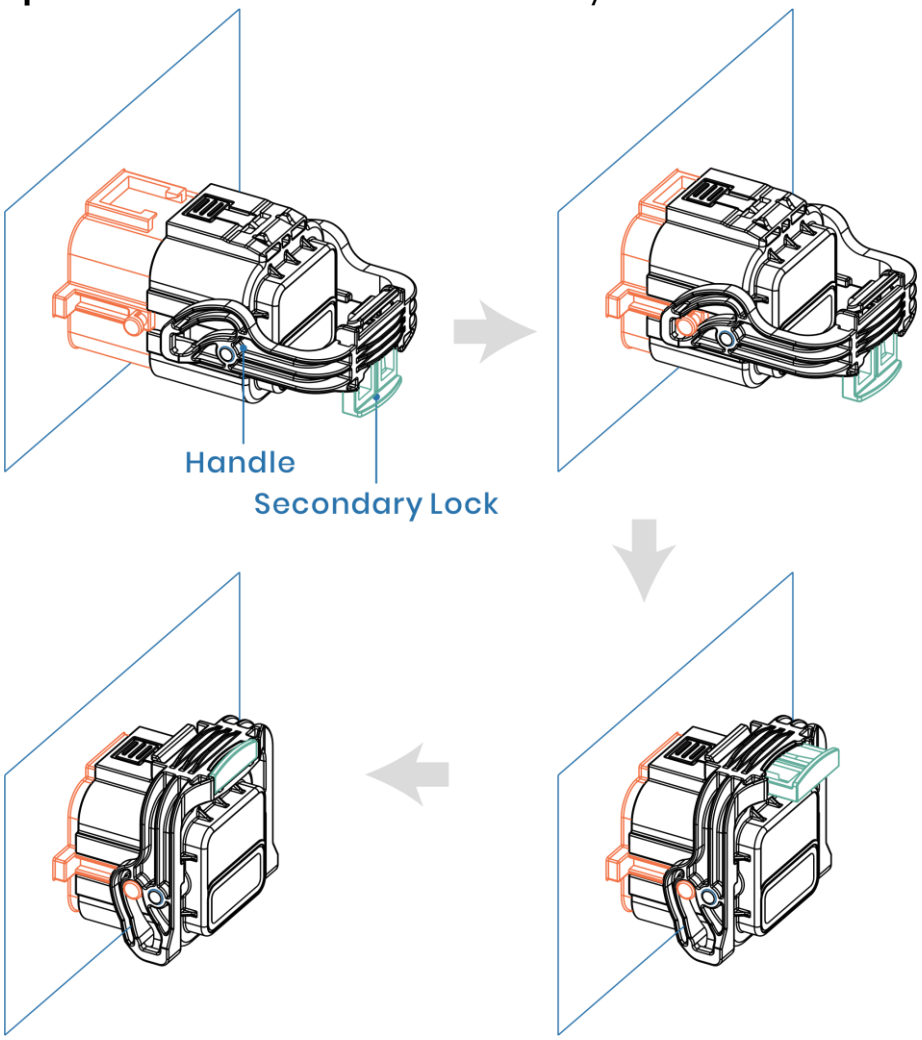


Figure 4-6 MSD Installation

5 System Power-On & Power-Off

5.1 Pre-Power-On Inspection

Table 5- 1 Pre-Power-On Inspection

No.	Inspection Item	Acceptance Criteria
1	Equipment Appearance	The equipment is intact and free of visible damage, rust, or peeling paint. Repaint any areas with peeling paint.
		All labels on the equipment are clearly visible and legible. Replace damaged labels promptly.
2	Cable Appearance	Cable protective layers are well wrapped and free of visible damage.
		Cable conduits/hoses are intact.
3	Cable Connection	Cable connections are correctly positioned according to the design.
		Terminals are properly installed in accordance with specifications, and connections are secure and reliable.
		All cables are clearly identified at both ends with legible labels that are oriented in a consistent manner.
4	Cable Routing	Cables are routed by separating strong and weak power systems.
		Cabling is organized in a neat and orderly manner.
		Cable ties are trimmed flush, eliminating sharp edges or protrusions.
		Bends are properly managed with sufficient slack, without over-tensioning cables.
		All cables are routed straight and smooth inside the ESS, avoiding crossovers.
5	Switch	All circuit breakers in the power distribution ESS are in the OFF position.
		All switches in the HV box are in the OFF position.

6	Liquid Cooling Piping	All secondary pipeline valves must be in the open position.
		There must be no leakage in the liquid cooling piping.
7	Enclosure Grounding	Each cabinet must have at least two grounding points with secure connections. The bonding resistance shall be ≤ 0.1 Ω, and the system grounding resistance shall be ≤ 4 Ω.
8	Identification	Identification is correct, legible, and complete.
9	Sealing of Cable Openings	All cable openings are properly sealed.
10	Battery Pack	All battery packs are free of visible damage.
11	Foreign Objects	Remove all foreign objects from inside the ESS, such as tools and leftover installation materials.
12	Power Distribution Area Cover Plate	The cover plates in the power distribution area are free of visible cracks, dents, scratches, breakage, or looseness.
13	Individual subcomponents (EMS, BMS, UPS, etc.)	The exterior of each subcomponent must be free of damage.

5.2 Power-On Procedure

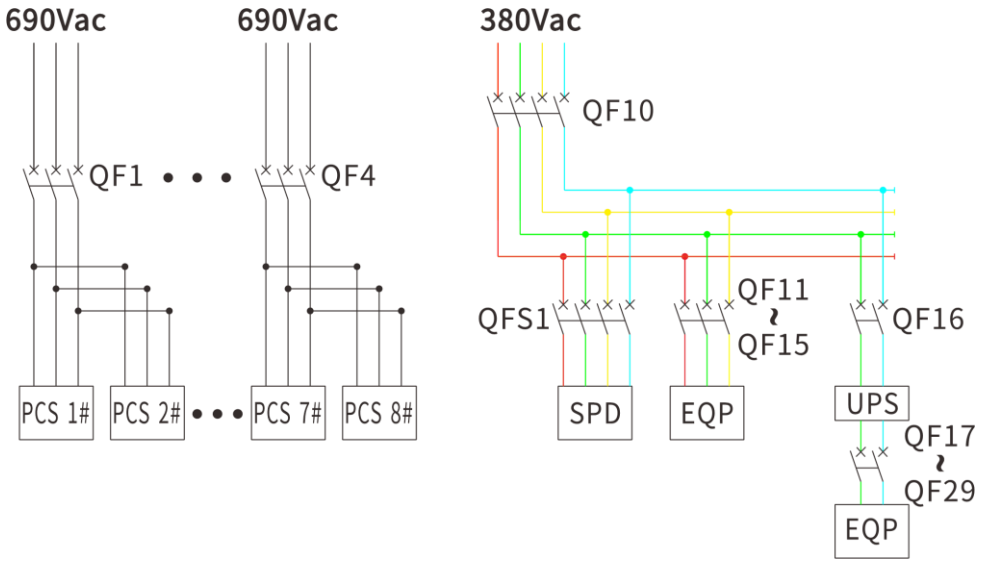


Figure 5-1 Wiring

Table 5- 2 Power-On Procedure

Step	Item	Remark
1	Close the auxiliary power switch QF10.	/
2	Sequentially close QFS1 and QF16 (UPS).	Press the UPS button, and release immediately when a beep is heard.
3	Sequentially close QF11–QF15 and QF17–QF29.	The equipment will be energized.
4	Close the AC incoming line switches QF1, QF2, QF3, QF4.	/
5	ESS power-on complete.	Check that all equipment is powered on and ensure safety measures are observed.
Note : Before closing the ESS auxiliary power breaker (QF10), verify that all power connection cables are properly secured.		

WARNING

- The ESS may only be put into operation after confirmation by qualified personnel and approval from the local power authority.
- For an ESS that has been offline for an extended period, a thorough inspection must be conducted before powering on to ensure all parameters meet the required standards.

5.3 Power-Off Procedure

Table 5- 3 Power-Off Procedure

Step	Item	Remark
1	Issue a shutdown command from PANGU to de-energize the DC side. The system enters a stopped state, and the ESS main circuit is disconnected. There is no high voltage across the positive and negative output terminals.	/
2	Turn off the AC breakers QF1-QF4 to cut off AC input power.	/
3	Disconnect QF11–QF25 and QF17–QF29.	/
4	Disconnect QFS1 and QF16.	Press the UPS button, release immediately when a beep is heard to turn off the UPS.
5	Turn off the 380V auxiliary power main switch QF10.	/
Note: After switching off the ESS auxiliary power circuit breaker (QF10), the isolating switch (QS) of each cluster HV box must also be switched off to ensure that the DC side is fully de-energized.		

