WEIHENG

WH-TIANWU-100-233B

All-in-one Battery Energy Storage System

User Manual

*Due to domestic and foreign regulatory requirements, as well as differences in appearance and layout because of differences in product standards and specifications, no special explanations and distinctions will be outlined for the product picture on this page. The actual project requirements shall prevail.

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Preface

Overview

This document mainly describes how to install, connect, commission, and troubleshoot the TIANWU-100-233-B energy storage system (hereinafter referred to as the "energy storage system"). Please read this manual carefully to get familiar with the safety instructions and functions, and features of the energy storage system before installing and using the energy storage system.

Target Audience

This manual is intended for operators and qualified electrical technicians in power plants.

Symbol Conventions

For the purpose of this document, the following symbols that may exist herein mean as below.

Symbol	Description
Danger	A high-risk hazardous situation which, if not avoided, will result in death or serious injury.
Warning	A moderate-risk hazardous situation which, if not avoided, could result in death or serious injury.
Caution	A low-risk hazardous situation which, if not avoided, could result in mild or moderate injury.
Notice	This is used to convey device or environment safety warning information. Users are alerted of possible equipment damage, data loss, performance degradation, or unpredictable results, if not avoided. "Notice" involves no personal injury.
Description	This is used to highlight important/key information, best practices, and tips. "Note" is not safety warning information and involves no personal injury, equipment damage, or environment hazard.

Revision History

The revision history summarizes descriptions of each document update. The latest issue of the document contains all changes made in previous issues.

Document Version 01 (July 01, 2023)

V1.0

Document Version 02 (Oct 16, 2023)

V1.1

Changes：update the DC-side full-load voltage range. (500V→600V)

Document Version 03 (April 15, 2024)

V2.0

Changes：update the product appearance；add installation requirements；add F part-layout drawing

Table of Contents

1 Safety Precautions

1.1 General Safety Requirements

Statements

Please read this manual and follow the symbols on the device and all safety precautions in this manual before installing, operating, and maintaining the system.

The "Notice", "Caution", "Warning" and "Danger" in this manual do not represent all the safety precautions users should follow but only serve as a supplement to all the safety precautions. The Company does not assume any liability for damage or loss due to violation of general safety requirements or safety standards for the design, production and use of the system.

The system must be used in an environment that meets the design specifications. Otherwise, the system may be faulty. The resulting malfunction, component damage, personal injury, and property losses are not covered by the warranty.

Comply with local laws and regulations, and codes when installing, operating, and maintaining the system. The safety precautions in this manual only serve as supplements to local laws and regulations and codes.

The Company shall not be liable in any of the following situations:

- The system is installed and operated in an environment that does not meet requirements in applicable international, national, and regional standards.
- The system is not operated under the conditions of use described in this manual.
- The product is disassembled or modified, or the software code

is modified without authorization.
- The system is not operated according to instructions for use and safety precautions in the manual.
- Equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, debris flow, etc.).
- Damage caused by customer's failure to comply with shipping and installation requirements.
- Damage caused by improper storage conditions.
- Hardware damage or data corruption caused by customer's negligence, incorrect operation, or intentional damage.
- System damage caused by third parties or customers, including damage caused by improper relocation and installation of the system, as well as damage caused by improper adjustment, change or removal of identification marks.
- Defects, malfunctions or damages caused by acts, events, omissions or accidents beyond the reasonable control of the Seller, including power outage, electrical failure, theft, war, riot, civil unrest, terrorism, and intentional or malicious damage.

General Requirements

⚠ Danger

High voltage exits in the system. Improper operations may result in electric shock or fire, leading to death, serious personal injury, or property damage. Please:

- Follow the operation procedure and safety precautions provided in this manual and other related documents.
- Follow the warning signs, warnings and protective measures indicated on the system.
- Follow the instructions provided in this manual, use the correct tools, and know how to correctly use these tools.
- Follow the safety regulations of the power plant, such as operation ticket and work ticket system.
- Do not approach the system except for system operators. Erect a temporary warning sign or fence to isolate the operation area.
- The warning sign, warning information, and protective measures must be legible. Do not alter, damage or cover the content, and replace if necessary.
- Do not perform installation, connection, maintenance, and replacement

operations with power on.

- Do not clean the electrical components inside the system with water.
- Check the system for damage, such as holes, dents, or other signs of possible internal damage.
- Check that the pre-installed cables are securely connected.
- Check that the components inside the system are not displaced. Do not modify the structure or installation sequence without authorization.
- Do not power up the system when the system is not fully installed or confirmed by a professional.
- Measure the voltage at the contact before touching any conductor surface or terminal and ensure that the PE cable of the system or component to be repaired is reliably grounded and that there is no risk of electric shock.
- Press the emergency stop button and notify the site manager when any liquid dampens the system.
- Do not open the cabinet door when the system is operating.
- Wear arc protection clothing in the initial power-up or when you operate the main circuit with power on.

⚠ Caution

- Do not perform arc welding, drilling, or cutting operations on the system. Such operations may damage the sealing property of the entire cabinet, degrade the electromagnetic shielding performance of the system, or damage internal components and cables. Metal scraps generated during operations may enter the system, resulting in an electrical short circuit, malfunction or equipment damage.
- The housing is hot when the system is operating. Do not touch the housing. Otherwise, burn injury may occur.
- Immediately stop the system when a fault is detected that may cause personal injury or equipment damage, then report the event to the person in charge, and take effective protection measures.
- Evacuate from the scene immediately when the fire alarm is triggered.
- Close and lock the cabinet door when the equipment under operation and maintenance is left unattended temporarily.

ⓘ Notice

- Transport, transfer, install, connect, and maintain the system in strict accordance with the laws, regulations, and related standards of your country or region.
- User-supplied materials and tools required for operation shall meet the

laws, regulations, and related standards of your country or region.
- The system can be connected to the grid only when permitted by the electric power department of your country or region.
- Clean the water, snow, ice, or other debris, if any, on the cabinet top before opening the cabinet door for installation, operation or maintenance to prevent debris from falling into the cabinet.

Description

- Do not perform reverse engineering, decompilation, disassembly, reprogramming, implantation, or other derived operations on the software. Never research the internal implementation of the device in any way, obtain the source code of the software, steal intellectual property rights, nor disclose the results of any software performance tests.
- You are advised to prepare your own camera device and record the detailed information of installation, operation, and maintenance.

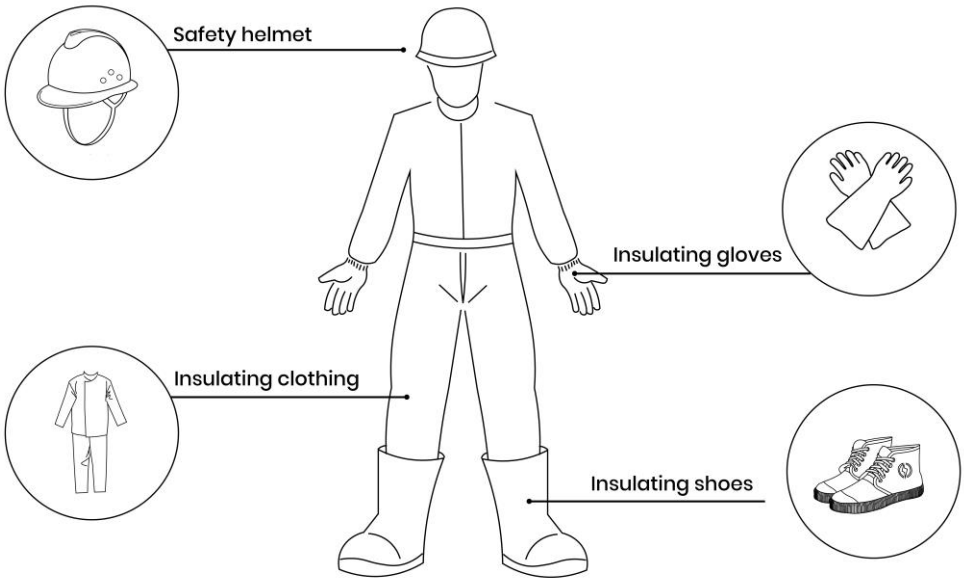
1.2 Personnel Requirements

- Only qualified personnel can operate the equipment, including transportation, transfer, installation, cable connection, and maintenance. Wear personal protective equipment that meets local safety protection requirements while operating the equipment.
- Operators must receive the relevant training and pass the examinations of the Company and have professional knowledge of the energy storage system.

Description

For qualification requirements, refer to your local laws and regulations and industrial standards.

Figure 1-1 Wearing method of PPE



- Do not wear conductive objects such as watches, bracelets, rings, and necklaces during installation, operation, and maintenance to avoid burn injury due to electric shock.
- Transport, transfer, install, connect, and maintain the system in strict accordance with the laws, regulations, and related standards of your country or region.
- Keep familiar with the compositions and working principles of the energy storage system and operate the equipment according to the User Manual.

1.3 Storage and Installation Environment Requirements

General Requirements

Description

- Keep certificates demonstrating compliance with product storage requirements, for example, temperature and humidity log data, storage environment photos, and inspection reports.
- Do not store the energy storage system for a prolonged period of time. Long-term storage of a lithium battery will result in capacity loss. A

lithium battery will generally be subject to irreversible capacity loss of 3% to 10% when it is stored at the recommended storage temperature for more than 12 months.

- Store the product in a clean and dry place that is free of dust and water vapor erosion. Avoid rain or ground water erosion.
- The ambient air must not contain corrosive or flammable gases.
- Do not tilt the product or store it upside-down.
- The devices, except for lithium battery packs, stored for two years or more, must be inspected and tested by professionals before being put into use.

Storage Requirements of Energy Storage System

- Do not stack up.
- Ensure that the storage area is level (long-term or temporary).
- Keep the cabinet door tightly closed.
- Storage temperature: -30°C to +60°C, humidity: 5%RH to 95%RH.
- The energy storage system contains a lithium battery pack. Avoid direct sunlight or rain, and keep the environment dry, well-ventilated, and clean. There is no large amount of infrared radiation, organic solvents, or corrosive gases. Keep away from the ignition source.
- The lithium battery pack must not be stored and transported for more than five months in total (calculated from the date of delivery). Beyond this timelimit, the lithium battery pack must be recharged to 30% SOC and then subject to SOC calibration. Otherwise, the battery performance may be degraded and the service life may be reduced.
- The warehouse keeper should make monthly statistics on the storage capacity of energy storage systems, regularly inform the planning sequence of the inventory of energy storage systems, and recharge the energy storage systems that are stored for an extended period of time.
- The FIFO principle must be strictly followed for the delivery of energy storage systems.

Installation Environment Requirements

For site selection, refer to **3.1 Site Selection Requirements**. The following installation requirements must be met:

- Energy storage systems should be installed and arranged

according to fire-break distance or fire partition wall requirements in your local standards, including but not limited to *GB 51048-2014 Design code for electrochemical energy storage station* and *NFPA 855 Standard for the installation of stationary energy storage systems*.

- Never place the equipment in an environment with flammable or explosive gas or smoke, nor perform any operations in such an environment.
- Do not install, use, or operate outdoor equipment and cables (including but not limited to transporting equipment, operating equipment and cables, plugging and unplugging signal cables connected to outdoor ports, working at heights, or installing outdoors) in severe weather conditions such as lightning, rain, snow, and force 6 wind or higher.
- Protective measures such as fences and enclosures must be set up for energy storage systems, and safety warning signs must be erected for isolation to prevent unauthorized personnel from accessing the equipment when it is operating. Otherwise, personal injury or property damage may occur.
- Do not block the vents and cooling system when the equipment is operating to prevent fire hazards due to high temperatures.
- The equipment should be installed in an area away from liquid, and should not be installed under water pipes and air outlets that are prone to condensation. Do not install the equipment under the air conditioner vent, air vent, or cable leading-out window of the equipment room to prevent liquid from entering the equipment and causing malfunction or short circuit.
- Keep the installation location away from an ignition source. Keep the equipment away from flammable or explosive materials.
- If the equipment is installed in a vegetated area, in addition to routine weeding, the foundation beneath the equipment needs to be hardened to prevent weeds.

Requirements for Working at Heights

- Take protective measures, wear PPEs including a safety helmet, safety belt, and waist strap, and tie the safety belt and waist strap to a rigid

structure. Do not hang to an unstable moving object or metal with sharp edges to prevent the hook from slipping, leading to falling accidents.

- Define a restricted zone by setting a visible sign reading "No Entry" when working at heights.
- Do not stack scaffolding, springboards, and other foreign matters on the ground underneath the work platform. Personnel on the ground should not stay or pass through underneath the work platform.
- Do not throw objects at heights to the ground or from the ground to the height. Instead, use ropes, hanging baskets, elevated vehicles, or cranes to transport objects.
- Inspect the scaffolding, springboard, and work platform for safety to guarantee that the structure is rigid and the scaffolding is not overloaded.
- Do not work at heights on rainy days or other dangerous situations. When this happens, always ask the safety director and engineers to re-inspect various operation equipment for safety before proceeding with working at heights.
- Erect fences and signs at edges and openings when working at heights to prevent missing steps.
- Carry the operating apparatuses and tools to prevent the tools from falling.
- The person in charge of the site and the safety officer should immediately point out operations against regulations, if any and hold them accountable for correction before proceeding with operations.

1.4 Unloading and Transport Requirements

Danger

Maintain and unload the lithium battery pack in accordance with your local laws and regulations and industrial standards. Improper unloading may result in damage or short circuit, leading to electrolyte leakage, breakage, explosion or fire hazard.

Notice

This product has passed UN38.3 *(UN38.3：Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria)* and SN/T 0370.2-2009 *Rules for the inspection of packaging for export dangerous goods - Part 2: Performance test*, and this product belongs to Class 9 dangerous goods.

Shipping conditions:

- Check the energy storage system before shipping that the cabinet is intact, the cabinet door is closed and tightened, no foreign body is extended from the cabinet, and no smoke or smell of scorching is detected.

Description

Handle the equipment with due care during loading and unloading and transport and take protective measures against moisture. With environmental limitations (such as temperature, transport, and storage), technical specifications shall be subject to the date of delivery.

Transport requirements:

- The energy storage system or battery shall not be transported by railway or air.
- For sea transport requirements, refer to *International Maritime Dangerous Goods Code* (IMDG CODE).
- For land transport requirements, refer to ADR or JT T617.
- Meet the regulatory requirements of the transport regulatory authorities of the departure country, the transit country, and the destination country.
- Comply with the international rules for the transport of dangerous goods and the regulatory requirements of the

respective national transport regulatory authorities.
- The transport process is fully monitored.
- The vehicle used for land transport shall be capable of carrying a single energy storage system weighing about 2700 kg.
- Speed limit for land transport: 80 km/h on a level road and 60 km/h on a rough road. In case of conflict, the local traffic regulations shall prevail.
- Do not stack up at ports or during sea transport.
  Avoid the following conditions during transport:
- Falling into water.
- Fall or mechanical impact.
- Upside-down or tipping over.

Description

If any one of the preceding situations occurs, initiate an emergency plan as described in Section 1.9.

1.5 Electrical Safety

Cabling Requirements

- Do not push cables directly down from the transport vehicle.
- Do not route cables through air inlet and outlet of the equipment.
- Tie cables of same type together. Route cables of different types at least 30 mm apart. Do not twine or cross cables each other.
- Always seal cable holes with sealing mud upon completion of cabling or it is left unattended for a short period of time to avoid tiny animals.
- The insulation layer may be aged or damaged when cables are used at high temperatures. The cables should be at least 30 mm away from the heating device or heat source.
- Select cables that comply with local laws and regulations.
- The edges of cable ducts and holes must be free of burr and well protected.
- Protect cable ducts and holes against damage due to sharp edges and burrs.

- Cables used in the energy storage system must be securely connected, properly insulated, and of appropriate specifications.
- After cables are connected, fix them with cable supports and cable clips. Ensure that cables in the backfilling area are tightly fitting to the ground to prevent deformation or damage caused by stress on cables during backfilling.
- At extreme low temperature, violent shock or vibration may result in brittle cracking of plastic cable sheath. The following requirements should be met to guarantee construction safety:
  - ✧ All cables should be routed and installed under temperature above 0°C. Handle cables with due care, especially in a low-temperature environment.
  - ✧ If cables are stored at temperature lower than 0°C, store cables at room temperature for at least 24 hours before routing.

Grounding Requirements

- Do not damage the grounding conductor.
- Do not operate the equipment without a ground conductor installed.
- First install the PE conductor for the equipment to be grounded. The PE conductor shall be removed in the last step when the equipment is to be removed.
- The primary grounding body shall be permanently connected to the protective grounding net. Check the electrical connections before the operation to ensure that the equipment is reliably grounded.
- The ground impedance shall meet GB 50054 and local electrical standards.

AC and DC Control Requirements

- Cut off the power switch before installing and removing the power cord.
- Check that the power cord is correctly identified before connecting.
- If there are multiple power inputs, cut off all power inputs and wait until the equipment is fully powered off before operating the equipment.

Operation, Maintenance, and Repair Safety Requirements

1. Cut off the respective circuit protection switch before connecting or removing a cable.
2. Erect a warning sign reading "Don't Turn On" at disconnected switches.
3. Use an electroscope at the corresponding voltage rating to check for power and ensure that the equipment has been completely powered off.
4. If there are charged bodies nearby, cover or wrap them with an insulating board or tape.
5. Connect the circuit to be repaired to the grounding circuit with a grounding wire reliably before operation, maintenance, and repair.

Notice

- Check that cables are correctly identified before connecting.
- If there are multiple power inputs, cut off all power inputs and wait until the equipment is fully powered off before operating the equipment.

6. Upon completion of maintenance, remove the grounding wire between the circuit to be repaired and the grounding circuit.

1.6 Mechanical Safety

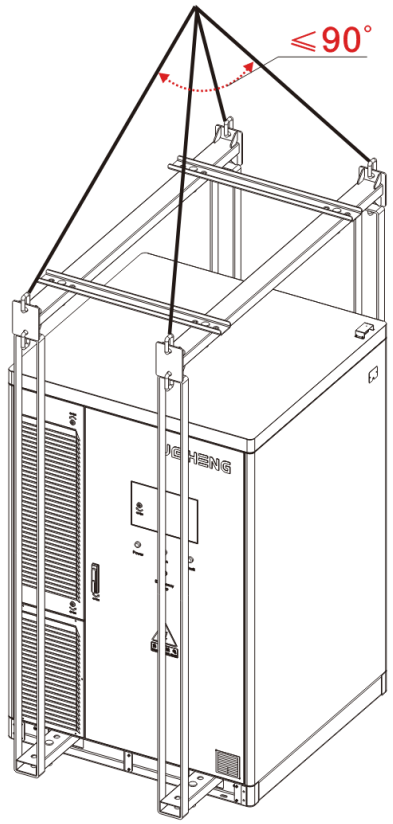
Lifting Safety

Notice

- This equipment shall be lifted with a lifting bracket.

- The foundation where lifting operation will be performed shall be solid enough to load the crane.
- Before lifting, ensure that the lifting appliances are firmly fixed to a rigid structure or wall that meets the load-bearing requirements.

- Do not drag wire ropes and slings during lifting operations. Avoid impact from hard objects.
- Do not walk under the crane jib or lift load.
- Erect a temporary warning sign or fence to isolate the lifting area.
- Ensure that the angle between two ropes is no more than 90° during the lifting operation, as shown in the following figure.
- When a flexible lifting sling or rope is used, a single rope shall be capable of loading a weight of not less than 3 tons.
- Keep the hook at least 1 m above the cabinet top.
- The cabinet is tilted not more than 10°.
- The Q235 cold-formed rectangular hollow section (120×60×4 mm) with a length not less than 2500 mm is recommended as the lifting bracket.

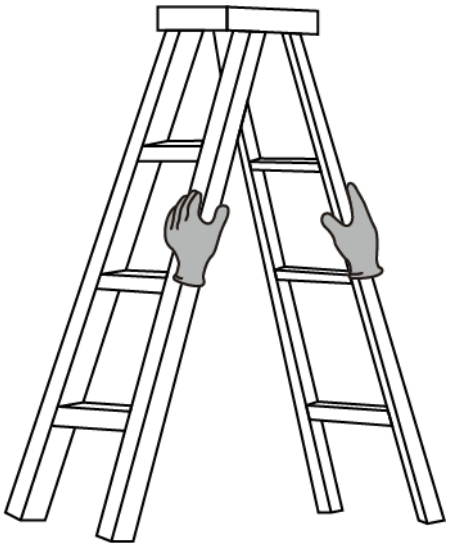


Ladder Safety

- Do not use a straight ladder.
- Please check that the ladder is in good condition and meets

load capacity requirements before use.

- Use a wooden ladder or fiberglass ladder to ascend a height.
- A platform ladder with guard is preferred for ascending a height. All four feet must be fixed and the ladder is held securely by someone when an operator is working at heights.
- If a herringbone ladder is used, the rope must be secured and the ladder is held securely by someone when an operator is working at heights.



- Please pay attention to the following rules to reduce the risk and guarantee safety when climbing the ladder.
  - **Keep your body in a stable posture.**
  - **The maximum standing height of the operator's feet should not exceed the fourth step of the ladder from the top down.**
  - **Make sure your center of body weight does not deviate from the edge of the ladder assembly.**

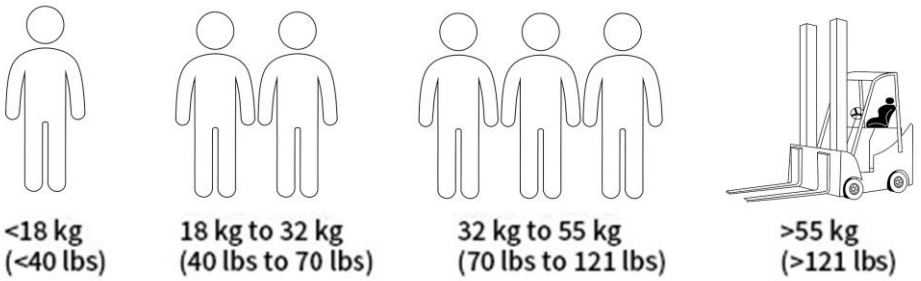
Drilling Safety Outside Equipment Body

- Before drilling, select a proper position to ensure that no short circuit exists.
- Always wear PPEs including goggles and protective gloves during drilling operation.
- Cover the equipment during drilling operations to prevent debris from falling into the equipment. Clean up debris

immediately after drilling.

Handling Safety

- Work together with the number of workers as recommended in the drawing to get prepared for moving heavy loads.



- Always wear PPEs including protective gloves and anti-smashing shoes when handling the equipment with hands.
- Do not scratch the surface of the equipment, damage components, or damage cables when handling the equipment.
- A forklift, if used, shall hold the equipment in the middle to prevent tipping over. Before moving, please fasten the equipment to the forklift with a rope, and when moving, assign a person to care for the movement.
- Move the equipment with due care to avoid impact or falling.

1.7 Battery Safety

Statements

The Company shall not be responsible for damages caused by the battery provided by the Company due to the following reasons:

- Extended storage, capacity loss or irreversible battery damage due to delayed charging on the customer side.
- Battery damage caused by delayed acceptance on the customer side.
- Degraded battery performance due to incorrect system operation management policy on the customer side.
- Unauthorized change to battery pack usage scenario on the customer or third party side without prior notice to the

Company, for example, connecting an extra load to the battery pack or mixing the battery pack provided by the Company with that provided by other manufacturers, including but not limited to mixing battery packs from different manufacturers or of different rated capacities.

- Direct damage to the battery pack because the equipment operating environment or external power supply parameters fail to meet environment requirements for normal operation, including too high or low operating temperature of the battery pack.
- Frequent overdischarge due to improper maintenance, unauthorized on-site capacity expansion, or failure to fully charge the battery pack for a prolonged period of time on the customer side.
- Failure to correctly maintain the battery pack according to the User Manual, including but not limited to, checking whether the cooling system is in good condition, the high voltage wiring harness is loose or broken, and the screws fixing the structural parts are loose.
- The lithium battery pack is stolen.
- Lithium battery pack beyond the warranty period.

General Requirements

⚠ Danger

- Do not expose the lithium battery pack to high temperature or heat source, such as direct sunlight, ignition source, transformer, heater, etc. Too high temperature of the lithium battery pack may lead to fire or explosion hazard.
- Do not disassemble, modify, or destroy the lithium battery pack, for example, inserting a foreign body or immersing it in water or other liquid, to avoid leakage, overheating, fire or explosion hazard of the battery pack.
- The lithium-ion battery energy storage system is at high risk of fire hazard. Take into full account the following safety risks before operating the battery:
  - The electrolyte in the lithium battery pack is flammable, toxic and volatile.
  - The thermal runaway of the lithium battery pack will produce flammable gases, as well as harmful gases such as CO and HF.

- There is a risk of deflagration and explosion caused by accumulated combustible gas after the thermal runaway of the lithium battery pack.

- If the lithium battery pack is flooded unexpectedly, stop the installation and then transport it to the safety isolation point, and apply for replacement parts in time.
- The storage area shall avoid direct sunlight or rain. Keep the environment dry, well-ventilated, and clean. There is no large amount of infrared radiation, organic solvents, or corrosive gases.
- The lithium battery packs shall be stored with their original packages in a separate warehouse. Do not store them together with other materials. Do not store them outdoors. Do not stack lithium battery packs up too high. The site must be equipped with the necessary firefighting facilities, such as a fire sandbox, fire extinguisher, etc.
- The energy storage system shall be regularly checked for firefighting safety at least once a month.
- Do not remove the original package of the lithium battery pack under normal circumstances. Ask a specialist to recharge the lithium battery pack when necessary. Install the lithium battery pack into its original package after recharging.
- In outdoor scenes, you are advised to power up the lithium battery pack within 24 hours after it is unpacked. Otherwise, place the lithium battery pack indoors in a dry, non-corrosive gas environment.
- The lithium battery pack must be correctly placed according to the "Keep Upright" symbol or label on the package to avoid battery leakage due to upside-down for an extended period of time.
- The lithium battery pack should avoid impact.
- Handle the lithium battery pack according to orientation requirements. Do not place it upside down or tilt it.
- Please use the lithium battery pack within the temperature range specified in this Manual. Do not charge the lithium battery pack when the ambient temperature is lower than the operating temperature lower limit. Otherwise, charging at low

temperatures will result in condensation, leading to a short circuit of the lithium battery pack.

