



User Manual for Liquid Cooling
1.28MW2.7MWh Container Products

ZHEJIANG WOLONG ENERGY STORAGE SYSTEM CO.,LTD.

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Revision

Revision	Date	Chapter	Description
1.0	2025.12.03	/	First Release

About this manual

This manual mainly describes the methods for transportation and storage, mechanical installation, electrical connection, power-on commissioning and power-off shutdown, troubleshooting, and maintenance of outdoor containers.

Target Readers

This manual is applicable to operators of energy storage power stations and qualified electrical technicians.

All operations such as installation **must be performed by and only by professional technicians**. Professional technicians shall meet the following requirements:

- Have received specialized training
- Have read this manual in full and mastered the relevant safety precautions
- Be familiar with local standards and relevant safety specifications for electrical systems

Manual Usage

Before using the product, please read this manual carefully and store it in an easily accessible place.

To continuously improve customer satisfaction, both this product and its manual are constantly being improved and upgraded. If there is any discrepancy between the manual you received and the product, it may be caused by a product version upgrade. Please refer to the physical product for accuracy.

Symbol Usage

To ensure the personal and property safety of users during product use and enable more efficient and optimized product operation, this manual provides relevant information, which is highlighted using the following symbols.

The symbols that may be used in this manual are listed below. Please read them carefully to make better use of this manual.

DANGER

Indicates an imminently dangerous situation that, if not avoided, will result in death or serious injury.

 WARNING

Indicates a moderately hazardous situation that, if not avoided, will result in death or serious injury.

 CAUTION

Indicates a mildly dangerous situation that, if not avoided, could result in minor or moderate injury.

 NOTICE

Indicates a potential hazard that, if not avoided, will result in equipment failure or property damage.



“Notes” are additional information in the manual that emphasize and supplement the content. They may also provide tips or tricks for optimizing product use, helping you solve a problem or save time.

Icon	Name
	There is high voltage inside! There's a risk of electrocution if you touch it.
	This symbol indicates a protective earth terminal, which needs to be securely grounded to ensure the safety of the operator.
	Read the instructions before performing any operations on the product.
	Electrically charged parts! Do not touch them for 15 minutes after disconnecting the power.

Icon	Name
	Caution Danger. Do not operate this product while it is energized!
	Watch out for heavy objects. Lifting heavy objects may cause back injuries. Use appropriate tools to lift heavy objects.
	Watch out for explosions.
	Watch out for corrosion.
	Do not dispose of this product as household waste.
	There's no fire.
	There should be a medical center nearby.
	If inadvertent eye contact occurs, flush eyes immediately with running water or saline; and seek prompt medical help.

Icon	Name
	Goggles are required.

 NOTICE

Do not tear or damage warning labels; replace immediately if blurred or damaged.

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1. Safety Precautions

1.1. Personnel Requirements

Lifting and transportation, installation and wiring, operation and maintenance of the Energy Storage System (ESS) must be performed by qualified personnel complying with local regulations. Operators must meet the following requirements:

- Possess relevant expertise in electronics, electrical wiring, and mechanical systems, with proficiency in interpreting electrical and mechanical schematics.
- Be familiar with the composition and operating principles of the ESS, as well as the composition and operating principles of the ESS and its upstream and downstream equipment.
- Have undergone specialised training relevant to the installation and commissioning of electrical equipment.
- Possess the capability to respond to emergencies or hazardous situations arising during installation or commissioning.
- Be familiar with the relevant standards and regulations of the country/region where the project is located.
- When performing relevant operations with the equipment energized, proper insulation protection measures must be taken, and at least two staff members shall be present on-site for supervision.

1.2. Electrical Safety

DANGER

Operations on the product (including but not limited to handling, installation, electrical connection, power-on, maintenance, and high-altitude operations) are strictly prohibited under adverse weather conditions such as thunderstorms, rain, snow, and winds of Force 6 or above.

DANGER

- Touching the power supply or connected contacts, terminals, and other components inside the equipment poses an electrical shock hazard!

- Voltage may be present on both the battery side and the grid side. Before touching, always use a standard voltmeter to confirm that no voltage exists.

 DANGER

Lethal high voltage exists inside the equipment!

- Observe and comply with all warning labels affixed to the equipment.
- Comply with the safety precautions listed in this manual and other relevant documentation for this equipment.
- Comply with all relevant battery protection requirements and precautions.

 WARNING

All lifting, transportation, installation, wiring, operation, and maintenance activities must comply with the relevant regulations and ordinances of the project location. The product must be operated strictly in accordance with the safety instructions in this manual. Failure to do so may result in equipment damage or safety incidents.

 WARNING

To prevent unauthorised personnel from approaching the product and causing accidental operation or incidents, observe the following precautions:

- Affix conspicuous warning signs at the upstream and downstream switches of the product to prevent accidents caused by inadvertent energisation.
- Erect warning signs or establish safety cordoning near the operational area.

1.3.Battery Safety

 WARNING

The product is prohibited from being in a low-voltage or low-State of Charge (SOC) condition for an extended period. Capacity loss caused by the following circumstances is not covered under the warranty:

- The voltage of a discharged battery cell remains below 2.65V for 100 consecutive hours. •
The voltage of a discharged battery cell drops below 2V.

- During maintenance or shutdown, if the SOC of any battery cluster is 0% and persists for more than 100 hours.

WARNING

Cell Voltage Upper & Lower Limit Protection Alarms

End users must prioritise addressing the aforementioned faults and alarms reported by the WOLONG energy storage container's local controller. The user interface will prominently display fault or alarm information. Furthermore, users should promptly contact WOLONG to resolve issues in a timely manner, preventing battery warranty expiry due to over-discharge or over-charge.

NOTICE

To avoid triggering warranty invalidation conditions, when the system activates the "Cell Voltage Upper Limit Protection" or "Cell Voltage Lower Limit Protection", the user **shall contact the Wolong Energy Storage (WOLONG) team within 24 hours** and conduct subsequent operations in strict accordance with Wolong Energy Storage's requirements.

NOTICE

- If the system is out of operation for an extended period (7 days or more), regularly monitor the State of Charge (SOC) of the energy storage system to prevent warranty expiration caused by over-discharging.
- During maintenance or shutdown, if the SOC of any battery cluster reaches 0%, charge the SOC to 30% or above within 100 hour

To ensure the safe use of the product, technicians must read and comply with the following safety requirements carefully. The company shall not be liable for product malfunctions, component damage, personal safety accidents, property losses, or other consequences caused by the following reasons:

- Capacity loss or irreversible damage to the battery due to failure to charge the battery within the required period by the customer.
- Battery damage, drop, electrolyte leakage, etc., caused by improper operation or failure to operate the battery in accordance with requirements.
- Battery damage caused by over-discharging due to failure to power on the battery in a timely manner by the customer.

- Battery damage caused by using improper equipment for charging and discharging by the customer.
- Frequent over-discharging of the battery due to improper maintenance by the customer, on-site capacity expansion by the customer, or long-term inability to fully charge the battery.
- Battery damage caused by incorrect setting of battery operating parameters by the customer.
- Direct damage to the battery due to on-site operating environment failing to meet the environmental requirements for normal operation.
- Change of battery application scenarios by the customer without authorization, including but not limited to: connecting additional loads to the battery without permission;
- Failure of the customer to properly maintain the battery in accordance with the supporting equipment system manual.
- Product damage caused by the customer continuing to use batteries beyond the warranty period.
- Product damage caused by using defective or deformed batteries.
- Mixing the batteries provided by the company with other batteries, including but not limited to: mixing with batteries of other brands, mixing with batteries of different rated capacities.
- Product damage or other property losses caused by storing or installing the battery together with flammable/explosive materials.
- Personal safety accidents, property losses, etc., caused by failure to wear standard-compliant protective equipment during battery-related operations—all such operations must be performed by professional personnel.

1.4.Lifting and Transportation

DANGER

- To ensure high-altitude operation safety, operators must wear a safety helmet and fasten a safety harness. The safety harness shall be securely attached to load-bearing structural components to ensure a stable and reliable connection point.
- Fixing the safety harness to moving objects, unstable supports, or metal components with sharp edges is strictly prohibited, so as to avoid falling risks caused by harness hook detachment.

WARNING

- Using tools that are damaged, failed in inspection, or beyond their validity period is strictly prohibited. Before use, carefully check the tool condition to ensure it is firmly connected and never use it beyond its rated load.
- To ensure operation safety, all tools must be fully prepared and can only be used after passing inspection and certification by a professional organization.

WARNING

When traversing equipment tops, adhere to relevant height work procedures.

1.5.Operations and Maintenance

DANGER

Improper maintenance operations may result in personal injury or equipment damage!

- Before performing maintenance, ensure the equipment is de-energised. Verify the absence of voltage and current using detection equipment, then wear protective gear when servicing the equipment;
- Burn hazards persist after shutdown; allow the product to cool before handling, wearing protective gloves.

DANGER

Disassembling or incinerating batteries may cause them to ignite.

 DANGER

Ensure escape routes remain clear.

 WARNING

Personal protective equipment must be worn when performing maintenance, repairs, or similar work on the product.

Maintenance personnel must wear safety goggles, helmets, insulated footwear, gloves, etc. Implement all necessary auxiliary measures to ensure personnel and equipment safety.

 WARNING

There are no user-serviceable components inside the battery unit. Users must not attempt to service the battery themselves. Only personnel authorised by Wolong Energy Storage may remove, replace, or handle the battery.

 WARNING

To minimise the risk of electric shock, do not perform any operations beyond those specified in this manual.

Should maintenance be required, contact Wolong Energy Storage customer service personnel.

 WARNING

To ensure continuous fire protection, replacement of internal components must only be performed by qualified personnel.

 WARNING

Wear protective eyewear and other safety equipment when handling coolant (ethylene glycol solution) or performing maintenance on liquid cooling pipes.

 NOTICE

- Do not spray any components inside or outside the equipment.
- Do not clean the equipment with detergents or expose it to corrosive chemicals.

 NOTICE

Before operating the product, always verify that the tools being used have undergone regular maintenance.

 NOTICE

Energy storage power stations housing this product are typically situated in remote, wilderness environments away from urban areas. Appropriate wilderness first-aid facilities should be prepared as required to enable intervention when necessary.

1.6.Noise Protection

During equipment operation, in accordance with standard requirements, when the sound pressure level (SPL) of noise exceeds 85 dB(A) at a horizontal distance of 1 m from the equipment (under conditions where the system can generate the maximum sound pressure level), noise protection measures must be implemented.

 WARNING

Please adhere to noise protection regulations, such as wearing noise-cancelling earplugs.

1.7.Product Disposal

When the entire energy storage system or individual internal equipment needs to be discarded, it shall not be treated as regular waste. Some components of the internal equipment can be recycled and reused, while others may cause environmental pollution.

Please contact a local authorized professional recycling organization to properly dispose of the product and its internal components.

2. Product Introduction

2.1.Product Overview

Typical Application Scenarios

The WOLONG containerized energy storage system is mainly applied in medium and large-sized energy storage power stations. It adopts an integrated design combining electrochemistry, power electronics, and power grid (the "Three-Electric Integration" design), realizing the integrated integration of the energy storage system.

The 20ft standard cabinet design facilitates transportation, and the built-in Power Conversion System (PCS) enables efficient energy conversion.

Through technical means such as full liquid-cooled intelligent temperature control, modular design, systematic safety design, and intelligent management & operation and maintenance (O&M), the energy storage system achieves advantages including temperature uniformity, high efficiency and long service life, and convenient installation and O&M.

The Battery Energy Storage System (BESS) is used in conjunction with the Transformer Container (optional when the grid voltage level over 0.4kV). The typical application scenario is shown in the figure below. The low-voltage AC cables of the BESS are connected to the circuit breaker busbar inside the medium-voltage Transformer Container, and the voltage is boosted by the Transformer before being connected to the power grid.



Figure 1 Typical application scenarios for energy storage system

Table 1 System description

NO.	Equipment
A	Battery Container
B	Transformer Container
C	Public Grid
D	Loads

2.1.1. Product Parameters

Table 2 Technical parameters

System Model	WL-ESS-1280kW2700kWh-400V-IEC
Battery Parameter	
Battery Cell Type	LFP/314Ah
Battery Configuration	8P336S
Battery Capacity at DC Side(BOL)	2700kWh
Voltage Range	940.8~1209.6V
Battery Cooling Method	Liquid Cooling
AC Parameters	
Rated Power	8× 160kVA
Rated Voltage	400Vac, 3P4W
Rated Frequency	50Hz
Power Factor	-1 ~ +1
THDi	≤3% (Nominal power)
System Parameters	
Isolation Method	Transformerless
Dimensions (W×H×D)	6058×2896×2438 mm

System Model	WL-ESS-1280kW2700kWh-400V-IEC
Weight	27000 kg
Noise	<75 dB @1m
IP Level	IP55
Relative Humidity	5%-95%
Anti-corrosion	C5
Fire Suppression System	Temperature Detector/Smoke Detector/Combustible Gas Detection/Aerosol/Dry Pipe Fire Sprinkler
Operating Temperature Range	-20℃~+50℃ (Derating >45℃)
Altitude	≤3000m (Derating >3000m)
Communication Protocol	Modbus TCP, Modbus RTU
Communication Interface	Ethernet, RS485

2.2.External Design

2.2.1. Container Appearance

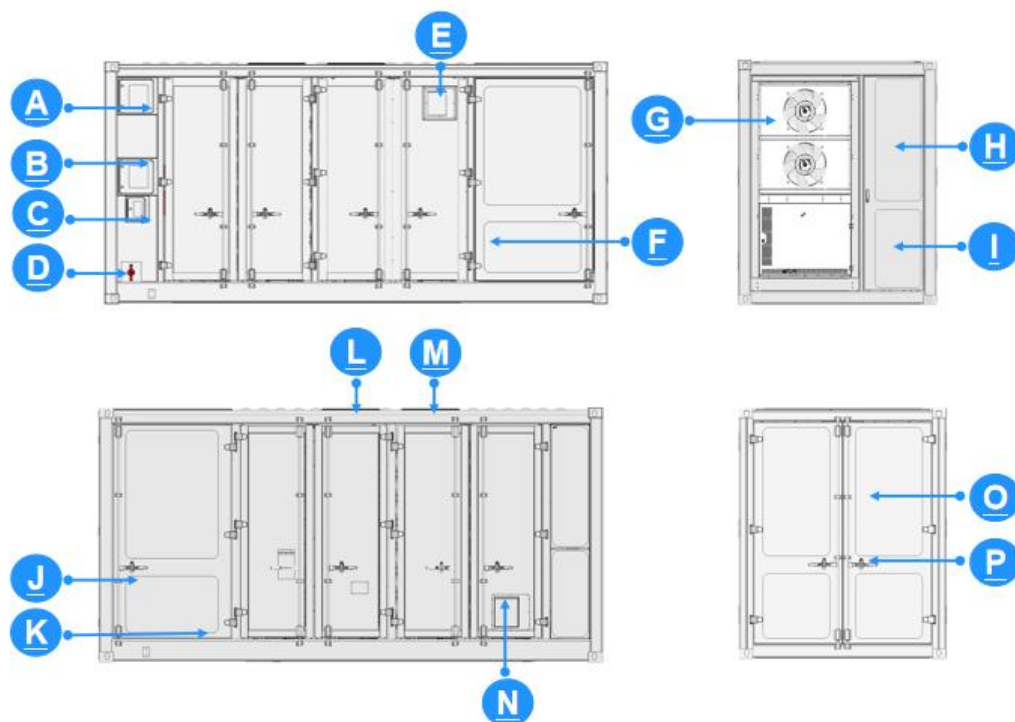


Figure 2 Exterior view of battery container

Table 3 Appearance description

NO.	Equipment Name	No.	Equipment
A	Fire alarm bell, audible and visual alarm	I	Fire Suppression System Control Room
B	Firefighting Emergency Start/Stop Button & Manual/Automatic Switch Device & Accident Ventilation Start/Stop Switch	J	Control Room
C	BESS Emergency Stop Button	K	Power Distribution Room
D	Water Firefighting External Interface	L	Deflagration Panel 1
E	Air Outlet	M	Deflagration Panel 2
F	Air Conditioner for Control Room	N	Air Inlet
G	Liquid Cooling Unit	O	PCS Room
H	Air Conditioner for Battery Room	P	Circuit Breaker Room

Emergency Stop Button

In the event of an emergency, pressing the emergency stop button on the cabinet panel will immediately halt the system and cease operation.