⚠WARNING

- Do not operate this function while the equipment is running, as doing so may affect operation and pose safety risks.
- WHES shall not be held liable for any personal injury or property damage resulting from improper use of this function.

6 System Commissioning

6.1 Prepare and Enter WHES OS

Operating Procedure

Step 1: Connect the computer to any LAN port of the switch labeled “NET1” using an Ethernet cable.

Step 2: Verify that the computer IP address is set to 133.144.155.XXX.

Step 3: Open a web browser and enter 133.144.155.209:8080/lite to access the WHES OS interface.

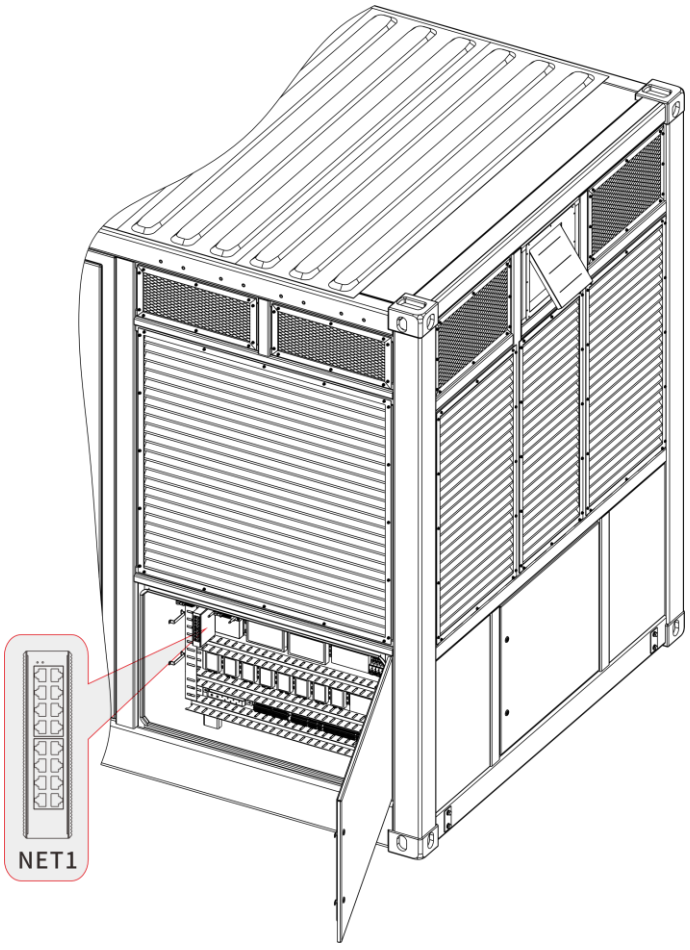


Figure 6-1 Commissioning Network Cable Wiring

6.2 Introduction to the WHES OS Interface

6.2.1 WHES OS Home Page Overview

1. After entering the interface, language, time zone, display settings, and other parameters can be configured in the upper-right corner.
2. This page displays the energy flow of the energy storage cabinet, as well as the real-time operating status of the battery, grid, and load. Alarm information indicates system operating conditions, and the data is refreshed every 5 s.
3. The flow diagram shows the grid power and energy, the power, energy, and SOC of the energy storage cabinet, and the load power.
4. Operating Status of the Energy Storage Cabinet:

- Charging: Indicates that the system is currently charging.
- Discharging: Indicates that the system is currently discharging.
- Offline: Indicates that the system is not connected or is out of service.
- Standby: Indicates that the system is functioning normally, with no faults and no charging or discharging activity.
- Shutdown: Indicates that the system has stopped operating.

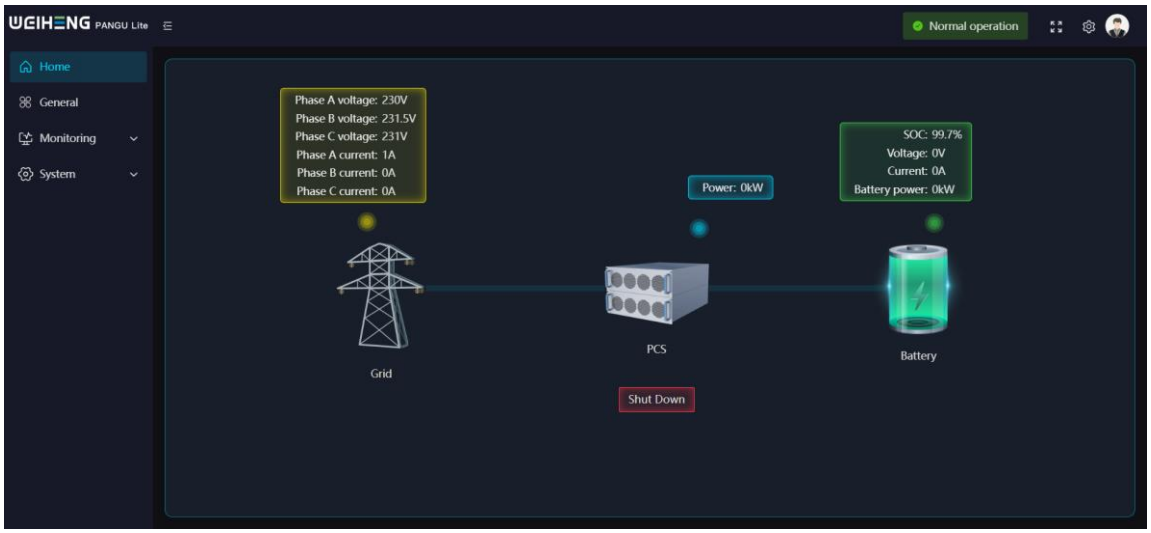


Figure 6-2 Home Page

6.2.2 ESS Overview

This interface displays the basic system information, including the rated power, rated capacity, maximum charge/discharge power, number of PCS units, number of battery clusters, total charge/discharge power, commissioning time, days of safe operation, currentavailable/usable charge and discharge capacity, SOH and SOC, total grid consumption and total grid feed-in energy, today's revenue, and the real-time charge/discharge power curve.

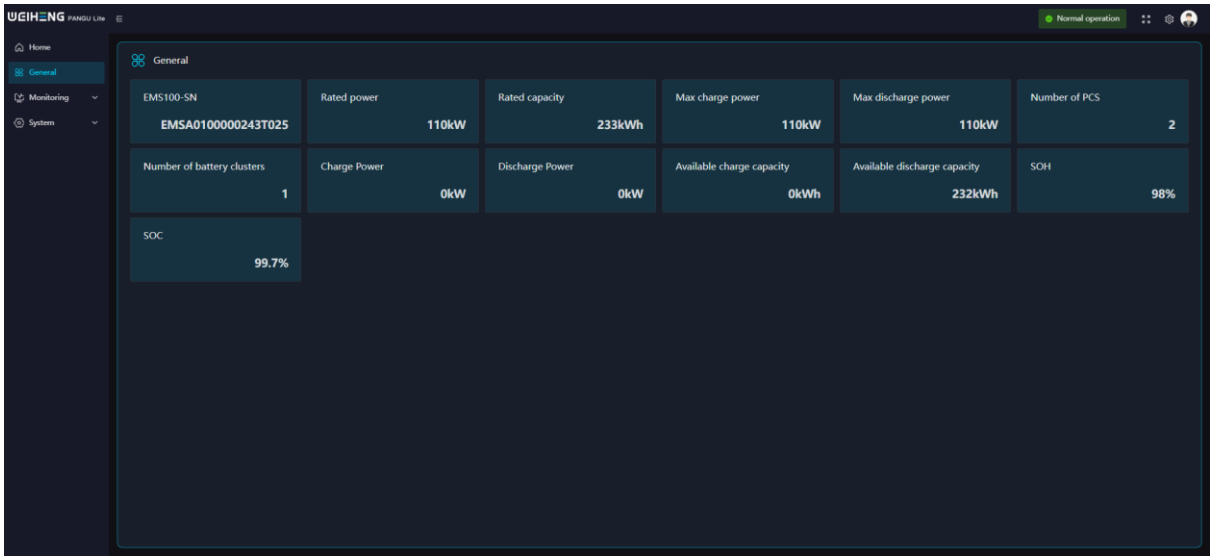


Figure 6-3 Figure 6-3 ESS Overview

6.2.3 Operational Monitoring

PCS Interface:

This interface supports real-time monitoring of DC current, DC voltage, and three-phase phase voltage data. It also monitors all operating states of the PCS, and displays PCS operational data as well as simulation data.