- Please dispose of scrapped lithium battery packs according to local laws and regulations. Do not dispose of lithium battery packs as household waste. Improper disposal of lithium battery packs may result in environmental pollution.
- Do not use damaged lithium battery packs (dented housing or other damage). Damaged lithium battery packs may release flammable gases. Do not store damaged lithium battery packs near good ones.
- Store damaged lithium battery packs in a place free of flammable materials and erect a "No Entry" sign.
- Check damaged lithium battery packs for signs of smoke, fire hazard, electrolyte leakage or heating during storage.

Recharging Requirements

- Recharge stored lithium battery packs at least every 5 months. Otherwise, the battery performance may be degraded and the service life may be reduced.
- You can get the time of production of lithium battery packs through their SN or consulting with the service engineer of the Company.

Installation Requirements of Lithium Battery packs

Description

Check that the lithium battery pack is in good condition before installation. Any one of the following symptoms is deemed as a malfunction of the lithium battery pack:

- The housing of the lithium battery pack is obviously deformed or damaged.
- The total positive voltage or total negative voltage of the lithium battery pack is far below the specification range.

- Please use the lithium battery pack of the specified specification. A non-genuine lithium battery pack can be easily damaged.
- Please check whether the package is in good condition before installing the lithium battery pack. Do not use the lithium battery pack with damaged package.
- Place the lithium battery pack at a level and solid surface.
- Do not place installation tools or loads on the lithium battery pack during installation.
- Pay attention to the polarity of the lithium battery pack during installation. Do not short-connect positive and negative poles.
- Tighten the connection terminals with a torque wrench and regularly check that connection terminals are not loose.

Short-circuit Protection

Danger

Short-circuit may produce transient current surge and release a large amount of energy that may lead to personal injury or property loss.

- Wrap the exposed cable terminals in the lithium battery pack with insulating tape during installation and maintenance.
- Prevent foreign bodies (such as conductive objects, screws, and liquid) from entering the lithium battery pack, causing short circuits.

Hazard and Toxicity

Danger

- Hazard: A damaged lithium battery pack may cause heating or electrolyte leakage. The electrolyte is flammable, and if the electrolyte leaks, the lithium battery pack should be immediately kept away from the ignition source.
- Toxicity: The steam produced by the combustion of the lithium battery pack may irritate the eyes, skin and throat.

Exception Handling Measures

⚠ Danger

- When there is electrolyte leakage or abnormal odor, do not expose to the leaking liquid or gas. Stay away and contact a professional immediately. A professional shall wear PPEs including goggles, rubber gloves, gas mask, and protection suit to prevent the harm caused by electrolyte spillage.
- The electrolyte is corrosive and exposure may cause skin irritation and chemical burns. The following measures should be taken if you expose to the electrolyte.
  - Inhalation: Evacuate from the contaminated area, move to fresh air immediately, and seek medical attention immediately.
  - Eye contact: Immediately flush eyes with plenty of fresh water for at least 15 minutes. Do not rub your eyes. Seek medical attention immediately.
  - Skin contact: Wash contact areas immediately with plenty of soapy water, and seek medical attention immediately.
  - Ingestion: Seek medical attention immediately.

When Lithium Battery pack Falls

- When the lithium battery pack falls (with or without packing materials), but the appearance is not significantly deformed or damaged, and there is no obvious odor, smoke, and fire, perform the following operations on the premise of guaranteeing safety:
  - Warehouse: Evacuate personnel, ask a professional to transport the lithium battery pack to an open and safe place with mechanical tools, and contact the service engineer of the Company. Rest the equipment for 1 hour and check that the temperature of the lithium battery pack is

within the range of room temperature ± 10℃ before proceeding.

- Site: Evacuate personnel, shut down the energy storage system, ask a professional to transport the battery pack to an open and safe place with mechanical tools, and contact the service engineer of the Company. Rest the equipment for 1 hour before proceeding.

- If there is obvious odor, damage, smoke or fire when the lithium battery pack falls, immediately evacuate personnel, contact a professional, and call firemen. The professionals on-site shall use fire fighting facilities to extinguish the fire on the premise of guaranteeing safety.
- Stop using the lithium battery pack when it falls. Instead, contact the service engineer of the Company for evaluation.

1.8 Maintenance and Replacement

⚠ Caution

Ensure that the remaining components are secure before removing a component from the cabinet.

- Assign two or more persons on site to maintain the energy storage system.
- Cover charged parts nearby with insulating materials during maintenance.
- Do not open the cabinet door in rainy, snowy, thunder, dusty, or foggy weather.
- Do not touch the fan in operation with any objects (such as fingers, parts, screws, or tools) while the fan is running before the fan is powered off and stops.
- Do not power on the equipment before trouble is eliminated.
- When inspecting the system with power on, pay attention to the hazard sign on the equipment. Do not stand near the cabinet door.
- Wait at least 15 minutes after devices except for the lithium battery pack are powered off. Ensure that these devices are completely powered off before performing operations.
- Erect a warning sign reading "Don't Turn On" at disconnected

switches during maintenance.

- When the power unit of the energy storage system is replaced or cables are changed, manually start wiring test and run topology identification to avoid malfunction.
- Lock the cabinet door immediately after maintenance and replacement, fix the safety rope, and keep the key safe.

1.9 Emergency Plan

When dangerous accidents occur on site, including but not limited to the following accidents, give priority to personal safety and contact the service engineer of the Company.

In Case of Fire

Danger

Suggestions for on-site operation and maintenance personnel:

1. In case of fire, evacuate personnel from the building or equipment area and press the fire alarm bell. Immediately call your fire emergency number to notify professional firemen, and provide them with relevant product information, including but not limited to the type of lithium battery packs, the capacity of the energy storage system, and the layout of lithium battery packs.
2. Do not enter the burning building or equipment area again under any circumstances, and do not open the cabinet door. Isolate and guard the scene and erect a sign reading "No Entry".
3. Call your fire emergency number and remotely power the system off on the premise of ensuring personal safety.
4. Provide on-site firemen with relevant product information, including but not limited to: the type of lithium battery packs, the capacity of the energy storage system, the layout of lithium battery packs, and the User Manual.
5. After the fire is extinguished by firemen, the professionals shall take measures in accordance with local laws and regulations. Do not open the cabinet door without authorization.
6. Maintenance after an incident: Contact the service engineer of the Company for evaluation.

Suggestions for firemen:

1. Have knowledge of product information provided by the operation and maintenance personnel, including but not limited to the type of lithium battery packs, the capacity of the energy storage system, the layout of

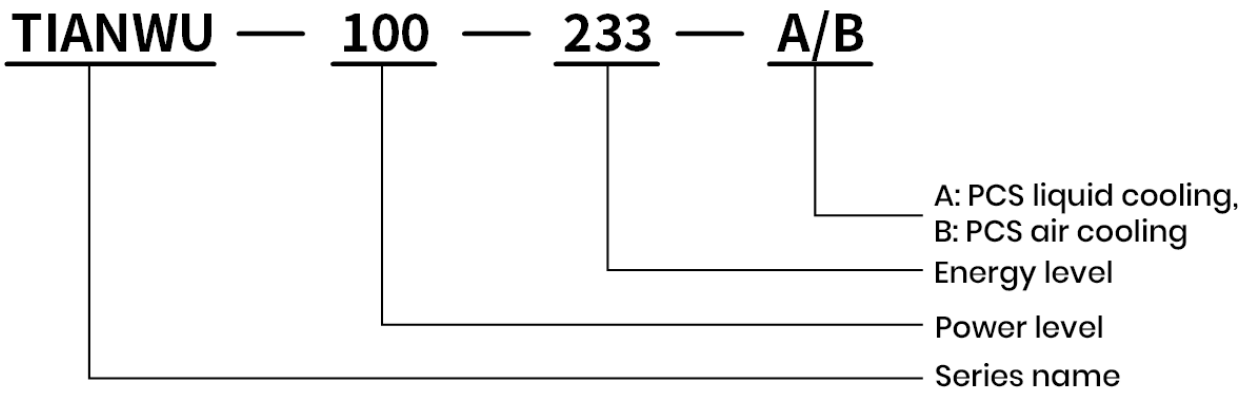
lithium battery packs, and the User Manual.

2. Do not open the cabinet door when the internal safety of the energy storage system cannot be guaranteed.
3. Please follow local firefighting regulations.

2 About Product

2.1 Model Description

Model description:



This document mainly describes the following model:

WH-TIANWU-100-233B

2.2 Functions and Features

Functions

The TIANWU-100-233-B energy storage system can run on grid or off grid.

- On-grid mode

  The AC side of the energy storage system is connected to the power grid and the DC side is connected to the battery pack. The product can be applied in power expansion, photovoltaic power generation, energy storage, and charging power consumers, as well as peak-load shifting. The product can charge or discharge lithium batteries at constant voltage, current, and power according to the selected operation mode.

- Off-grid mode

  When connected to the power grid, the energy storage system

can output three-phase AC voltage with fixed frequency and RMS. When used with a transformer, the system continuously supplies power to the loads on the AC side. When used with STS, the system can seamlessly switch between on-grid mode and off-grid mode.

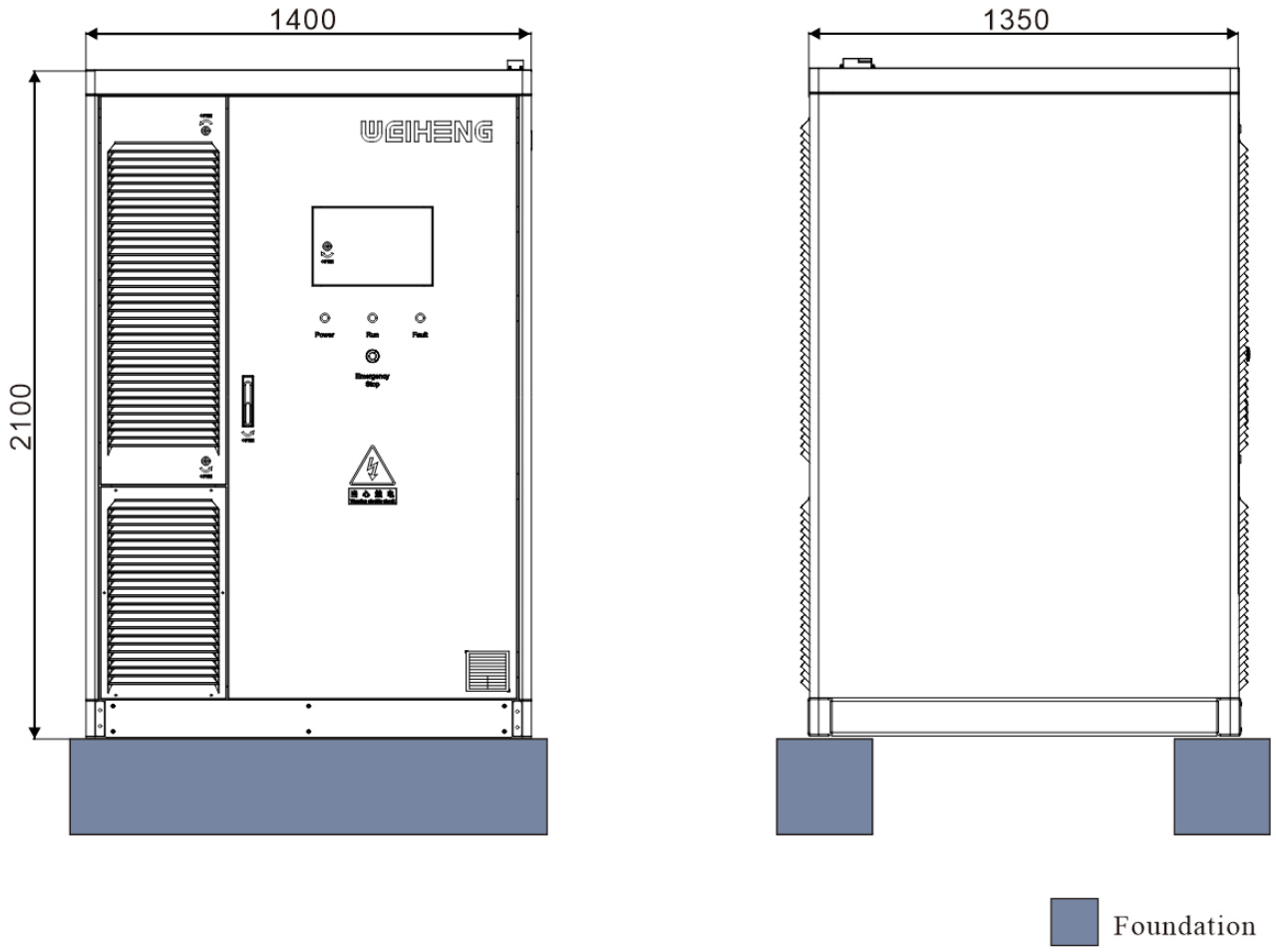
Features

The energy storage system integrates the power supply and distribution system, monitoring system, environmental control system, and fire suppression system, and features high safety and reliability, rapid deployment, low cost of ownership, high energy efficiency, and intelligent management.

- Racks are optimized individually and energy is managed at the rack level to avoid parallel loop of battery racks.
- Standard modules can be spliced as needed for easy maintenance and scaling up.
- Liquid cooling, high energy density, low footprint, and highly consistent cell temperature
- Systems can be connected in parallel.

2.3 Appearance

Figure 2-1 Appearance and dimensions



Description

For foundation requirements, refer to the description in the construction drawing, which is available from F part.

2.4 Parts

Figure 2-2 Parts (with cabinet door closed)

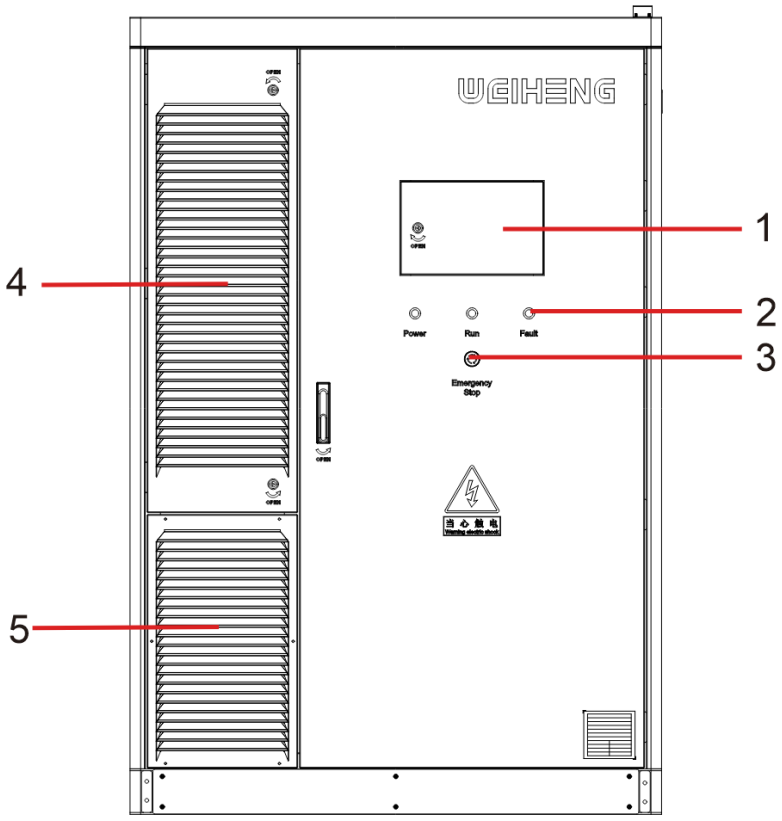


Table 2-1 Part configuration

SN	Name	Quantity	Description
1	Display screen	1	System display and operation screen.
2	Indicators	3	Power indicator: Green. The indicator goes on when the auxiliary power supply is turned on. HV indicator: Red. The indicator goes on when the DC relay in the HV box is turned on. Alarm indicator: Yellow. The indicator goes on when an alarm or fault occurs in the battery system.
3	Emergency stop button	1	You can press this button to stop the system immediately when the equipment malfunctions.
4	Chiller unit	1	Cools the system.
5	Air inlet	1	Air inlet of PCS.

Figure 2-3 Front and back sides of parts (with cabinet door opened)

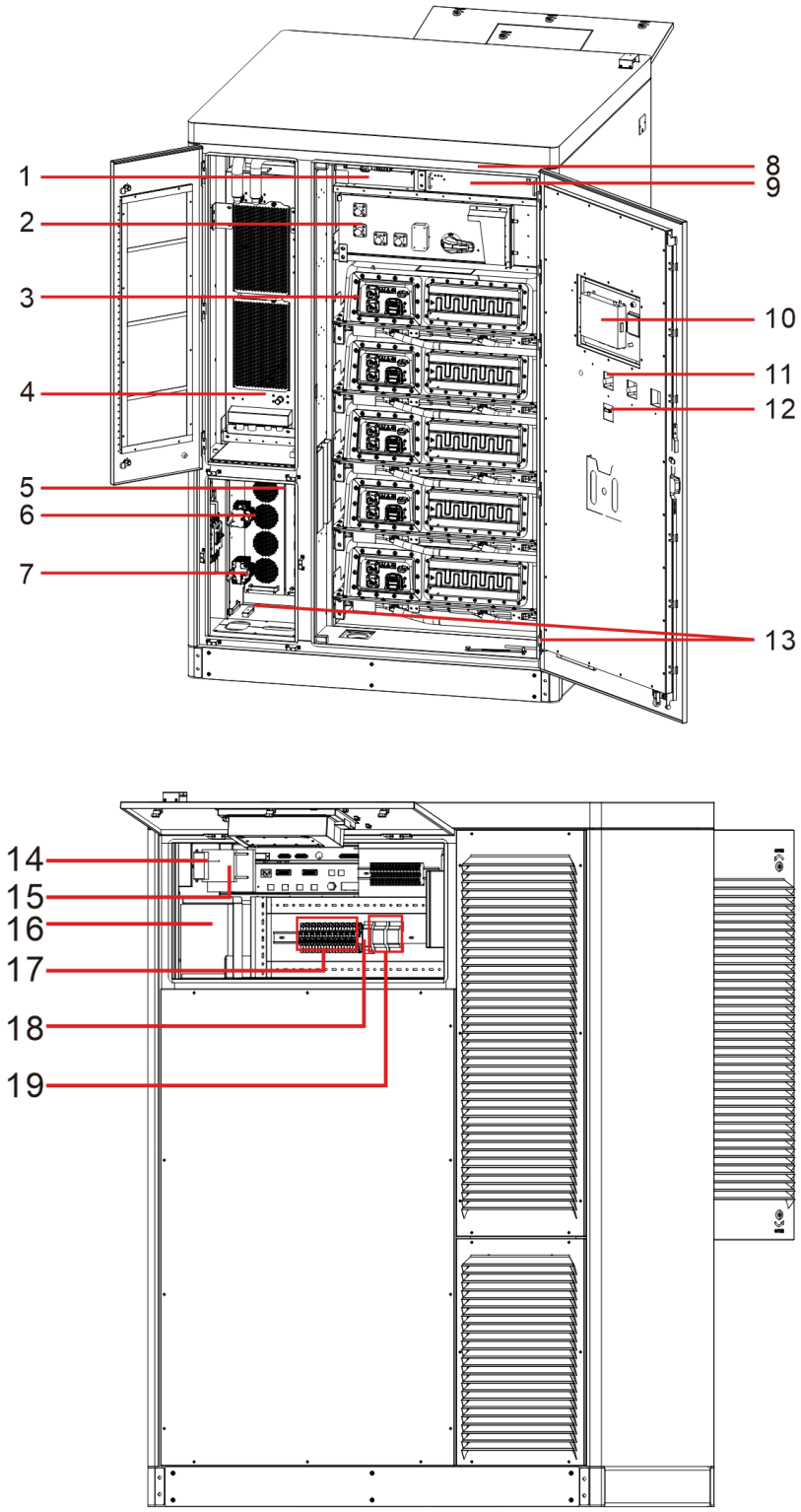


Table 2-2 Part configuration 2

SN	Modules	Quantity	Description
1	Fire control system	1	The system monitors the fire hazard of the battery inside the energy storage system. The system automatically starts the fire control system in case of fire.
2	HV box	1	Energy storage battery management system (five liquid cooling battery packs + one HV box), used for battery pack management, protection, and monitoring.
3	Lithium battery pack	5	
4	Chiller unit	1	Cools the battery system.
5	PCS	2	50 kW energy storage converter, used to switch energy between battery pack and power grid.
6	SPD	1	Surge protection device.
7	Auxiliary power switch	1	Supplies the 220 V power to a single device
8	BMS	1	Monitors the battery status and communicates with the EMS, ensuring the normal operation of the energy storage system.
9	EMS100	1	Local energy management system, used for energy distribution and internal communication of the energy storage system.
10	Touchscreen	1	Local monitoring system, used to display and operate the energy storage system.
11	Indicators	3	Power indicator: Green. The indicator goes on when the auxiliary power supply is turned on. HV indicator: Red. The indicator goes on when the DC relay in the HV box is turned on. Alarm indicator: Yellow. The indicator goes on when an alarm or fault occurs in the battery system.
12	Emergency stop button	1	You can press this button to stop the system immediately when the equipment malfunctions.
13	Water leak sensor	2	Detects water leak inside the cabinet to prevent water intrusion.
14	GPS	1	Provides location-based services
15	Router	2	Provides remote connection services
16	UPS	1	UPS, guaranteeing normal operation of the energy storage system upon power outage.
17	QF1~QF5	5	Circuit breaker bank.
18	SJ1	1	Signaling interface of water leak sensor.

19	Switching power supply	1	Provides 24 VDC power supply.

Figure 2-4 Power distribution area

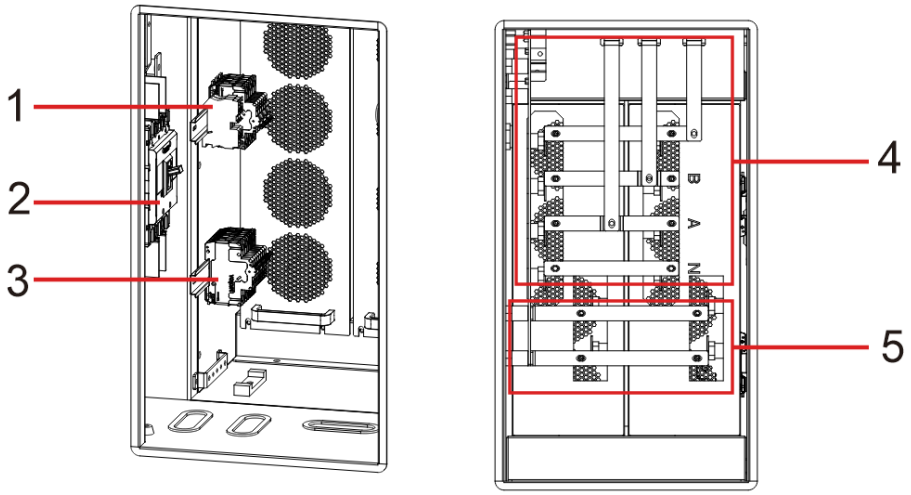
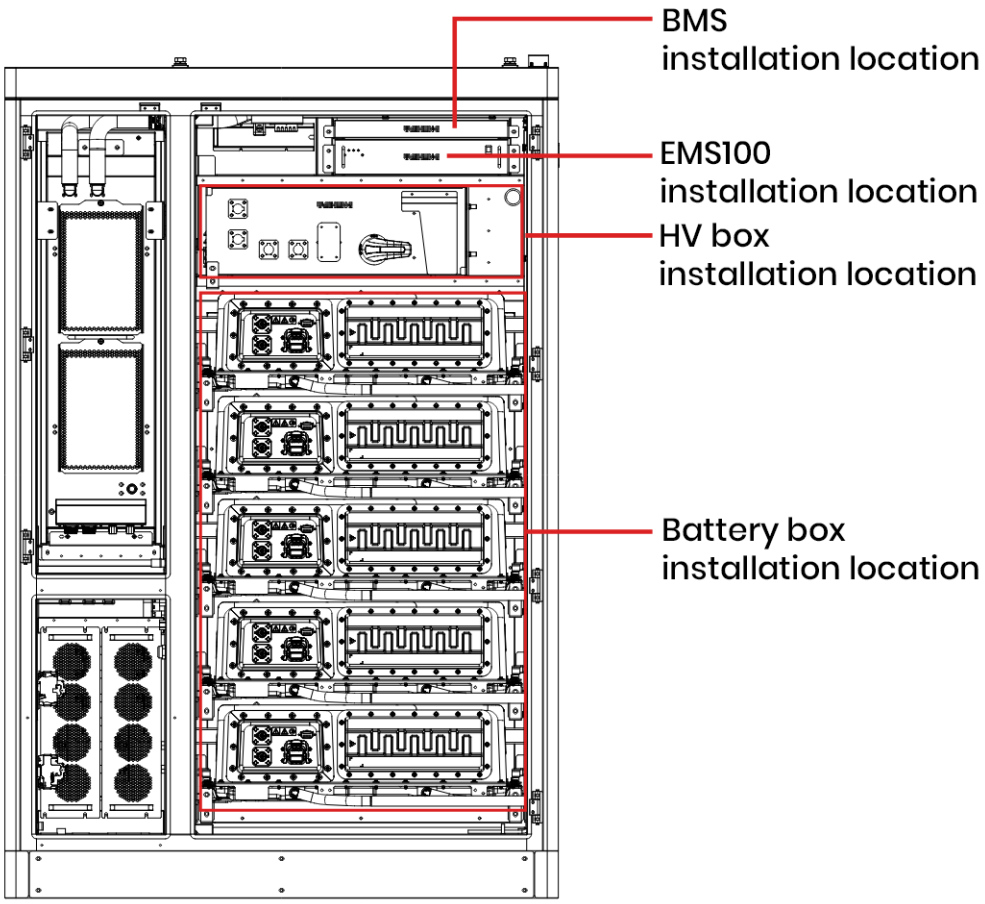


Table 2-3 Part configuration 3

SN	Modules	Quantity	Description
1	Lightning protection circuit breaker	1	SPD switch.
2	AC main switchboard	1	Main switchboard for alternating-current distribution.
3	Auxiliary power switch	1	220 V incoming switch
4	AC copper busbar	1 set	Connects to the AC incoming line and the power grid.
5	DC copper busbar	1 set	Connects to the HV box and the DC side of the battery.