DANGER

When the emergency stop button is pressed, the internal auxiliary power supply system will still remain energized. **Do not touch it!**

2.2.2. Mechanical Parameters

The external dimensions of the container are shown in the figure 3.

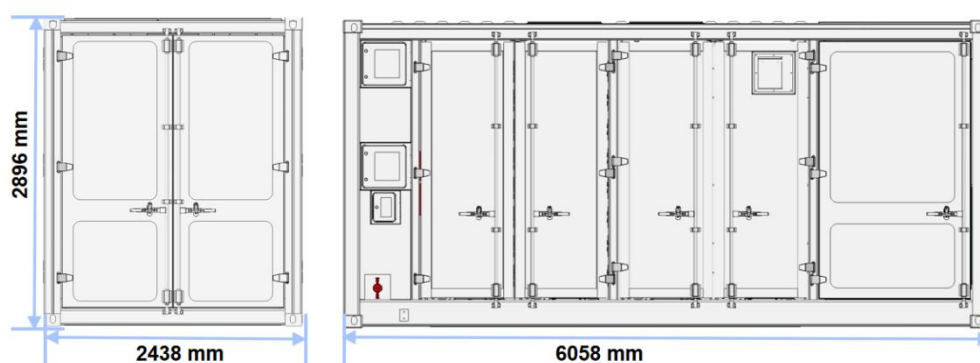


Figure 3 External dimensions of BESS

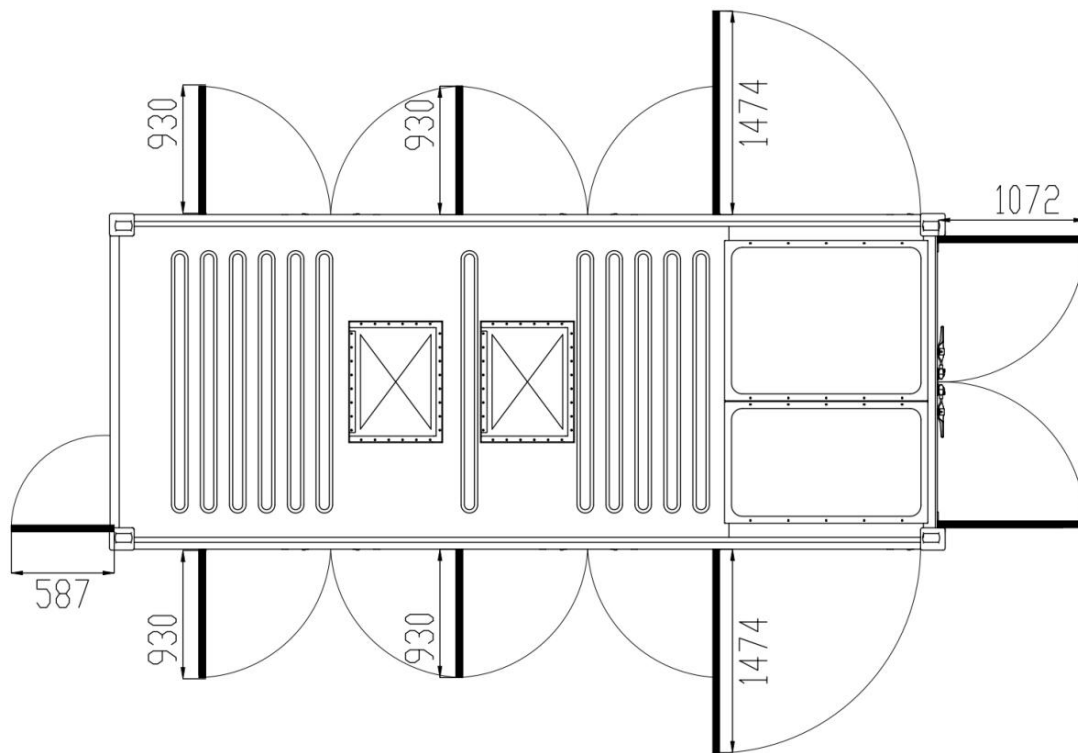
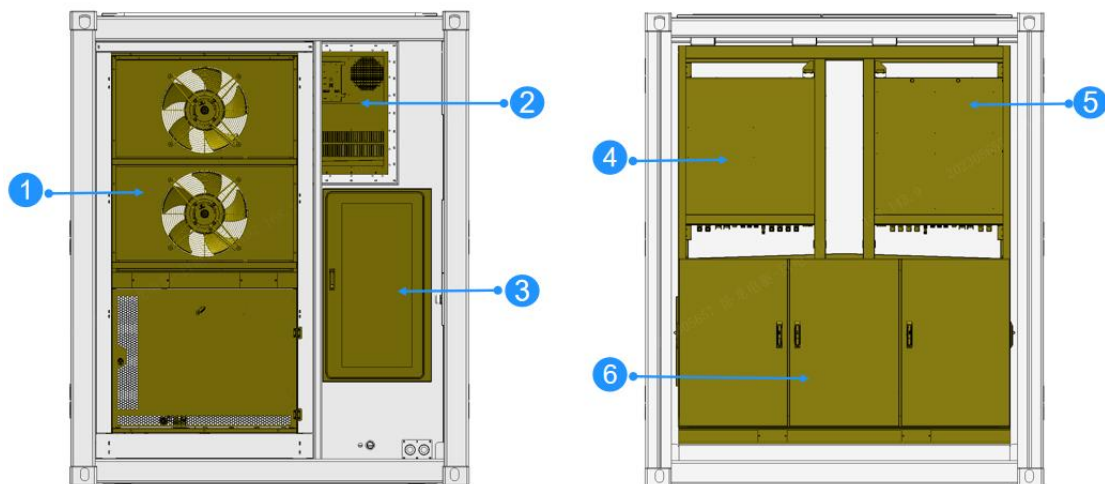


Figure 4 Maximum door opening dimensions

2.2.3. Internal Equipment

The main devices in the BESS are shown in the figure 5.



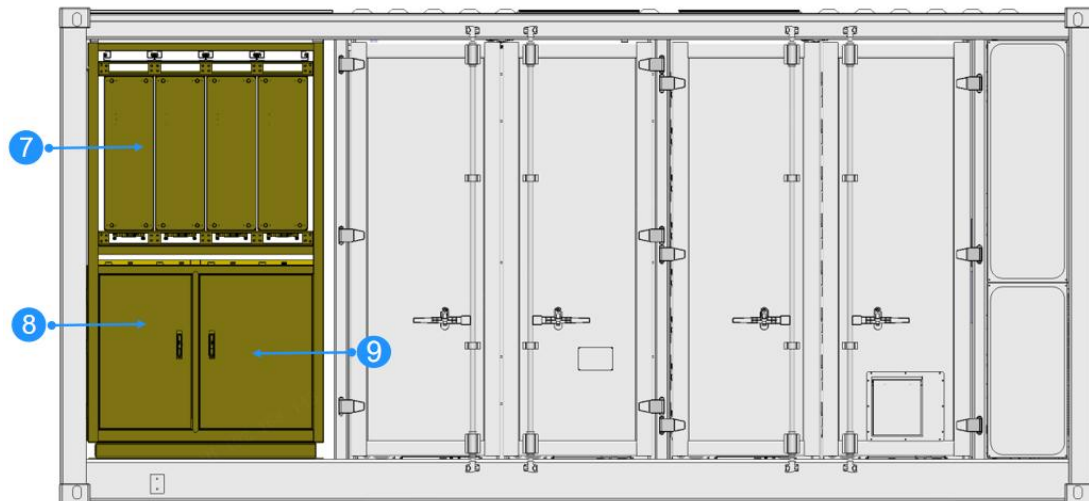


Figure 5 Internal equipment configuration

Table 4 Internal equipment description

NO.	Equipment Name	NO.	Equipment Name
①	Liquid Cooling Unit	⑥	Circuit Breaker Room
②	Air Conditioner for Battery Room	⑦	String PCS Module
③	Fire Suppression System Control Room	⑧	Control Room
④	String PCS Module	⑨	Power Distribution Room
⑤	String PCS Module	/	/

2.2.4. Introduction of Control Room and Power Distribution Room

The Control Room serves as a dedicated localised control and management unit for the battery compartment (an independent unit integrating core components such as the battery pack, BMS, thermal management, and fire suppression systems). Its functions focus on ensuring the safe operation of the battery compartment, monitoring its status, and facilitating coordination with external systems. It acts as a critical interface connecting the internal equipment of the battery compartment to external energy storage-related systems (such as the PCS, master control system, and EMS).

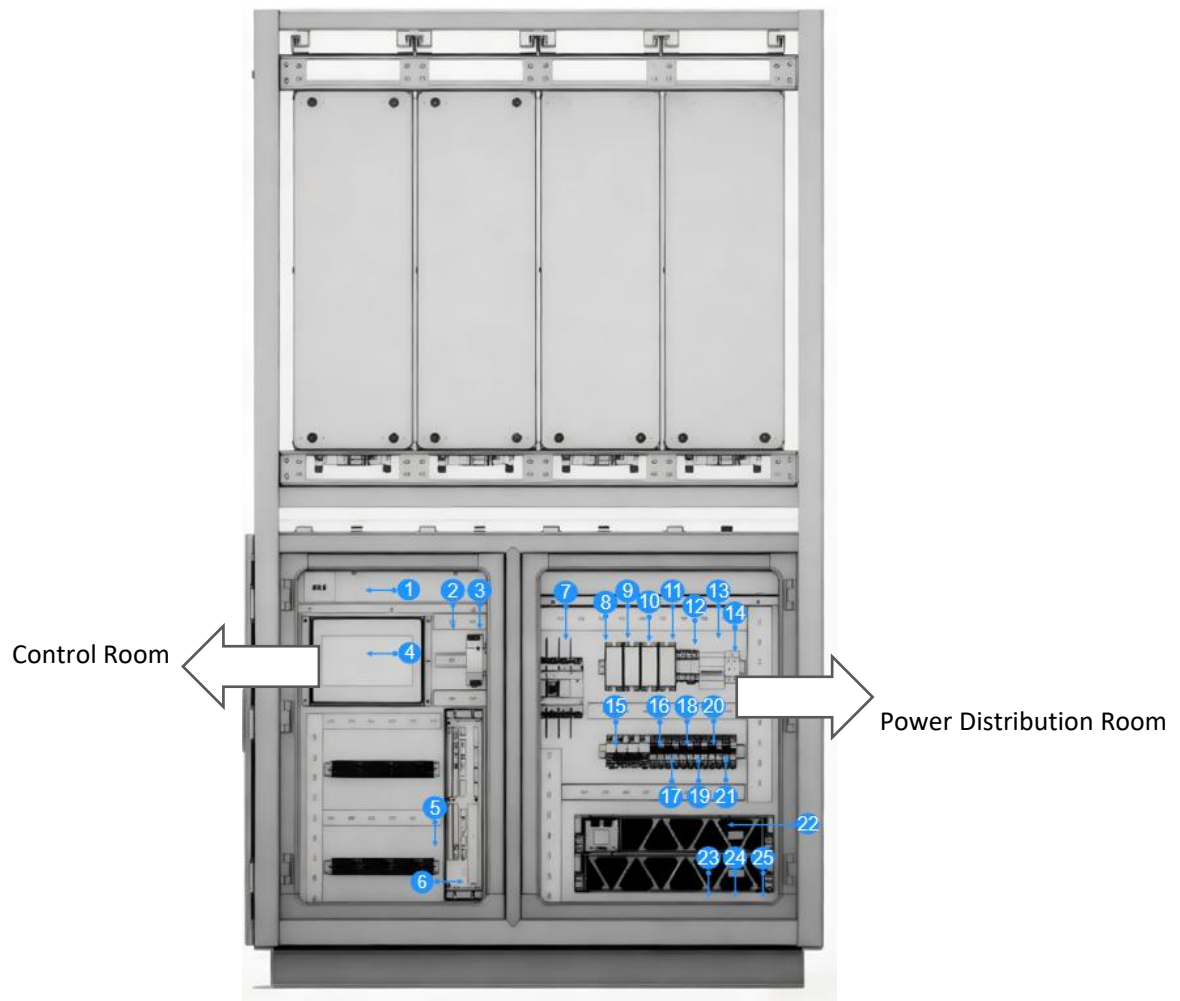


Figure 6 Appearance of the Control Room and Power Distribution Room

Table 5 Description of the Control Room

NO.	Equipment Name	Function
①	Temperature and humidity controller - WK	Temperature and humidity detection
②	Switch - SW	Communication with host computer
③	Switch power supply - UR	Convert 220Vac to 24 Vdc, 120W
④	SMS2000	Signal acquisition and processing, communication module
⑤	Water-Immersion Transmitter	Detecting water ingress within the monitoring enclosure
⑥	U2 control box	Signal acquisition and control from String PCS Module

The Power Distribution Room primarily serves to rationally allocate electrical power to auxiliary equipment, facilitating circuit switching operations and protection. It features a high safety protection rating and provides an intuitive visual indication of circuit conduction status.