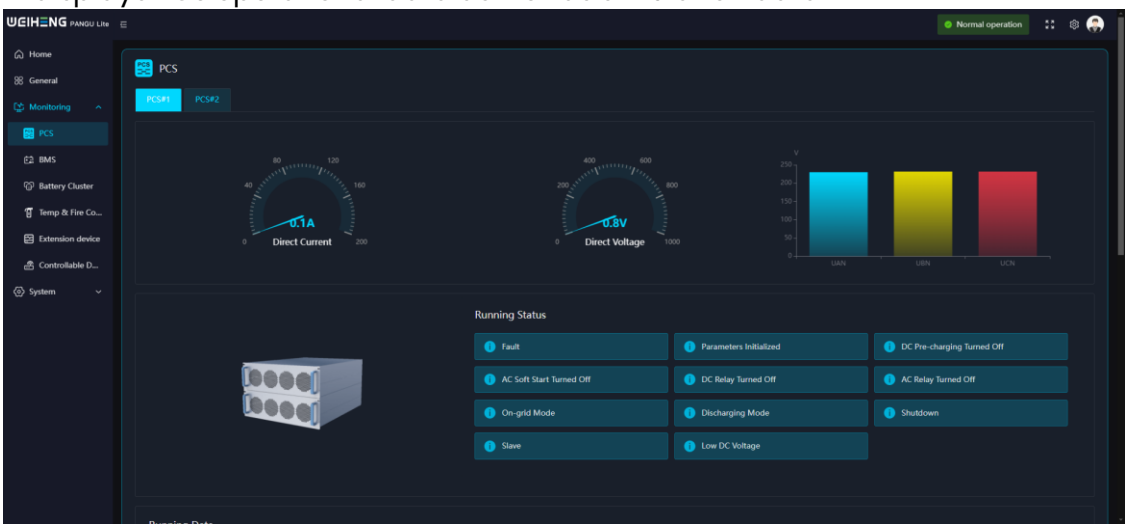


Figure 6-4 PCS Interface

BMS Interface:

This interface displays monitoring information for SOC and SOH, operating status, and detailed operational data of the battery BMS. It also provides real-time monitoring information for all battery clusters, including their current status and data.

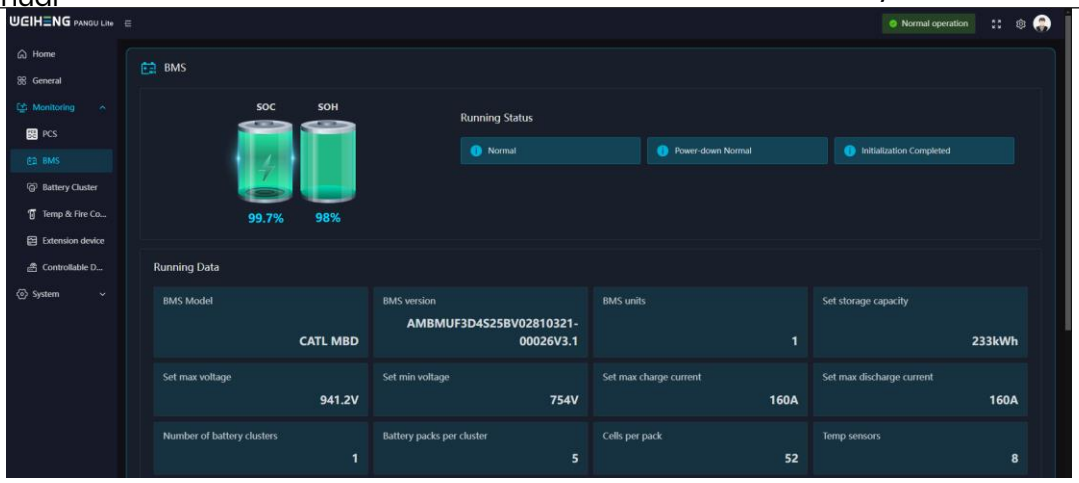


Figure 6-5 BMS Interface

Battery Cluster Interface:

This interface monitors the voltage and temperature of each individual battery within the battery pack, and tracks all operational data of the entire battery cluster.

Figure 6-6 Battery Cluster Interface

Temperature & Fire Control Interface:

This interface monitors the supply and return water temperature, pressure, and operating status of the water-cooling system. It also monitors the operating status of the air-conditioning equipment and fire protection devices.

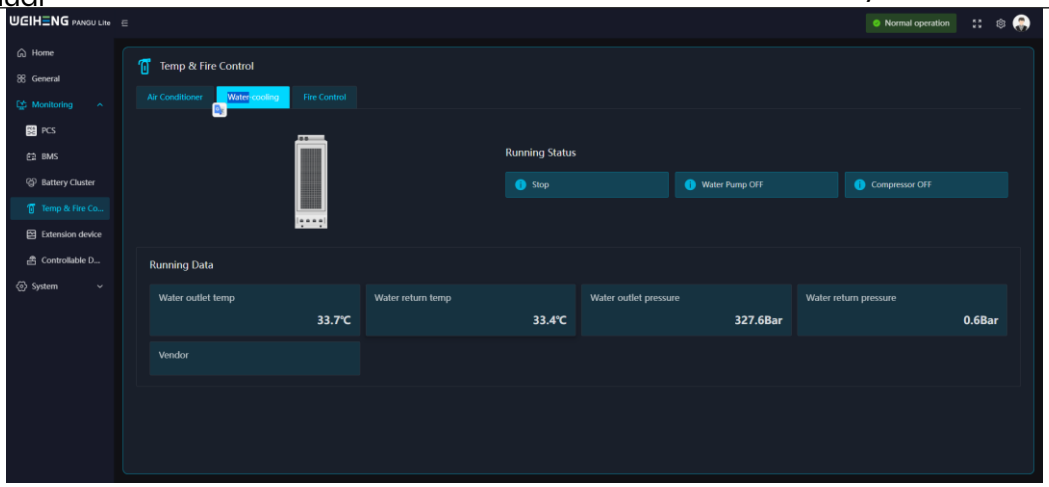


Figure 6-7 Temperature & Fire Control Interface

6.2.4 System Configuration

System Information Interface

This interface allows users to monitor system operating status and perform control operations.

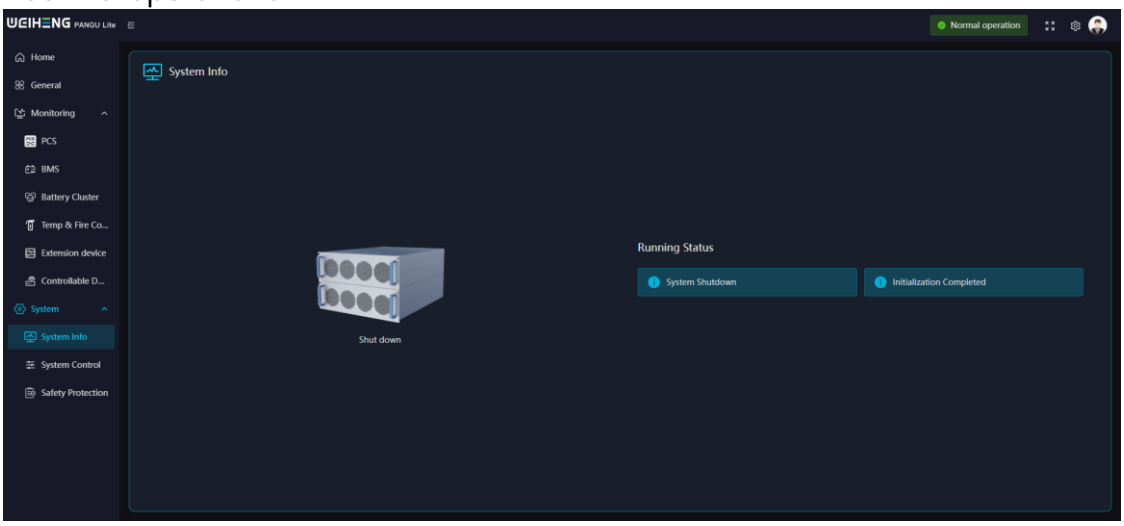


Figure 6-8 System Status Interface

System Control Interface:

This interface enables comprehensive ESS control, including system start/stop/reset, grid switch, control mode, minimum discharge SOC, power factor, power control, and coordinating controller.