2.4.1 Energy Storage Battery System

Figure 2-5 Schematic diagram of location of the battery system



2.4.1.1 BMS

Figure 2-6 Appearance of BMS

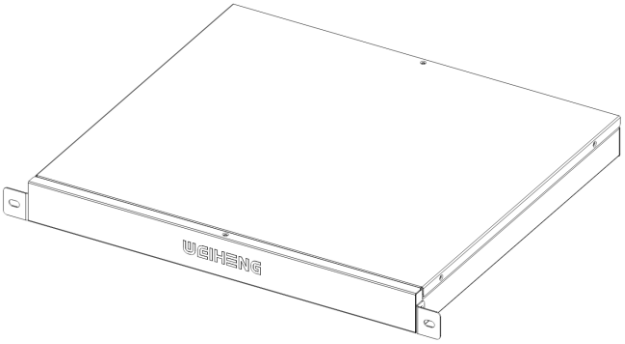
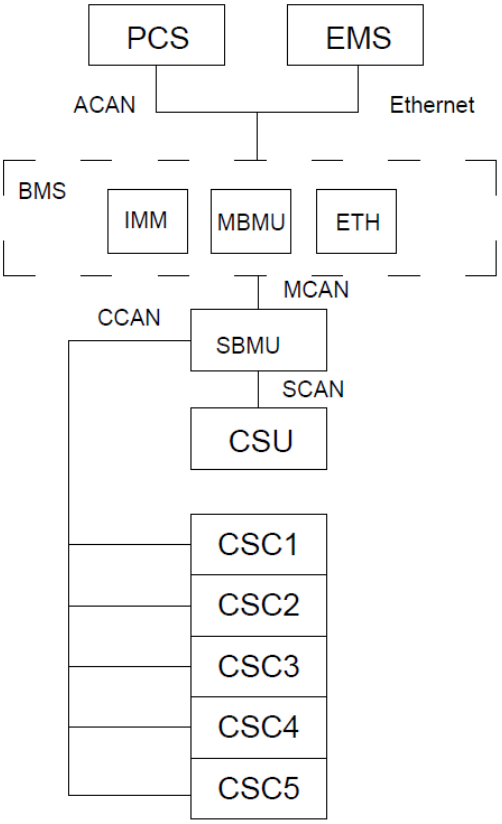


Figure 2-7 System topology



Module description:

Each module communicates with each other through CAN. The BMS control unit in this part mainly consists of a main battery management unit (MBMU), an isolation monitor module (IMM), and an Ethernet conversion module (ETH).

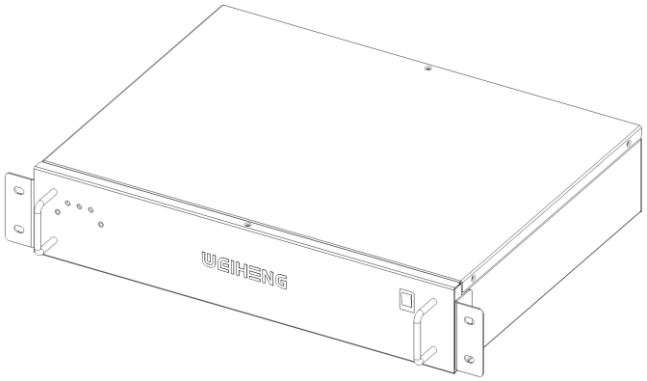
Table 2-4 Performance parameters

Item	Performance Parameter	Value	Remark
Storage temperature	Range	-40°C ~ +85°C	
Operating temperature	Range	-40°C ~ +60°C	
Operating voltage	Range	20V~26V	All BMSs function well
Ingress protection (IP)	Ingress protection	IP40D	
Single-cell	Range	1V~4.85V	

voltage sampling	Accuracy	±5mV	0°C ~ +60°C
		±10mV	-40°C ~ 0°C or 60°C ~ 85°C
	Number of single-cell voltage sampling channels	52/56	Up to 56 channels, configured as needed
In-module cell temperature sampling	Range	-40°C ~ +125°C	
	Accuracy	±2°C	-20°C~+60°C
		±3°C	-40°C~-20°C&+60°C~+85°C
	Number of temperature sampling channels	4+4+4+4	Up to 16 channels are supported for a single CSC
Current sampling	Range	±500A	
	Period	10ms	
	Accuracy	<1%FSR	-40°C ~ 85°C
HV sampling	Range	0V ~ 1500V	
	Accuracy	1%FSR	
Equalizing	Equalizing current	100mA@3.2V	Can be enabled for all channels
SOC	Accuracy	<±5%	LFP, determined by specific working conditions
SOH	Accuracy	<±5%	
Ambient temperature detection	Range	-40°C ~ +85°C	
	Accuracy	±3°C	
Insulation detection	Detection range	0 ~ 10MΩ	
	Accuracy	-30% ~ 0%	
	Detection time	≤10s	Single-sided Y capacitance ＜ 0.47 μf

2.4.1.2 EMS100

Figure 2-8 Appearance of EMS100



Module description: EMS100 is a master controller for the energy storage battery management system. It collects real-time data and fault information on the battery pack and implements fault protection and pick-up control. It also collects real-time operation data of the PCS and implements power control and fault protection. EMS100 can be used with a chiller unit and a firefighting unit, and you can configure multiple control policies to guarantee the stable operation of the system.

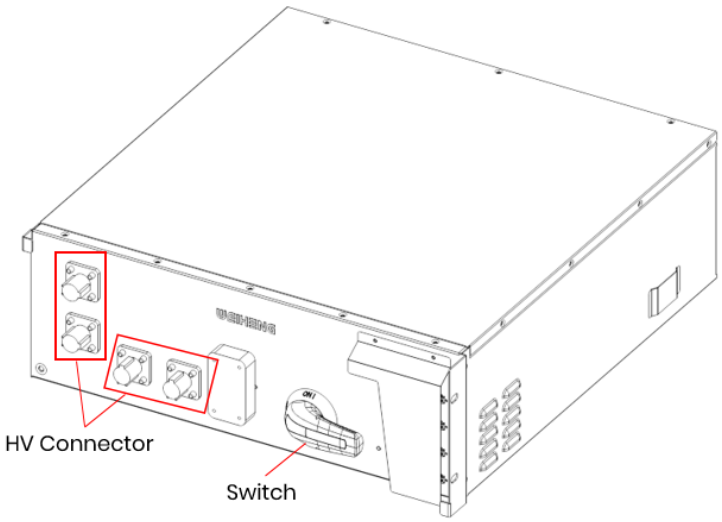
Table 2-5 Technical parameters

Item Name	Parameter Description
CPU	ARM master controller, Cortex A7 kernel
Memory	512MB DDR3
Storage	4GB eMMC
Operating system	Linux
Interface	Ethernet: 2 ways, 10/100 Mbps, Modbus TCP supported
	RS485: 4 ways, Modbus RTU
	CAN: 2 ways
	DI: 4 ways, passive dry contact and wet contact (24 V\9 V)
	AI: 2 ways, current (4 mA to 20 mA), voltage (0 V to 5 V, 0 V to 10 V), resistance (for example, 0 k to 10

	k or resistor type temperature-humidity sensor)
	DO: 4 ways, relay output (5 A@250 VAC/30 VDC)
Power supply	200~240Vac
Operating temperature	-30~60°C
Storage temperature	-40~85°C
Operating temperature range	0 to 95% (without condensation)
Ingress protection	IP20
Anti-corrosion grade	C1
Size (W×H×D)	2U
Installation method	Rack-mounted or wall mounted

2.4.1.3 HV box

Figure 2-9 Appearance of HV box



Module description: This module integrates SBMU, DC fan, circuit breaker, fuse, and 24 V power supply.

The main features include the followings:

- Battery rack current acquisition and total voltage acquisition
- Power-off protection upon battery fault
- Under the management of BMS, the module can separately implement capacity calibration and SOC calibration as the basis for subsequent charge and discharge management

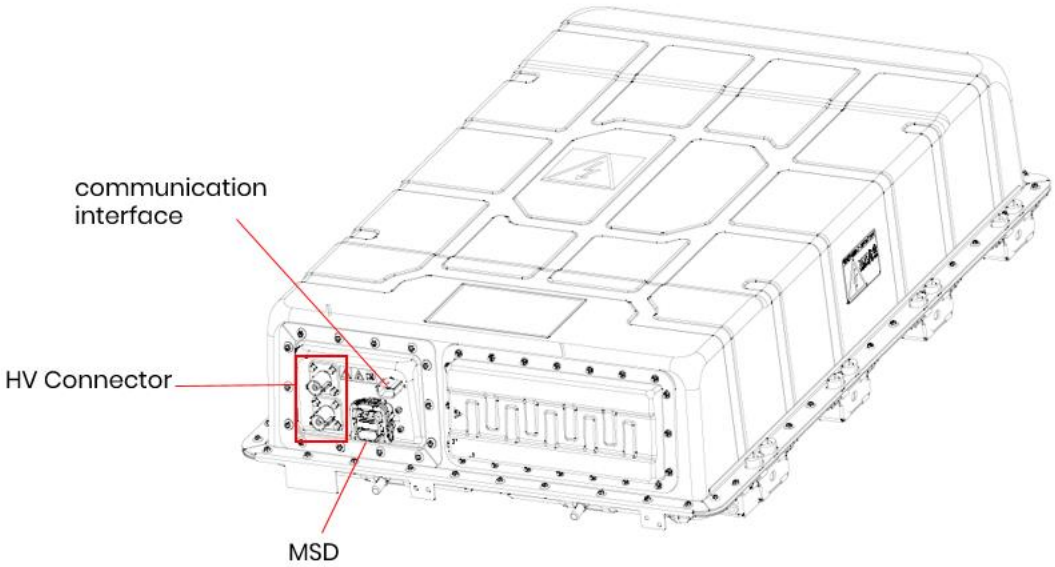
- The module collects SCS information through CCAN and transmits this information to the MBMU through MCAN.

Table 2-6 Technical parameters

Model	HVBX-A-140-01
Application scenario	Outdoors
DC rated voltage	DC1500V
DC rated current	140A
Max. power of auxiliary power supply	150W
Rated voltage of auxiliary power supply	220V，50Hz
Communication protocol	CAN
Size (W×D×H)	664.54*749.49*221.5mm
Weight (approximate value)	30kg

2.4.1.4 Battery Pack

Figure 2-10 Appearance of battery pack



Module description: A lithium battery pack contains 52 cells and a cell supervision circuit (CSC). A lithium battery pack contains eight NTC temperature sampling circuits and the cell supervision circuit collects cell voltage, current, and temperature inside the lithium battery pack.

Table 2-7 Technical parameters

No.	Item		Specification	Notes
1	Basic Parameter	Nominal Capacity (kWh)	46.59kWh	
2		Cell Number	52	
3		Cell Self-discharge Rate/month	≤3.5%	25°C, 30%SOC, 3 months after new battery produced
4		Voltage Range (V DC)	145.6~187.2	CELL:2.8V~3.6V
5		Nominal Voltage(V DC)	166.4VDC	
6		Rated charging rate	0.5P	
7		Rated discharging rate	0.5P	
8		Maximum continuous current	160A 1min	
9		Equalization way	Passive equalization	
10	working environment	Charge/Discharge Temperature (°C)	Charging: 0~55°C Discharging: -20~55°C	
11		Storage Temperature (°C)	-30~60°C	
12		Recommended operating temperature	21±3°C, average21°C	
13	Auxiliary power supply	Voltage range	20~26V DC	
14		Power(CSC power)	2W	
15	General parameter	Dimension (W*D*H)(mm)	810mm(W)*1152mm(D)*243.4mm(H)	
16		Weight (kg)	330±10kg	
17		IP code	IP66	
18		Cooling mode	Liquid cooling	
19		Communication	CAN	
20	Test &Certification	Battery pack	UN38.3	
21			UL9540A(V3)	

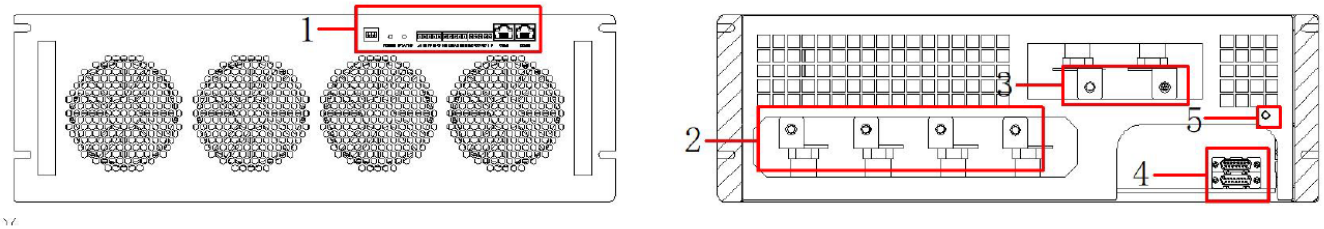
2.4.2 Energy Storage Converter System

2.4.2.1 PCS

Module description:

The energy storage converter system is mainly intended for electric energy conversion between power grid and battery, and monitors and manages the conversion process. The energy storage converter can run in on-grid mode and off-grip mode.

Figure 2-11 Appearance of PCS



(1) Signal ports (2) AC interfaces (3) DC interfaces (4) Parallel interfaces (5) GND port

- A signal port consists of a DIP switch, indicators, phoenix terminals, and RJ45 terminals.

Figure 2-12 Schematic diagram of signal ports

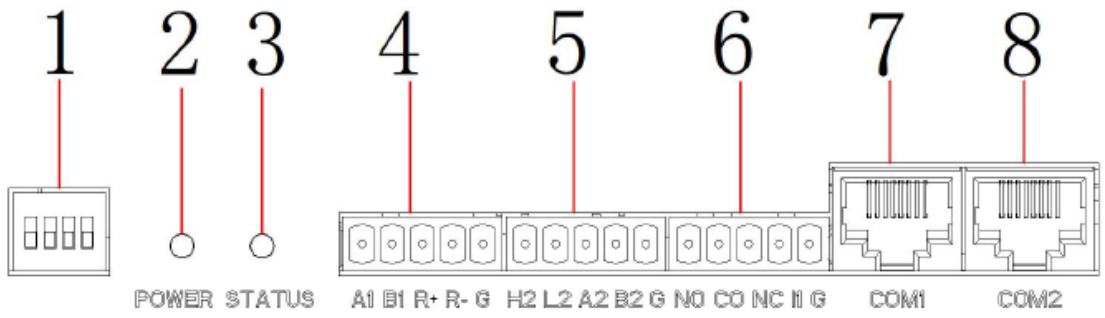
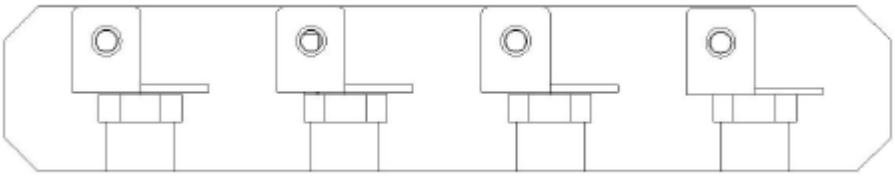


Table 2-8 Compositions of signal ports

SN	Name
1	DIP address
2	Power indicator (red)
3	Status indicator (green)
4	RS-485 communication interface 1
5	RS-485 communication interface 2
6	I/O interface
7	RJ45 interface 1 (CAN communication interface)
8	RJ45 interface 2 (CAN communication interface)

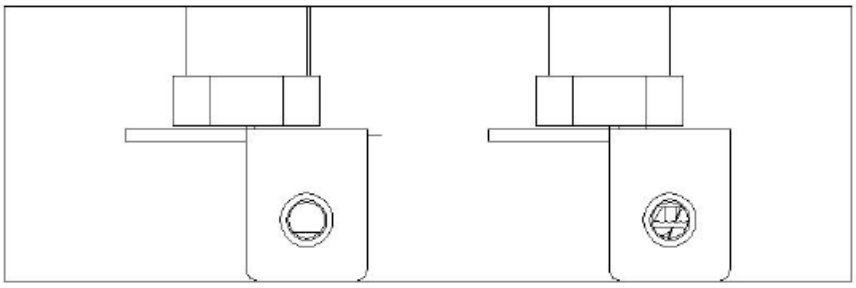
- The AC interfaces are connected with copper bars and connected to the power grid and fixed with M6 screws. The AC interfaces are C, B, A and N from left to right.

Figure 2-13 Schematic diagram of AC interfaces



- The DC interfaces are connected with a copper bar and connected to the DC power supply and fixed with M6 screws. The DC interfaces are DC- and DC+ from left to right.

Figure 2-14 Schematic diagram of DC interfaces



- Parallel interfaces: Used to connect multiple modules in parallel. A parallel connected cable must be used to connect the parallel interface of each module to the parallel interface of another module.

Figure 2-15 Schematic diagram of parallel interfaces

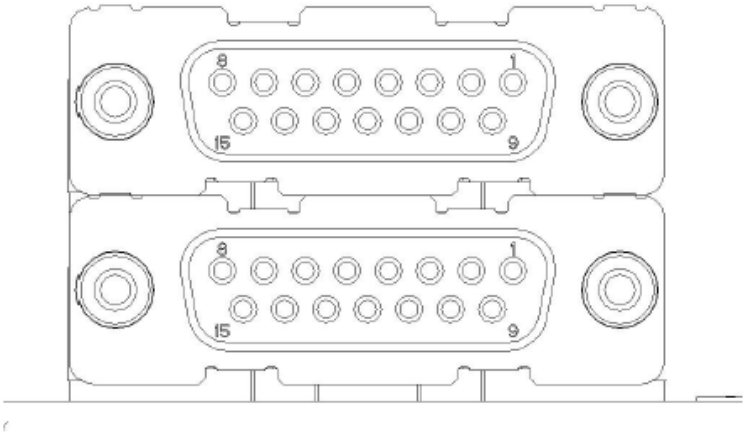


Table 2-9 Technical specification of 50 kW air cooling energy storage converter

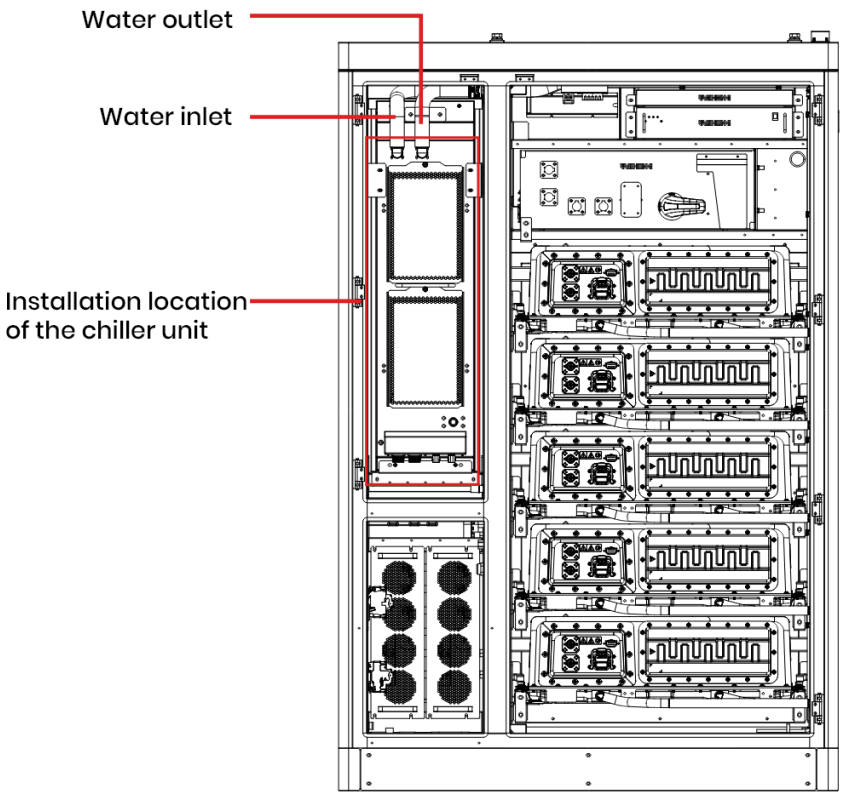
Model	WH-BEC-50AC
Rated power	50kW
Max. power	55kW
DC operating voltage range	500V~950V
DC-side full-load voltage range	600V~950V
Max. DC current	110A
Rated AC voltage	400Vac，3W+PE
Rated frequency	50/60Hz(±5Hz)
Rated alternating current	72A
Overload capacity	normal operation at 110% of rated load, and one minute at 120% of rated load
Current distortion	＜ 3% (rated power)
Power factor adjusting range	-1 lead to +1 lag
Unbalanced loading capacity	1/1/1900
Applicable batteries	Lithium battery/lead-acid battery/photovoltaic module/DC bus
Charging method	As directed by BMS/three-gradation charge/MPPT
Operation mode	Constant current, constant power, MPPT, AC voltage source
Max. efficiency	0/1/1900
Size (W×D×H)	483 (444 when the mounting lug is excluded)*600*150 mm
Weight (approximate value)	35kg

Isolation mode	Non-isolation
Ingress protection	IP21
Operating temperature	-25°C to +55°C (derating when the temperature is greater than 45°C)
Relative humidity	0 to 95% (without condensation)
Cooling method	Smart air cooling
Noise	<70dB
Altitude	3000 m (derating when the altitude is higher than 3000 m)
Communication interface	CAN

- GND port: Used to connect the equipment to the earth.

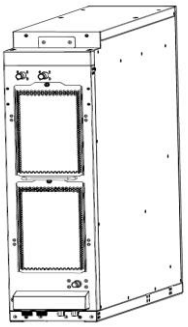
2.4.3 Liquid Cooling System

Figure 2-16 Schematic diagram of location of the liquid cooling system



2.4.3.1 Chiller unit

Figure 2-17 Appearance of the chiller unit



Part description: The chiller unit is an integrated structure with all parts enclosed in a cabinet and can be easily installed. Featuring modular design and compact structure, the unit can be easily embedded in the customer's machine frame to save space. The chiller unit is used to adjust the temperature of the battery pack in the energy storage system to ensure that the battery pack always works within the appropriate temperature range to maintain the best working condition of the system.

The main features include the followings:

I. Smart refrigeration

The chiller unit monitors the temperature at the liquid outlet in real-time, and makes intelligent adjustments according to the target temperature setting, so that the operating temperature of the battery in the container keeps stable within the appropriate range.

- When the temperature at the liquid outlet is higher than the refrigeration setpoint and the refrigeration enabling condition is met, the air-cooled chiller unit starts refrigeration and outputs different cooling capacities according to the actual temperature.
- When the temperature at the liquid outlet is lower than the refrigeration setpoint, the air-cooled chiller unit saves energy by shutting down the compressor and reducing the speed of the circulating water pump.

II. Electric heating

In a low-temperature environment, the coolant temperature is low when the batteries in the container are not charged or discharged. When the temperature at the liquid outlet is lower than the heating setpoint and the heating enabling condition is met, the chiller unit starts heating to ensure that the batteries are within the appropriate temperature range.

III. Remote monitoring

The chiller unit communicates with the host computer over Modbus/CAN protocol through RS485/CAN interface. On the host computer, users can remotely turn on or off the chiller unit, query the running status of parts of the air conditioning unit, and set control parameters through message interaction.