Table 6 Description of the Power Distribution Room

NO.	Equipment Name	Function	Specification
⑦	Molded Case Circuit Breaker QF9	Main switch of auxiliary power supply input	400Vac/4P/125A
⑧	Terminal block XT1	Auxiliary power supply terminal XT1	1000Vac/200A
⑨	Terminal block XT2	Auxiliary power supply terminal XT2	1000Vac/200A
⑩	Terminal block XT3	Auxiliary power supply terminal XT3	1000Vac/200A
⑪	Terminal block XT4	Auxiliary power supply terminal N	1000Vac/200A
⑫	AC Contactor KM	UPS/mains power supply switching	600Vac/30A
⑬	Miniature Circuit Breaker QF14	Socket protection switch	400Vac/2P/16A
⑭	Socket CZ	Socket	250Vac/16A
⑮	Miniature Circuit Breaker QF10	Liquid Cooling Unit protection switch	400Vac/4P/80A
⑯	Miniature Circuit Breaker QF11	Air conditioner protection switch for Control Room	400Vac/2P/16A
⑰	Miniature Circuit Breaker QF12	Secondary power supply protection switch for Control Room	400Vac/2P/16A
⑱	Miniature Circuit Breaker QF13	Battery room air conditioner protection switch	400Vac/2P/16A
⑲	Miniature Circuit Breaker QF15	UPS main circuit protection switch	400Vac/2P/16A
⑳	Miniature Circuit Breaker QF16	Fire Suppression System power supply switch	400Vac/2P/16A
㉑	Miniature Circuit Breaker QF17	High Voltage Box power supply protection switch	400Vac/2P/16A
㉒	Uninterruptible Power Supply	Uninterruptible Power Supply	220Vac/2000VA
㉓	Surge Protection Device SPD1~SPD2	Surge Protection for auxiliary three-phase input	400Vac/20kA/40kA/Type2
㉔	Fuse FU1~FU8	Backup protection for SPD	600Vac/32A/100kA
㉕	Fuse FU9~FU10	Switch power supply/Temperature and humidity controller backup protection	600Vac/4A/100kA

2.2.5. Circuit Breaker Room

The core function of the Circuit Breaker Room is to consolidate the AC outputs from 7 String PCS units, enabling isolation and protection. It simplifies system connections to the external power distribution system or grid, thereby enhancing safety and maintenance efficiency.

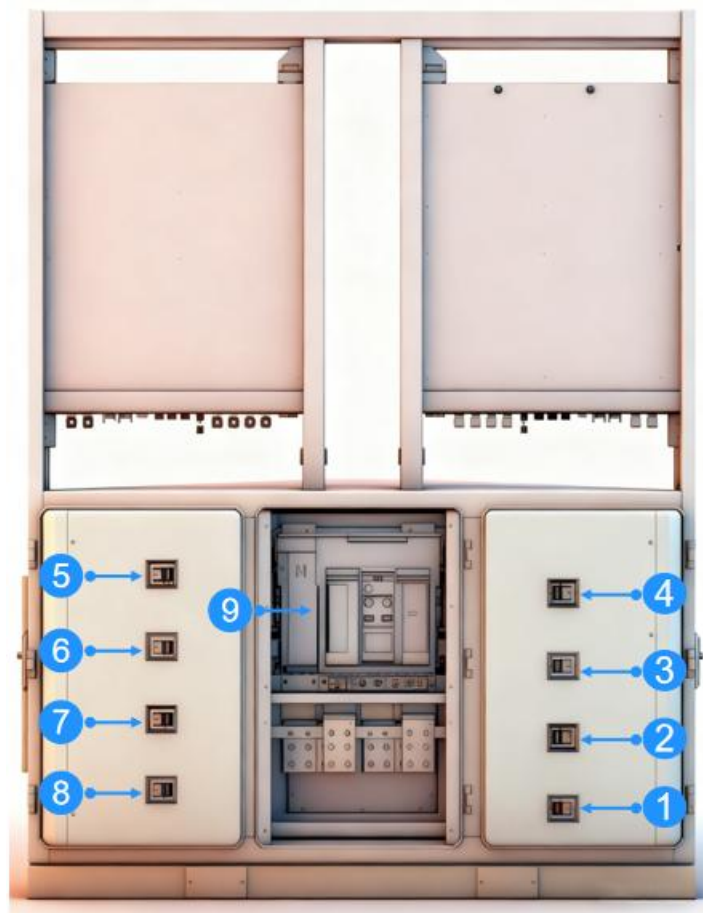


Figure 7 Appearance of Circuit Breaker Room

Table 7 Description of Circuit Breaker Room

NO.	Equipment Name	Function	Specification
①	Molded Case Circuit Breaker QF1	AC circuit protection switch for battery rack	400Vac/315A/4P
②	Molded Case Circuit Breaker QF2	AC circuit protection switch for battery rack	400Vac/315A/4P
③	Molded Case Circuit Breaker QF3	AC circuit protection switch for battery rack	400Vac/315A/4P
④	Molded Case Circuit Breaker QF4	AC circuit protection switch for battery rack	400Vac/315A/4P

NO.	Equipment Name	Function	Specification
⑤	Molded Case Circuit Breaker QF5	AC circuit protection switch for battery rack	400Vac/315A/4P
⑥	Molded Case Circuit Breaker QF6	AC circuit protection switch for battery rack	400Vac/315A/4P
⑦	Molded Case Circuit Breaker QF7	AC circuit protection switch for battery rack	400Vac/315A/4P
⑧	Molded Case Circuit Breaker QF8	AC circuit protection switch for battery rack	400Vac/315A/4P
⑨	Molded Case Circuit Breaker QF0	AC combiner circuit protection switch	400Vac/2900A/4P

2.2.6. PWS1-160M-H Power Conversion System

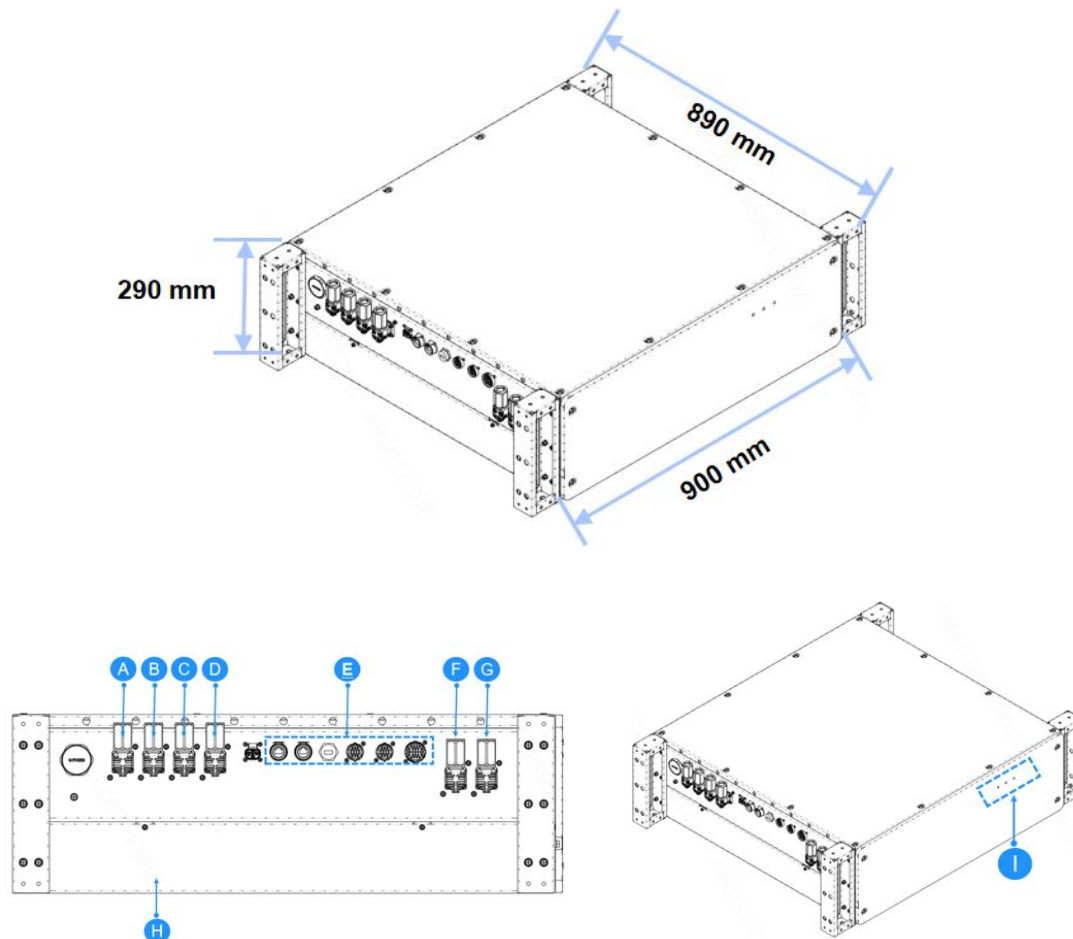


Figure 7 Appearance of 160kW String PCS Module

Table 8 Description of String PCS Module

NO.	Name	Function
A	Power terminal block	AC L1
B	Power terminal block	AC L2
C	Power terminal block	AC L3
D	Power terminal block	AC N
E	Communication terminal	CAN/485/Dry Contact/Ethernet
F	Power terminal block	DC positive
G	Power terminal block	DC negative
H	Bottom air inlet	Air inlet for heat dissipation
I	LED display	Operation status display

2.2.7. Battery System

The battery section of the energy storage system employs lithium iron phosphate cells as its fundamental unit, forming a multi-tiered battery cluster to ensure safe and efficient operation.

Battery Cell: The fundamental unit of energy storage, serving as the core carrier for electrical energy.

Battery Pack: Formed by connecting multiple cells in series to meet voltage and capacity requirements.

Battery Rack: Formed by further series connection of multiple modules, constituting the fundamental operational unit of the battery system.

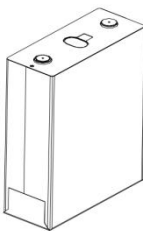
Battery Container: Integrates one or more battery clusters within an enclosed cabinet or container, incorporating auxiliary facilities such as cooling, fire suppression, and electrical connections to form an independent energy storage unit.

Battery Management System (BMS): The 'brain' of the battery section, responsible for monitoring battery status (voltage, temperature, SOC, etc.), balancing charge/discharge,

ensuring safety (overcharge/over-discharge/overheating protection), and communicating with external systems.

2.2.7.1 Battery Cell

Table 9 Battery cell technical parameters

Picture	Item	Specification
	Dimensions (W × H × D)	71.7±0.5 × 207.11±0.5 × 174.7±0.5 mm
	Weight	5.65±0.2kg
	Rated Capacity	314Ah
	Rated Energy	1.0048 kWh
	Rated Voltage	3.2V
	Voltage Range	2.5–3.65V

2.2.7.2 Battery Pack

The battery pack mainly consists of cells connected in series with voltage and temperature acquisition as well as balance control of all individual cells. A dedicated battery unit is used for battery management. Control commands are received via CAN communication and the collected data is reported.

Table 10 Battery pack technical parameters

Picture	Item	Specification
	Model	WL-R-314-1P48S
	Dimensions (W×H×D)	810 × 240 × 1090 mm
	Rated	0.5P
	Battery type	LFP 314Ah
	Battery configuration	1P48S
	Key components	1 Battery Management Unit, 48 battery cells
	Rated Energy	48.23kWh
	Weight	317kg

Picture	Item	Specification
	IP Rating	IP 67



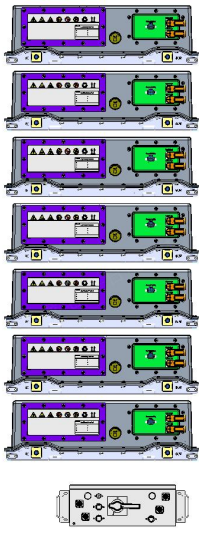
Figure 8 Appearance of battery pack/module

Table 11 Main components and functions of the battery pack

NO.	Components Name
①	Water inlet port
②	Water outlet port
③	Explosion-proof valve
④	Maintenance panel
⑤	Box Cover
⑥	Communication connector
⑦	Negative output connector socket
⑧	Positive output connector socket
⑨	PACK mounting fixing holes

2.2.7.3 Battery Rack

Table 12 Battery rack technical parameters

Picture	Item	Specification
	Model	WL-R-314-1P336S
	Dimensions (W×H×D)	997 mm × 2306 mm × 1094 mm
	Rated	0.5P
	Battery type	LFP 314Ah
	Battery configuration	1P336S
	Key components	7 Battery management units, 336 battery cells
	Rated Energy	337.61 kWh
	Weight	2219 kg
	IP Rating	IP 67

Battery Rack Layout



Figure 8 Front view of battery rack

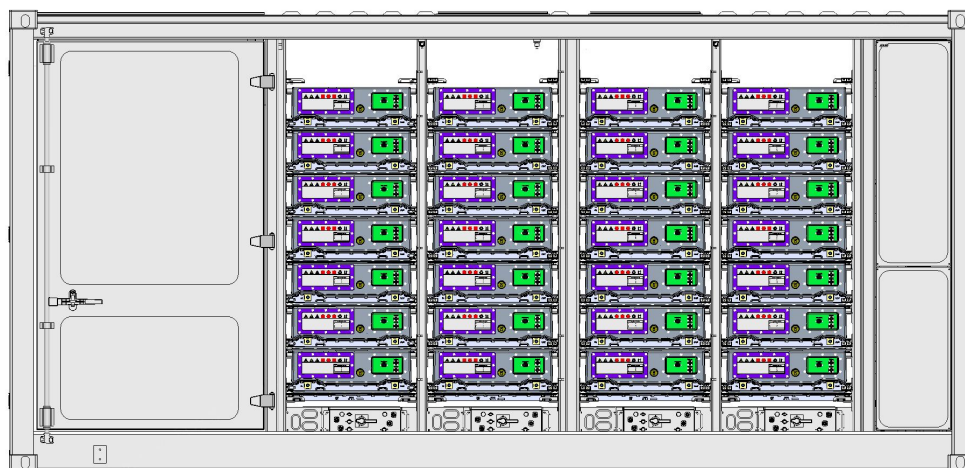


Figure 9 Back view of battery rack

2.2.8. Battery Management System

The Battery Management System (BMS) serves as the 'brain' of the battery system, responsible for monitoring battery status including voltage, current, and temperature. It manages the charging and discharging processes, prevents overcharging and over-discharging, balances battery states, ensures battery safety, and extends its service life.

Employing a **three-tier architecture design**, it comprises slave control, master control, and display control modules.

Slave Control Module: Provides real-time monitoring of individual cell voltage and temperature, while also possessing balancing capabilities.

Master Control Module: Primarily responsible for collecting cell voltage and current data, aggregating voltage and temperature information from individual cells within the cluster, calculating the cluster's SOC/SOH status, executing balancing strategy decisions and battery fault diagnostics, and implementing localised protection and relay control functions based on battery fault information.

Display and Control Module: Performs numerical calculations, performance analysis, alarm protection, and display/storage of real-time battery data transmitted from the BMS slave and master modules. Enables coordinated control with components such as the Power Conversion System (PCS) and the Energy Management System (EMS).