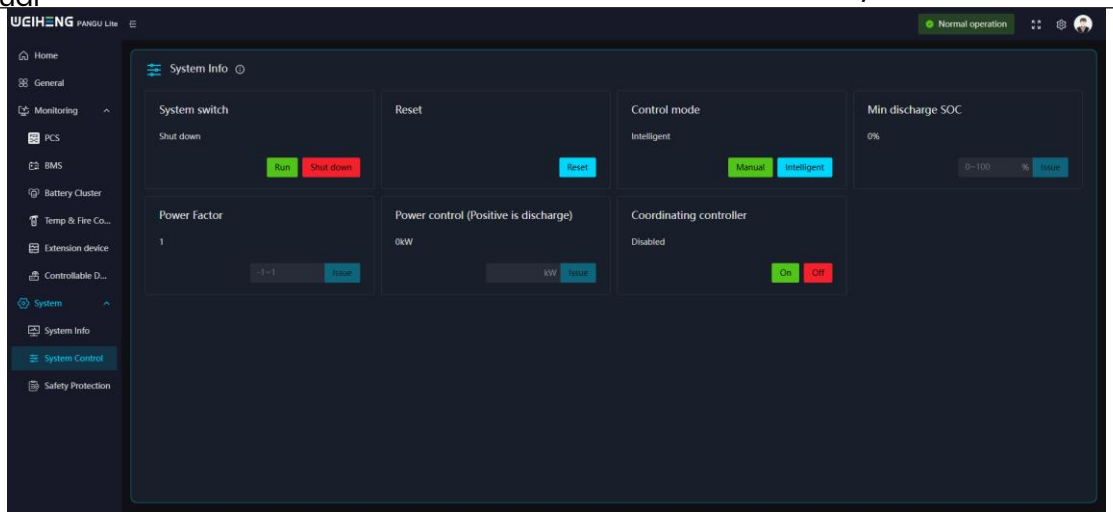


Figure 6-9 System Control Interface

6.3 Power-On with WHES OS

Operating Steps

Step 1: Navigate to "System > System Control". Click the “Run” button, and observe that the system switches to on-grid operation mode.

Figure 6-10 Power-On Step 1

Step 2: Check the “Home” screen to verify that the PCS has switched to standby mode.

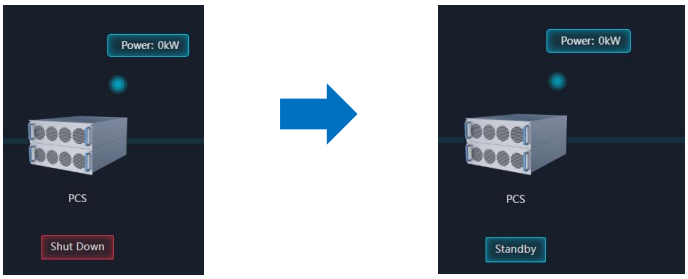


Figure 6-11 Power-On Step 2

Step 3: Navigate to the Power Station Control Strategy interface, create a new strategy, configure the charge/discharge power, schedule, and SOC, then click.

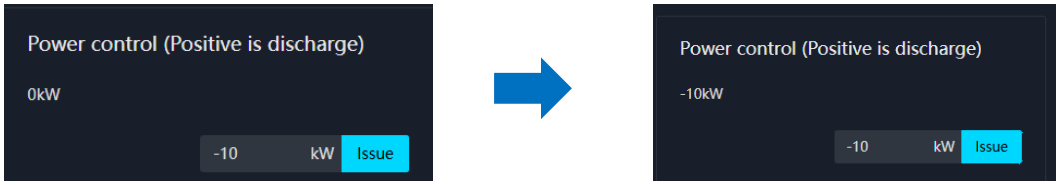


Figure 6-12 Power-On Step 3

Step 4: Check the “Home” screen to verify that the PCS has switched to charge mode, and observe the real-time system operating power.

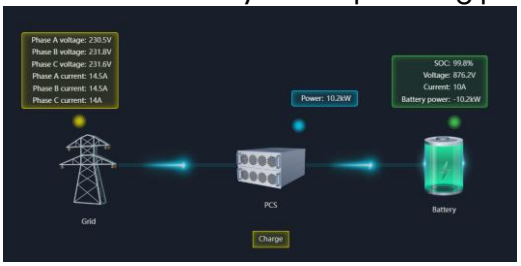


Figure 6-13 Power-On Step 4

6.4 Power-Off with WHES OS

Operation Procedures

Step 1: Navigate to "System > System Control". Enter 0 kW in the "Power Control" field, and click the "Apply" button.

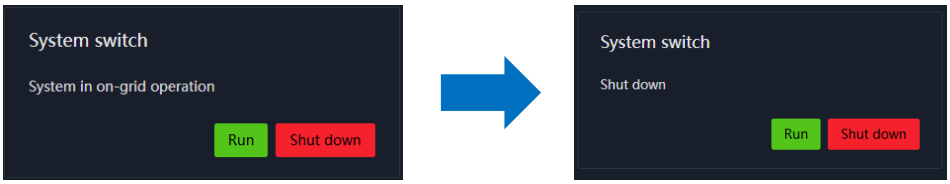


Figure 6-14 Power-Off Step 1

Step 2: Check the "Home" screen to verify that the PCS is in standby mode.

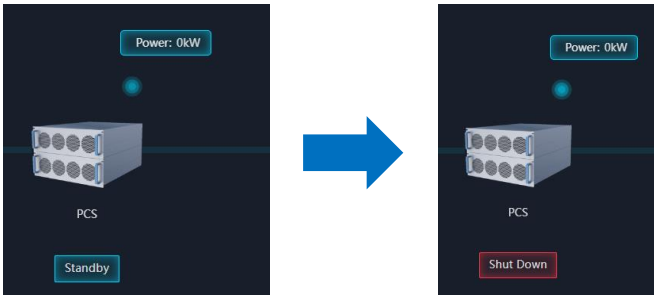


Figure 6-15 Power-Off Step 2

Step 3: Navigate to "System > System Control". Click the "Shut down" button, and verify that the system has switched to inactive mode.

Figure 6-16 Power-Off Step 3

Step 4: Check the "Home" screen to verify that the PCS is in inactive mode, indicating that the system has been shut down.