IV. Replenishment

Connect the chiller unit to the replenishment tooling. The replenishing pump in the replenishment tooling automatically pumps the coolant stored in the water tank into the circulation system to realize rapid replenishment. **(Refer to *WH Replenishment Process*)**

Table 2-10 Technical parameters of the chiller unit

Specification	Value
Operating voltage range	200~240VAC±10%，50/60Hz (Supporting dual live line inputs, 110 VAC，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%
Transport	Land transport, air transport, and sea transport
Operating altitude	0m~4000m Performance degraded for every increase of 1000 m from 1000 m to 4000 m altitude 3
Outline dimensions (W×D×H)	275mm×1185mm×1074mm

2.4.4 Environment Control System

Figure 2-18 Front view of environment control system

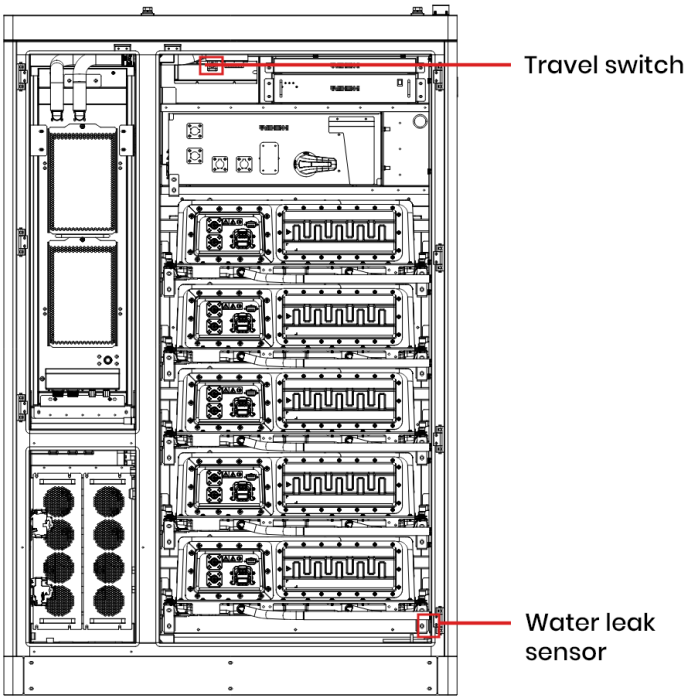
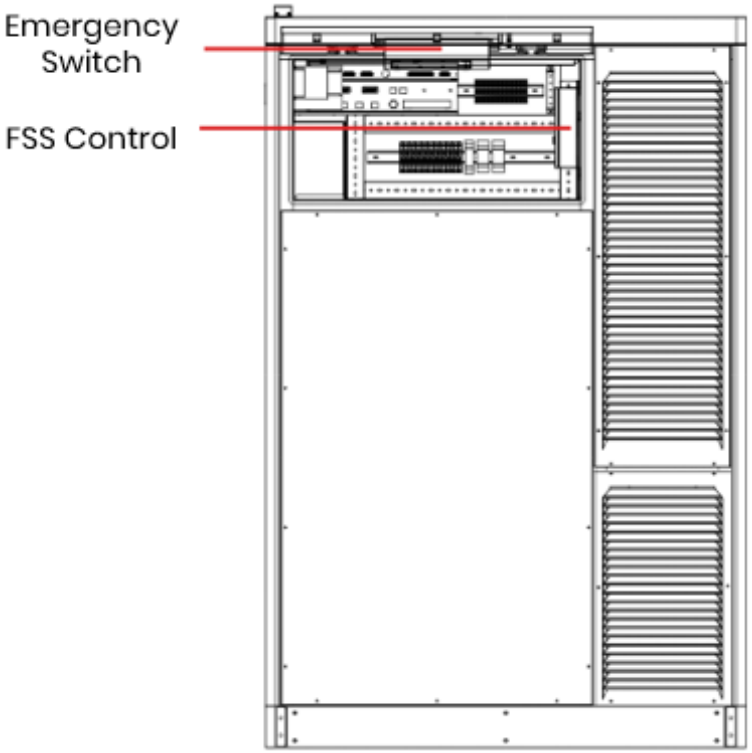
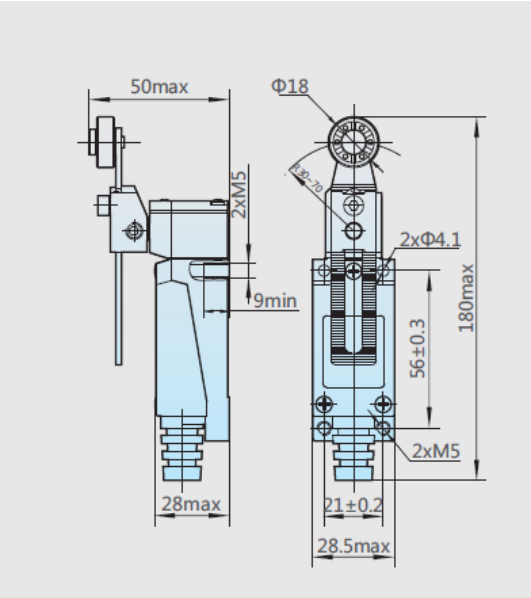


Figure 2-19 Rear view of environment control system



2.4.4.1 Travel switch

Figure 2-20 Appearance of travel switch



Part description: The travel switch is suitable for control circuits (50 Hz or 60 Hz, 380 VAC,
220 VDC) for the travel control of the motion mechanism, the change of the motion direction or speed, the automatic control of the machine tool, the limiting action of the motion mechanism, and the travel or sequence control.

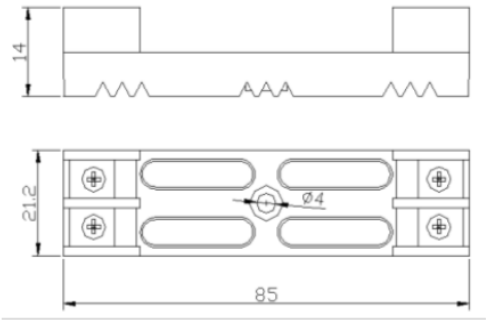
Table 2-11 Technical parameters

Model	CHNT/YBLX-ME/8108
Ingress protection	IP62
Operating frequency	20 time/minute
Ambient temperature	-5°C ~+40°C
Relative humidity	The relative humidity should not exceed 50% when the maximum temperature is +40°C. Higher relative humidity is permitted at a lower temperature. For example, when the humidity reaches 90% at 20°C, special measures should be taken for condensation occasionally caused by temperature changes.
Rated voltage	AC-15:380V DC-13:220V
Rated operating current	AC-15:0.8A DC-13:0.16A
Installation type	II

Pollution degree	Level 3
Rated insulation voltage	415V
Rated impulse withstand voltage	2.5kV
Altitude	≤2000m
Installation condition	Install in a location where there is no significant impact or vibration

2.4.4.2 Water leak sensor

Figure 2-21 Appearance of water leak sensor



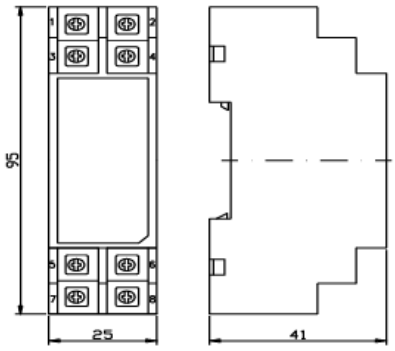
Part description: The sensor needs to be used with a transducer (see 2.4.4.3). The impedance changes when the water leak sensor is wetted between two stages. Based on this principle, the dedicated integrated chip amplifies, shapes, and compares the wetting input signal and outputs a dry contact or high-low level change signal to indicate whether the location whether the transducer is located is wetted.

Table 2-12 Technical parameters

Sensor Model	JS-DP Series
Operating temperature	-20°C ~60°C
Operating humidity	0%RH ~95%RH
Product weight	40g

2.4.4.3 Water leak transducer

Figure 2-22 Appearance of water leak transducer



Part description: The transducer needs to be used with a water leak sensor (see 2.4.4.2) to give a wetting alarm at the point where the sensor is located. This part is reverse polarity protected. The power supply, input, and output are isolated from each other. In addition, there are four sensitivity gears, enabling users to adjust sensitivity gears of the transducer as needed.

Table 2-13 Technical parameters

Model	JS-DP Series
Supply voltage	DC 24V (12V~36V)
Operating temperature	-20°C ~60°C
False alarm rate	＜100ppm
Quiescent power dissipation	0.5W
Max. alarm power dissipation	1.2W
Output form	Relay (load current 100 mA) High-low level output: VL is 0V (+0.5 V) VH is 5 V or 12 V (±0.5 V)
Gear adjustment	Do not use neutral position. Gear 2 is used by default Gear 1: 0 kΩ to 4 kΩ Gear 2: 0 kΩ to 10 kΩ Gear 3: 0 kΩ to 25 kΩ

	Gear 4: 0 kΩ to 430 kΩ
Load capacity	Solid state relay ≤ 100 mA (1 A for high current, customizable) High-low level ≥ 3 kΩ
Product weight	Transducer weighs about 65 g
Indicators	Green indicator ON - running. Red indicator ON - alarm.

2.4.5 Fire control system

Figure 2-23 Schematic diagram of front view of fire control system

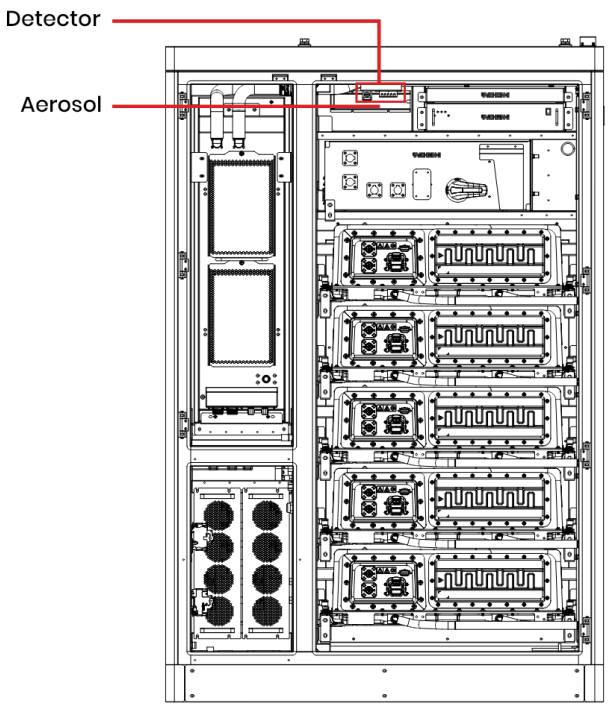
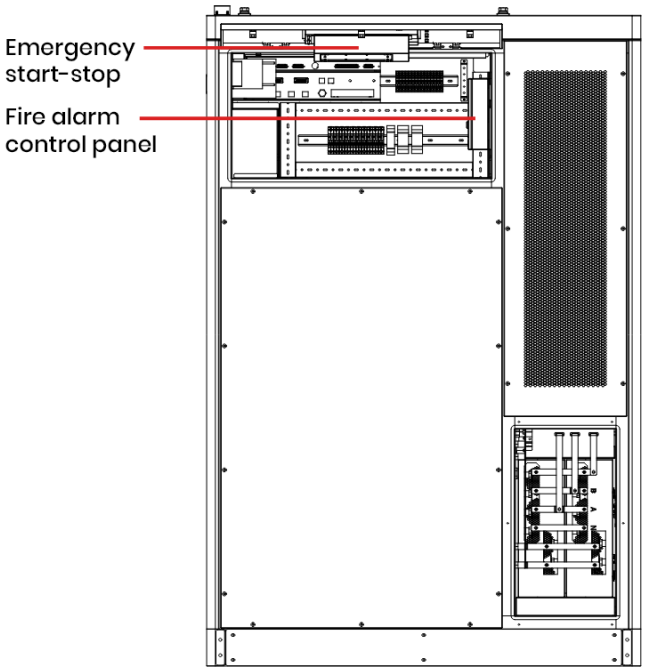
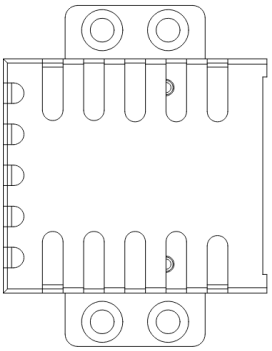


Figure 2-24 Schematic diagram of rear view of fire control system



2.4.5.1 Detector

Figure 2-25 Appearance of detector



Part description: The detector integrates a variety of detection sensors such as temperature, smoke, CO and electrolyte volatile gas and can detect various conditions of thermal runaway of batteries. The detector detects fire hazards in the battery pack and smartly identifies and suppresses incipient fire, and features early warning of thermal runaway, automatic extinguishing, and automatic start of fire extinguishing. There are four alarm levels, corresponding to incubation

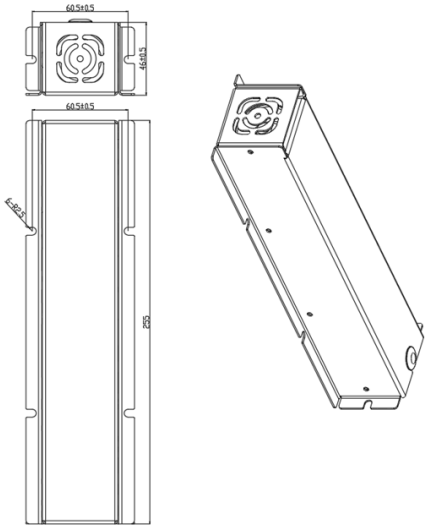
period, early warning period, alarm period, and open flame period throughout the fire development.

Table 2-14 Technical parameters

SN	Name	Unit	Technical parameters			
1	Supply voltage range	V	DC9-36V			
2	Normal operating current	mA	16.5mA			
3	Current in sleep mode	mA	<4mA			
4	Working temperature	°C	-40°C~85°C			
5	Working humidity	HR	<95%			
6	Working pressure W.P	hPa	55~106KPa			
7	Measuring range	/	CO	VOC (C2H5OH alcohol)	Smoke (C22H46 paraffin)	Temperature
			0~1000ppm	1~1000ppm	0~400 mg/m³	-40°C ~125°C
8	Precision	%\°C	1ppm	50ppm	10~100ug/m³	±0.5℃
9	Alarm mode	-	Smart instrument			
10	DAQ. Period	s	1s（Adjustable）			
11	Extinguisher control mode	-	AUTO, MANU			
12	Housing material		Aluminum alloy			
13	Product quality	g	58g			
14	Installation precautions		Install detection controllers in the corresponding battery pack according to ID thereon. IDs in each battery pack must not be duplicated.			

2.4.5.2 Aerosol

Figure 2-26 Appearance of aerosol



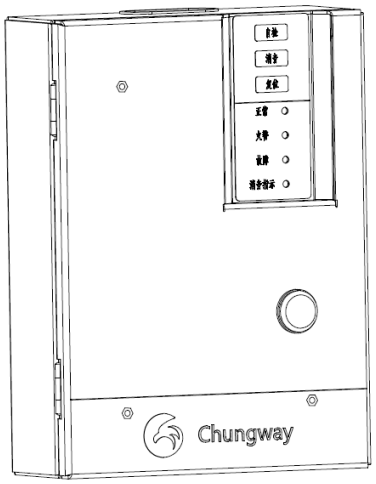
Part description: The QRR0.3G/S-Q condensed aerosol fire suppression device is a new and world-leading type of highly efficient environment-friendly fire suppression product that is domestically pioneered in China. When the QRR0.1G/S-Q condensed aerosol fire suppression device receives the start signal, the aerosol generator in the cartridge will be activated to decompose the chemical coolant on the upper layer so that the aerosol generator and the coolant work together to suppress a fire.

Table 2-15 Technical parameters

Model	QRR0.3G/S-Q
Executive standard for S-type condensed aerosol	GA499.1 *Aerosol fire suppression system - Part 1: Condensed aerosol fire suppression device*
Validity period	See the marking on the product
Start mode	Electric start/hot start
Hot start temperature	≥170°C
Safety current	≤200mA
Starting current	≥700mA
Extinguishing efficiency	100g/m³～130g/m³
Dimensions	68.5mm×46mm×255mm
Protected space	3m³
Operating ambient temperature range	-40°C～+90°C
Operating relative humidity	≤95%RH

2.4.5.3 Fire alarm control panel

Figure 2-27 Appearance of fire alarm control panel



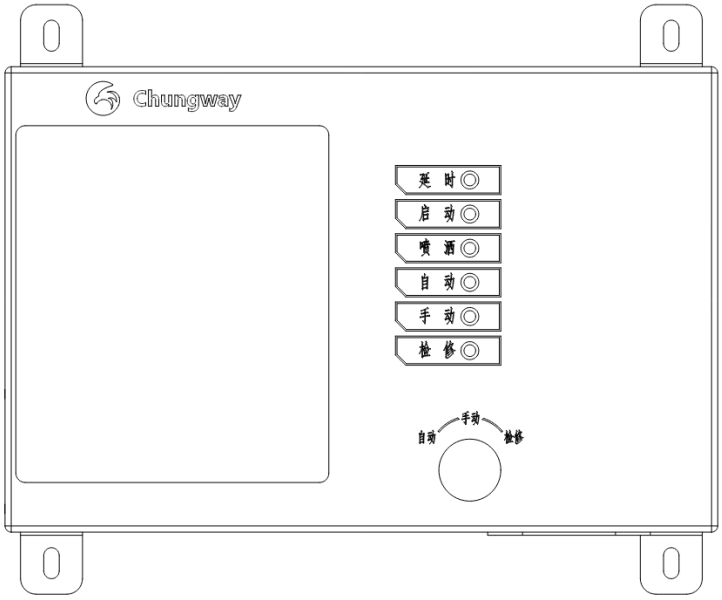
Part description: As the main fire control system in the cabinet, the fire alarm control panel features detector data acquisition, fire extinguisher startup, audible and visual alarm control, and in-station control system linkage communication.

Table 2-16 Technical parameters

Model	CW1310-99B
Supply voltage	DC24V
Weight	2kg
Installation method	Wall mounted
Size	230*170*64mm
Rated power	10W
Max. power (when a fire extinguisher starts)	120W
Operating temperature	-40°C ~ 85°C
Extinguisher startup interface	2 ways
Max. output upon extinguisher startup	DC24V,5A
Alarm interface	4 ways
Extinguisher alarm dry contact	5 ways (NO/NC), of which one way is normally open
Linkage communication interface	CAN/RS485
Input interface	2 ways
Indicators	Normal, fire alarm, fault, silence, main power, standby power, undervoltage

2.4.5.4 Emergency Start-Stop Switch

Figure 2-28 Appearance of emergency start-stop switch



Part description: This emergency start-stop switch integrates auto and manual control, forced start, emergency stop, and fire alarm indicators, and consists of casing, backplate, PCBA, and emergency start-stop button.

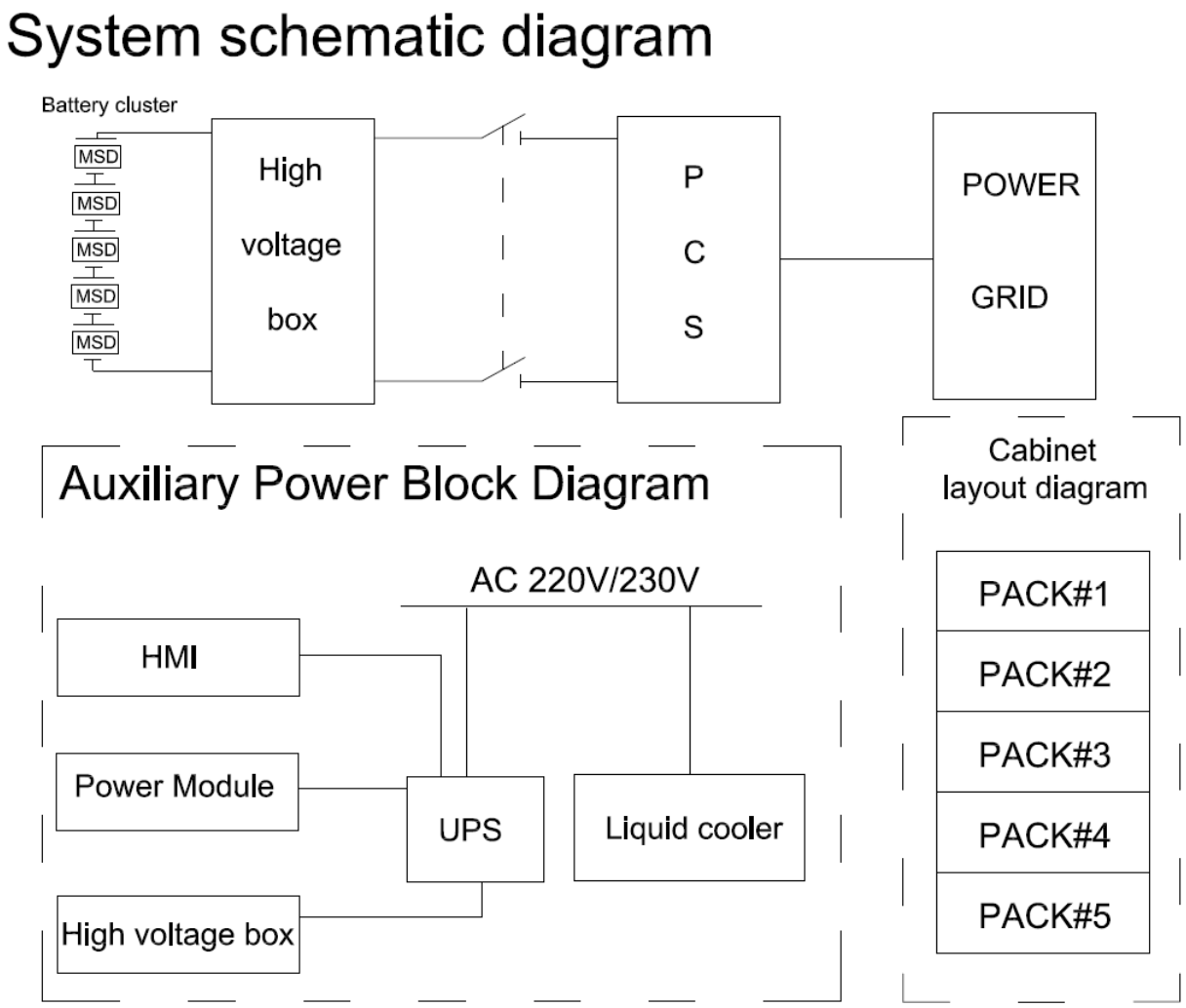
Table 2-17 Technical parameters

Start Switch		
SN	**Parameter**	**Value**
1	Model	CW1310-12B
2	Size	230*190*57.5mm
3	Rated voltage	DC24V
4	Rated current	15mA
5	Switch type	Emergency start, emergency stop, and auto-manual switchover
6	Indicator type	Delay indicator, spray indicator, auto-manual indicator, and service indicator
7	Communication mode	CAN、RS485

2.5 Operating Principle

2.5.1 Circuit Block Diagram

Figure 2-29 Circuit block diagram



2.5.2 Equipment States

There are five states for the energy storage system including running, shutdown, fault, standby, and offline.

Table 2-18 Description of equipment states

Equipment States	Description
Running	The energy storage system stores external direct current into battery packs or discharges battery packs' electric energy to outside units.
Shutdown	The energy storage system stops charging and discharging and powers off battery packs.
Fault	The equipment is faulty when a fault is detected.
Standby	The equipment is in standby mode.
Offline	The EMS is disconnected from the display screen.

2.6 Typical Applications

Figure 2-30 AC coupling

AC coupled with PV or other power sources together with grid, mainly for maximization of self generation and zero-consumption from grid.

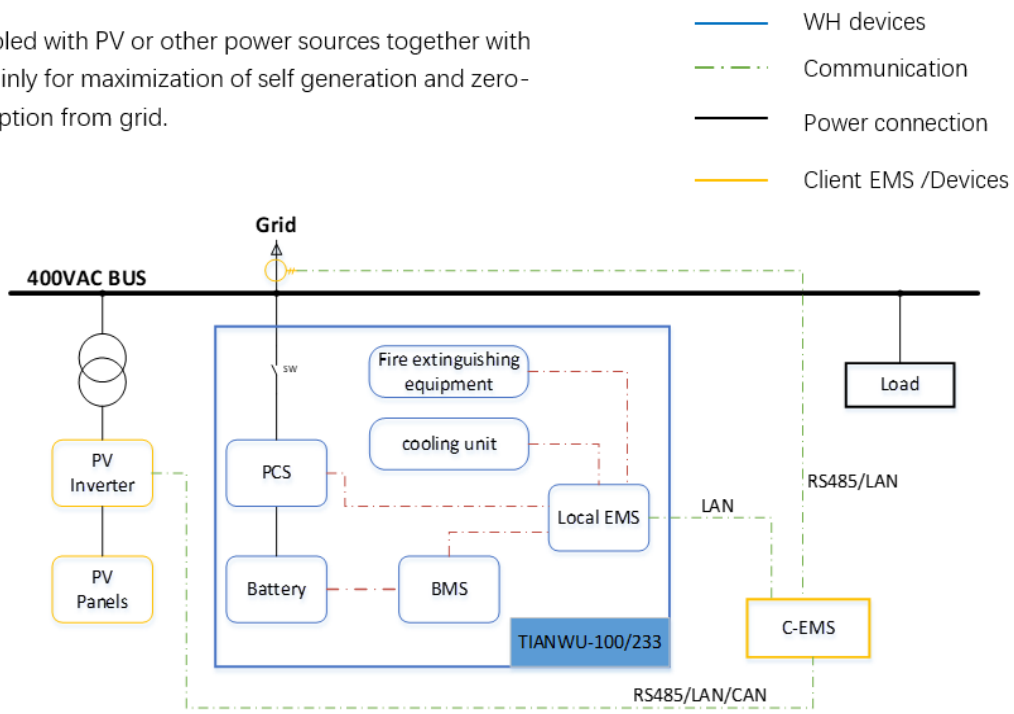
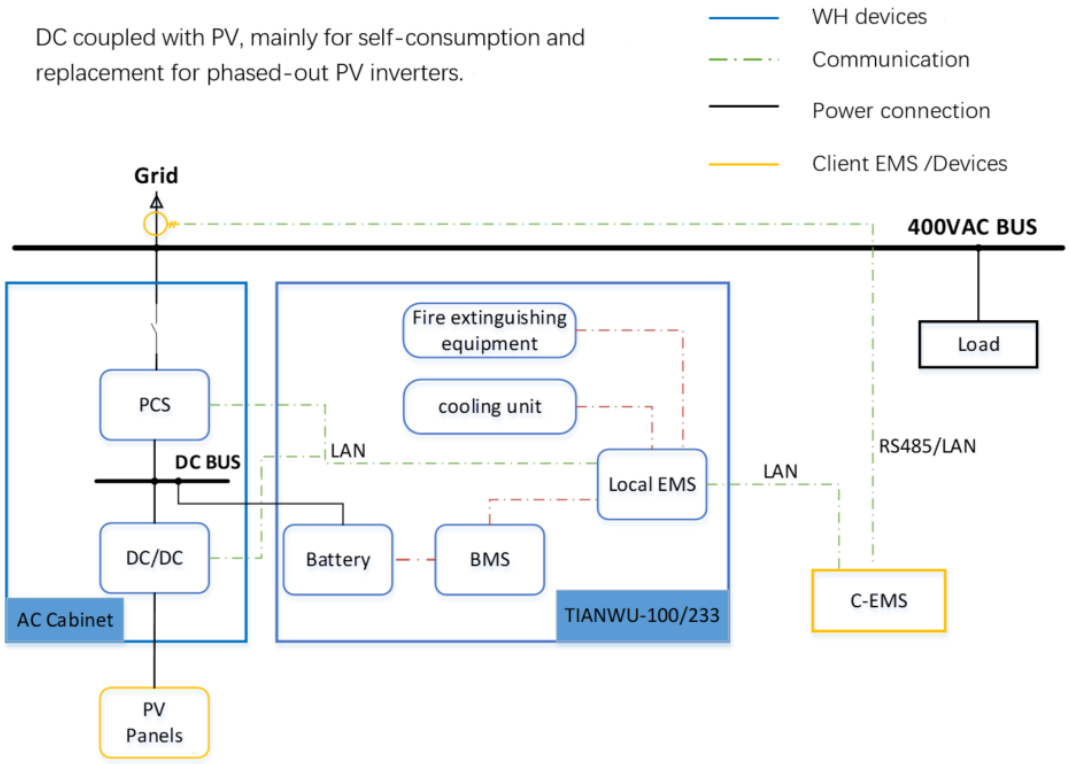


Figure 2-31 DC coupling

DC coupled with PV, mainly for self-consumption and replacement for phased-out PV inverters.