BAMS Topology

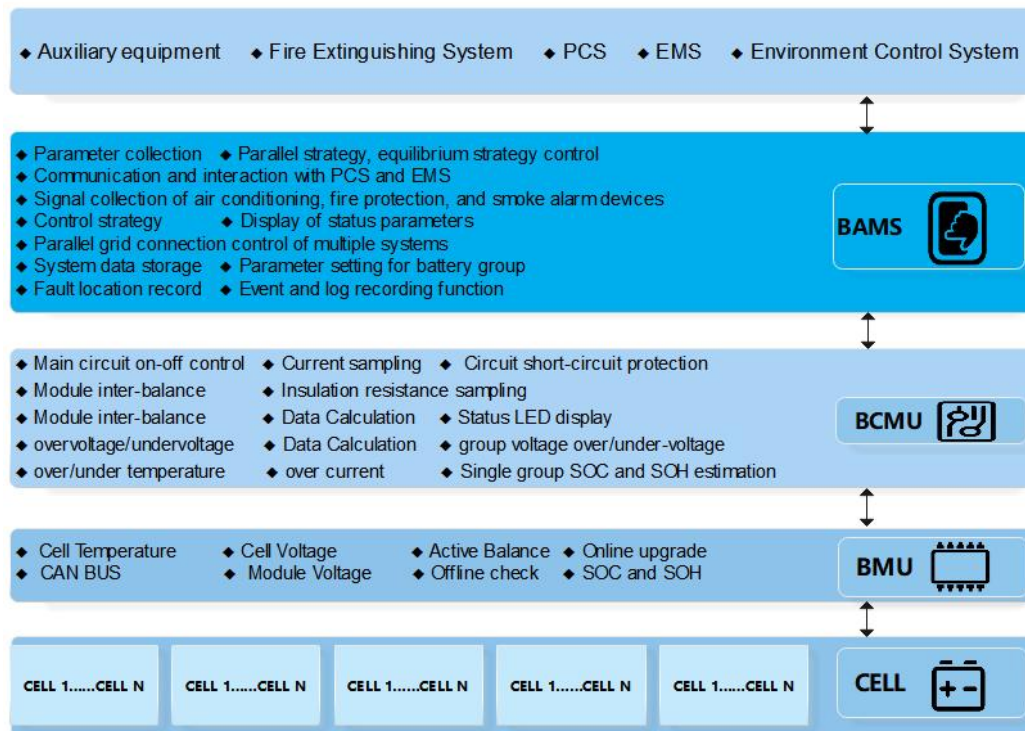


Figure 10 Battery Management System topology

Display Control



Figure 11 The appearance of BAU

The Battery Energy Storage Main Control System (BAMS) occupies the uppermost layer within the three-tier architecture of the energy storage BMS system (comprising the bottom-tier Battery Management Unit (BMU), middle-tier Battery Cluster Management Unit (BCMU), and top-tier BAMS). It primarily handles real-time data acquisition from the BCMU, performing real-time computation, performance analysis, alarm processing, protection handling, and record storage. This ensures balanced power output across all battery groups, guaranteeing optimal system performance and maximum operational uptime.

Additionally, the BAMS communicates with the power conversion system (PCS) and the Energy Management System (EMS) to achieve coordinated operation. The Battery Array Management Unit (BAMS) provides accurate and effective battery management information, serving as a crucial basis for the energy storage system's load control strategy. Through battery equalisation management, it significantly enhances battery energy utilisation efficiency and optimises load characteristics. Concurrently, it maximises battery service life, safeguarding the stability, safety, and reliability of the BESS.

Table 13 BAU hardware parameters

Components	Description
Display	10.1-inch 16:9 TFT LCD display
LCD Viewing Angle (Top/Bottom/Left/Right)	80°/80°/80°/80°
Resolution	1024 × 600
Colour	24-bit
Brightness	350 cd/m ²
Backlight	LED
LCD lifespan	50,000 hours
SD Card Expansion	Supported, TF card
RTC	Real-time clock built-in
Ethernet	2 × RJ45 ports, 10/100/1000Mbps / 1 × RJ45, 10/100Mbps
USB interface	2 × USB 3.0 Type-A ports
Serial communication port	COM0:RS485 (Isolation separately 1) COM1:RS485 (Isolation separately 2) COM2:RS485 (Isolation separately 3) COM3:RS485 (Isolation separately 4) COM4:RS485 (Isolation separately 5)
CAN communication port	CAN0 (Isolation separately 6) CAN1 (Isolation separately 7)
WIFI	Scalable, separate model
4G	Scalable (Built-in MiniPCIE interface), separate model
Digital input DI	8 DI, Dry contact input
Digital output DO	6 DO (1 DO with 1 common terminal, relay type, AC 250V/5A)
DI/DO expansion	Supports expansion with one 8 DI + 6 DO dedicated expansion board; expansion board has separate model.

High Voltage Box

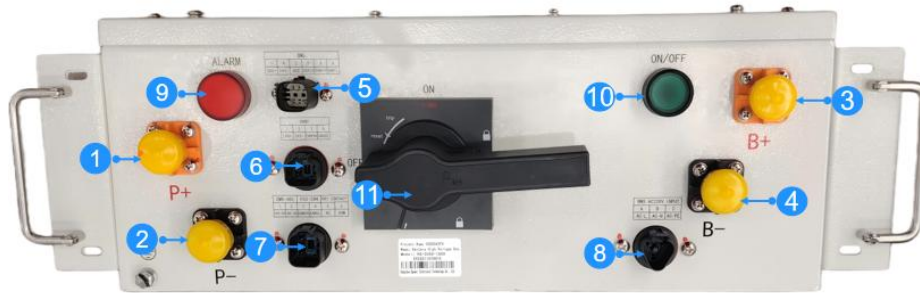


Figure 12 The appearance of the High Voltage Box

Table 14 High Voltage Box terminal definition

NO.	Designation	Description
①	P+ Terminal	High-voltage positive output terminal for connection to the high-voltage positive terminal of the busbar cabinet
②	P- Terminal	High-voltage negative output terminal, for connection to the high-voltage negative terminal of the busbar cabinet
③	B+ Terminal	Serves as the positive terminal connection for the battery rack, connecting to the battery cluster's overall positive phase.
④	B- Terminal	Serves as the negative terminal connection for the battery rack, connecting to the battery cluster's overall negative phase.
⑤	JP1	BMU Power Supply and Communication
⑥	JP2	BAMS Communication
⑦	JP3	Dry contact
⑧	JP4	AC220V Input
⑨	ALARM	Fault Indicator
⑩	ON/OFF	High-voltage box switch button
⑪	QF	Battery Cluster Master Switch

Bmu



Figure 13 BMU external view

Table 15 BMU technical specifications

Technical Specifications	Rated Specifications	Remarks
Module Supply Voltage	DC 24V $\pm$ 20%	/
Module Power Consumption	<2W	/
Number of battery monitoring cells	52 cells	Maximum single unit support (13+13+13+13)
Voltage detection range	0–5V	/
Voltage detection accuracy	$\pm$ 3mV	/
Number of temperature detection points	56	Maximum Support per Unit
Temperature detection range	-40 to 125°C	/
Temperature detection accuracy	$\pm$ 1°C	/
Battery balancing method	Passive balancing	/
Battery balancing current	100mA	/
Input Insulation Resistance	$\geq$ 50M Ω , 2500VDC	/
Data communication interface	CAN	/
Communication baud rate	250Kbps (default)	/
Dimensions and Weight	252 $\times$ 98 $\times$ 24.5 (mm)/0.3 kg	/
Mounting Method	Wall-mounted	/

2.2.9. Thermal Management System

The thermal management system comprises three principal components: the liquid cooling unit, liquid cooling piping, and coolant. By circulating coolant (ethylene glycol solution) through the channels of the battery module's liquid cooling plate, it absorbs or releases heat to achieve precise battery temperature regulation (maintaining the optimal range of 25-35°C). This facilitates rapid dissipation of heat from overheated cells, swift elevation of temperature in underperforming cells, and minimisation of temperature differentials between cells. Liquid cooling offers high heat exchange efficiency and uniform temperature control, making it suitable for high-power, large-capacity energy storage applications. It effectively mitigates thermal runaway risks, safeguarding battery performance and longevity.

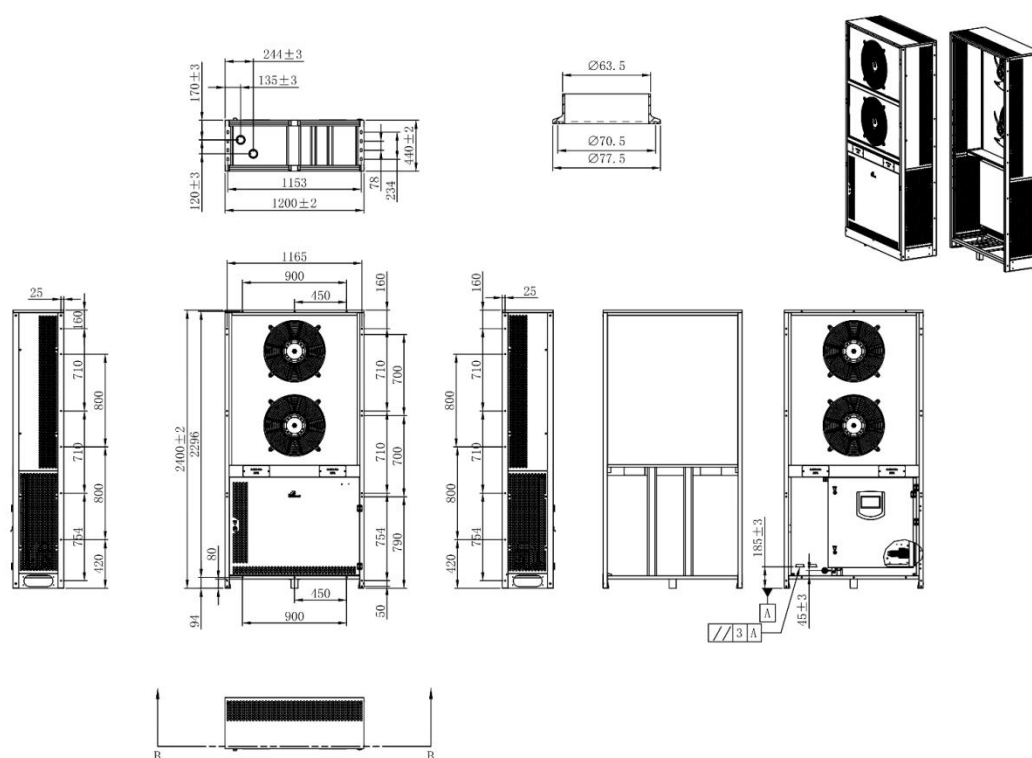


Figure 14 Liquid-cooled unit external dimensions

Table 16 Key parameters of Liquid Cooling Unit

Description		Specifications
Model		EMW300HCNC3E
Dimensions, Weight & Mounting Method		
External Dimensions (W × D × H)	mm	1200 × 440 × 2400
Mass (excluding secondary coolant)	kg	381
Installation method	/	Floor-standing

Description		Specifications
Operating Environment	/	Outdoor
Environmental Protection & Performance		
Operating Temperature Range	°C	-30 to +55
Storage Temperature Range	°C	-40 to +70
Operating Altitude	m	0-4000m (Derating by 5% for every 1000m above 1000m)
Noise Level	dB(A)	≤80
IP Protection Rating	/	IPX5
Anti-corrosion	/	C5-M
Refrigerant	/	R32
Secondary Coolant	/	50% ethylene glycol aqueous solution
RoHS 2.0 Certification	/	Yes
CE Certification	/	Yes
Cooling and heating capacity		
Cooling Capacity @ W18/L35	kW	30
Cooling Capacity @ W18/L45	kW	25
Heating Capacity @ W10	kW	12.4
Outlet Water Temperature	°C	18
Circulating water flow rate		
Rated circulating water flow rate	L/min	400@150kPa
Power consumption		
Cooling input power @ W18/L35	kW	12.1
Cooling input power @ W18/L45	kW	13.8
Heating input power @ Tu=10°C	kW	12.4
Self-circulation mode (pump operation only) power	kW	0.7
Power supply system		
Rated Operating Voltage	V, Hz	380-415V, 3 phase, 50/60Hz
Supported Voltage Range	V, Hz	380-415±15%V, 3 phase, 50/60±3Hz
Maximum Operating Current	A	27.7

Table 17 Liquid cooling system control logic

NO.	Designation	Description
Refrigeration	Activate cooling when cooling demand $\geq 100\%$.	$\text{Refrigeration Demand (\%)} = (\text{Actual Control Temperature} - \text{Refrigeration Set point}) / \text{Refrigeration Sensitivity} \times 100\%$ (Sensitivity defaults to 2°C) Example: When using return water temperature as the actual control temperature, with a cooling set point of 18°C , the unit activates cooling when return water temperature $\geq 20^{\circ}\text{C}$; cooling ceases when return water temperature $\leq 18^{\circ}\text{C}$.
	When cooling demand $\leq 0\%$, cooling ceases.	
Heating	When heating demand $\geq 100\%$, heating operation commences.	$\text{Heating demand (\%)} = (\text{Heating set point} - \text{Actual control temperature}) / \text{Heating sensitivity} \times 100\%$ Sensitivity defaults to 4°C Example: When using return water temperature as the actual control temperature, with a heating set point of 10°C , the unit activates heating when return water temperature $\leq 6^{\circ}\text{C}$; heating ceases when return water temperature $\geq 10^{\circ}\text{C}$.
	Heating demand $\leq 0\%$ will halt heating operation.	

2.2.10. Environmental Monitoring System

2.2.10.1. Industrial Air Conditioning

Industrial air conditioning units provide cooling, heating, and dehumidification functions, effectively controlling cabin temperature and humidity to prevent electrical component ageing and failure. This avoids risks such as short circuits and insulation faults caused by condensation resulting from excessive humidity.