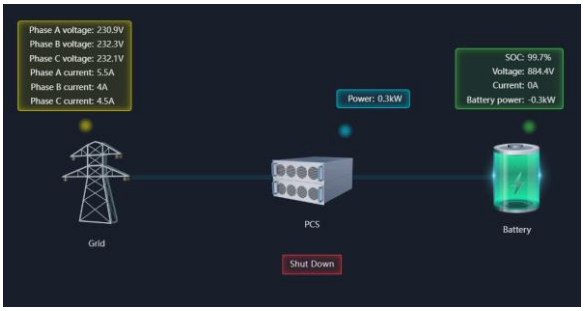


Figure 6-17 Power-Off Step 4

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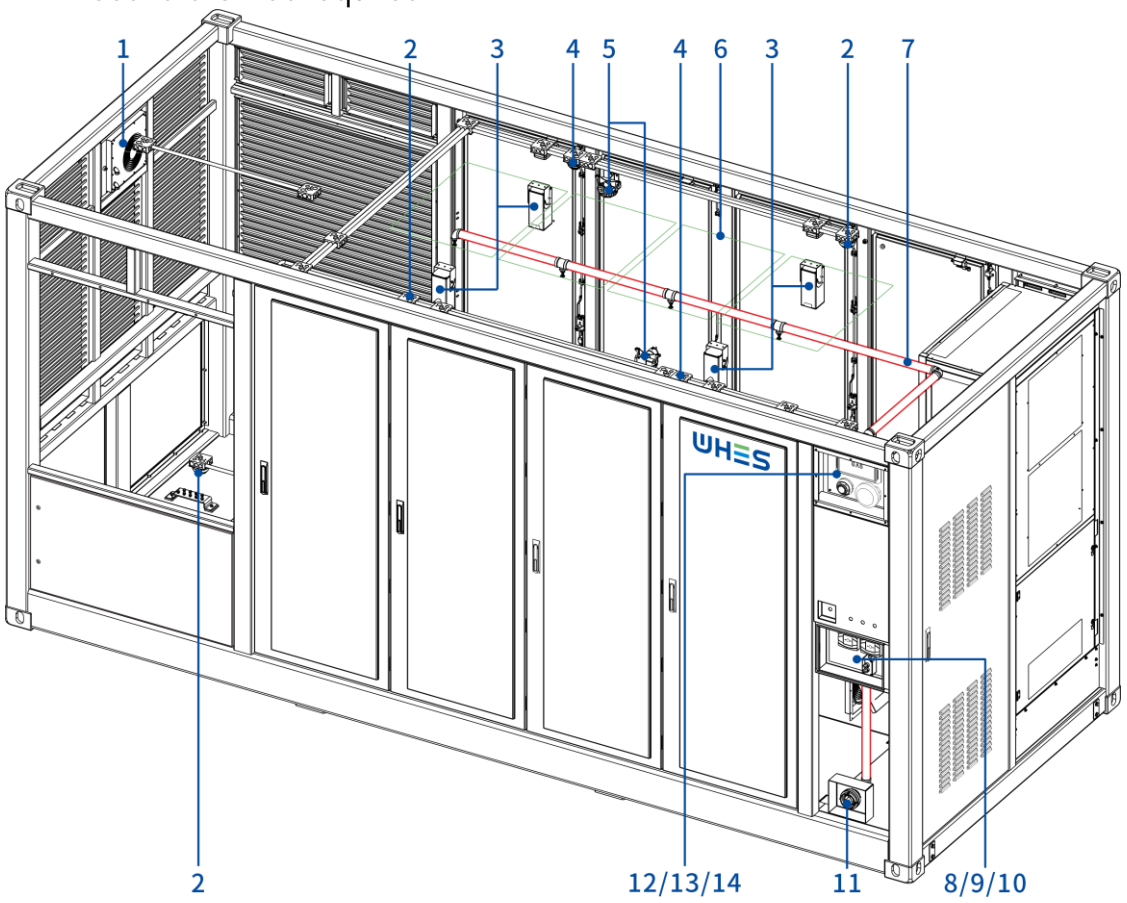
7 Fire Protection System

7.1 Fire Protection System Components

The ESS is equipped with an automatic fire alarm and interlock control system, a pressure relief system, gas detection and alarm systems, an emergency ventilation system, and a water-based fire suppression system. It is fitted with combustible gas detectors, smoke detectors, and temperature detectors. When an abnormal condition is detected, the fire alarm controller inside the outdoor ESS sends a signal to the station-level alarm panel to trigger a fire alarm.

CAUTION

To ensure the accuracy of the combustible gas detector, a functional test must be performed every six months. If a detector test fails, inspect the detector and recalibrate it as required.



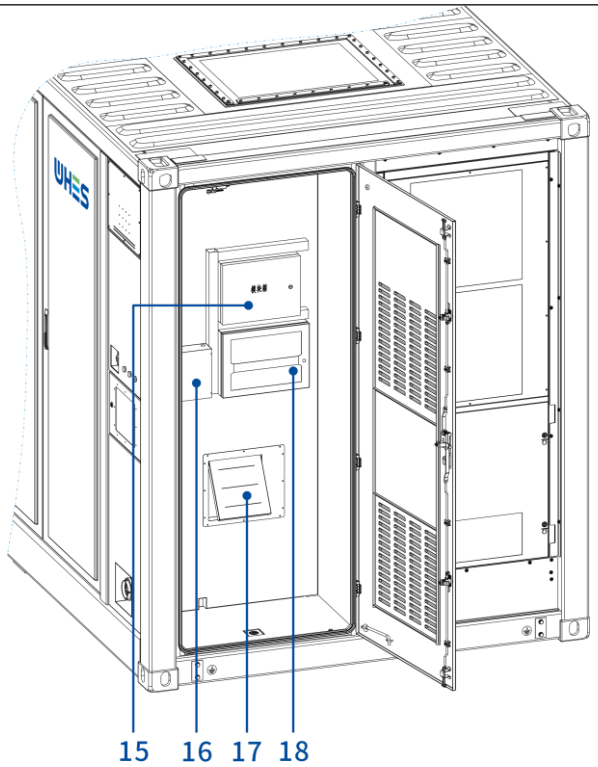


Figure 7-1 Schematic Diagram of the Fire Protection System

Table 7- 1 Component Configuration

No.	Component	Description
1	Fire Exhaust Fan	Used to quickly expel smoke and heat in the event of a fire or abnormal battery thermal release, ensuring compartment safety and supporting fire suppression and emergency response.
2	Smoke Detector	Used to monitor smoke conditions inside the compartment in real time.
3	Aerosol	Used to rapidly release fire-extinguishing aerosol when a fire is detected, suppressing combustion through chemical inhibition.
4	Temperature Detector	Used to monitor temperature changes inside the compartment in real time.
5	Flammable Gas Detector	Used to detect the presence of combustible gas leakage inside the compartment.
6	Vent Plate	Used to rapidly release internal pressure and gases in the battery compartment during abnormal overpressure or thermal runaway, preventing structural damage and reducing the risk of further accidents.
7	Water Firefighting Pipeline	Used to deliver firefighting water to sprinkler heads or fire hydrants, enabling automatic or manual fire suppression.
8	Emergency Start Button	Used to manually and immediately activate the fire protection system or related

		emergency devices during a sudden fire or hazardous situation.
9	Emergency Stop Button	Used to immediately cut off the system power and stop operating equipment in emergency situations.
10	Fan Start/Stop Button	Used to manually control the start and stop of the fire intake and exhaust fans.
11	Water Firefighting Interface	Interface used to connect the firefighting water supply to the system piping, enabling rapid activation and operation of sprinklers or fire hydrant systems during a fire.
12	Vent Indicator Light	Used to indicate whether the battery compartment or equipment is currently releasing gas.
13	Audible and Visual Alarm	Used to simultaneously alert personnel with audible and visual signals during fire, gas leakage, or equipment fault conditions.
14	Alarm Bell	Used to emit a loud alarm sound during a fire or emergency, alerting personnel to evacuate quickly and take necessary emergency actions.
15	Fire Protection System Module Box	Used for centralized installation and management of various fire protection module devices.
16	Fire Protection System Backup Power Box	Used to provide emergency backup power for fire protection equipment.
17	Fire Intake Fan	Used to supply air to fire-protected areas or smoke exhaust systems during a fire or smoke event.
18	Fire Control Main Unit	The core control unit of the fire protection system, used to centrally monitor, manage, and coordinate various fire protection devices, enabling fire alarm, smoke exhaust, sprinkler, and other functions.

7.2 Fire Protection System Control Logic

7.2.1 Gaseous Fire Suppression & Flammable Gas Detection System

The battery cabinet is equipped with an aerosol gas fire extinguishing system with a tiered warning function. Under a Level 1 warning, personnel should evacuate as soon as possible; under a Level 2 warning, personnel must evacuate immediately.

Fault: If any component of the fire protection system is wired incorrectly or damaged, the fire control main unit will perform a self-test upon power-up. The fire fault information will be displayed on the fire controller screen and simultaneously uploaded to the EMS and the station.

Level 1 Fire Alarm: A Level 1 fire alarm is triggered if any of the following occurs: H2 low-level alarm from the smoke detector, temperature detector, or combustible gas detector, or a low-level CO alarm from the combustible gas detector. The controller will activate the alarm bell to prompt on-site technical personnel to quickly check the cabinet, while unrelated personnel should move away from the area. The fire controller simultaneously uploads the Level 1 fire alarm signal to the EMS and the station.

Level 2 Fire Alarm: A Level 2 fire alarm is triggered when both a smoke detector and a temperature detector in the battery cabinet activate simultaneously. The controller activates audible and visual alarms (including the alarm bell), alerting on-site technicians to investigate the cabinet immediately while all unrelated personnel must evacuate the area. The fire controller uploads the Level 2 fire alarm signal to the EMS and the station and starts a 30-second countdown. After the countdown, the aerosol fire suppression device is activated, the aerosol spraying feedback device operates, and the ventilation indicator light illuminates to warn personnel to stay clear of the cabinet.