3 Site Requirements

3.1 Site Selection Requirements

Notice

The site should be selected according to *GB 51048 Design code for electrochemical energy storage station*, *NFPA 855 Standard for the installation of stationary energy storage systems*, and local laws and regulations.

The energy storage system is suitable for outdoor applications and deployed outdoors. For indoor applications, refer to local laws and regulations. General site selection requirements:

- The system should not be installed in low-lying areas, and the installation level should be greater than the highest water level on records in this area.
- There should be at least a 2 km distance from the airport, landfill, river bank or dam.
- Select an open location and ensure that there are no obstacles within 10 m of the site.
- Keep at least 50 m away from residential areas to avoid noise pollution.
- The installation area shall have convenient transportation conditions and be equipped with a reliable fire suppression system.
- The future requirements for the site area must be taken into account, and there should be sufficient reserve space for future needs throughout the life cycle.
- Select a well-ventilated place.
- The energy storage system, when installed in a place subject to salt damage, may be corroded and thus cause fire hazards. Do

not install the energy storage system outdoors in salt-affected areas. Salt damage areas are those within 2 km of the coast or affected by sea breezes. The areas affected by sea breezes vary with meteorological conditions (for example, typhoons, and seasonal winds) or topographical conditions (for example, dams and hills).

Description

1. It is recommended to relocate the site When the safety distance cannot meet the requirements of applicable national standards.
2. If there is no more suitable site, it is recommended to install a fire division wall capable of resisting fire for no less than 3 hours for security protection purposes, and the space requirements for equipment transportation, installation, and maintenance shall be taken into account.
3. As recommended in T/CEC 373-2020, the length and height of the fire division wall shall exceed the outer contour of the prefabricated module by 1 m each, and as described in NFPA 855-2020 *Standard for installation of stationary energy storage systems*, the spacing can be reduced to 914 mm when there is an independent fire division wall capable of resisting fire for at least 1 hour.

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

- Areas with strong vibration, strong noise source and strong electromagnetic field interference.
- A place where dust, oil fumes, harmful gases, or corrosive gases are produced or exist.
- A place where corrosive, flammable or explosive materials are produced or stored.
- Places with existing underground facilities.
- Ground with adverse geological conditions such as rubber soil and soft soil layer, and ground prone to water accumulation and subsidence.
- Earthquake area with earthquake fault and fortification intensity greater than 9 degrees.
- Areas with direct hazards such as debris flow, landslides, quicksand or karst caves.
- Within the boundary of mining subsidence (fault dislocation)

areas.

- Within the range of blasting hazard.
- Areas likely to be flooded if a dam or levee breaks.
- Important water source sanitation protection area.
- Protected areas of historical relics and monuments.
- Crowded places, high-rise buildings, and underground buildings.

3.2 Forklift Requirements

- Before using the forklift, ensure that the forklift meets the load-bearing requirements: The load-bearing capacity must be at least 5 tons.
- The recommended fork length is at least 1.5 m.

3.3 Lifting Requirements

- Before lifting operation, ensure that the crane and rope meet the load-bearing requirements. The energy storage system must be lifted using a lifting bracket.
- Do not drag the lifting equipment on the cabinet to prevent it from being scratched during installing or removal operation.

Lifting Process	Precaution
Before lifting	Crane lifting capacity > 5 tons, working radius ≥ 2 m. Consult a professional to evaluate the working conditions on site when on-site conditions are not met.
	A lifting operator shall receive training and be certified before starting the lifting operation.
	The lifting appliances shall be tested and checked for completeness.
	Ensure that the lifting appliances are firmly fixed to a rigid structure or wall that meets the load-bearing requirements.
	It is recommended to perform lifting operations in clear weather without high wind in outdoor applications.
	Check that the crane and wire rope meet requirements before lifting operation.
	All the equipment doors are tightly closed.
	Check that the wire rope is safely and reliably connected.
	It is recommended to perform lifting operations from left to right or right to left to ensure smooth operation.
During lifting	Do not enter the lifting area without authorization or stand underneath the crane jig.
	Ensure that the crane is properly positioned and do not allow long-distance lifting operations.
	Keep the cabinet stable with a diagonal inclination not more than 5°.
	Ensure that the angle between wire ropes is not more than 90°.
	Handle the crane with due care. Gently and smoothly lower the cabinet to avoid impact on the equipment inside.

	Wait until the cabinet contacts the base and the base is uniformly stressed before removing the lifting rope.
	Do not drag wire ropes and slings during lifting operations to avoid impact.
	Fix the cabinet you have lifted and then proceed with lifting other cabinets.

4 Installation

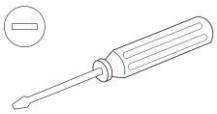
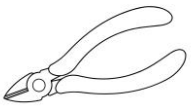
4.1 Preparations before Installation

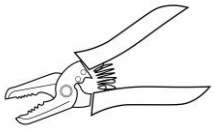
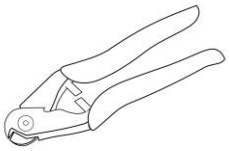
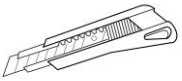
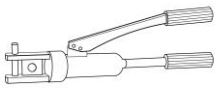
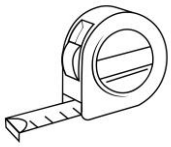
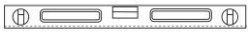
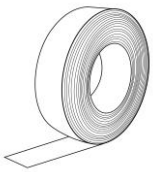
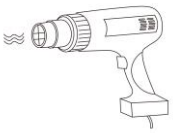
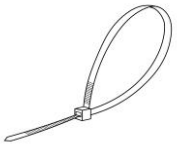
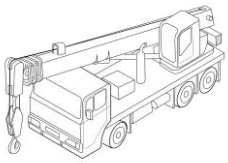
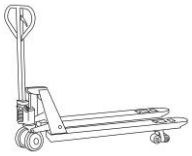
4.1.1 Tools

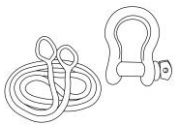
Description

- The tools given here are for reference only.
- The tool list may not list tools that may be rarely used on site, depending on site conditions. On-site installers and users are advised to prepare tools that are not listed.

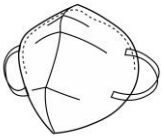
Installation Tools

 Phillips insulated torque screwdriver	 Insulated torque socket wrench (including extension bar) • Socket specification: 7 mm to 19 mm • Socket depth ≥ 32 mm • The socket coupling matches the torque wrench • Torque range: 1.2 N·m to 45 N·m	 Slotted insulated torque screwdriver	 Diagonal pliers

 Wire stripper	 Wire cutter	 Rubber hammer	 Utility knife
 Crimping tool	 Hydraulic tongs	 Allen wrench: 5 mm to 12 mm	 Multimeter with DC voltage measuring range ≥ 1500 VDC
 Steel tape	 Spirit level	 Vacuum cleaner	 Impact drill
 Drill bit Φ16mm	 Heat shrink tubing	 Hot air gun	 Cable tie
 Insulating ladder	 Crane	 Manual forklift	 Forklift

 Lifting rope and lifting eye, rope length ≥ 2200 mm×8	 Lifting bracket: Q235 rectangular hollow section 120×60×4 mm with not less than 2500 mm is recommended	 Crowbar	

PPE

 Insulating gloves	 Protective gloves	 Goggles	 Dust mask
 Insulating shoes	 Reflective vest	 Safety helmet	 Safety belt

4.1.2 Checklist before Installation

Checking Outer Package

Before unpacking, check the outer package for visible damages, such as holes, cracks, or other signs of possible internal damage, and check the device model against the packing list. For any packaging defect or incorrect device model, do not unpack and immediately contact your vendor.

Description

You are advised to unpack the cabinet within 24 hours before installing it.

Warning

If the cabinet is more than 2 m high, please take protective measures for working at heights when removing the outer package.

Checking Deliverables

Check the deliverables for completeness or visible appearance damage before removing the outer package. For any omission or damage, contact your vendor.

4.2 Installing Energy Storage System and Cables

Precaution

⚠ Danger

- Before making electrical connections, please ensure that all switches of the energy storage system are in the "OFF" position. Otherwise, the high voltage that exists in the energy storage system may lead to electric shock.
- Measure the voltage at the contact before touching any conductor surface or terminal and ensure that the PE cable of the system or component to be repaired is reliably grounded and that there is no risk of electric shock.

⚠ Warning

- Equipment damage caused by improper connection shall not be covered by the warranty.
- Only an electrical engineer can make electrical connections.
- An operator shall wear PPEs during electrical connections.

Description

The cable colors in the electrical connection diagrams in this section are for reference only. The cables must be selected in strict accordance with local cable standards. The yellow and green cables can only be used for protective earthing.

Cable Requirements

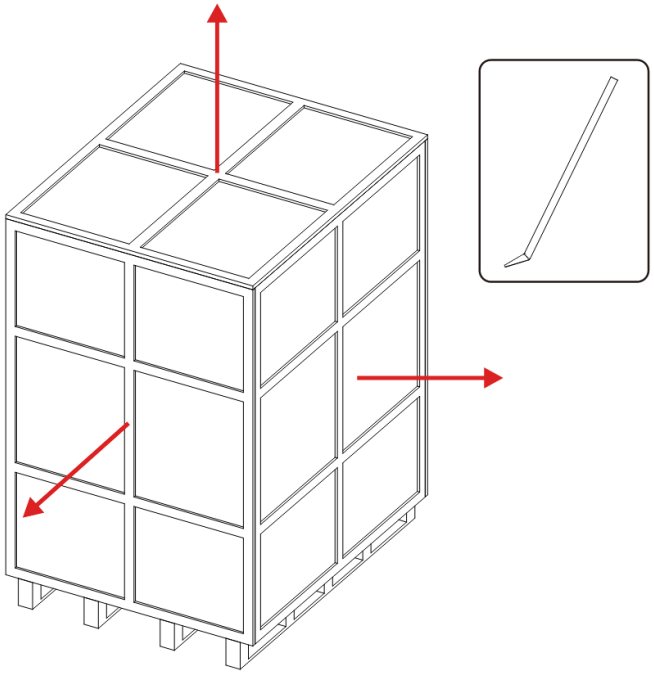
For crimping OT/DT terminals, see **A Crimping OT/DT Terminals**.

Name	Type	Conductor Cross Section Area Range	Description
AC incoming line	3-conductor copper core/ copper-clad aluminum/aluminum alloy cable for outdoor use	≥70mm²	User-supplied
AC line for auxiliary power supply	2-conductor (L, N) copper core/copper-clad aluminum/aluminum alloy cable for outdoor use	≥6mm²	User-supplied
PE cable	Single-conductor copper core/ copper-clad aluminum/aluminum alloy cable for outdoor use	25mm²~50mm²	User-supplied The specification of the PE cable is determined according to this table, or calculated according to IEC 60364-5-54.

Installation Procedure

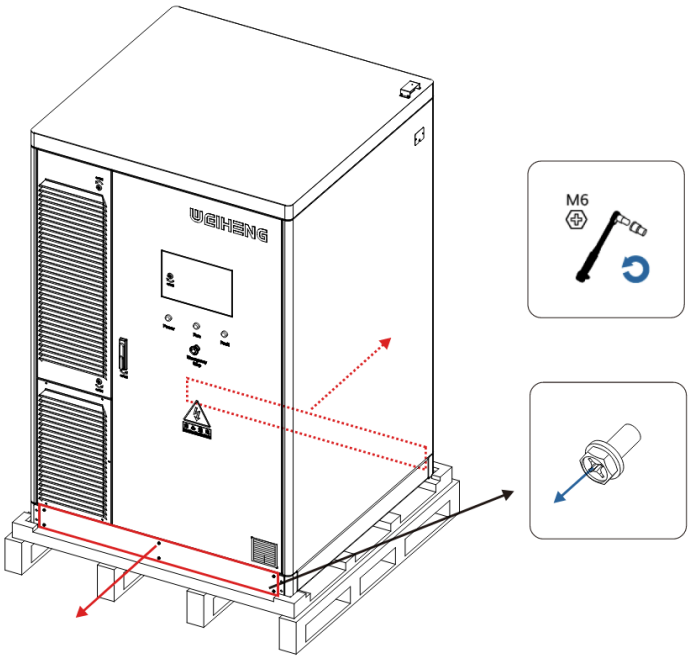
Step 1 Remove the outer package of the energy storage system

Figure 4-1 Remove the outer package



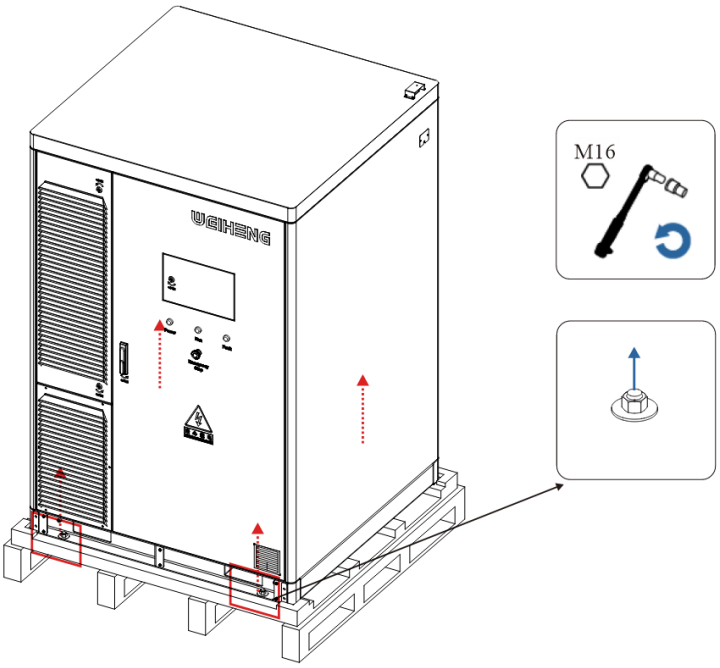
Step 2 Remove the front and rear plates.

Figure 4-2 Remove the front and rear plates



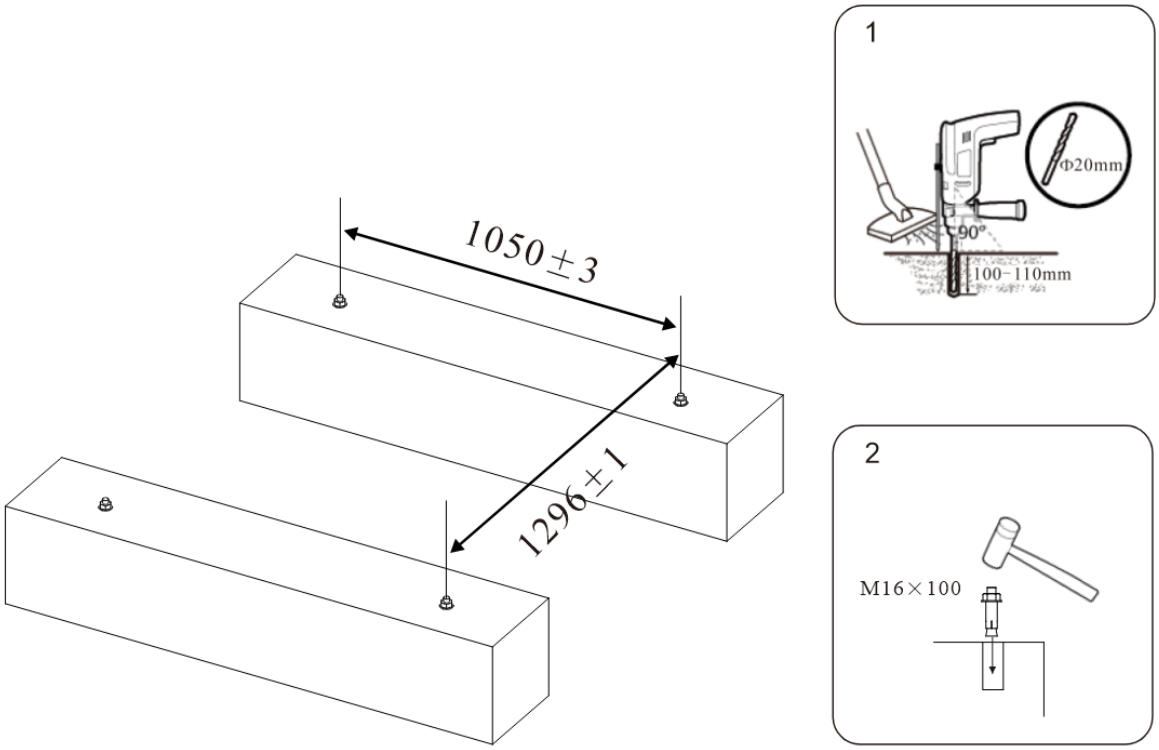
Step 3 Remove the pallet.

Figure 4-3 Remove the pallet



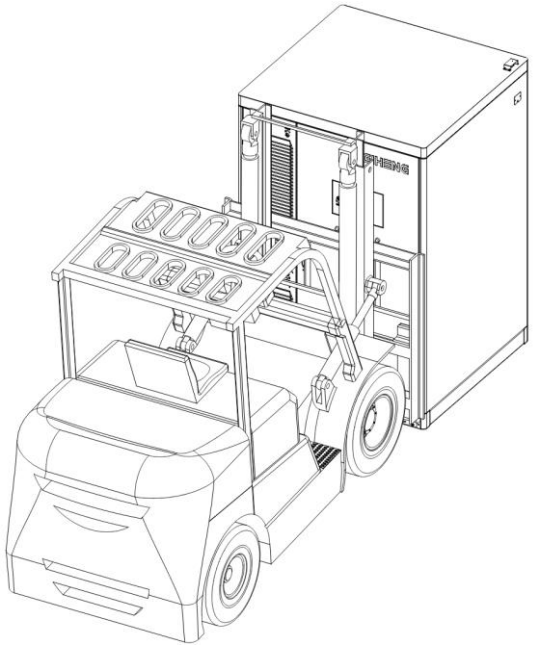
Step 4 Drill holes on the installation foundation and install expansion screws (M16×100, four screws).

Figure 4-4 Drill holes on the installation foundation and install expansion screws



Step 5 Use a forklift to move or lift the equipment to the installation platform.

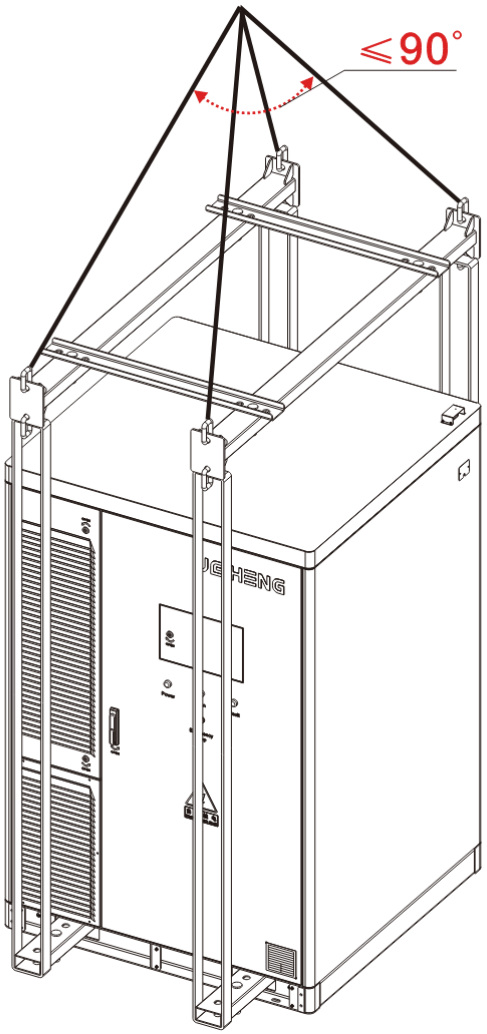
Figure 4-5 Use a forklift to move the equipment to the installation platform



Notice

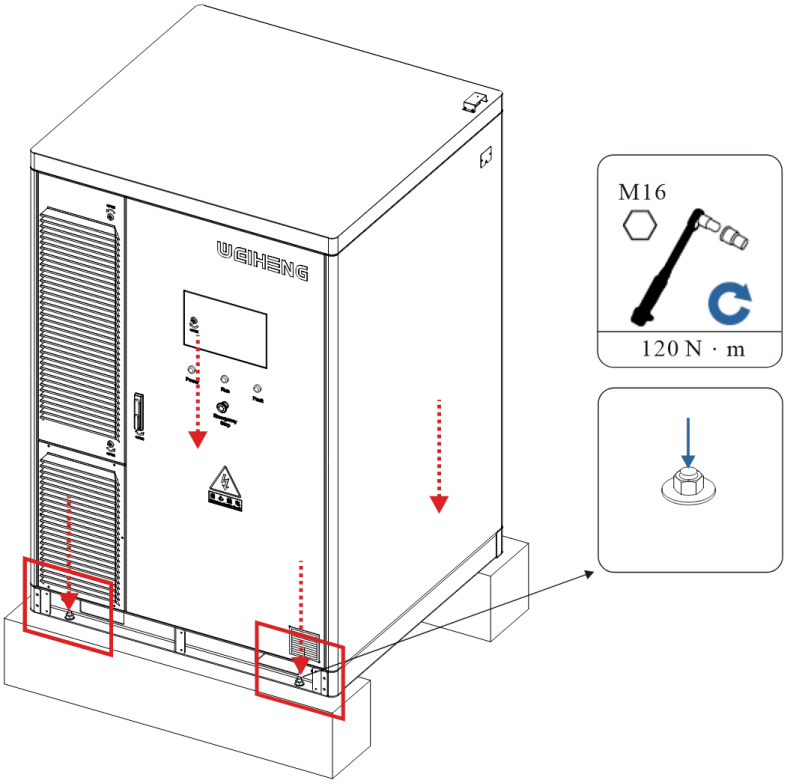
When a forklift is used to move the equipment, bind and fix the equipment according to site conditions to prevent tipping over.

Figure 4-6 Lift to the installation platform



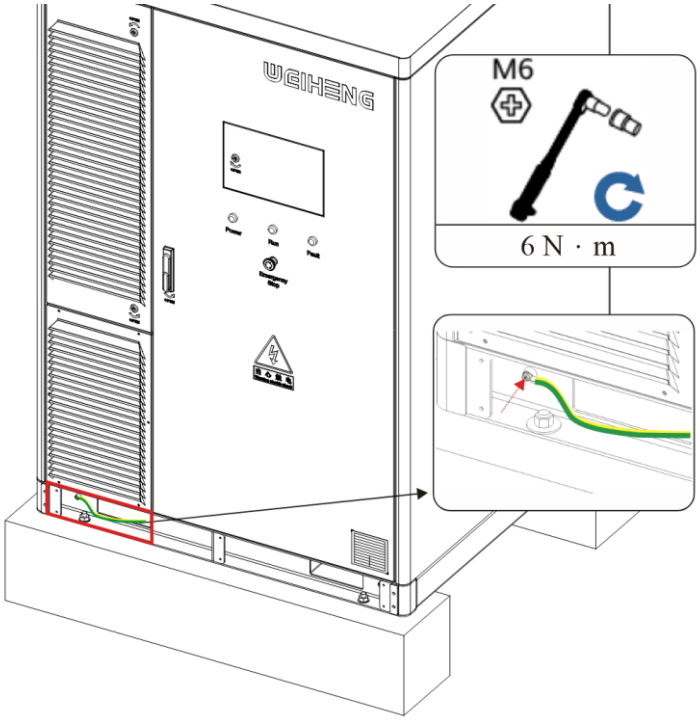
Step 6 Fix the energy storage system.