Battery room air conditioner

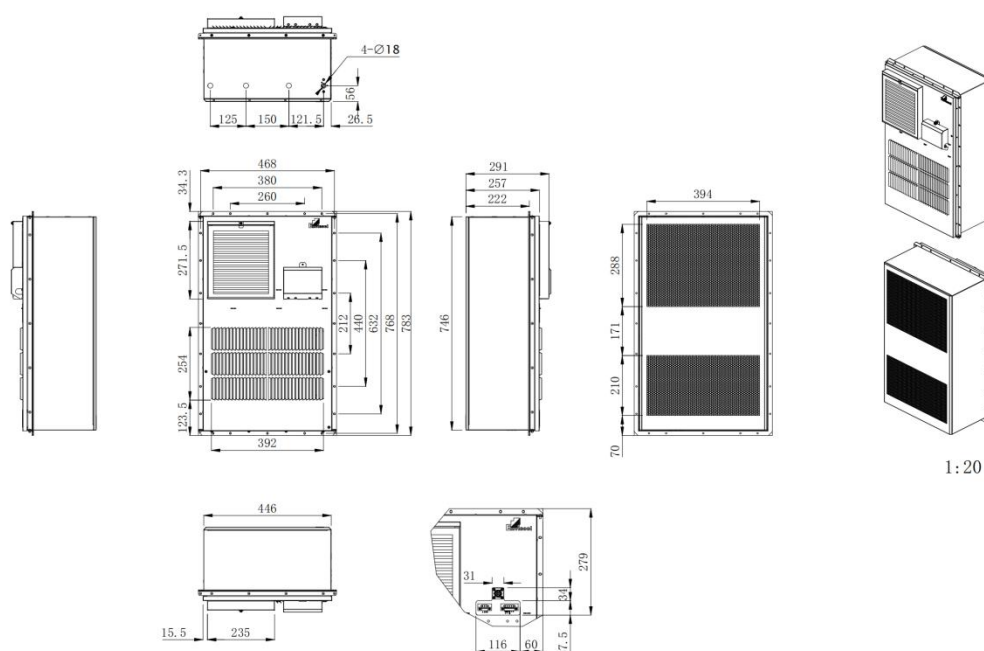


Figure 15 Battery room air conditioner dimensions

Table 18 Battery room air conditioner key specifications

Description		Specifications
Model		EC20HDNCE
Dimensions,Weight & Mounting Method		
External Dimensions (H × W × D)	mm	746 × 446 × 257
Dimensions with flange (H × W × D)	mm	783 × 483 × 257
Weight	kg	39
Installation method	/	Door Mounting
Application Environment	/	Outdoor
Environmental Protection		
Operating Environment Range	°C	-15 to +55 (cooling) / -40 to +55 (heating)
Noise Level	dB(A)	65
Unit Colour	/	RAL7035
IP protection rating	/	IP55
Refrigerant	/	R513A
RoHS 2.0 compliant	/	Yes
Cooling/Heating Capacity		
Cooling capacity L35/L35 50Hz	W	2100
Cooling capacity L35/L35 60Hz	W	2100
Heating capacity L5 50Hz	W	850
Heating capacity L5 60Hz	W	900
Power consumption		
Cooling input power L35/L35 50Hz	W	830
Refrigeration input power L35/L35 60Hz	W	900
Refrigeration input current L35/L35 50Hz	A	3.8
Refrigeration input current L35/L35 60Hz	A	4.2
Maximum operating current	A	7.8
Airflow		
Internal circulation air volume (at 0 Pa outlet static pressure)	m³/h	650
Display		

Description		Specifications
Display	/	Optional
Power supply specification		
Power supply range	V, Hz	230±10%, 50/60
Rated Operating Voltage	V, Hz	230±10%, 50/60

Control room air conditioner

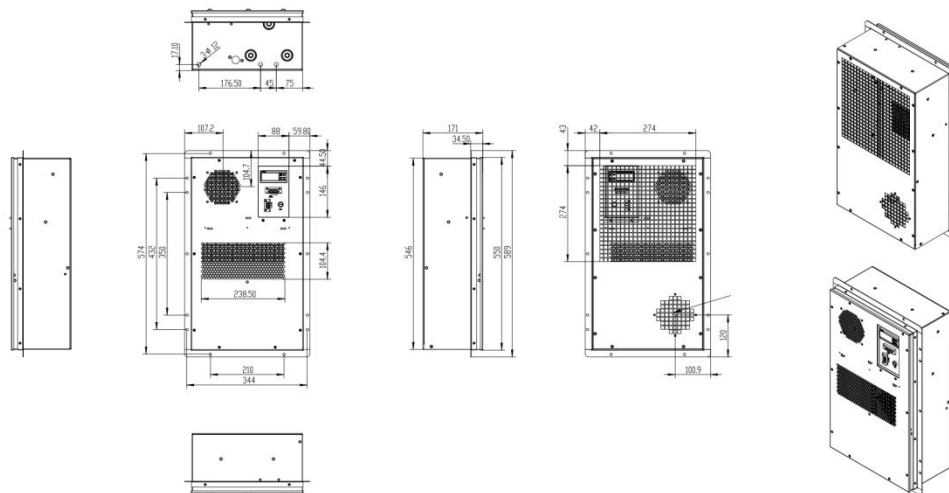


Figure 16 Control room air conditioner dimensions

Table 19 Control room air conditioner key specifications

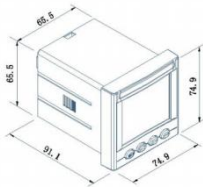
Item	Unit	Specifications
Operating ambient temperature	°C	-30 ~ +55
Rated AC power supply input	Hz	220V/50Hz±15%/60Hz±10%
Cooling capacity (L35/L35)	W	600
Rated AC input power (L35/L35)	W	300
Rated current (L35/L35)	A	1.35
Maximum operating current	A	3.5
Heating capacity	W	500
Heating power	W	656
Maximum current (cooling/heating)	A	2.25/2.9
MCA/MOP	A	4/6
Compressor RLA/LRA	A	1.52/4.82

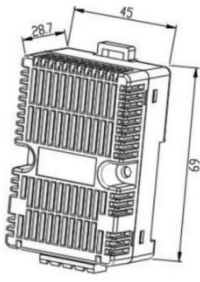
Item	Unit	Specifications
Maximum discharge pressure	Mpa	2.94
Maximum suction pressure	Mpa	1.15
Fan FLA	A	0.14
Box size (H × W × D)	mm	550 × 320 × 171
Flange external dimensions (H × W × D)	mm	583 × 352 × 171
Weight	kg	17
Installation method	/	The door is embedded 35mm
Maximum sound pressure level noise	dB(A)	58
Waterproof and dustproof grade	/	IP55
Cryogen	/	R513A/0.175kg
Surface preparation	/	Electrostatic spraying (RAL9003)

2.2.10.2. Temperature and Humidity Controller

Energy storage containers house a large number of battery packs, which are highly sensitive to temperature and humidity. The temperature and humidity controller continuously monitors the internal ambient temperature (typically controlled within 15~35℃) and relative humidity (usually required to be below 60% RH, non-condensing) in real time, and provide over-temperature or over-humidity early warning, effectively preventing equipment failures caused by low or high temperatures, as well as creepage and flashover accidents induced by moisture or condensation.

Table 20 Product dimensions

Product Name	Product Image	External Dimensions	Installation Location
Temperature and Humidity Controller			On the power box door

Product Name	Product Image	External Dimensions	Installation Location
Temperature and Humidity Sensor			One sensor mounted on the interior wall of the central control room, The other is mounted on the battery compartment wall

2.2.10.3. Water immersion system

The water immersion system, also known as the water immersion monitoring and protection system, is a safety device for liquid intrusion in key areas of battery rooms. Its core function is to monitor water ingress risks and trigger emergency responses, preventing electrical short circuits or equipment damage.

Table 21 Product dimensions

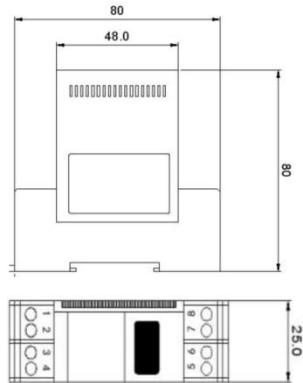
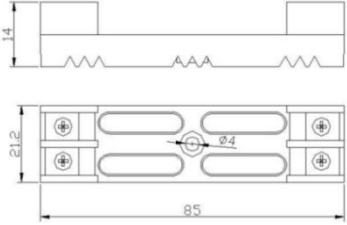
Product Name	Product Image	Dimensions	Installation Location
Water-immersed Transmitter			Control Inside the box
Water immersion sensor			Battery room base plate

Table 22 Water immersion system function description

No.	Name	Description
①	Transmitter	The transmitter modulates the excitation signal to the water immersion sensor. Upon detecting water at the designated location, the altered excitation signal is fed back to the transmitter. The transmitter's dedicated chip amplifies, shapes, and compares this
②	Protective Probe	

No.	Name	Description
	Sensor	signal before outputting a high/low logic level or triggering a relay alarm.

2.2.11. Fire Suppression System

2.2.11.1. Fire Suppression System Overview

Fire Protection for energy storage systems constitutes the core safeguard for battery and equipment security. It addresses thermal runaway risks through a comprehensive prevention and control process encompassing "monitoring and early warning – rapid response – efficient fire suppression – prevention of reignition".

Please comply with the fire safety regulations and ordinances of the country/region where the project is located.

Regularly inspect and maintain fire Protection equipment to ensure all performance indicators remain within normal parameters.

NOTICE

When operational management personnel receive an alarm or fault signal from a storage cabinet via software or the station-level fire alarm control panel, a qualified fire protection technician must conduct an on-site investigation under safe conditions before performing a manual reset.

2.2.11.2. Fire Protection System Composition

- **Monitoring and Early Warning:** Real-time monitoring of battery container anomalies via smoke detectors, temperature sensors, and combustible gas detectors, combined with BMS thermal runaway temperature warning signals, enables early fire detection.
- **Rapid Response:** Upon alert activation, immediately trigger audible alarms and visual indicators, simultaneously disconnecting the battery from external circuits and shutting down ventilation systems (to prevent fire spread).
- **Efficient Fire Suppression:** Adopts aerosol cooling technology to rapidly suppress or extinguish initial fires, preventing reignition.
- **Water-Based Fire Suppression:** Pre-installed water system pipe interfaces enable immersion-based fire suppression during emergencies.
- **Safe Containment:** Maintains container integrity post-fire to prevent toxic gas leakage, buying time for personnel evacuation and subsequent handling.

This system constitutes a critical defence against fires and explosions caused by battery thermal runaway, ensuring the safe operation of energy storage systems.

NOTICE

- Smoke and temperature detectors require periodic functional testing to ensure proper operation. Testing intervals shall not exceed one year; malfunctioning detectors must be promptly repaired or replaced.
- Flammable gas detectors require regular maintenance, with intervals adhering to product specifications and not exceeding one year. During maintenance operations, promptly repair or replace any malfunctioning detectors.

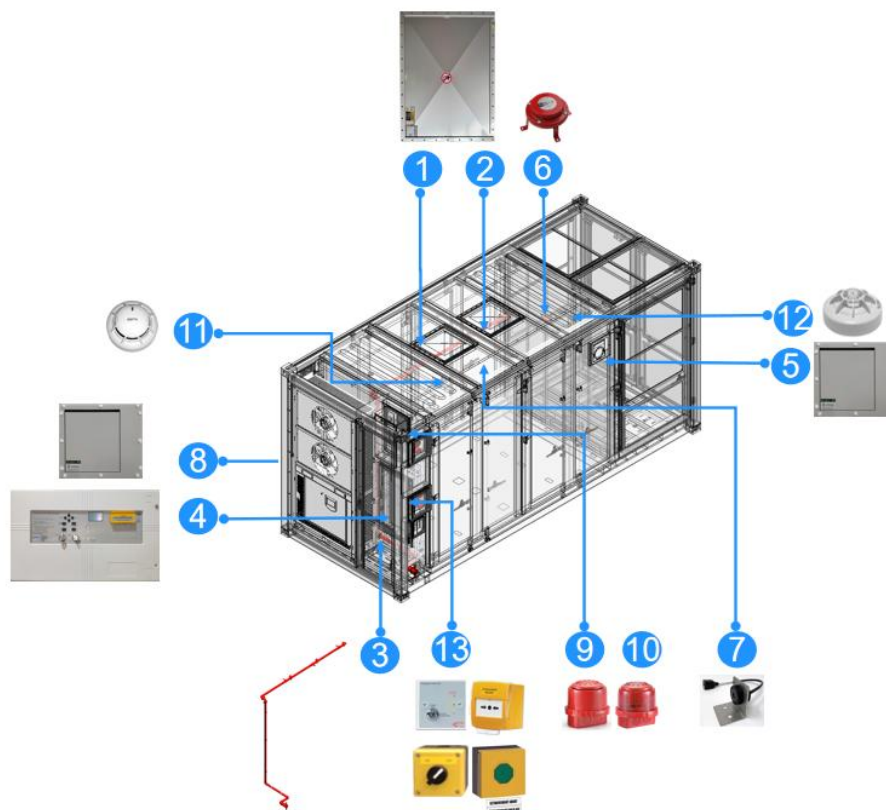


Figure 17 Diagram of fire fighting system composition

Table 23 Fire Protection system equipment

No.	Name	Quantity
①	Deflagration panel 1	1
②	Deflagration panel 2	1
③	Water fire fighting pipe / fire sprinkler	a length of pipe/ 3

No.	Name	Quantity
④	Fire suppression controller	1
⑤	Exhaust fan outlet	1
⑥	Aerosol	3
⑦	Combustible Gas Detector	1
⑧	Inlet louver	1
⑨	Alarm bell	1
⑩	Audible and visual alarm	1
⑪	Temperature detector	2
⑫	Smoke detector	2
⑬	Prohibited use button, Emergency start-up button, Fan start or stop button, Manual/Automatic Conversion Device	1 /1 /1 /1

2.2.11.3. Fire Suppression System Control Logic

Aerosol Fire Suppression System

Tiered Alarm Trigger Conditions

- **Level 1 Alarm:** A Level 1 alarm is triggered when any single device in the battery compartment (including point-type smoke detectors, point-type heat detectors, or combustible gas detectors) activates independently.
- **Level 2 Alarm:** A Level 2 alarm is triggered when both the point-type smoke detector and point-type heat detector in the battery compartment activate simultaneously.

Level One Alarm Response

- Upon triggering a Level 1 alarm, the system immediately activates the alarm bell, emitting a warning signal to indicate a potential incipient fire or anomaly.

Secondary Alarm Response

- Upon triggering a secondary alarm, a series of interlocked controls are activated:
- The gas extinguishing controller immediately interlocks to close fire intake dampers and exhaust fans, preventing fire spread through the ventilation system; Interlocks the PCS energy storage system to shut down and disconnect the battery high-voltage DC output circuit. Enters a 30-second countdown discharge state, allowing time for personnel evacuation and system preparation; Upon countdown completion, releases the extinguishing agent.

Combustible Gas Detection Alarm & Accident Ventilation System

Explosion-Proof Exhaust and Ventilation System

When the combustible gas detector detects that the gas concentration in the compartment reaches the alarm threshold, it will output a signal to activate the electric louvers and explosion-proof fans.

If the ventilation system is operating when the aerosol fire suppression system activates, it will interlock and shut down.