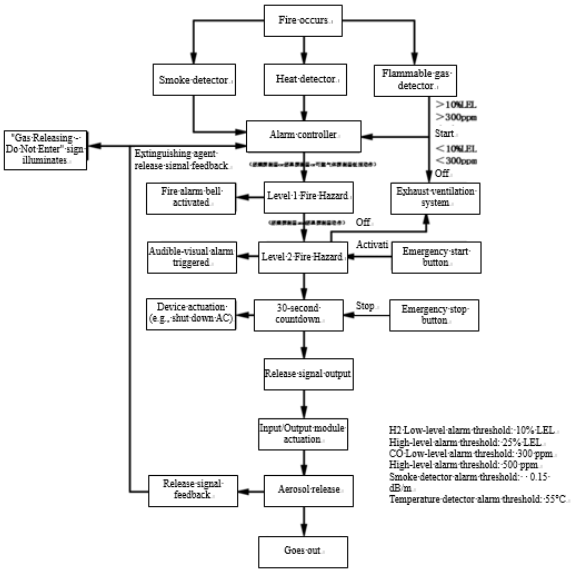


Figure 7-2 Control Logic for the Gaseous Fire Suppression & Flammable Gas Detection System

7.2.2 Emergency Ventilation System

The combustible gas detection equipment installed inside the ESS triggers the fire alarm and gas fire suppression controller, which activates activate the fire intake and exhaust fans when the detected combustible gas reaches 10% LEL. The intake and exhaust fans will stop when a Level 2 fire alarm is triggered or when the detected combustible gas level drops below 10% LEL.

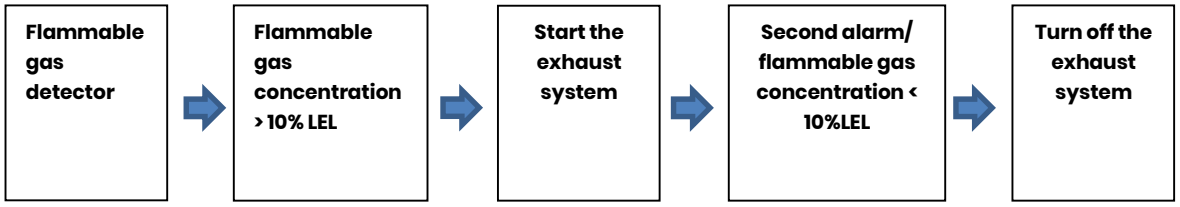


Figure 7-3 Emergency Ventilation System Control Logic

7.3 Fire Control Box

The ESS is equipped with a fire control box, which includes an emergency ventilation switch and emergency start/stop buttons.

7.3.1 Emergency Ventilation Switch

The emergency ventilation switch can be manually used to start or stop the Ventilation system.

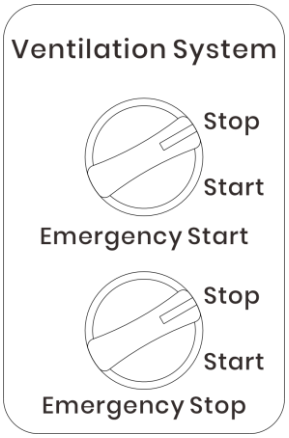


Figure 7-4 Emergency Ventilation Switch

7.3.2 Emergency Start/Stop Button

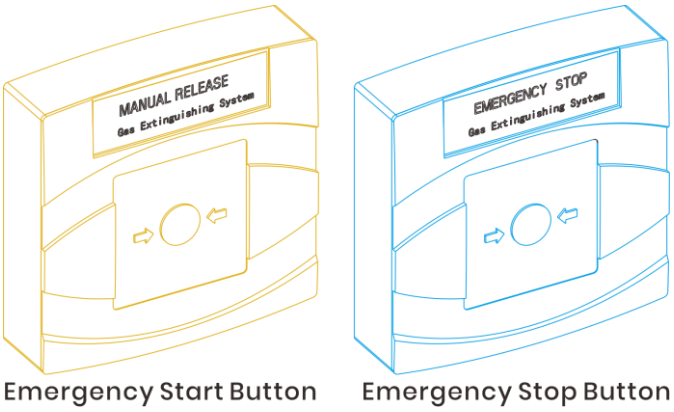


Figure 7-5 Emergency Start/Stop Button

Table 7- 2 Button description

Item	Description
Start Button	After pressing the button, the audible and visual alarm is activated, and he aerosol system is ready for discharge.
Stop Button	Pressing the button during the fire suppression countdown will stop the aerosol discharge.

7.4 Water-Based Fire Protection System

The prefabricated water sprinkler piping system inside the ESS is manually activated to start the water-based fire suppression system. The external water supply pipe and equipment must be connected to the designated coupling on the ESS. The connection method should be determined according to site conditions. The sprinkler system uses sprinkler heads to ensure effective coverage of all areas within the ESS.

CAUTION

Customers using the automatic water sprinkler system must use external piping, which is to be designed by the customer.

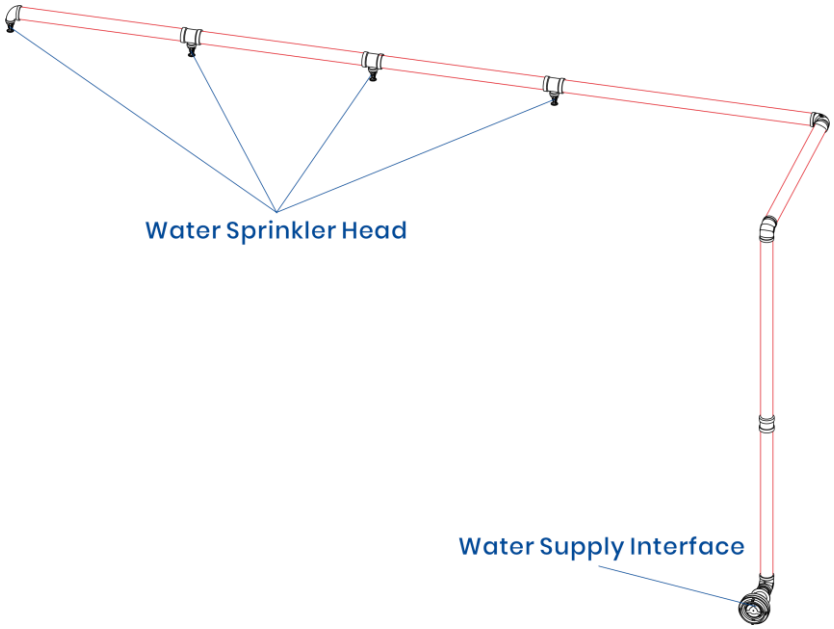


Figure 7-6 Emergency Start/Stop Button

8 Product Maintenance

8.1 Precautions Before Maintenance

The ESS requires regular maintenance, with increased frequency under harsh operating conditions. All services must be properly recorded.

WARNING

- Do not perform maintenance on the ESS during heavy rain, strong winds, or other adverse weather conditions. WHES will not be held liable for any damage resulting from non-compliance with this warning.
- To avoid electric shock, do not perform any maintenance or repair operations beyond the scope of this user manual.
- ESS maintenance must be performed only by qualified technicians.

8.2 Maintenance Item

NOTE

- The maintenance interval of the product may be affected by on-site environmental conditions. .If the operating environment contains heavy dust or frequent exposure to sand and dust, it is necessary to shorten the maintenance interval and correspondingly increase the maintenance frequency.

Table 8- 1 Maintenance Item

Maintenance Interval	Maintenance Item	Inspection Method
First Grid Connection	**Electrical connection**	Verify that the material and specifications of the input and output cables meet the required standards.
		Check whether the material, specifications, and installation orientation of the wiring terminals meet the required specifications.
		Inspect the cable connections for any loose contacts or short-circuit conditions.
		Verify that the cable phase sequence is correct.
		Check whether the cable insulation meets the requirements. An insulation resistance test must be performed.
		Verify that the equipment grounding resistance meets the specified requirements.
Every 6 months	**ESS condition**	Check the ESS for signs of oxidation, rust, or corrosion.
		Inspect the ESS and internal equipment for any damage or deformation.
		Check the top and surrounding area of the ESS for any flammable materials.
		Check whether all welds between the ESS to the foundation steel plate are secure and free of rust.
		Check whether the cabinet door locks and latches can open and close smoothly.
		Check whether the sealing strips and gaskets are securely installed.