Figure 4-7 Fix to the installation platform



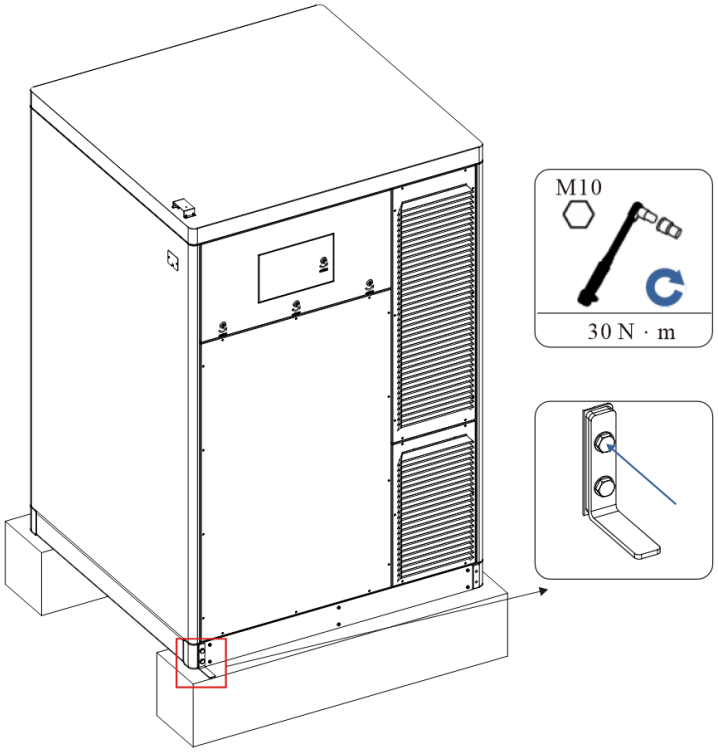
Step 7 Install the PE cable.

Figure 4-8 Install the PE cable (front)



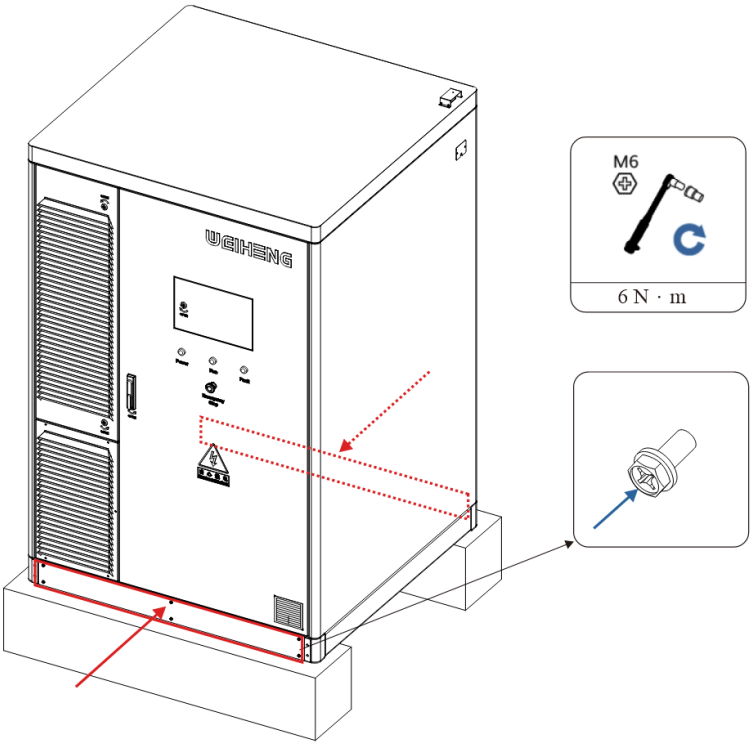
or connect the rear PE cable after Step 8

Figure 4-9 Install the grounding bar (rear)



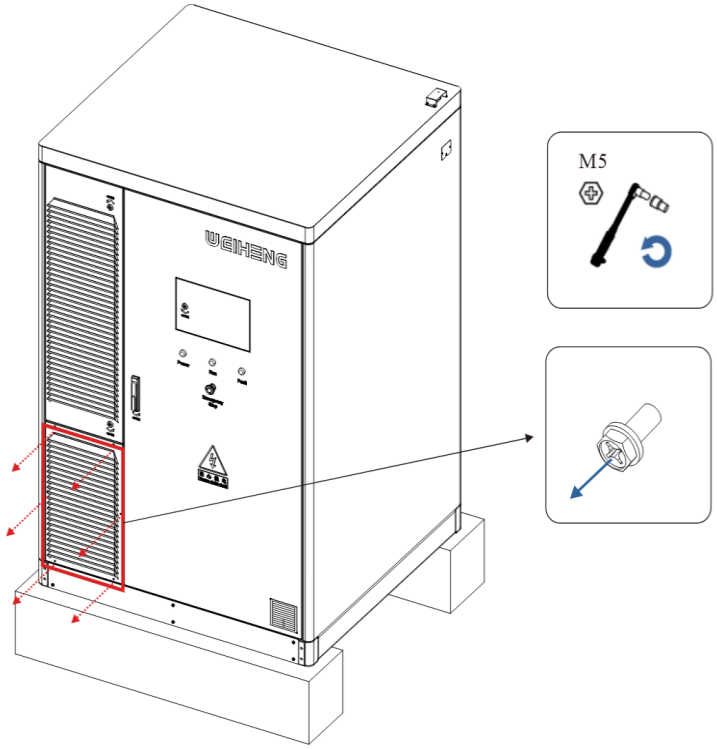
Step 8 Install the front and rear panels.

Figure 4-10 Install the front and rear panels



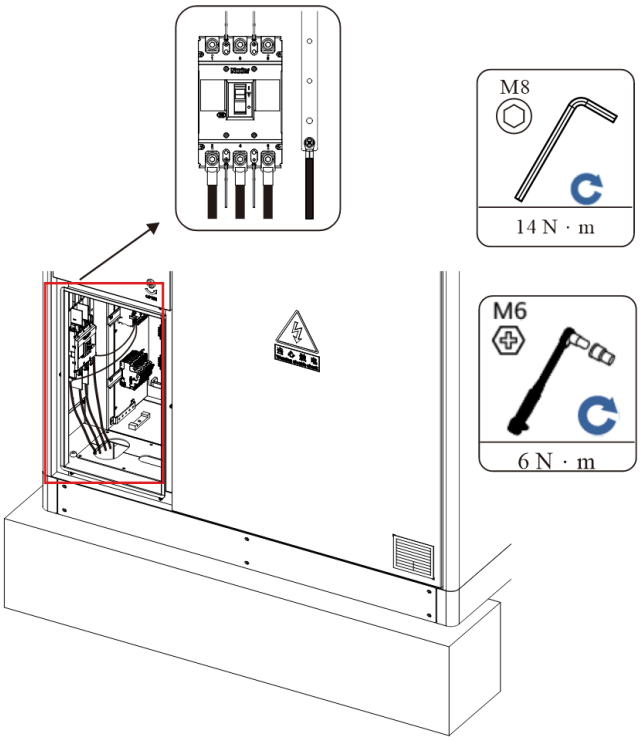
Step 9 Remove the front panel of the PCS.

Figure 4-11 Remove the front panel of the PCS



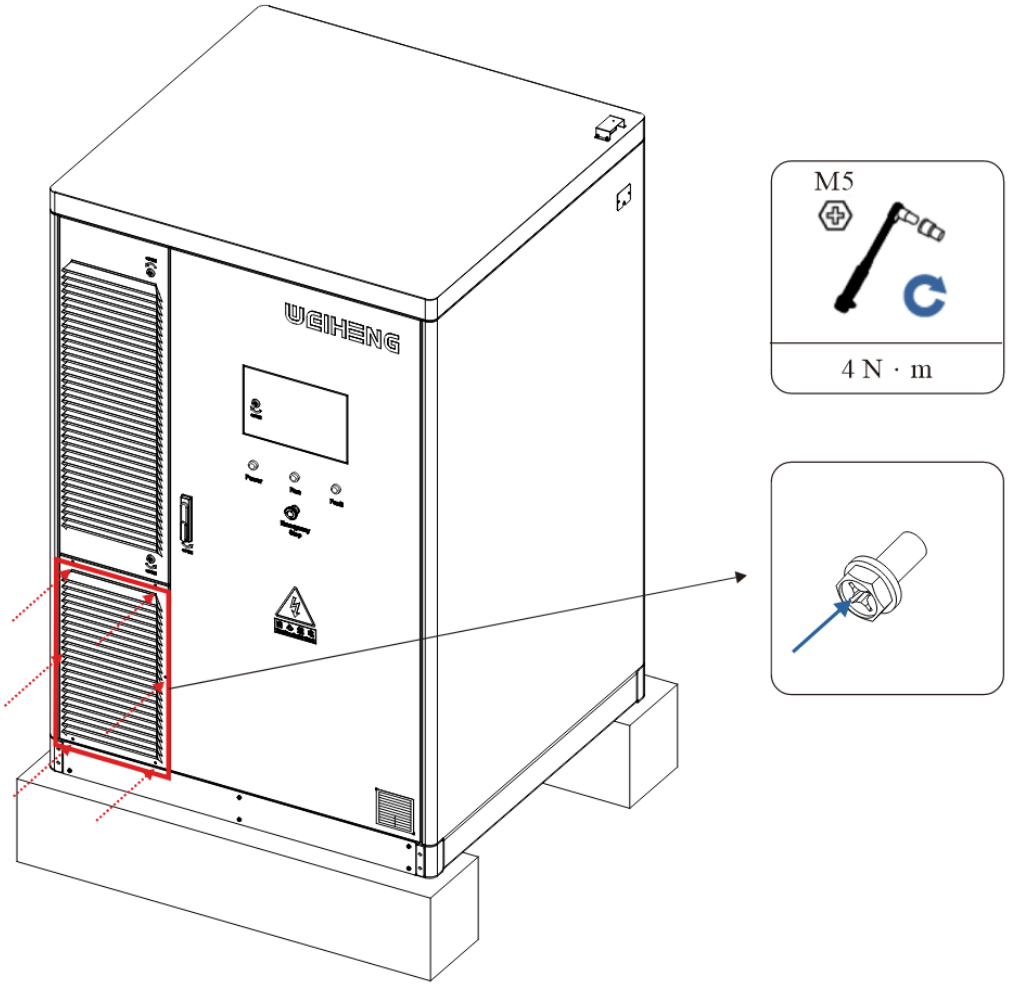
Step 10 Install the power cable.

Figure 4-12 Install the power cable



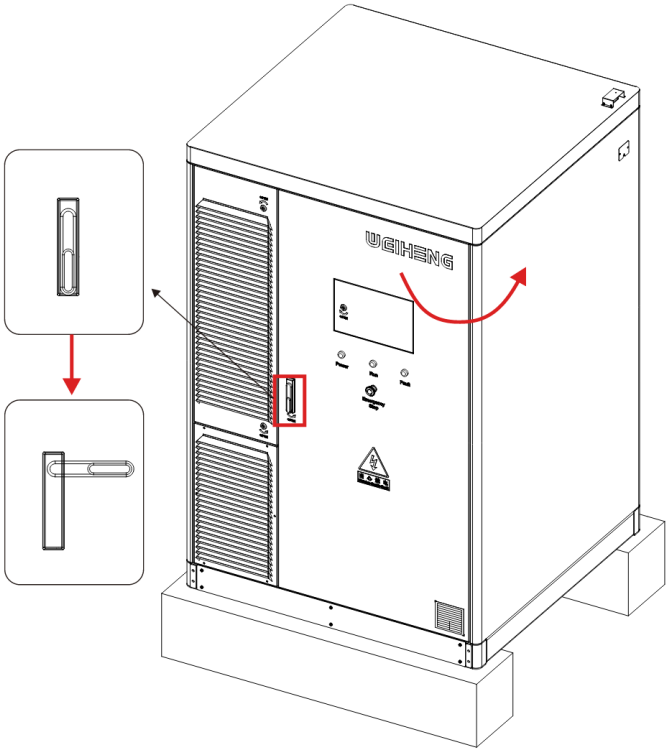
Step 11 Install the front panel of the PCS.

Figure 4-13 Install the front panel of the PCS



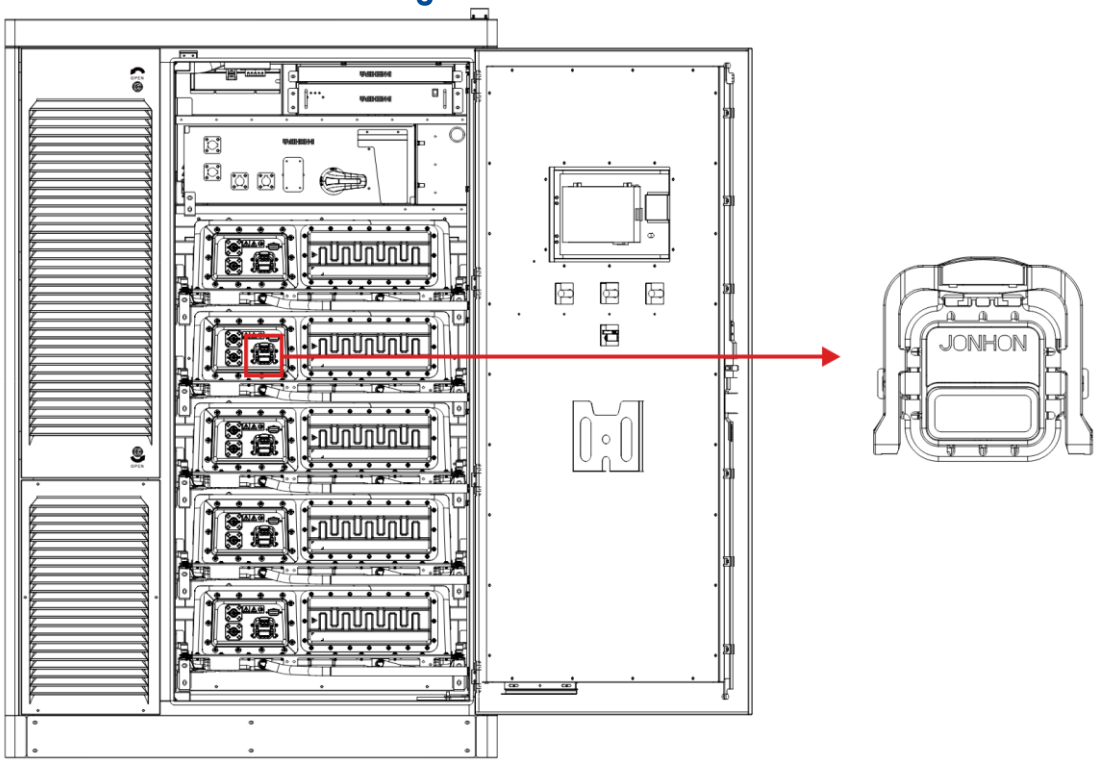
Step 12 Open the front door of the battery compartment.

Figure 4-14 Open the front door of the battery compartment

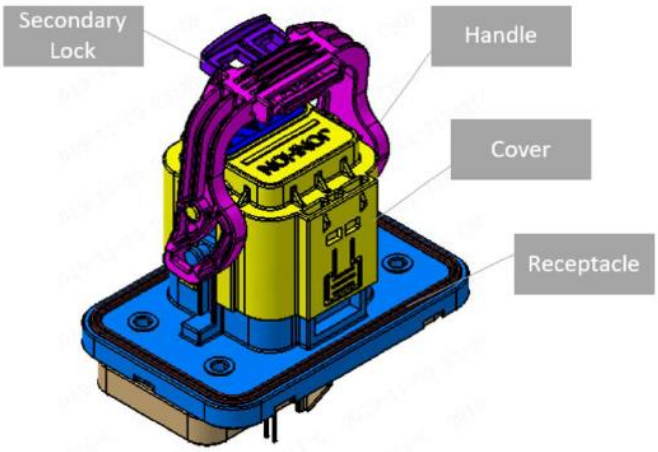


Step 13 Install the manual service disconnect (MSD).

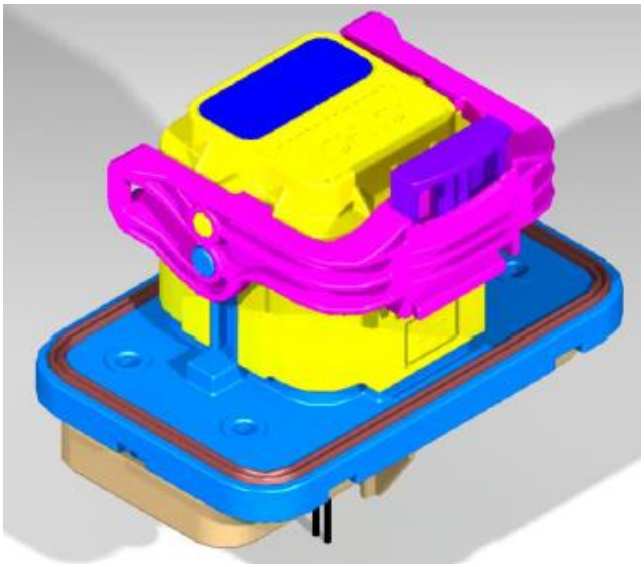
Figure 4-15 Install the MSD



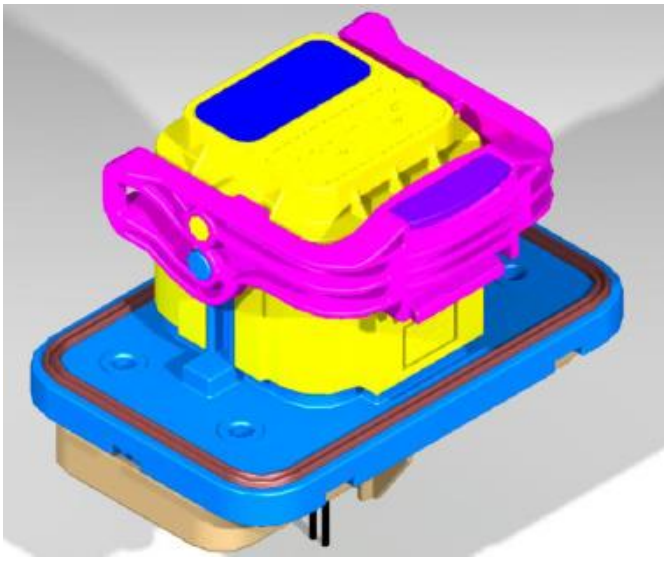
- Put the handle in the vertical state and align the cover of the maintenance switch with the receptacle.



- Push it in and rotate the handle.



- When you can hear the “da da” sound, push in the secondary lock(the disassembly method is opposite), and the installation is completed

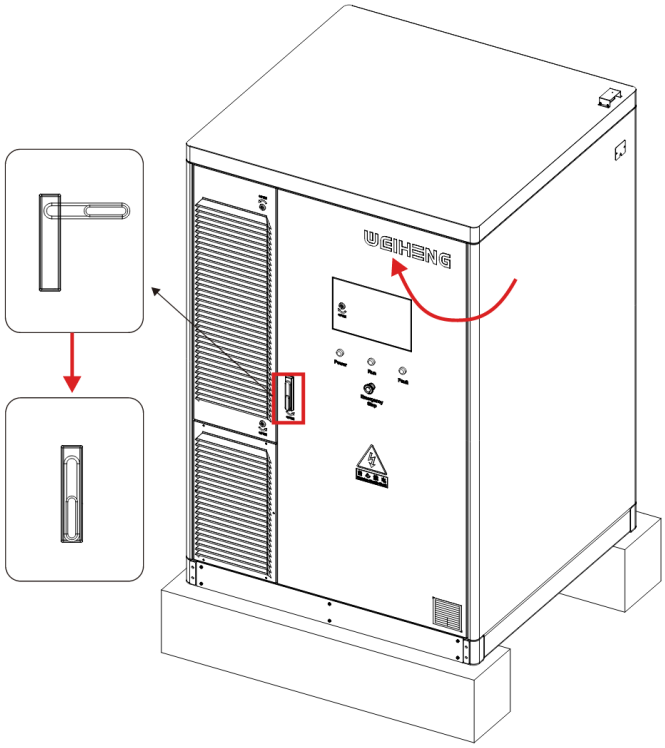


⚠ Warning

Tighten the installed MSD.

Step 14 Close the front door of the battery compartment.

Figure 4-16 Close the front door of the battery compartment



5 Power On

5.1 Checklist before Power On

5.1.1 Routine Check

SN	Check Item	Acceptance Criteria
1	Equipment appearance	• The equipment is free of appearance defect, damage, rusting, or painting defect. If painting peels off, please repair the paint. • The label on the equipment is legible. Replace a damaged label immediately.
2	Cable appearance	• The cable sheath is intact and free of visible damage. • The cable duct is in good condition.
3	Cable connection	• Cable connections are consistent with the design drawing. • Terminals are manufactured in strict accordance with standards and securely and reliably connected. • Labels at two ends of various cables are legible and uniformly oriented.
4	Cable layout	• HV cables and LV cables are properly routed and separated. • Cables are routed in a pleasant style. • Cable connectors are cut to a proper length without burr. • Suitable length is reserved at turns as required. Do not pull cables tight at turns. • Cables are routed straightly and smoothly without crossing in the cabinet.
5	Copper bar in the lithium battery pack	The copper bar is not deformed and the PVC coating is not damaged.
6	Switch	• The circuit breaker of the distribution cabinet is in OFF position. • The HV box switch is in the OFF position.

5.1.2 Checking the Installation of the Energy Storage System

Checking Cabinet

SN	Check Item	Acceptance Criteria
1	Installation	• The energy storage system is installed in accordance with the design drawing. • The cabinet is installed on a level surface and cabinet doors can be normally opened.
2	Appearance	The surface of the cabinet is free of cracking, pitting, or scratching. If painting peels off, please repair the paint.
3	Grounding of the cabinet	Each cabinet has at least two grounding points and is reliably grounded with grounding resistance not more than 0.1 Ω.
4	Accessories	The number and location of installed accessories meet design requirements.
5	Marking	The marking is correct, legible, and complete.

Checking Cabinet Inside

SN	Check Item	Acceptance Criteria
1	Circuit breaker	The circuit breaker is open.
2	Copper bar	The copper bar is not obviously deformed and free of foreign matters.
3	Cables	Cable mounting bolts are tightened and cables are not loose when pulled.
4	Blockage of cable holes	Cable holes are blocked.
5	Lithium battery pack	Each lithium battery pack is free of appearance defect.
6	Foreign matters	Clean up foreign matters inside the cabinet, such as tools or excess materials.
7	Shield plate for the power distribution area	The shield plate for the power distribution area is free of cracking, pitting, scratching, or looseness.

8	Parts (detector, fire alarm control panel, high voltage box, circuit breaker)	Parts are free of appearance defects.
9	Grounding of the cabinet	The grounding conductor is reliably connected to the grounding terminal board or the copper bar of the cabinet.

5.1.3 Checking the PCS

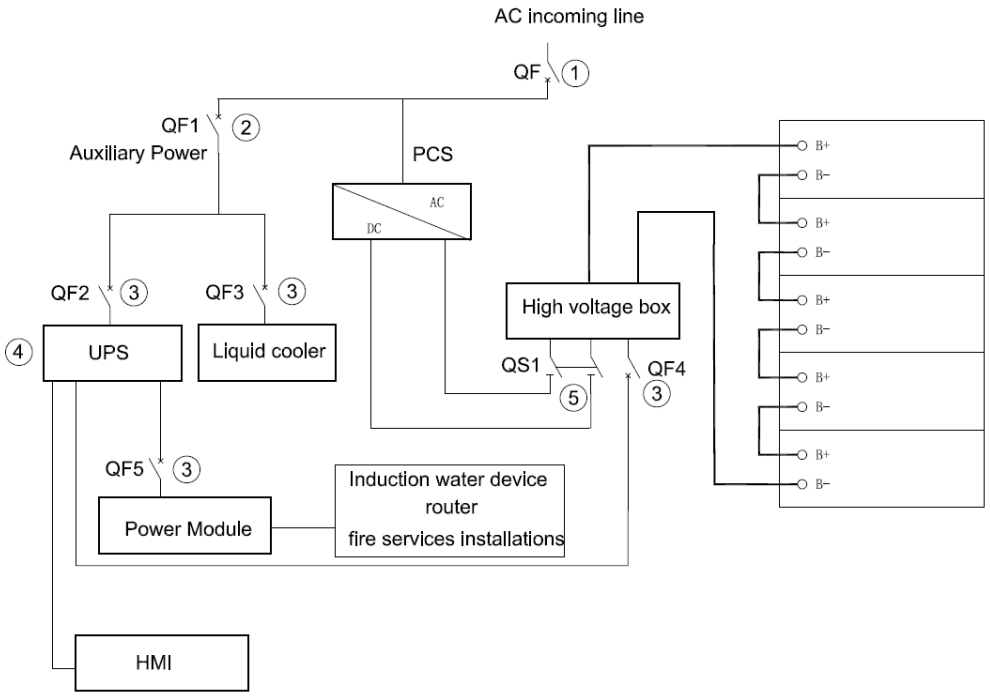
Check Item	Description
Checklist of electrical connections	Check whether the preceding AC circuit breaker switch and the DC switch of the HV box are in the OFF position.
	Check that all cables are not damaged or cracked and ensure that all cables are in good condition.
	Check whether all the ground cables are securely connected.
	Check whether all AC cables are correctly, securely, and reliably connected, without break or short circuit.
	Check whether the polarity of the DC cable is correct and whether it is securely and reliably connected without break or short circuit.
	Check whether the front and rear cabinets of the PCS are clean and tidy and ensure that there are no construction residues.
	Check whether the front and rear shutters are closed and whether the screws on the door are tightened.