Fire Suppression Control and Emergency Ventilation System Flowchart:

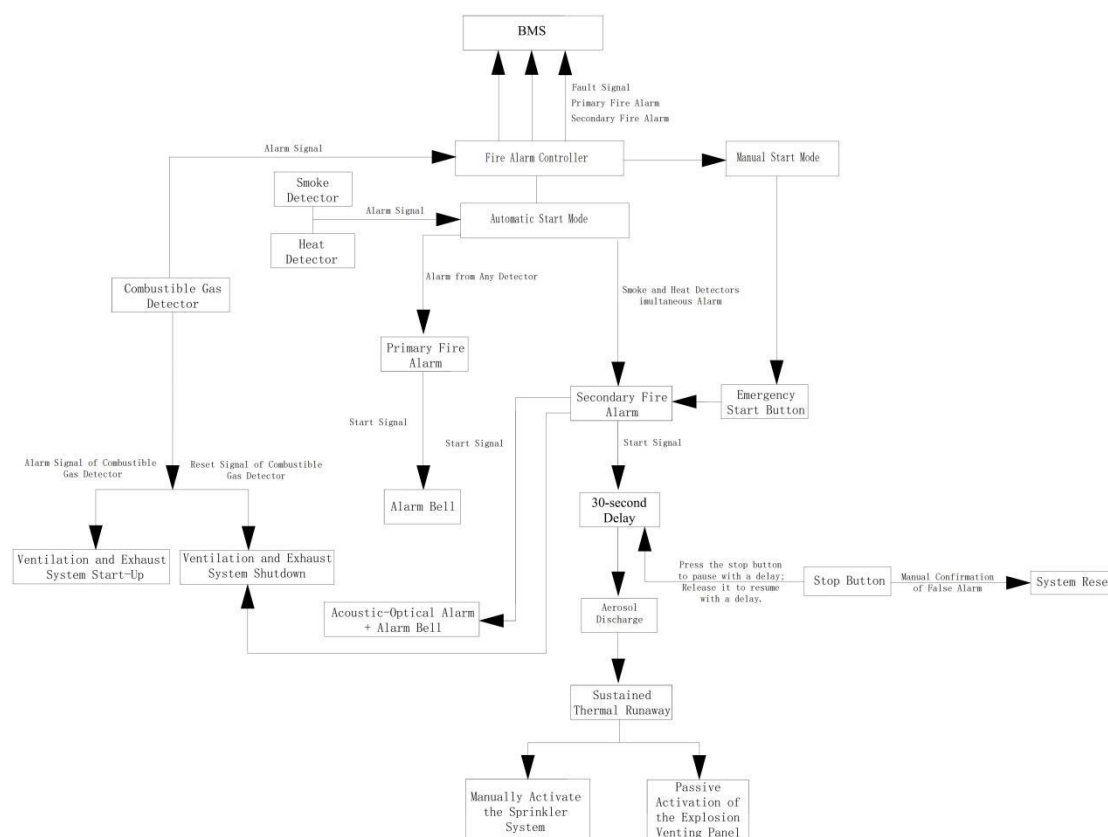


Figure 18 Ventilation system control logic

Deflagration Panel

The Deflagration Panel of the energy storage system container is a safety pressure relief device for battery thermal runaway, installed in the battery compartment. When deflagration occurs due to battery fire in the compartment and pressure rises sharply, the deflagration Panel will rupture preferentially to quickly release high-temperature and high-pressure gas and flames, preventing the compartment from exploding due to overpressure. Meanwhile, it directionally guides the deflagration direction to reduce damage to surrounding equipment and personnel, serving as a key component for passive fire and explosion protection.

Fire Control Box

The battery container is equipped with a **Fire Control Box containing a accident ventilation start/stop switch**, an emergency start/stop button, and a manual/automatic switch device.

● Accident Ventilation Start/Stop Switch

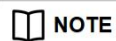
The accident ventilation start/stop switch has two operating status: stop/start.

Rotate the button to "ON" to activate the ventilation system. Rotate the button to "OFF" to turn off the ventilation system.



Figure 19 The image of accident ventilation start/stop switch

● Emergency Start/Stop Button & Manual/Automatic Switch Device



Under normal operating conditions, it should be set to automatic mode.



Figure 20 The appearance of the Fire Control Box

Table 24 The description of the Fire Control Box

No.	Designation	Description
A	Emergency Start Button	Upon pressing, the fire suppression system is activated
B	Emergency Stop Button	Upon pressing, the fire protection system ceases operation
C	Manual/Automatic Switch Device	Fire Suppression System mode switch
D	Firefighting mode I	Enter firefighting access mode
E	Firefighting mode O	Exit firefighting access mode
F	Manual/automatic switch key	For manual-automatic switching
G	Manual/automatic switch key	For manual mode only

2.2.11.4. Water Fire Suppression System

The water fire suppression system consists of fire sprinkler pipes and fire sprinklers.

The battery container has an external water inlet port. In the event of a fire, if the fire suppression system fails to extinguish the flames or if the fire reignite subsequently, firefighting water should be introduced. The water is channelled through the fire sprinkler pipes and sprinkler heads to cool the energy storage system and achieve immersion-based fire suppression.

(Requirements: DN65 BS336 British-style double-eared coupling / Water pressure 1.0MPa)



Figure 21 Water fire suppression system diagram

NOTICE

When using the automatic sprinkler system, the external pipe must be installed, which shall be designed and installed by the user.

3. Transportation and Storage

3.1. Precautions

CAUTION

Failure to transport and store in accordance with this manual may invalidate the warranty.

3.2. Transportation Method

The product features an integrated design and convenient lifting structure for easy transport, suitable for carriage by lorry.

WARNING

Throughout loading, unloading, and transportation, strictly adhere to the outdoor container handling safety regulations of the project's country/region!

- Both the ESS and any tools used during operations must be properly maintained.
- All personnel involved in loading, unloading, and securing operations must receive appropriate training, particularly regarding safety protocols.
- Do not transport the ESS at temperatures below -30°C.

NOTE

Throughout the entire loading, unloading, and transportation process, the mechanical parameters (external dimensions and weight) of the ESS must be kept in mind at all times.

Transportation and movement of ESS must satisfy the following conditions:

- All ESS cabinet doors must be securely locked.
- Select an appropriate crane or lifting equipment based on site conditions. The chosen equipment must possess sufficient load-bearing capacity, boom length, and swing radius. Additional towing devices may be required for manoeuvres such as movement on slopes.
- Clear all existing or potential obstacles from the route, such as trees and cables.
- Transport and relocation of the ESS should be scheduled during favourable weather conditions whenever possible.
- Warning signs or safety tape must be erected to prevent unauthorised personnel from entering the lifting and transport area, thereby avoiding accidents.

- Battery cabinets must be maintained in an upright position during transport.
- During transport, battery cabinets must be positioned horizontally with a maximum tilt angle of $\leq 15^\circ$.
- When transporting battery PACKs individually, stacking must not exceed three layers.
- Avoid collisions or severe vibrations during product transportation.
- For land transport, vehicles equipped with mushroom-head locks are recommended. If such locks are unavailable, secure the product with ropes. Ensure ropes connect the top and bottom of the product to the transport vehicle to prevent slippage or overturning due to excessive tilt during transit.
- When placing equipment on a truck, non-slip mats must be laid at the base.
- When loading the equipment onto a lorry, anti-slip mats must be laid at the base.

3.3.Storage Requirements

NOTICE

Should the energy storage cabinet remain unused for over three months, store the product in accordance with these requirements. Damage resulting from non-compliant storage conditions will not be covered under warranty.

- To prevent condensation forming inside the ESS cabinet or the cabinet base becoming waterlogged during rainy seasons, the ESS base must be elevated to a reasonable height determined by site geological and meteorological conditions.
- Store the ESS on a dry, level, solid platform with sufficient load-bearing capacity and free from any vegetation cover. The storage The ground must be level, free of standing water, and without any bumps or unevenness. The upper surface of the foundation must be on the same horizontal plane, with a level deviation of 0–5 mm and a gradient strictly below 5° .
- Prior to storage, ensure all ESS cabinet doors and internal equipment cabinet doors are securely locked. Avoid unnecessary door openings during storage.
- System storage ambient temperature: -20 to 50°C . Recommended storage temperature: $+25^\circ\text{C}$.
- Prolonged battery storage is not advised due to capacity degradation over time. Furthermore, even when stored at the recommended optimal temperature, irreversible capacity decline may occur due to calendar effects. The longer the storage duration, the greater the potential for irreversible capacity loss.

- Recommended relative humidity for storage: $\leq 65\%$, non-condensing.
- Provide effective protection for the intake and exhaust vents of the ESS liquid-cooled unit. Maintain the integrity of vent protection throughout storage and implement measures to prevent ingress of rainwater, dust, or debris into the unit.
- Conduct regular inspections. Inspect at least once every fortnight to verify packaging integrity and prevent damage from vermin. Should any damage be detected, immediately replace the packaging. Inspect the cabinet and all internal equipment for damage.
- Prior to installing ESS units stored long-term (over six months), open the cabinet doors for visual inspection to confirm the cabinet and internal equipment are undamaged. Additionally, power-up and start-up checks must be performed. Where necessary, installation should only proceed after testing by qualified personnel before proceeding with installation.
- Avoid storage in dusty environments, areas with high concentrations of dust, smoke, or lint, as particulate matter may accumulate on the unit's air vents or heat sinks, impairing heat dissipation and potentially causing damage under severe conditions.
- Avoid storage in locations where corrosive gases or dust may be generated or accumulate. Additionally, avoid areas within 10 kilometers of saline-alkali land or industrial complexes with potential pollution or polluted industrial complexes.
- Do not store cabinets in environments contaminated with halogens or sulphur compounds.
- Do not store cabinets in environments with vibration or magnetic fields exceeding 30 A/m.
- When storing packs individually, in addition to meeting ESS storage requirements, it is recommended to store them indoors in a clean, dry location, avoiding exposure to direct sunlight or rain. Storage locations must be free from harmful gases, flammable or explosive products, and corrosive chemicals. Avoid mechanical impact, heavy pressure, and exposure to strong magnetic fields.
- When stored individually, Packs may be stacked to a maximum of three layers.
- Take precautions against harsh environmental conditions such as sudden cold, sudden heat, and collisions to avoid damage to the Pack.
- For ESS units stored for over six months from the date of dispatch from the Wolong Energy Storage manufacturing plant, provided the above conditions are met, perform one charge-discharge cycle to bring the system SOC to 30%–50%. After recharging, the SOC must be maintained consistently.

4. Mechanical Installation

WARNING

Throughout the entire mechanical installation process, strictly adhere to all relevant standards and requirements applicable to the project location.

4.1. Pre-installation Inspection

4.1.1. Delivery Item Verification

Verify the completeness of delivered items against the accompanying packing list.

4.1.2. Inspect Equipment

- Verify that the actual product received matches the ordered model.
- Inspect the product and internal components to ensure no damage is present.

Should any issues or queries arise, please contact your distributor or Wolong Energy Storage Company promptly.

WARNING

Only products that are complete and free from any damage may be installed!

Before installation, ensure:

- The product itself is intact and free from any damage.
- All internal components are in perfect working order and free from damage.

NOTICE

Prior to installing products that have been in long-term storage (exceeding six months), the cabinet doors should be opened for a visual inspection to confirm that

the cabinet and internal equipment are intact. Additionally, inspection must be conducted after powering on and starting the unit. Where necessary, installation should only proceed after testing by qualified personnel before proceeding with installation.

NOTICE

Inspect the equipment for paint chips, damage, or other defects. To prevent corrosion, it is advisable to repair any paintwork. For specific steps refer to the operation and maintenance manual.

4.2. Installation Environment Requirements

4.2.1. Site Selection Requirements

- The site must be stable, with foundation bearing capacity meeting all equipment weight and dynamic load requirements (battery compartment, converter, transformer, etc.).
- The surrounding environment must be dry and well-ventilated.
- Ensure no trees are present near the installation site to prevent branches or leaves being blown by strong winds and blocking the energy storage system's doors or air intakes.
- Locate away from areas with concentrated toxic or hazardous gases; keep distant from flammable, explosive, or corrosive substances.
- Installation away from residential areas is recommended. Specific distance and noise requirements must comply with local laws and regulations. Local conditions If these requirements cannot be met, noise reduction measures may be implemented. For specific solutions, consult the design team or contact Wolong Energy Storage for support.
- Avoid installation in dusty environments, areas with high concentrations of dust, smoke, or lint. Particulate matter in the environment may accumulate on the equipment's exhaust vents or heat sinks, impairing heat dissipation and potentially causing damage under severe conditions.
- Avoid installing in locations where corrosive gases or dust may generate or accumulate. Also, avoid installation within a 10-kilometer radius of saline-alkali land or industrial complexes with pollution.
- Do not install the equipment in environments contaminated with halogens or sulphur compounds.
- Outdoor deployment is permitted for locations over 2000 m from the coast. Energy storage systems are not recommended for use between 500 and 2000 m from the coast (consult your dealer or company engineer if necessary).
- No underground facilities exist at the site.

NOTICE

The product must not be installed in environments subject to strong seismic activity or intense electromagnetic fields. An intense magnetic field environment refers to conditions where the magnetic field strength exceeds 30 A/m.

4.2.2. Foundation Requirements

WARNING

The equipment is relatively heavy. Prior to constructing the foundation, a detailed assessment of all site conditions (primarily geological conditions and environmental climate factors) must be conducted. Only upon this basis should foundation design and construction commence.

The selection of the installation site and foundation construction are typically completed prior to equipment delivery; consequently, this manual does not elaborate further on the relevant procedures.

An unsuitable foundation design may cause significant difficulties or inconveniences for equipment placement, door operation, and subsequent operation. Therefore, the installation foundation must be designed and constructed in advance according to specific standards to meet requirements for mechanical support, cable routing, and subsequent maintenance and inspection requirements.

Foundation construction must meet the following minimum requirements:

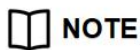
- The installation site soil must possess adequate compaction. Design must strictly adhere to local regulations and design codes. If the soil is loose, measures must be taken to ensure foundation stability.
- Where equipment is installed in areas with dense vegetation, in addition to routine weeding, harden the ground beneath the equipment to prevent weed growth.
- The base of the foundation pit must be compacted and levelled to provide adequate and effective support for the enclosure.
- The upper surface of the ESS foundation must be maintained at a uniform level, with flatness deviation within 0–5 mm.

NOTICE

- Should flatness deviation exceed specifications, level the surface by welding shims before hoisting the equipment onto the foundation.
 - After positioning the equipment, ensure doors operate smoothly before securing the unit to the foundation.
- Foundation height shall comply with local design codes. It is recommended that the foundation height exceeds the historical maximum water level to prevent rainwater ingress

into the equipment base and interior. Foundation height shall accommodate operational and maintenance accessibility.

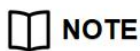
- The foundation's cross-sectional area and height must meet requirements. The recommended foundation height is 300 mm to 500 mm, with a maximum not exceeding 700 mm and a minimum not less than 100 mm. Should dimensions fall outside this range, please contact Wolong Energy Storage for verification 700 mm and no less than 100 mm. Should dimensions fall outside this range, please contact Wolong Energy Storage for verification.
- Appropriate drainage measures must be constructed in accordance with local geological conditions to prevent the ESS base or internal equipment from becoming waterlogged during periods of heavy rainfall or heavy precipitation.
- Cable routing must be considered during foundation construction.



Excavated soil must be promptly removed to prevent obstruction during subsequent equipment hoisting.

Ensure sufficient clearance around equipment for door operation, whilst accounting for required space around air inlets/outlets. For specific dimensions, refer to the "Maximum Door Opening Dimensions" diagram.

- Where welding is employed for fixation, embedded anchors must be pre-installed and treated with anti-corrosion measures.
- Provision must be made for cable entry/exit conduits. The specifications and quantity of conduits shall be determined based on the selected cable type and the number of cable entries/exits.
- The foundation must incorporate grounding flat steel, securely welded to the outdoor container's earth connection.
- Temporarily seal both ends of all embedded conduits to prevent ingress of contaminants; failure to do so may hinder subsequent cabling operations.
- After connecting all cables, seal cable entry/exit points and joints with fire-resistant putty or other suitable materials to prevent rodent intrusion.