			Inspect the inside of the ESS for foreign objects, fallen screws, dust, dirt, or condensation.
			Check whether any internal equipment produces abnormal noise during operation.
			Check whether the internal temperature of the ESS is excessively high.
			Check whether the internal humidity of the ESS is within the normal range.
		Cables	Check whether the cables are damaged.
		Air inlet and outlet	Check the ESS's air inlet and outlet for foreign objects and ensure they are not blocked.
		Safety functions	Check the functionality of the emergency stop button.
			Check whether the warning labels on the equipment and other device markings are clear and undamaged. If any labels are faded or damaged, replace them promptly.
		Internal component inspection	Check whether the fans are operating normally and whether there is any abnormal noise.
			Check the temperature and dust accumulation on the heat sinks. If necessary, clean the heat sinks and associated modules using a vacuum cleaner.
			Replace the air filter if necessary.
		Component maintenance	Perform a routine inspection for corrosion on all metal components.
			Perform an annual inspection of the contactors (including auxiliary and micro switches) to ensure proper mechanical operation.
			Check the operating parameters, with particular attention to voltage and insulation.
	Every year	**Cable shield grounding cable shielding layer**	Check the cable shielding and insulation sleeves for proper contact, and ensure that the grounding copper busbar is securely fastened.
		SPD and fuse	Check whether the surge protection devices and fuses are in good condition.
		Wiring and cabling	Check whether the cable routing is proper and whether there is any insulation damage.

		Any abnormalities must be corrected immediately.
		Check that all cable entry and exit holes in the ESS are properly sealed.
		Check whether the power cable connections are loose, and re-tighten them according to the previously specified torque.
		Inspect the power and control cables for any damage, paying particular attention to the outer sheath in areas contacting metal surfaces for signs of cuts or abrasions.
		Check whether the insulation tape on the power cable terminals is intact and free of peeling.
	Grounding inspection	Check the grounding resistance; the value must not exceed 4 Ω.

A Crimping OT/DT Terminals

OT/DT Terminal Requirements

- For copper core cables, please use copper terminals.
- For copper-clad aluminum cables, copper terminals are required.
- For aluminum alloy cables, use copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition pads.

BEWARE

- It is strictly forbidden to connect aluminum terminals directly to terminal blocks, as this may cause electrochemical corrosion and affect the reliable cable connection.
- When using copper-aluminum transition terminals, or aluminum terminals with copper-aluminum transition pads, ensure compliance with IEC61238-1.
- When using copper-aluminum transition pads, ensure proper orientation so that the aluminum side of the pad contacts the aluminum terminal, and the copper side contacts the terminal block.

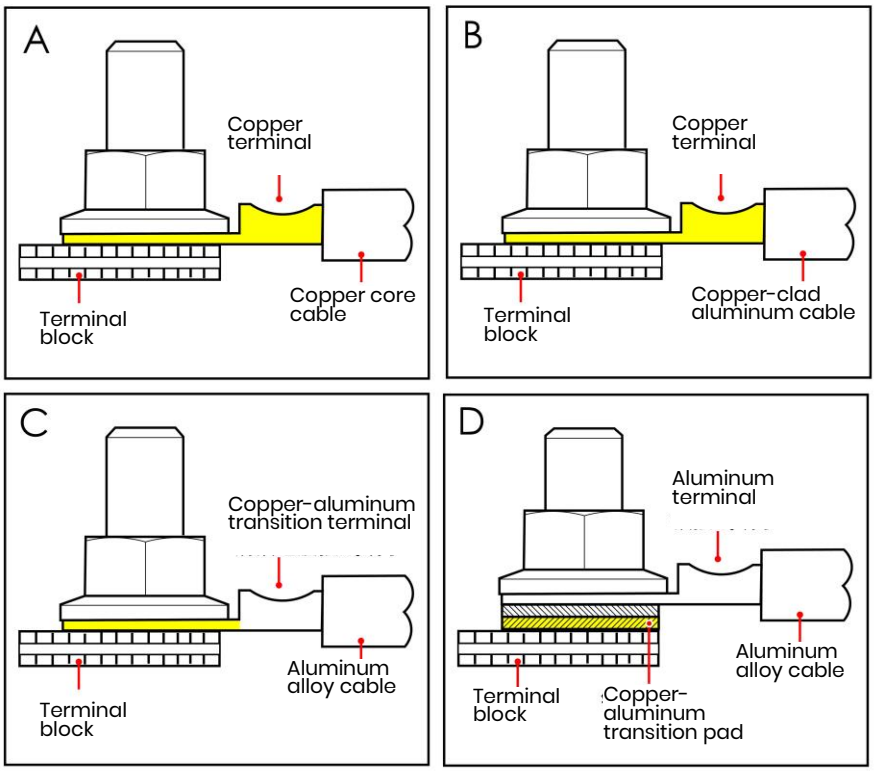


Figure A-1 OT/DT Terminal Requirements

Crimping OT/DT Terminals

BEWARE

- Do not scratch the conductor when stripping the cable.
- After crimping, the cavity formed by the conductor crimping tab of the OT/DT terminal shall completely enclose the conductor, and the conductor shall be tightly connected to the OT/DT terminal without any looseness.
- The crimped area can be covered with heat shrink tubing or insulating tape. Below is an example of using heat shrink tubing.
- When using a heat gun, pay attention to safety precautions to prevent damage to the equipment.

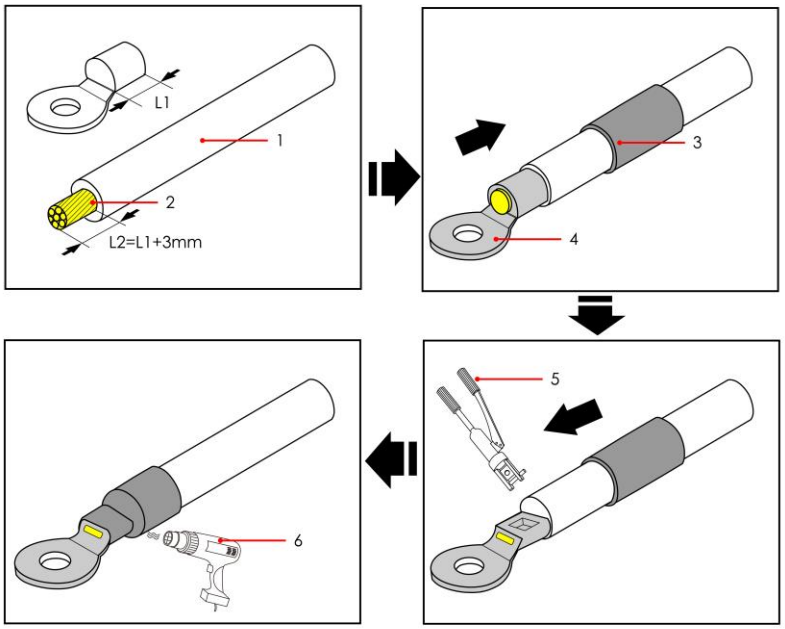


Figure A-2 Crimping OT Terminal

(1) Cable (2) Conductor (3) Heat shrink tubing
(4) OT terminal (5) Hydraulic crimping pliers (6) Heat gun

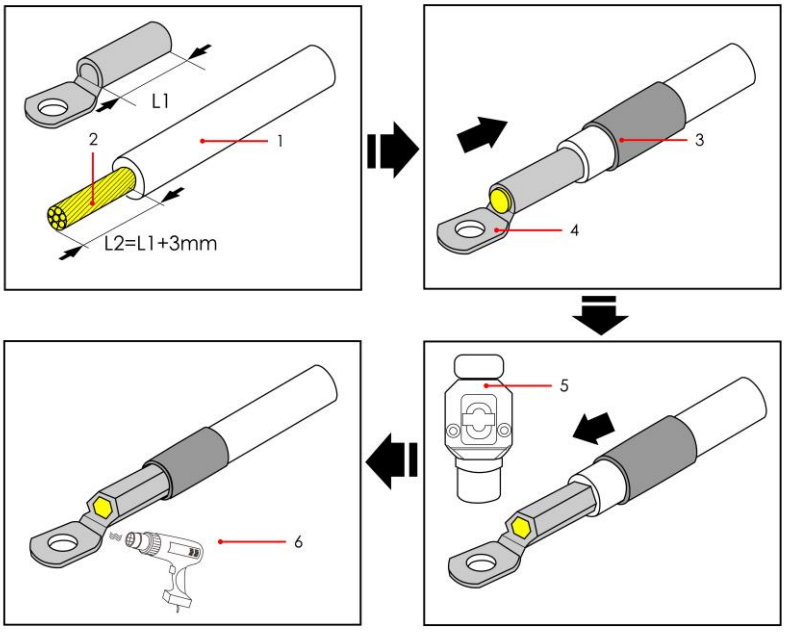


Figure A-3 Crimping DT Terminal

(1) Cable (2) Conductor (3) Heat shrink tubing
(4) DT terminal (5) Hydraulic crimping pliers (6) Heat gun

B How to Recycle Used Batteries

BEWARE

- WHES does not provide battery recycling services. Customers are responsible for contacting local recyclers for disposal.
- If no local service is available, customers are advised to contact the nearest national recycler for disposal.