5.2 Power-On Procedure

Table 5-1 Power-on procedure

Procedure	Item	Remark
1	Power on the on-grid AC power distribution cabinet and close the AC circuit breaker QF	The QF0 SPD is turned on by default. No manual intervention is required
2	Close QF1 and power on the auxiliary power supply	220 V main power switch of auxiliary power supply
3	Close QF2 to QF5 in turns	Supply power to the UPS, chiller unit, and HV box
4	On the UPS, press and hold the ON/MUTE button to start AC power output.	Hold and press the ON/MUTE button until you hear the power-on sound and ON is displayed.
5	Turn on the switch QS1 of the main control box, and issue a power-on command from PANGU LITE. The battery cabinet will automatically close the HV relay upon completion of pre-charging. In this case, the positive and negative output poles of the battery cabinet will produce high DC voltage.	After the power-on command is issued, the relay pulls in, and the DC side produces DC voltage.
Note a: Check whether the auxiliary AC supply voltage is within the specified voltage range (220 V±10%) before closing the auxiliary power supply switch of the energy storage system.		

Figure 5-1 Power-on procedure



6 Power-on commissioning (PANGU-LITE)

Preconditions

1. All devices on site are commissioned upon delivery.
2. The system can be normally powered on and alarms are cleared.
3. Boot commissioning equipment for gets ready on site.

6.1 Getting Ready and Accessing PANGU LITE

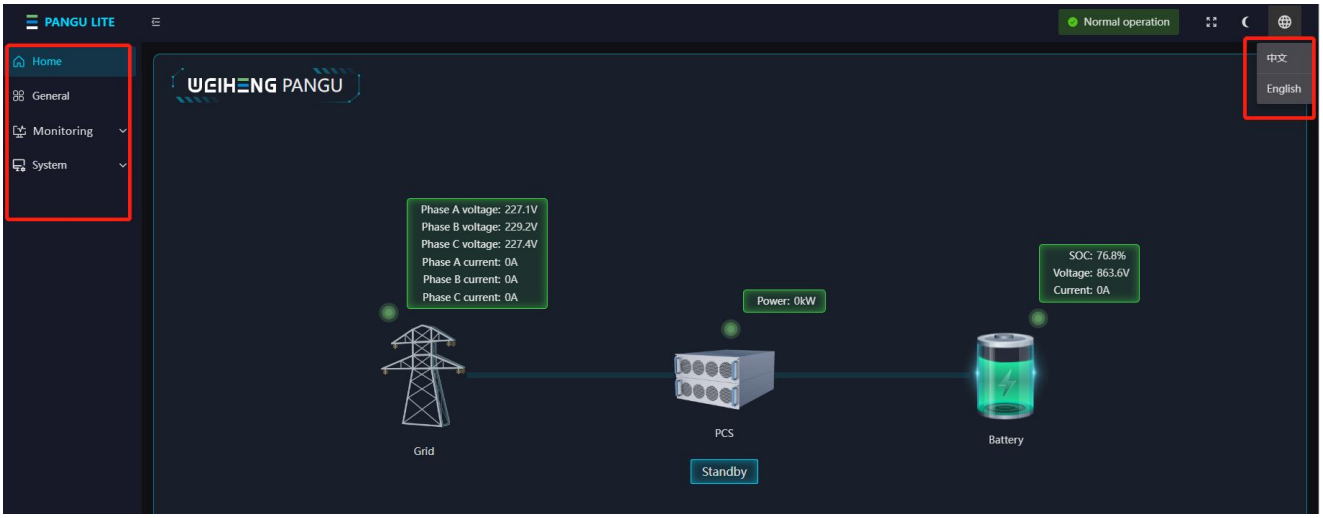
Operation Procedure

After the auxiliary power supply is turned on, the touchscreen on the front cabinet door of TIANWU is turned on and you are directed to the PANGU LITE screen.

6.2 Boot Wizard

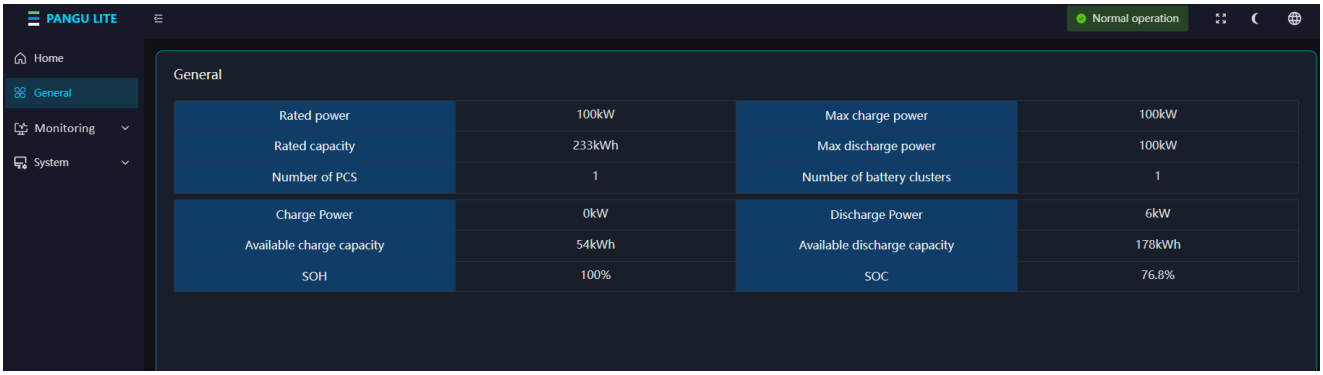
Figure 6-1 PANGU LITE screen

On this screen, you can set Language to Chinese or English in the upper right corner. The left area contains three modules.



- General: You can view PCS power, battery SOC, and other information.

Figure 6-2"General" screen



- Monitoring: You can view PCS, BMS, battery rack, AC and firefighting information.

Figure 6-3 PCS screen

Figure 6-4 BMS screen

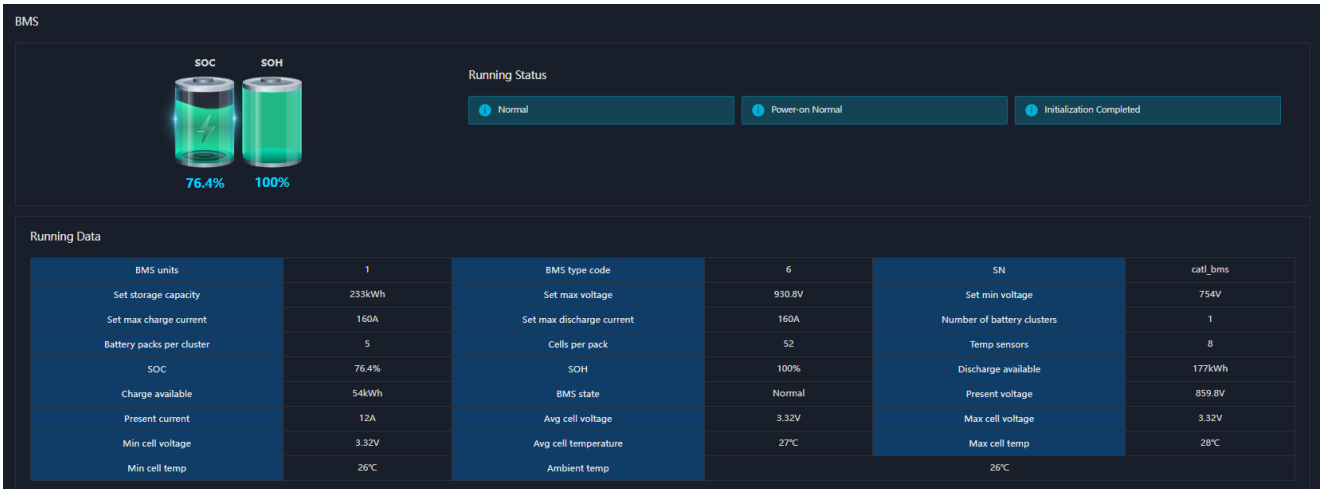
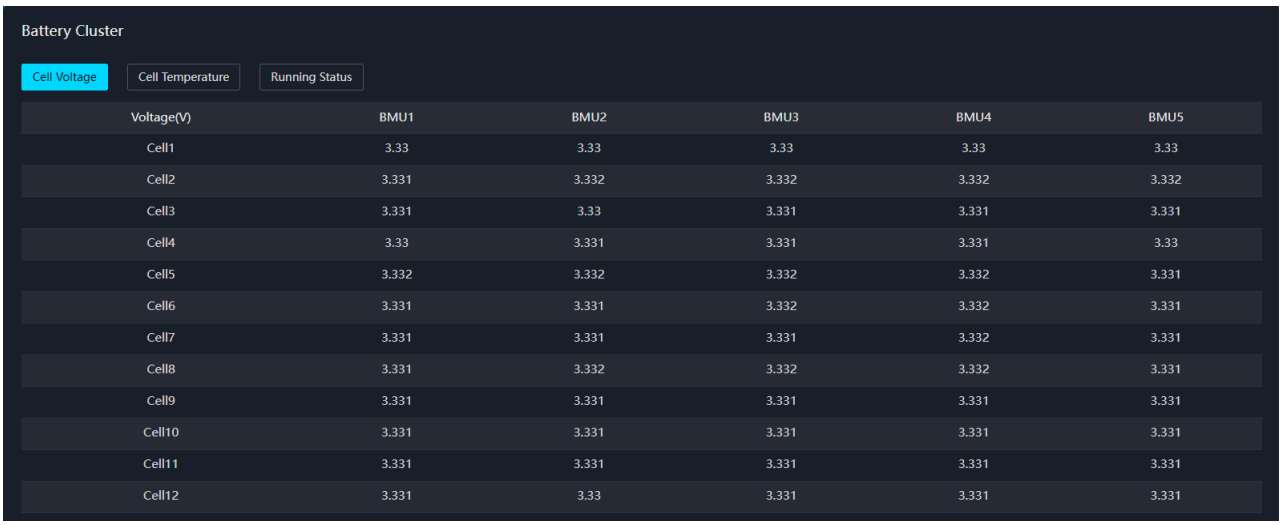
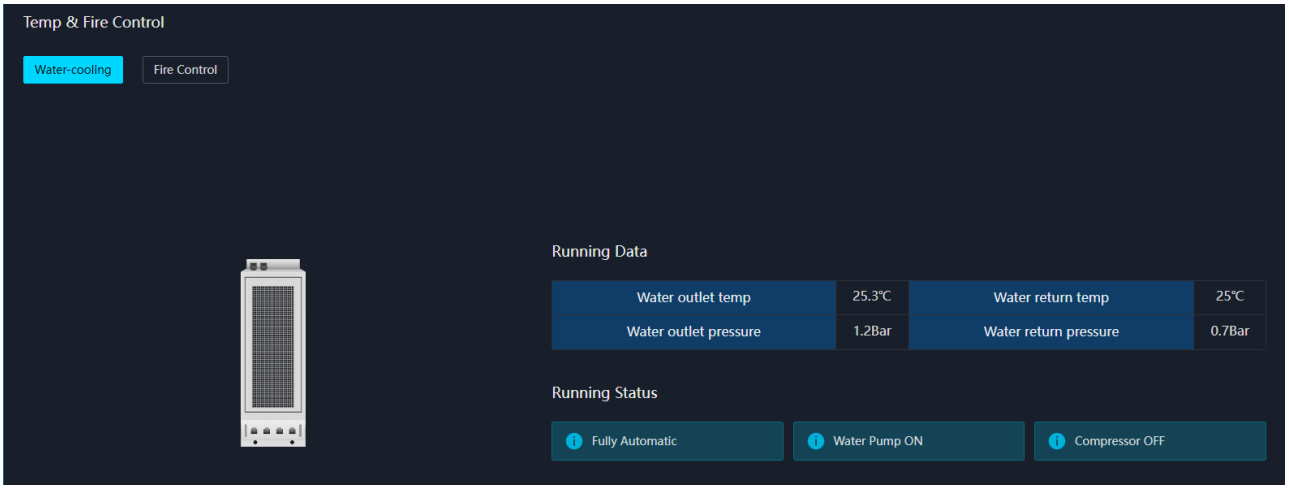


Figure 6-5 Battery rack screen



Voltage(V)	BMU1	BMU2	BMU3	BMU4	BMU5
Cell1	3.33	3.33	3.33	3.33	3.33
Cell2	3.331	3.332	3.332	3.332	3.332
Cell3	3.331	3.33	3.331	3.331	3.331
Cell4	3.33	3.331	3.331	3.331	3.33
Cell5	3.332	3.332	3.332	3.332	3.331
Cell6	3.331	3.331	3.332	3.332	3.331
Cell7	3.331	3.331	3.331	3.332	3.331
Cell8	3.331	3.332	3.332	3.332	3.331
Cell9	3.331	3.331	3.331	3.331	3.331
Cell10	3.331	3.331	3.331	3.331	3.331
Cell11	3.331	3.331	3.331	3.331	3.331
Cell12	3.331	3.33	3.331	3.331	3.331

Figure 6-6 AC and firefighting screen



- System: You can view system running status and perform system control.

Figure 6-7 System status screen

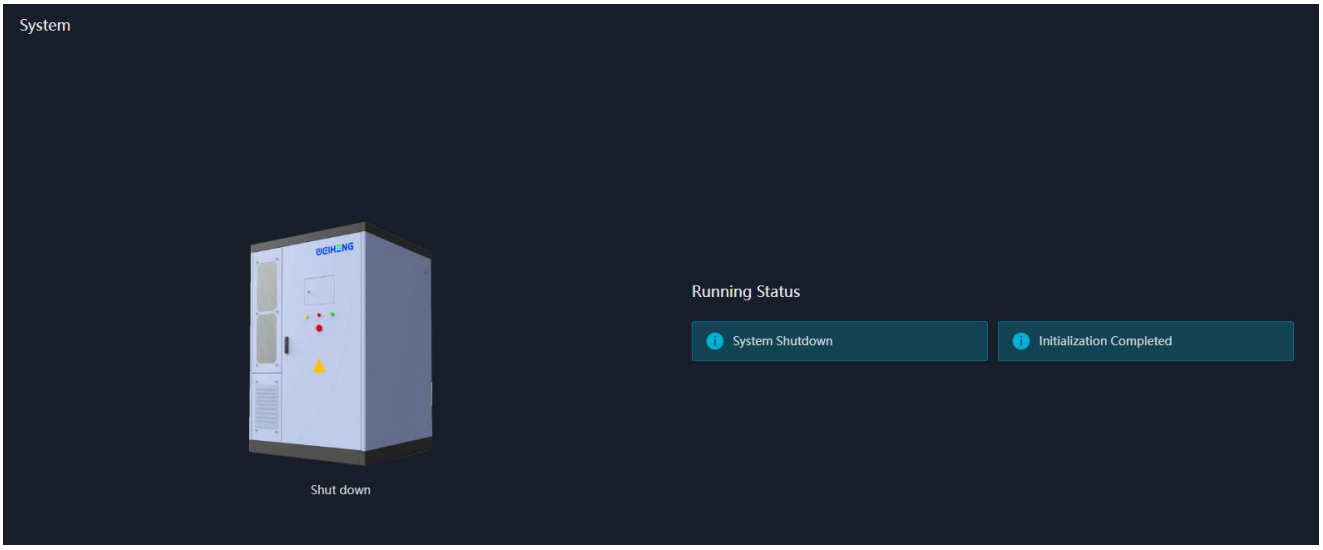
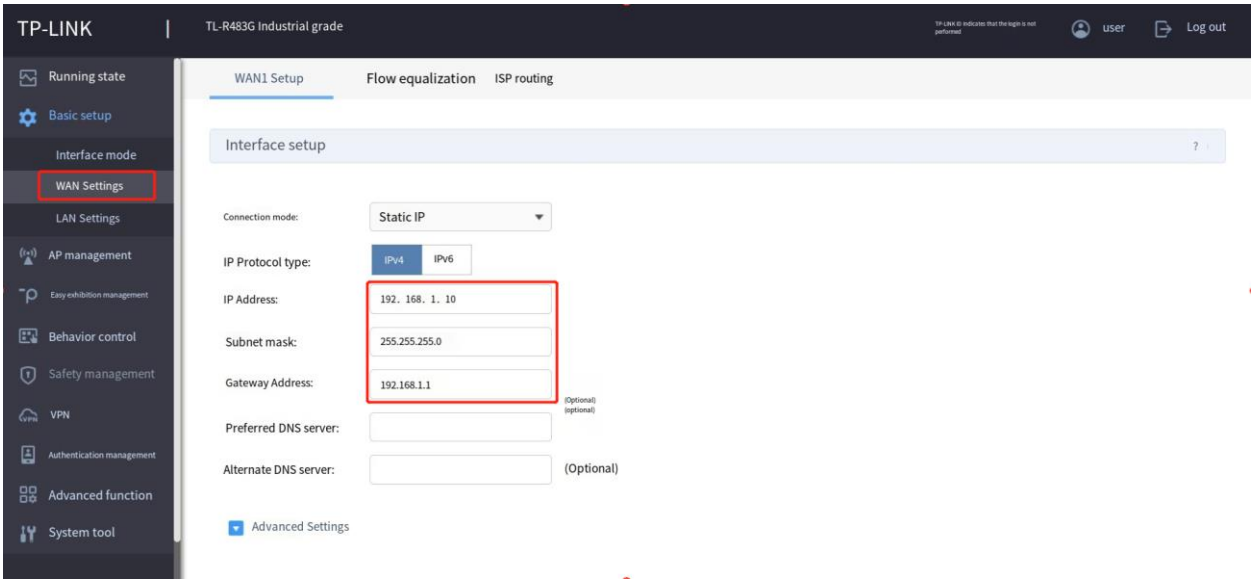


Figure 6-8 System control screen

On the System Control screen, you can turn on/off battery (power on/off), set control mode, issue power, and set SOC and power factor.
Among these, in Manual mode, you can implement local control on the LITE screen, and in PANGU mode, the TIANWU is controlled from a cloud server.

6.3 Communication Interface Configuration

1. Prepare tools
   ① Computer
   ② RJ45 cable
2. Set the steps
   ① Connect the computer to the lan port of the TP-LINK router and automatically obtain the address of 133.144.155.0/24
   ② Enter 133.144.155.1 to log in to the router management interface;
   Login account: root password Weiheng@66
   ③ Change the IP address of the wan port (a private IP address that accesses the public network is required, and can be changed onsite).



④ Restart the router to test whether the public network can be accessed

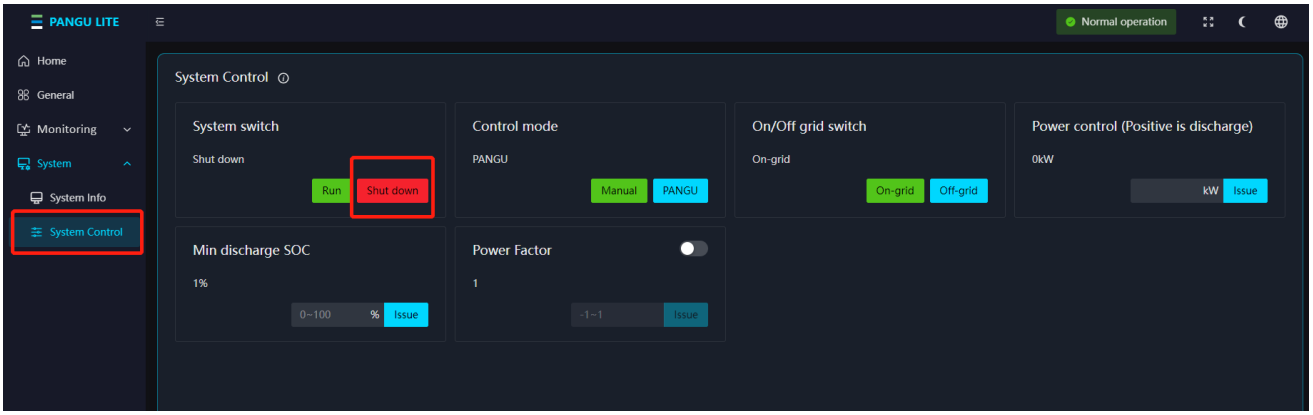
7 Power Off

7.1 PANGU LITE Issues Shutdown Command

Operation Procedure

Step 1 On the PANGU LITE screen, click "System Control > Shutdown" to implement the shutdown command.

Figure 7-1 Shutdown command

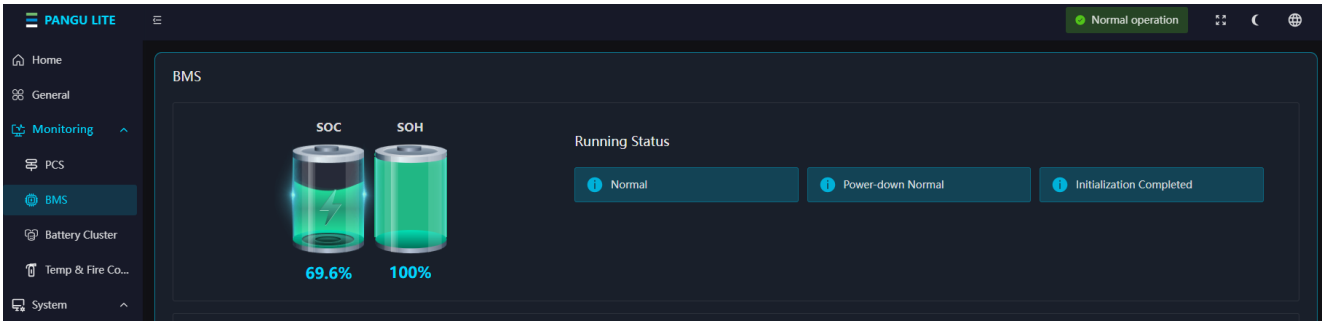


Step 2 Click "Monitoring > PCS " to check system status, power, and DC-side voltage and check that the shutdown sequence is executed.

Figure 7-2 Check PCS information and check that the system is shut down

Step 3 Click "Monitoring > BMS" to view running status and check that the shutdown sequence is executed successfully.

Figure 7-3 Check BMS status and check that the system is shut down

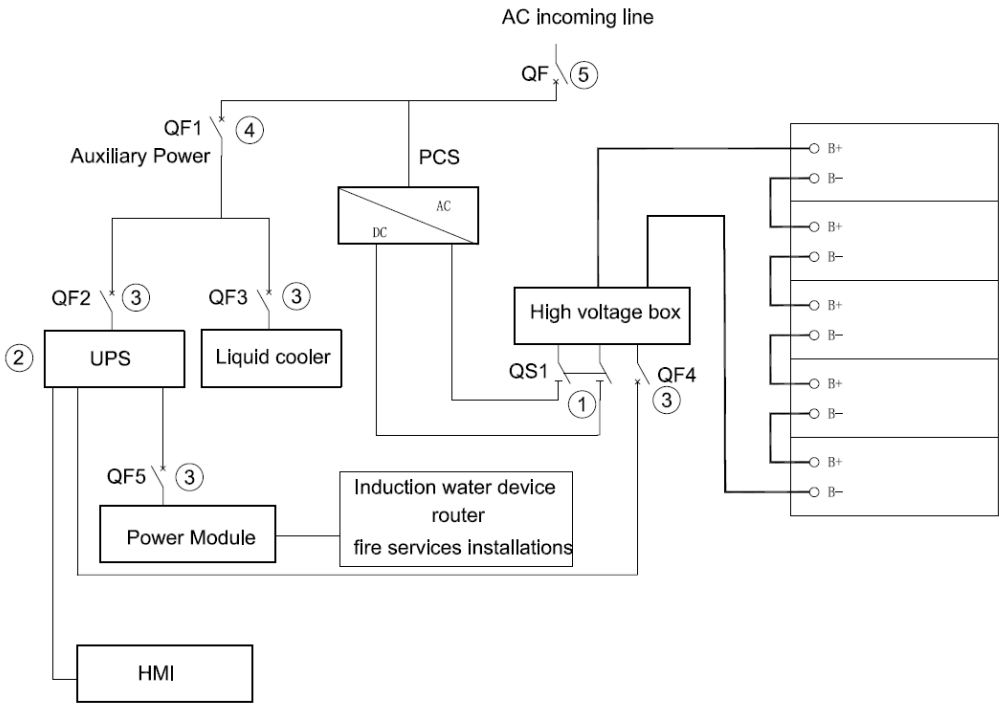


7.2 Power-off Procedure

Table 7-1 Power-off procedure

Procedure	Item	Remark
1	PANGU LITE issues the shutdown command to power off the DC side. Then manually turn off the switch QS1.	The system is shut down. In this case, the primary circuit of the electric control cabinet is disconnected and the positive and negative output poles has no high voltage.
2	On the UPS, you need to press and hold the OFF/ENTER button to turn off the AC power supply.	
3	Turn off QF2 to QF5 in turns	Cut off the UPS and other power supplies
4	Turn off QF1	Turn off the 220 V main power switch of auxiliary power supply
5	Power on the on-grid AC power distribution cabinet and turn off the AC circuit breaker QF	Cut off the AC input

Figure 7-2 Power-off procedure



8 Technical Specifications

Model	WH-TIANWU-100-233B
Battery Data	
Rated capacity (kWh)	233
Rated voltage DC (VDC)	832
Voltage range(VDC)	728-936
Battery type	LFP(LiFePO4)
Cell specification	3.2V/280Ah
Connection mode	1P260S
AC Data On-grid Mode	
Rated AC Power (kW)	100
Rated AC Output Voltage(V)	400
Grid connection type	3W+PE
Rated AC Output Frequency (Hz)	50/60
Power factor at nominal power/Adjustable Power Factor Range	>0.99/1 leading – 1 lagging
Adjustable reactive power range	-100 % – 100 %
Max. Total Harmonic Distortion	< 3% (at nominal power)
Auxiliary power supply voltage(V)/ max power(kW)	230V,50/60Hz (L-N)/6
General data	
Degree of protection	IP55
Topology	Transformerless
Operating temperature range	-20~55°C (derating @ > 45°C)
Cooling Method	Air cooling (PCS), Liquid cooling (Battery)
Max. Operating Altitude	Max. 2000m
Data interface	Modbus TCP/IP
Noise emission, typical	<75dB
Dimensions (W x Dx H)	1400*1350*2100mm
Weight(kg)	~2700
Certificates and approvals (more available upon request)	IEC62477,IEC62109,EN50549-1, IEC61000-6-2/4,VDE4105,CEI-021

9 Maintenance

9.1 Terms Explanation

➢ Normal operating: Refers to the system that works every day.