Embed the grounding unit in accordance with the relevant standards of the country/region where the project is located.

4.2.3. Foundation Construction

NOTICE

- Foundation dimensions and depth must satisfy the bearing capacity requirements of the load-bearing layer. Bearing capacity determination shall be based on the geological survey report, and must not fall below the minimum structural load-bearing requirements dictated by geological conditions;
- Written confirmation with the manufacturer is recommended to clarify technical compatibility requirements. Should relevant parameters not be confirmed with the manufacturer, the manufacturer shall bear no liability for subsequent quality issues, safety risks, or economic losses arising from foundation-product incompatibility.
- The ground must be solid and level, with no risk of collapse or slippage.
- Sufficient clearance must be maintained around the product to facilitate door opening. Specific dimensions may be referenced in the "Maximum Door Opening Dimensions".

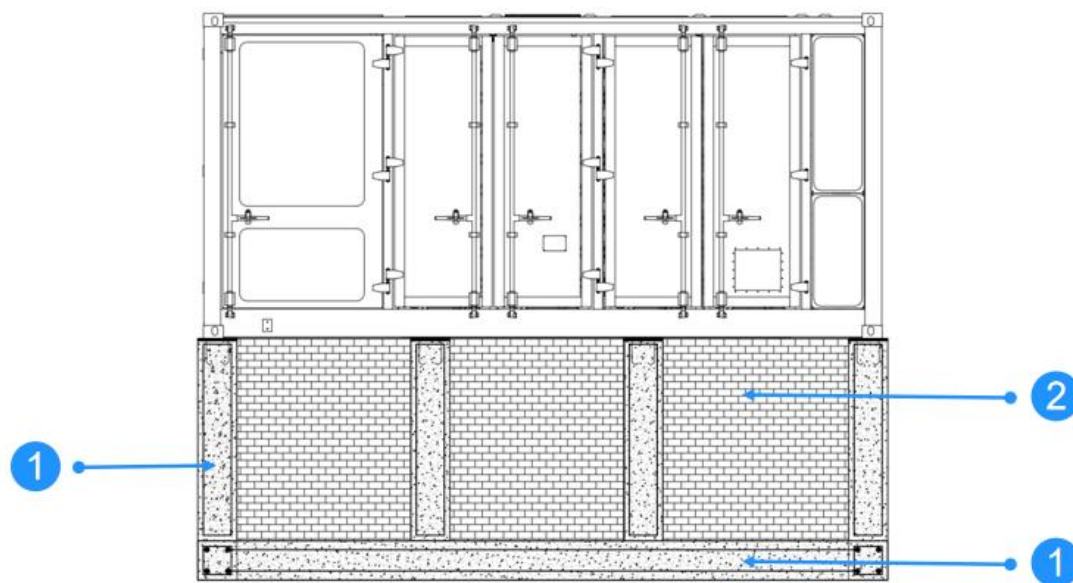


Figure 22 The diagram of the foundation

Table 25 Foundation description

No.	Description
①	Recommended C25 concrete
②	Prior to routing cables into the container, cable support brackets must be installed at the base of the container foundation



Figure 23 Cable entry hole diagram

Table 26 Cable entry hole description

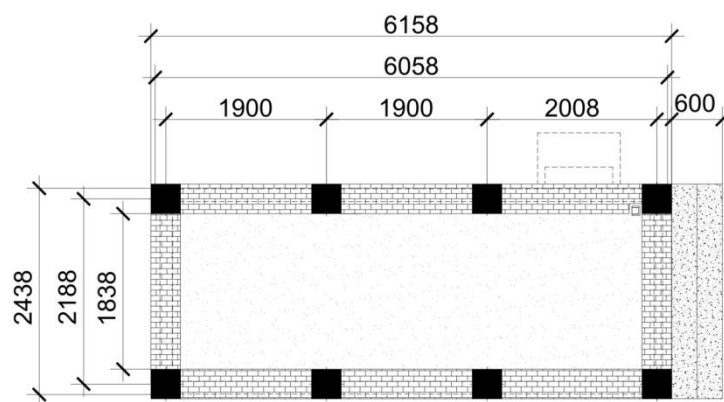
No.	Description
A	Communication cable hole
B	Power cable hole

NOTICE

This section is not intended for use in foundation construction, but solely for reference during the foundation design process.

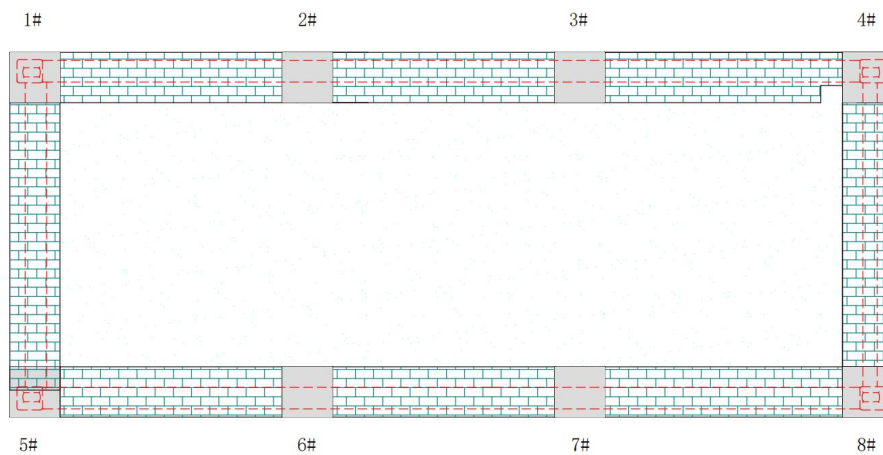
4.2.4. Foundation Leveling Plan

Prior to equipment hoisting and securing, the foundation's flatness shall be measured and verified. The equipment shall be installed upon eight column foundations, with column positions distributed as illustrated below:

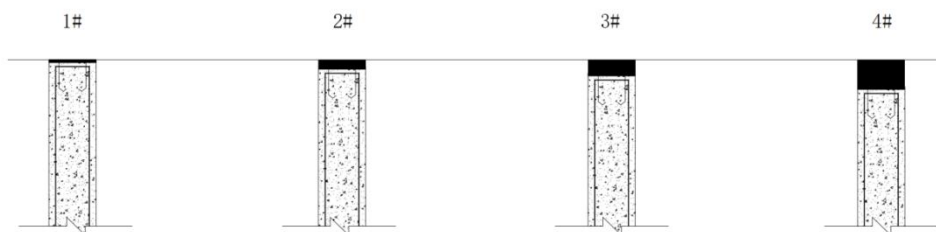


If the height difference between the highest and lowest points of foundations 1 to 8 falls within 0 to 5 mm, the foundation flatness meets design requirements and the equipment may proceed

with normal hoisting and foundation fixing. Should the height difference exceed 5 mm, on-site foundation leveling is required, with the leveling procedure outlined below.



- **Step 1:** Identify the highest foundation plane based on the acceptance results. Use this highest plane as the reference level to calculate the height differences between the remaining foundations and the highest plane.
- **Step 2:** Weld shims of corresponding thickness to each foundation support point (excluding the highest foundation point) to ensure all foundation upper surfaces lie on the same horizontal plane.



- **Step 3:** Following foundation leveling, proceed with equipment hoisting and secure it to the foundations.
- **I End**



NOTE

The material for shims may be selected according to actual site conditions.

4.2.5. Installation Space Requirements

This section provides recommended minimum distances between cabinets solely for product-related considerations such as heat dissipation, installation, and operational maintenance. Customers may increase distances based on local fire regulations, and firewalls may be added where necessary.

NOTICE

- The following layout distance requirements represent the minimum spacing between cabinets, not between foundations.

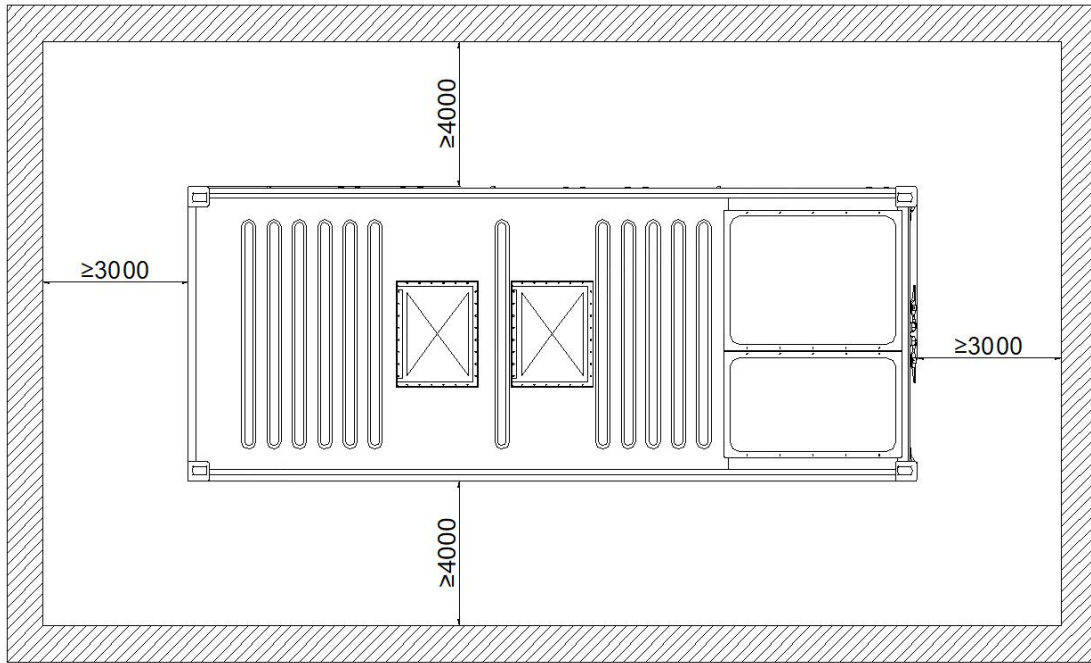


Figure 24 Installation space requirements for individual equipment (unit:mm)

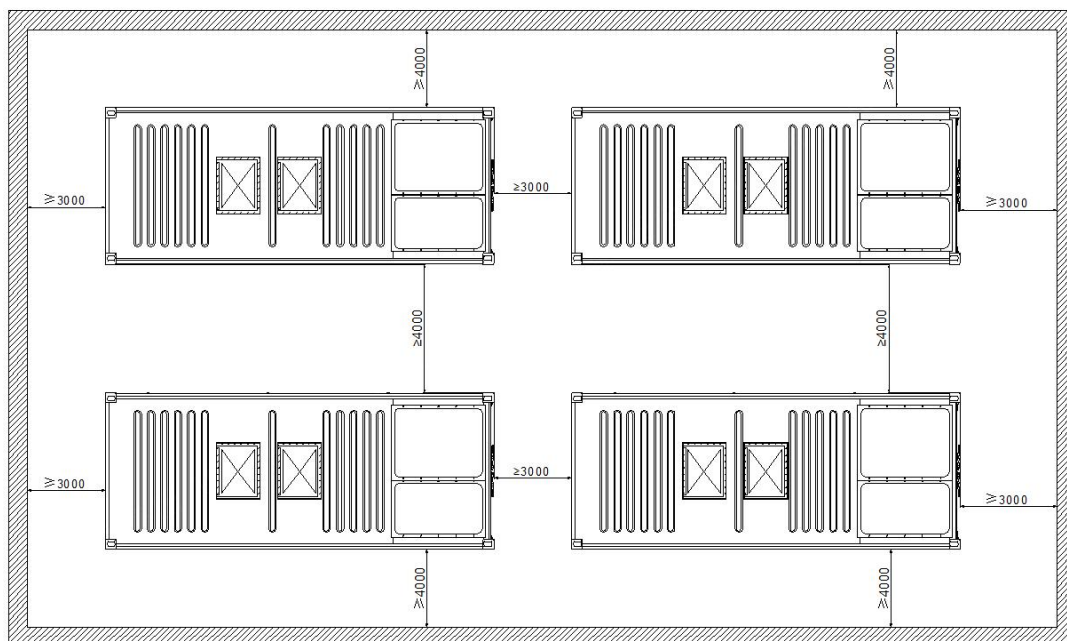


Figure 25 Distance requirements for multiple units (unit:mm)

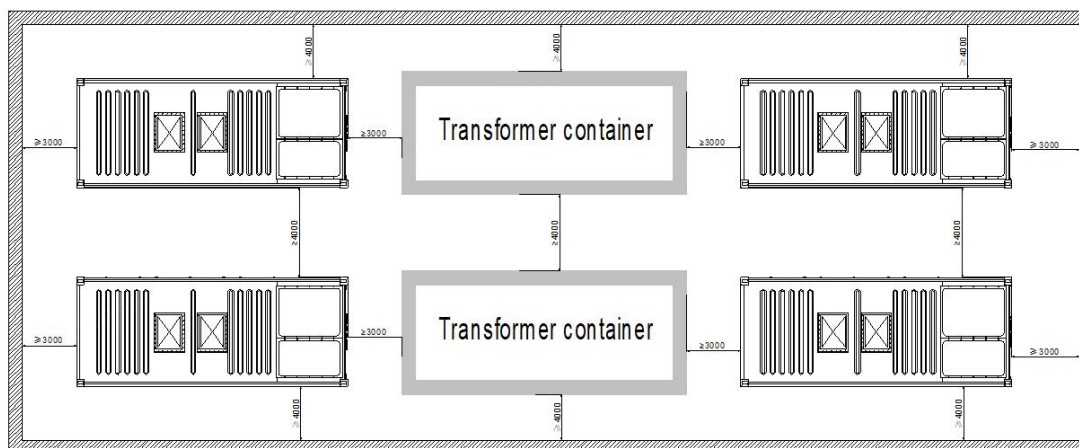


Figure 26 Distance requirements between battery containers and MV Turnkey Station (unit:mm)

4.3.Lifting and Securing Equipment

4.3.1. Lifting Precautions

During lifting operations, safety regulations must be strictly adhered to in order to ensure the safety of personnel, equipment, and the surrounding environment.

Prerequisites for Lifting:

- Qualifications:

It is imperative to engage a qualified professional lifting company to undertake equipment hoisting operations.

- Foundations:

- Sufficient space has been reserved for cable ducts, which have been pre-embedded.

- Foundation layout markings have been completed.

- Prior to lifting, the foundation must undergo re-leveling verification. Height variations must not exceed 5 mm, and slopes must not exceed 5°.

- Should any deviations in flatness or gradient occur, rectification must be undertaken or an adequate quantity of metal shims prepared in advance. The size of these shims must correspond to the load-bearing points.

- Familiar with equipment layout:

- Carefully reference the project layout diagram to arrange the sequence of trailer entry based on equipment distribution. Vehicles carrying lifting gear shall be given priority.

- Confirm the positioning and orientation of each piece of equipment.

- **Equipment Condition:**

- Equipment and lifting gear have passed inspection; all cabinet doors are securely locked.