Step 1 Contact the nearest recycler.

Step 2 The recycler evaluates the recycling cost.

Step 3 The recycler recycles batteries using one of the following two methods:

- On-site recycling: The recycler collects lithium batteries from the customer site, at a price determined based on the actual travel distance/transportation cost and other factors.
- Centralized recycling: The customer brings all lithium batteries to be recycled to a designated location for centralized collection by the recycler.

  Transportation cost arising from the on-site recycling service is to be borne by the customer.

Step 4 The recycler is fully responsible for the disposal of the recycled batteries. The recycler takes full responsibility for disposing of the recycled lithium batteries, with no further involvement from the customer.

C Contact Details

Please contact us if you have any questions about this product.

Table D-1 Customer Service Contact Details

Country	E-mail	Phone
China	service@whes.com	+86 4008776999

D Abbreviations

B	
BMS	Battery Management System
C	
CAN	Controller Area Network
CSC	Cell Supervision Circuit
E	
EMS	Energy Management System
ESS	Energy Storage System
H	
HV	High Voltage
L	
LAN	Local Area Network
M	
MSD	Manual Service Disconnect
N	
NTC	Negative Temperature Coefficient
P	
PCS	Power Conversion System
S	
SOC	State of Capacity
SBMU	Slave Battery Management Unit
U	
UPS	Uninterruptible Power System

E Technical Data

Model	IA-1488 kW/2980 kWh-DA10	IA-1302 kW/2600 kWh-DA10	IA-1116 kW/2230 kWh-DA10	IA-930 kW/1860 kWh-DA10	IA-744 kW/1490 kWh-DA10	IA-744 kW/2980 kWh-DA10
Battery						
Battery Type	LFP , 3.2 V / 280 Ah					
Battery Pack Configuration	1P*52S					
Battery Capacity	2981 kWh (46.59 kWh * 8 * 8)	2609 kWh (46.59 kWh * 8 * 7)	2236 kWh (46.59 kWh * 8 * 6)	1863 kWh (46.59 kWh * 8 * 5)	1490 kWh (46.59 kWh * 8 * 4)	2981 kWh (46.59 kWh * 8 * 8)
Rated Battery Voltage / Voltage Range	1331.2 V / 1164.8...1497.6 V					
Max. Charging/Discharging Current	140 A * 8	140 A * 7	140 A * 6	140 A * 5	140 A * 4	140 A * 4
Max. Charging/Discharging Power	1456 kW /1528 kW	1274 kW /1337 kW	1092 kW / 1146 kW	910 kW / 955 kW	728 kW / 764 kW	728 kW / 764 kW
AC Parameters (On-grid)						
Rated Output Power	186 kW * 8	186 kW * 7	186 kW * 6	186 kW * 5	186 kW * 4	186 kW * 4
Rated Voltage	3W+PE, 690 V					
Voltage Range	587...759 V					
Rated Output Current	1245 A	1089 A	933 A	778 A	622 A	622 A
Rated Frequency	50/60 Hz					
Total Harmonic Distortion (THDi)	< 3%					
Power Factor	-1...+1					
General Data						
Dimensions (W*D*H)	6058*2438*2896 mm					
Weight	~32 t	~28.4 t	~24.8 t	~21.2 t	~17.6 t	~ 32t
Operating Temperature Range	-25°C...+60°C （derating @ > 50℃）					
Relative Humidity	0...95% (Non-condensing)					
Altitude	≤3000m(derating @ > 2000m)					
Cooling	Smart Air Cooling (PCS) Liquid Cooling (Battery)					
Noise	< 75dB					
Ingress Protection	IP55					

Fire Protection	Smoke Detector, Heat Detector, Alarm Sounder, Aersol, Sprinkler, Flammable Gas Detector, Vent Plate
Communication	Ethernet
Installation	Floor-standing
Standards	IEC62619、IEC63056、IEC62477、IEC61000、UN38.3、EN50549-1、EN50549-2、EN50549-10

F Troubleshooting

According to Section 6.1, you can enter the PANGU interface. In the upper right corner of the interface  , you can view the fault alarm information.

Please troubleshoot according to the following methods. If the troubleshooting methods do not help you, please contact the after-sales service center. When contacting the after-sales service center, please collect the following information to facilitate quick problem-solving.
1. Software version, equipment installation time, time of failure occurrence, frequency of failure occurrence, etc.
2. Equipment installation environment (e.g., weather conditions) and system information (e.g., serial number). It is recommended to provide photos, videos and other files to assist in problem analysis.
3. Grid conditions.

Table G -1 Troubleshooting Guide

No.	Fault Name	Cause	Solution
1	PCS Communication Fault	Communication fault between PCS and EMS	1. Check if PCS is properly powered on. 2. Check all communication cables between EMS and PCS. 3. If the fault persists, contact the dealer or after-sales service center.
2	Water Chiller Communication Fault	Communication fault between water chiller and EMS	1. Check the water chiller power supply. 2. Check the signal cable connections.
3	Fire System Communication Fault	Communication fault between fire system and EMS	1. Check the fire system power supply. 2. Check the signal cable connections.
4	BMS Communication Fault	Communication fault between BMS and EMS	1. Check the HV box power supply. 2. Check the signal cable connections.
5	Single Cell Overvoltage Level 1 Alarm	Poor cell balancing	Stop charging and perform standby balancing.
		System overcharge	Stop charging.
6	Emergency Stop Fault	System triggered emergency stop	1. Check if the emergency stop signal circuit is properly connected. 2. Check if the emergency stop button on the ESS is pressed.

7	No Mains Power	1. Grid outage2. AC line or AC switch disconnected	1. Check if the grid voltage is normal. 2. Check if the switch is closed. If none of the above causes apply and the fault persists, contact the dealer or after-sales service center.
8	Ac circuit breaker disconnection fault	AC circuit breaker fault	Check whether the circuit breaker is closed.
9	Door Open Fault	EMS indicates door open fault	Check whether the cabinet door is open.
10	Single Cell Undervoltage Alarm	Poor cell balancing	Stop charging and perform standby balancing.
		System overdischarge	Stop discharging.
11	Battery High Voltage Indicator Not Lit	HV relay failure	Replace the relay.
		SBMU fault	Replace SBMU.
		Indicator light failure	Replace the indicator light.
12	Grid Phase Sequence Error	Incorrect grid wiring	1. Check whether the three-phase AC cable sequence is correct. 2. If the fault persists, contact the dealer or after-sales service center.
13	Grid Overfrequency	Grid frequency exceeds overfrequency point	1. If occasional, it may indicate a transient grid anomaly. The PCS will automatically resume normal operation once stable grid conditions are restored, requiring no manual intervention. 2. If frequent, check whether the grid frequency is within the allowed range: If the frequency exceeds the allowed range, contact the local power operator. If the frequency is within the allowed range, modify the PCS grid frequency protection point or disable the protection function with local operator approval.
14	Grid Underfrequency	Grid frequency below underfrequency point	1. If occasional, it may indicate a transient grid anomaly. The PCS will automatically resume normal operation once stable grid conditions are restored, requiring no manual intervention. 2. If frequent, check whether the grid frequency is within the allowed range: If the frequency exceeds the allowed range, contact the local power operator. If the frequency is within the allowed range, modify the PCS grid frequency

			protection point or disable the protection function with local operator approval.
15	Grid Overvoltage Fault	Grid voltage exceeds AC overvoltage point	1. If occasional, it may indicate a transient grid anomaly. The PCS will automatically resume normal operation once stable grid conditions are restored, requiring no manual intervention. 2. If frequent, check whether the grid voltage is within the allowed range: If voltage exceeds the allowed range, contact the local power operator. If voltage is within the allowed range, modify the PCS AC voltage protection point or disable the protection function with local operator approval.
16	Grid Undervoltage Fault	Grid voltage below AC undervoltage point	1. If occasional, it may indicate a transient grid anomaly. The PCS will automatically resume normal operation once stable grid conditions are restored, requiring no manual intervention. 2. If frequent, check whether the grid voltage is within the allowed range: If voltage exceeds the allowed range, contact the local power operator. If voltage is within the allowed range, modify the PCS AC voltage protection point or disable the protection function with local operator approval.
17	Battery Undervoltage Alarm	Battery voltage too low at power-on	1. Check whether the battery voltage is too low. 2. If the battery voltage is within the allowed range and the fault persists, contact the dealer or after-sales service center.