➢ Intermittent operating: Refers to a system that does not have a fixed monthly running frequency and cannot guarantee daily work.

➢ Long-time unused: The battery system that has not started working for more than 5 months (the battery system needs to be charged to 50% SOC before being suspended).

9.2 Operating Instructions for Normal Operating System

➢ Perform battery maintenance on the system every twelve months to prevent battery damage. Refer to
Section 9.6 for specific maintenance operating method.

➢ Conduct an inspection of ESS every twelve months (refer to *Appendix 1*) and make inspection record.

9.3 Operating Instructions for Intermittent Operating System

➢ The operating instructions are the same as those of normal operating system.

9.4 Operating Instructions for Long-time Unused System

➢ SOC range of battery storage: 30%~50%., avoid long-term storage of batteries below 15% SOC. If the battery is not used for a long time, it is necessary to cut off the power-consuming equipment in time

➢ Conduct an inspection of ESS every five months (refer to *Appendix 1*) and make inspection record.

➢ Perform battery maintenance on the system every five months to prevent battery damage. Refer to
Section 9.6 for specific maintenance operating method.

➢ Before the first usage of long-time unused system, the battery system must be fully charged at least once to activate the battery system in order to recover the battery performance to the best condition.

Tips
If the energy storage system is not used for a long time, it will cause irreversible damage to the battery. Please perform regular maintenance.

9.5 Function of Isolating Switch

a) The isolating switch is an electrical component used to manually cut off the high voltage circuit for safety protection (pictured, right).

b) Before the maintenance work is performed on the system, the relevant personnel must disconnect the isolating switch. After the maintenance work is completed, ensure that the isolating switch is in the ON state.

9.6 Operating Method of Battery Maintenance

In order to ensure the long-term safe and reliable operation of your energy storage system, please read and follow the instructions below:

Maintenance process:

Plan 1 This plan is applicable when SOC of the battery system is low

1.Discharge the battery system to the cut-off condition (Average cell voltage< 3.1V or the lowest voltage<2.8V), then stop discharging, standing for 1 hour.

2.Full charging automatically to the battery system (The highest voltage>3.65V), after charging, standing for 1 hour.

3.Discharge the battery system to 50% and stop

Plan 2 This plan is applicable when SOC of the battery system is high

1.Full charging automatically to the battery system (The highest voltage>3.65V), after charging, standing for 1 hour.
2.Discharge the battery system to the cut-off condition (Average cell voltage< 3.1V or the lowest voltage<2.8V), then stop discharging, standing for 1 hour.
3.Charge the battery system to 50% and stop

Tips
1.Check to ensure environmental safety, system safety, no alarm, no fault before performing maintenance operations. 2.After the battery maintenance of ESS is completed, you can notify our after-sales engineer to perform data analysis for free.

9.7 Maintenance Requirements for Liquid Cooling System

➢ In case of liquid leakage inside the electric cabinet, please stop the machine in time and contact Weiheng for maintenance.

➢ The coolant shall be BASF GLYSANTIN G30 and Sinopec OEVC electric vehicle thermal-35 recommended by Weiheng. Once every five years. If the coolant deteriorates to the following level, it needs to be replaced.

PH value ＜ 6.5 or PH value＞ 9.5

Chloride concentration > 60ppm

Appearance: turbid coolant with impurities

➢ The energy storage water cooling pipeline uses a liquid level alarm. If the liquid level sensor prompts an alarm, the liquid needs to be added.

➢ If you purchase the coolant by yourself, you need to choose the coolant with the ice point lower than the local minimum temperature. It is recommended that the concentration of 40% ~ 50% glycol is good for aluminum corrosion resistance, and the maintenance should be carried out according to the requirements of the coolant supplier. It is recommended to increase the maintenance frequency. Any damage to the relevant parts of the electric cabinet caused by the use of other coolants not recommended by Weiheng is not covered by the warranty.

A Crimping OT/DT Terminals

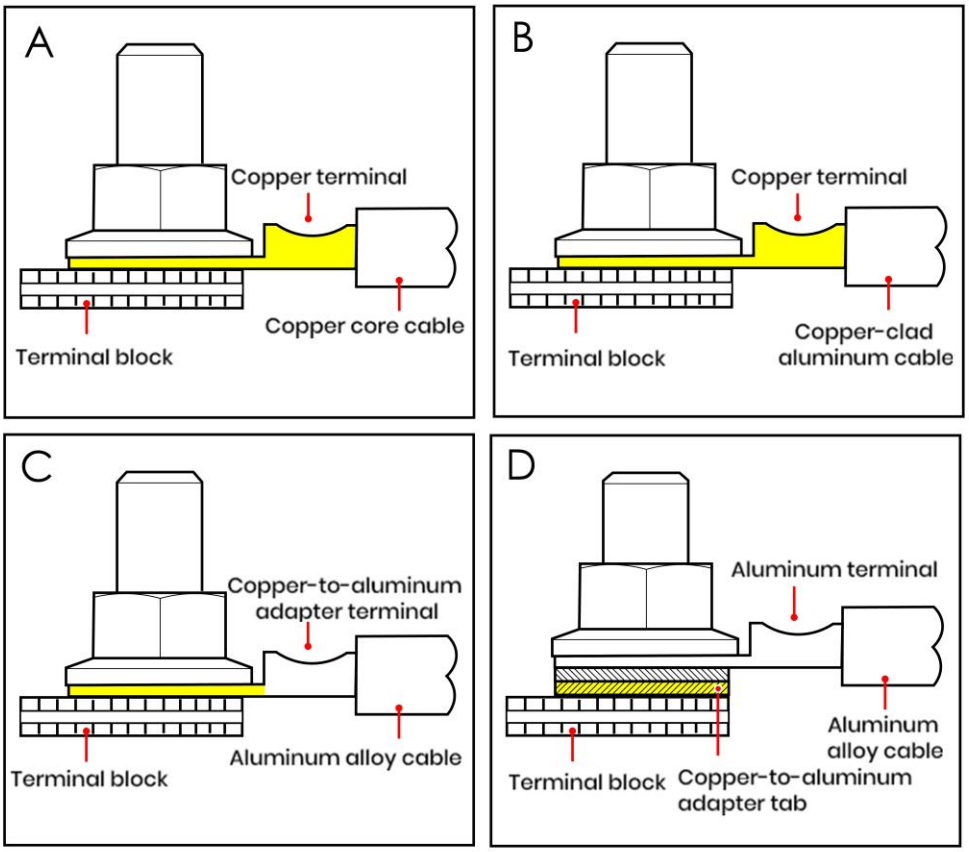
OT/DT Terminal Requirements

- When a copper core cable is used, a copper terminal must be used.
- When a copper-clad aluminum cable is used, a copper terminal must be used.
- When an aluminum alloy cable is used, a copper-to-aluminum adapter terminal or an aluminum terminal with copper-to-aluminum adapter tab must be used.

Notice

- Do not connect an aluminum terminal directly to the terminal block. Otherwise, electrochemical corrosion may occur, affecting the reliability of cable connection.
- When a copper-to-aluminum adapter terminal or an aluminum terminal with copper-to-aluminum adapter tab is used, the requirements defined in IEC61238-1 must be met.
- When a copper-to-aluminum adapter tab is used, the front and back sides shall be identified. The aluminum side of the tab contacts the aluminum terminal and the copper side contacts the terminal block.

Figure A-1 OT/DT terminal requirements

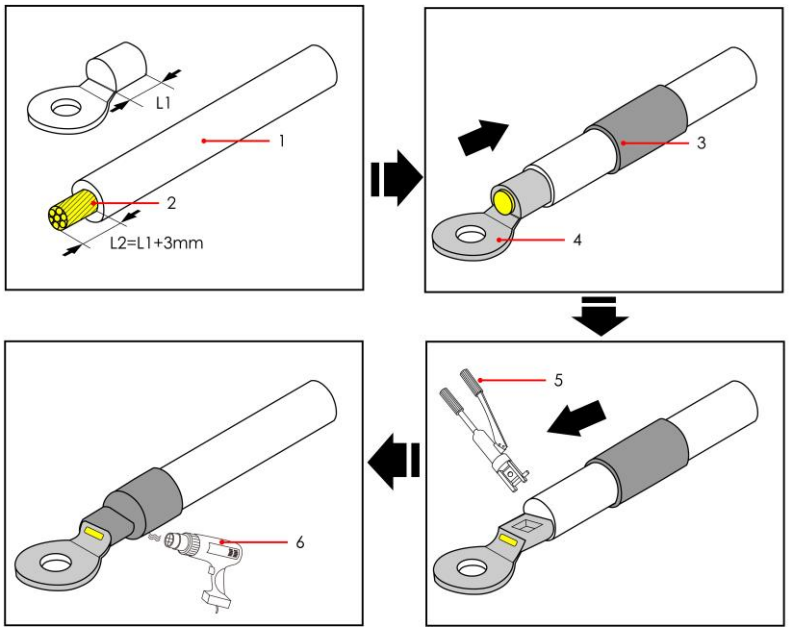


Crimping OT/DT Terminals

Notice

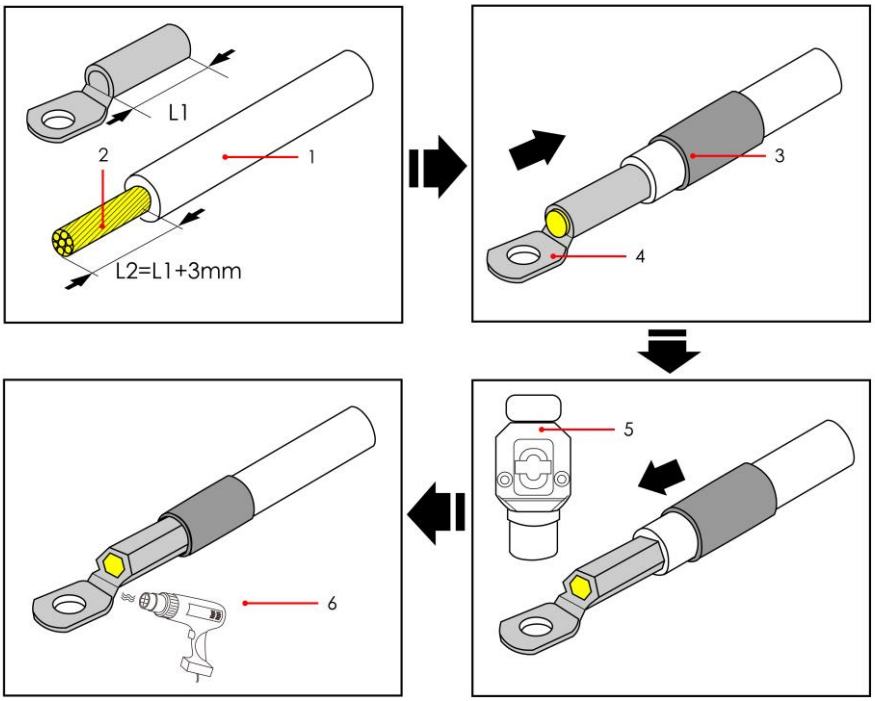
- Do not damage the core while stripping.
- The cavity formed after crimping the conductor tab of the OT/DT terminal should completely cover the core, and the core should be tightly bonded to the OT/DT terminal without loosening.
- The crimping point can be covered with heat shrink tubing or insulation tape. Here, the heat shrink tubing is used as an example.
- Take protective measures when using a hot air gun to prevent equipment damage.

Figure A-2 Crimping OT terminal



(1) Cable (2) Core (3) Heat shrink tubing
(4) OT terminal (5) Hydraulic tongs (6) Hot air gun

Figure A-3 Crimping DT terminal



(1) Cable (2) Core (3) Heat shrink tubing
(4) DT terminal (5) Hydraulic tongs (6) Hot air gun

B How to Repair Paint

Preconditions

- Do not repair paint in bad weather conditions such as rain, snow, wind, sand storm, without shelter outdoors.
- The paint that meets the requirements has been prepared according to the color palette provided at the time of delivery.

Important

The equipment appearance shall be in good condition. Immediately repair paint if any painting defect exists.

Description

Visually inspect the painting defect and prepare necessary tools and materials. The number of materials is subject to on-site evaluation for paint repair.

Table B-1 Paint repair

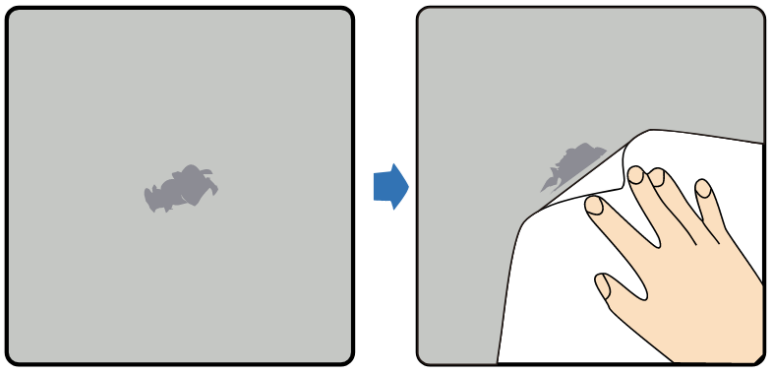
Degree of Painting Defect	Tools and Materials	Operation Procedure	Description
Light scratches (The steel sheet substrate is not exposed)	Spray paint or paint, brush (for small-area repainting), fine sandpaper, anhydrous ethanol, cotton cloth, and spray gun (for large-area repainting).	Go through step 1, step 2, step 4, and step 5.	1. For the color of the top coating (acrylic paint), refer to the color palette provided at the time of delivery and Pantone color code indicated on the color palette. 2. Spray paint or brush painting is
Stains or rusting that cannot be wiped off			
Deep scratches (The primer is broken and the steel sheet substrate is exposed)	Spray paint or paint, zinc-rich primer, brush (for small-area repainting), fine sandpaper,	Go through step 1, step 2, step 3, step 4, and step 5.	

	anhydrous ethanol, cotton cloth, spray gun (for large-area repainting).		recommended for small scratches and small-area stains and rusting. 3. A spray gun is recommended for a large number of scratches and large-area stains and rusting. 4. The paint film should be as thin and uniform as possible, the paint film should not be droplet shaped, and the surface should be smooth. 5. Rest the painted surface for about 30 minutes before proceeding with subsequent operations.
Logo and pattern defects	For logo or pattern defects, identify the logo size and color code, and then ask a local painting service provider to establish a repainting plan and make repairs according to logo size, color, and defect condition.		
Pitting	1. When the pitting area is less than 100 mm2 and the depth is less than 3 mm, pitting area should be filled with unsaturated polyester resin putty (Poly-Putty base), and then repainted as deep scratches. 2. When the pitting area is larger than 100 mm2 and the depth is greater than 3 mm, ask your local service provider to put forward a repainting solution according to actual needs.		

Operation Procedure

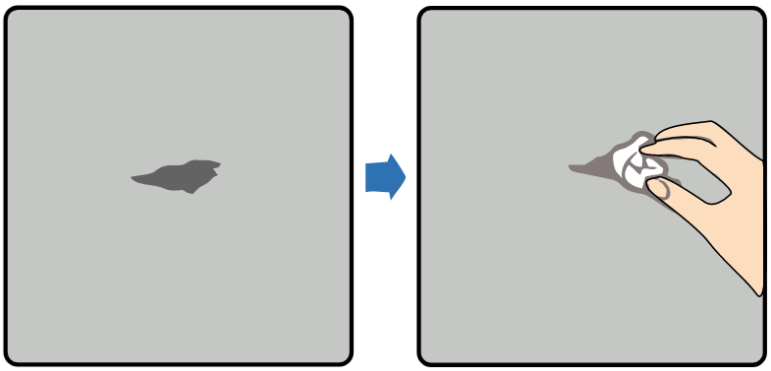
Step 1 Gently grind the damaged area with fine sandpaper to remove dirt or rust.

Figure B-1 Grind the damaged area with fine sandpaper



Step 2 Wet the cotton cloth with anhydrous ethanol, wipe the sanded area or the area to be repaired to remove surface dirt and dust, and then wipe dry with clean cotton cloth.

Figure B-2 Treat the damaged coating with anhydrous ethanol



Step 3 Apply zinc-rich primer to the damaged area with brush or spray gun

Notice

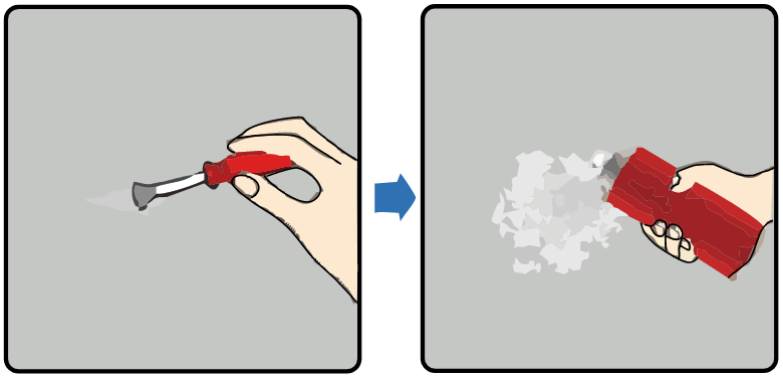
- If the substrate is exposed in the area to be repaired, an epoxy zinc-rich primer must be applied first until the substrate is not exposed after the paint is dry, and then an acrylic top coating should be applied.
- Select an epoxy zinc-rich primer or an acrylic top coating of the corresponding color according to the top coating color of the equipment.

Step 4 Select one of the methods of spray painting, brush painting, spray gun spraying according to paint defect degree to evenly repaint the damaged area until the coating defect is not visible.

Notice

- It should be noted that the paint film should be as thin and uniform as possible, the paint film should not be droplet shaped, and the surface should be smooth.
- If the patterns on the equipment use multiple colors, use tape and white paper to cover the parts of other colors other than the damaged paint before repainting to avoid contamination of other color parts during repainting operation.

Figure B-3 Repainting on damaged coating



Step 5 Upon completion of painting, leave the equipment rest for about 30 minutes, and then check whether the painting area meets the requirements.

Description

- The color of the painting area should match that of its surrounding area. Use a colorimeter to measure the color difference. Check that the color difference ΔE is not more than 3. If a colorimeter is not available, verify that there is no significant edge between the repainted area and its surrounding area. The painting area should also be free of swelling, scratching, peeling off or cracking.
- For spray painting, it is recommended to spray paint 3 times first, and then check whether the requirements are met. Repeat spraying paint until requirements are met, when necessary.

C How to Recycle Used Batteries

Notice

- The Company does not recycle used batteries. The Customer needs to contact their local recycling plants for disposal of used batteries.
- If no local recycling plant is available, the Customer is recommended to contact recycling plants in their nearest countries or regions for disposal of used batteries.

Step 1 Contact your nearest recycling plant.
Step 2 The recycling plant evaluates the recycling cost.
Step 3 The recycling plant recycles used batteries in two ways:

- Door-to-door recycling service: A recycling plant will provide the door-to-door recycling service. This way, however, may incur time or transportation cost.
- Centralized recycling service: The Customer collects all recycled lithium batteries in a designated place and a recycling plant disposes of these used batteries in a centralized manner.

Description

The transportation cost incurred from the recovery service needs to be borne by the Customer.

Step 4 The recycling plant has full power to dispose of recycled batteries. The recycling plant has full power to dispose of recycled lithium batteries, without customer engagement.

D Contact Information

If you have any questions about this product, please feel free to contact us.

Table D-1 Customer support information

Country or Region	Customer Support Email	Telephone
China		

E Abbreviations

A

ACAN	CAN used for communication between MBMU and PCS

B

BMS	Battery Management System

C

CSC	Cell Supervision Circuit
CCAN	CAN used for communication between CSC and SBMU
CAN	Controller Area Network

E

ETH	Ethernet Module
EMS	Energy Management System

I

IMM	Isolation Monitor Module

L

LAN	local area network

M

MCAN	CAN used for communication between SBMU and MBMU
MSD	Manual Service Disconnect

S

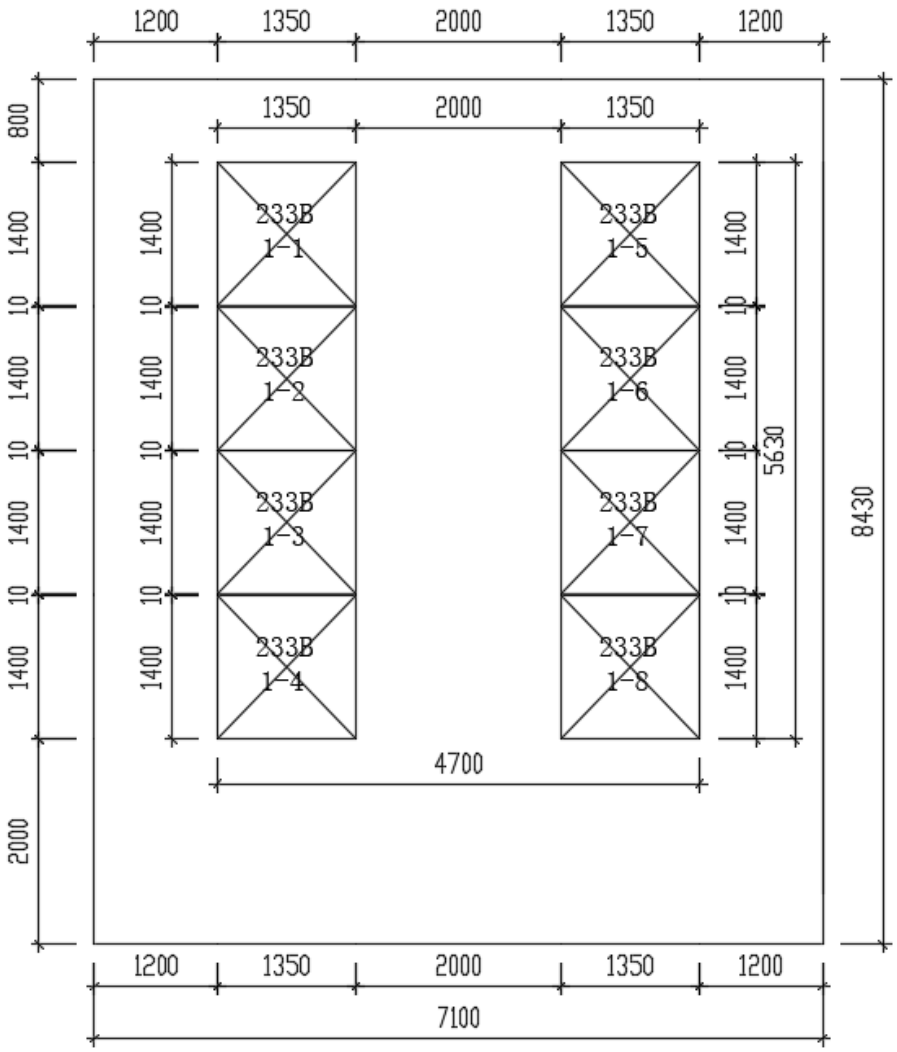
SOC	state of capacity
SCAN	CAN used for communication between SBMU and CSU

U

UPS	uninterruptible power system

F Layout Drawing

Figure F-1 Installation layout diagram



Notice

- Ensure a distance of at least 1M between the installation location of the equipment and the electrical equipment.
- Ensure that a maintenance channel is reserved on one side, with a width of at least 2M.

Appendix 1

Inspection project	Method	Yes-√ No-× Not applicable-O	Abnormal record
Is the fire extinguishing system	Visual inspection		
Whether the fire extinguishing system is within the validity period	Visual inspection		
Is the cooling system complete	Visual inspection		
Is the cooling system air duct blocked	Visual inspection		
Whether the appearance of the electric cabinet is deformed	Visual inspection		
Whether the appearance of the electric cabinet is rusted or damaged	Visual inspection		
Is there water vapor inside the electric cabinet	Visual inspection		
Whether the LV harness is loose or damaged	Visual inspection		
Whether the HV harness is loose or damaged	Visual inspection		
Whether the wiring harness interferes with the structural parts	Visual inspection		
Whether the high voltage connection is ablated	Visual inspection		
Whether the fixing bolt of structural parts is loose or missing	Visual inspection		
Is MSD complete and reliable	Visual inspection		
Whether the water cooling pipe is damaged	Visual inspection		
Is there a foul smell in the battery compartment	Sniffing		
Is there a pungent smell in	Sniffing		

the electric cabinet			
Whether HV connection part has burnt smell	Sniffing		
Is the summary data complete	Monitor master computer		
Is the cell voltage data complete	Monitor master computer		
Is the cell temperature data complete	Monitor master computer		
Whether there is an abnormal alarm in the alarm bar	Monitor master computer		
Note: If any abnormalities are found during the inspection, please feedback in time, and contact the relevant personnel for processing.			