Lifting Equipment Requirements:

Rigging must be prepared strictly in accordance with the performance requirements specified in the "Lifting Diagram".

Lifting Safety Regulations:

 WARNING

- Throughout the entire equipment lifting process, operations must strictly adhere to national and regional lifting safety regulations, including but not limited to the following precautions:
- Suspend lifting operations during adverse weather conditions such as heavy rain, dense fog, or strong winds.
- Warning signs or caution tape must be erected to prevent unauthorised personnel from entering the lifting and transport area, thereby avoiding casualties.
- All personnel involved in lifting, loading/unloading, and securing operations must undergo appropriate training, particularly in safety procedures.
- No personnel shall be permitted beneath moving machinery or within a 10-metre radius to prevent fatalities or injuries.
- A qualified supervisor must be present throughout the operation to direct activities.
- All equipment used during operations must be properly maintained.
- Lifting operations must be conducted with gentle lifting and lowering; dragging or colliding with loads is not permitted.
- Lifting operations must not be conducted in conditions of insufficient light or poor visibility.
- Do not lift loads when persons or moving objects are present on the load.

4.3.2. Lifting Operation Procedure

- **Step 1: Rigging Installation**

- 1 Thread the four shackles through the four lifting ropes respectively;

- 2 Connect the four shackles to the four lifting lugs on the top of the outdoor container;

3. Pass the four slings through the crane hooks to complete rigging installation.

- **Step 2: Smooth Lifting**

1. Pause once the equipment is lifted 300 mm off its support surface to inspect the rigging connections.

2. Only proceed with lifting once the rigging is confirmed securely attached and the equipment's self-adjustment results in an inclination angle of less than 5° from the horizontal plane.

- **Step 3: Lower the equipment steadily onto the foundation's marked positioning lines.**

- **Step 4: Inspect and adjust load-bearing points.**

1. Verify that cabinet doors open and close correctly, the equipment frame shows no deformation, and all load-bearing points are properly seated.

2. Should any deformation be present, lift the equipment slightly again. After adding shims to the load-bearing points, lower the equipment gradually until all load-bearing points are fully supported.

support points are fully loaded.

- **Step 5: Remove the lifting gear.**

- **End**

The equipment is now securely and neatly positioned on the foundation base marking, with all load-bearing points properly supported. The equipment remains undamaged and free from deformation, and cabinet doors open and close.

4.3.3. Lifting Diagram

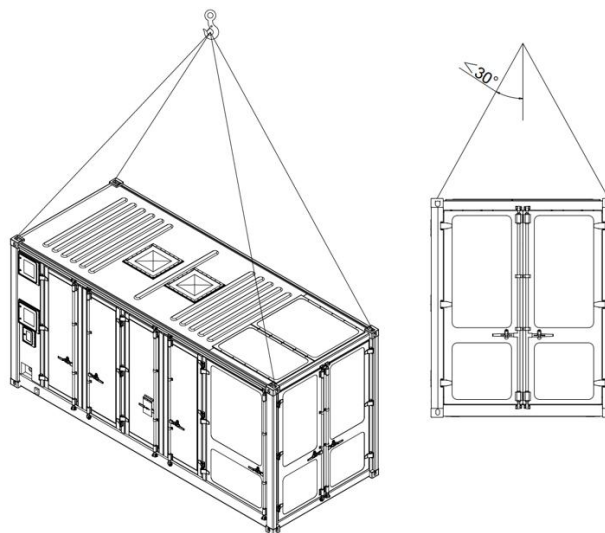


Figure 27 Lifting diagram

The above images are for reference only. Please refer to the actual items received!

Table 27 Recommended Lifting Equipment List

Component Name	Performance Requirements	Quantity
Sling	Steel wire rope, sling length >8m, single strand load capacity ≥ 30 tonnes	4 pieces
Angle between suspension rope and vertical direction	$\leq 30^\circ$	/
Shackle	U-shaped, individual shackle load capacity ≥ 30 tonnes, safety factor ≥ 4	4

NOTE

- Ensure lifting equipment meets the above performance requirements and that lifting operations are only conducted following rigorous and professional assessment by the lifting contractor.
- After use, store the lifting gear securely for subsequent emergency deployment.

4.3.4. Securing the Container

After transporting the outdoor container to the installation site, secure it in place.

Welding method: Embedded anchors

Embedded anchors are used for welding the outdoor container in place. Refer to the diagram below for anchor positioning.

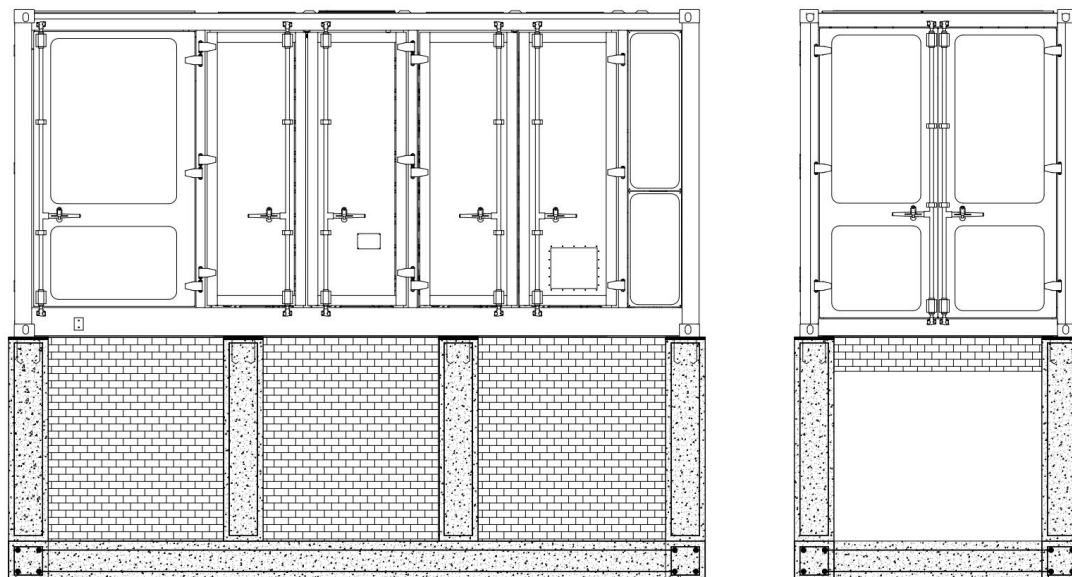


Figure 28 Embedded fitting welding diagram

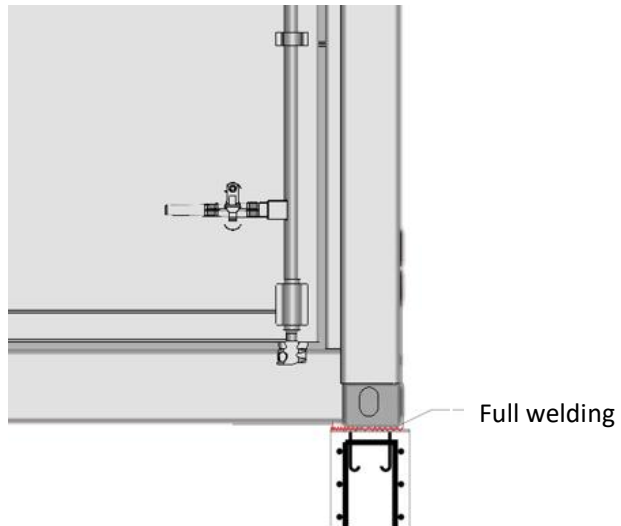


Figure 29 Full-weld diagram

Welding equipment must be fully welded to the embedded parts. Following welding completion, apply anti-corrosion treatment to the welded joints.

5. Electrical Connection

5.1. Precautions

DANGER

- High voltage! Electric shock!
- It is strictly forbidden to directly touch the live parts in the unprotected state!
- Before installation, make sure that both the AC and DC sides are not energized.
- Do not place the component on a flammable surface.
- Be sure to use specialized insulated tools during wiring. Electrical connection must only be performed by qualified personnel who wear personal protective equipment.
- Do not perform electrical connections in harsh weather conditions, such as thunder and lightning, rain, snow, and level 6 or stronger wind.

WARNING

To prevent operational impairment or damage to the electrical equipment within the battery container from sand and humidity, adhere to the following:

- Prohibit all electrical connection work during sandstorms or when the ambient relative humidity exceeds 95%.
- Execute electrical connections exclusively under fair, dry, and dust-free weather conditions.

WARNING

- Inspect the device for any damage prior to initiating electrical connections to prevent potential hazards.
- Adhere to all warning labels located on the product.
- Verify the correct polarity of all input cables before proceeding with wiring.
- During installation, avoid subjecting wires and cables to forceful pulling, which can degrade their insulation.
- Ensure adequate clearance is provided for all cable bends.

⚠ DANGER

- Implement appropriate support methods to minimize mechanical stress on all cables and wires.
- Upon completing a connection, confirm that it is both correct and securely fastened.

⚠ WARNING

When an external short circuit occurs in the Rack circuit, the fuse in the terminal box and the inter-cluster fuse must be replace.

5.2.Overview of Wiring

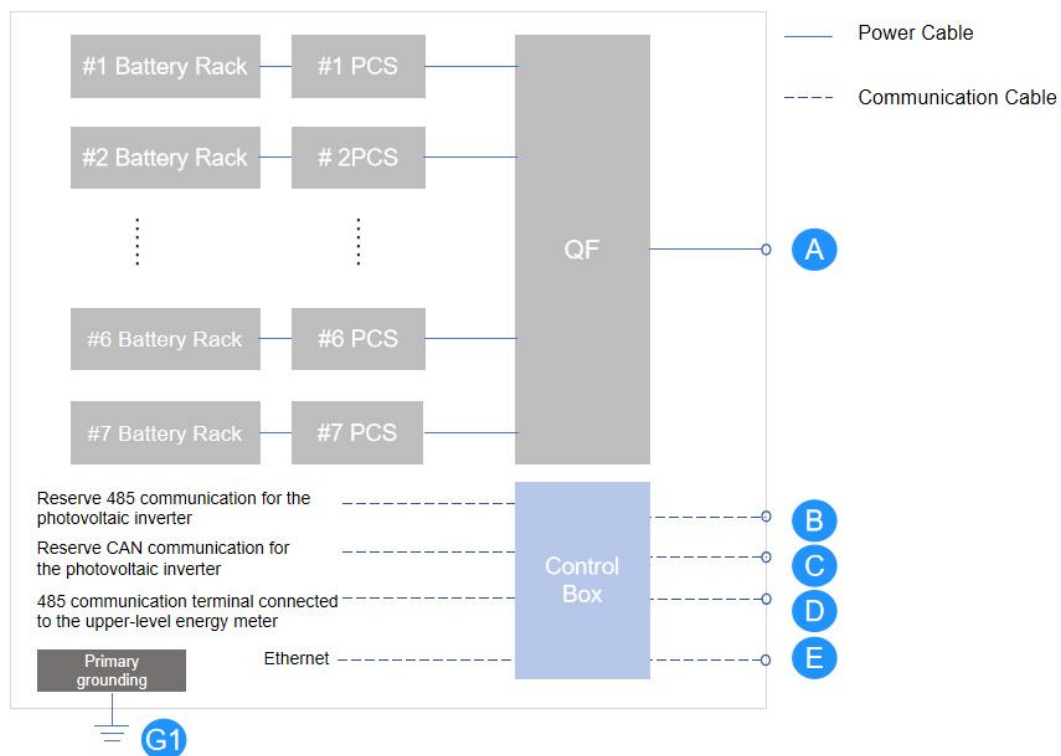


Figure 30 Overview of wiring

Table 28 Wiring interface description

Interface	Description	Recommended cable specifications	Remark
A	AC main circuit cable port	300 mm ² , 4 PC for each phase	Adopting dual hole wiring terminals, hole pitch 45 mm, hole size $\phi 16$
B	Communication port	2×1.5 mm ² Armored shielded twisted pair cable	Reserved for communicating with PV system, tube type wiring terminal

Interface	Description	Recommended cable specifications	Remark
C	Communication port	2×1.5 mm ² Armored shielded twisted pair cable	Reserved for communicating with PV system, tube type wiring terminal
D	Communication port	2×1.5 mm ² Armored shielded twisted pair cable	Reserved for communicating with upper meter, tube type wiring terminal
E	Ethernet communication port	CAT5e S/FTP	Communication between battery system and EMS
G1	Primary grounding cable port	100 mm ² Grounding flat steel per point	Located outside the container, two connection holes per point, hole size φ12

⚠ DANGER

- Ensure the product and the devices connected to the product are completely powered off, and verify that no voltage is present at the connection points using a measuring instrument before electrical connection.
- Ensure all switches remain in the open state before electrical connections are completed. Disconnect all external connections to the battery container and connections to the internal power supplies of the equipment. Besides, ensure the points of disconnection will not be re-connected to power by accidents.

⚠ WARNING

- All electrical connections must be carried out strictly in accordance with the wiring diagram.
- All electrical connections must be carried out when the equipment is completely uncharged.

⚠ WARNING

Electrical connections can only be performed by qualified electricians. Please comply with the requirements in “Safety Precautions” in the manual. Wolong shall not be held liable for any personal injury or property damage caused by ignoring these safety precautions.

⚠ CAUTION

- The installation of the battery container must be in accordance with the regulations or standards where the project is located.
- Failure to follow the installation requirements in this manual may result in faulty device or system, and the damage caused is not covered by the warranty.

- The cable specifications in the table are only applicable to copper cables.

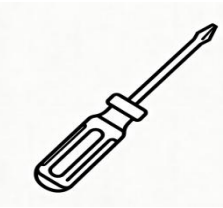
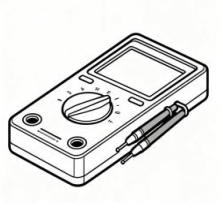


NOTE

- The cable specifications in the table are recommended cables for BESS standard configuration. If you have any special requirements, please inform our staff when placing an order. Please refer to the actual product purchased.

5.3.Preparation Before Wiring

5.3.1. Preparing Installation Tools

		
Goggles	Wire stripper	Screwdriver
		
Safety gloves	Torque screwdriver	Heat gun
		
Safety shoes	Torque wrench	Multimeter

5.3.2. Prepare Cables

DANGER

- Before electrical connection, please check and ensure that the cables are all intact and well-insulated. Poor insulation or cable damage may result in safety hazards. If necessary,

replace the cable immediately.

- When making cables, please be sure to operate in a safe area away from the equipment. Prevent cable debris from entering the interior of the equipment and posing a risk of short circuit and ignition.

The selected cables must meet the following requirements:

- Ensure the current-carrying capacity of all cables is adequate. Key determinants of this capacity include, yet are not limited to:
 - Ambient conditions
 - Conductor insulation type
 - Installation method
 - Cable's core material and cross-sectional area.
- Select cables with a sufficient conductor diameter to handle the maximum anticipated load, and ensure they are of adequate length.
- Provide ample bending radius for all cables and wires to prevent stress concentration.
- Avoid applying excessive tensile force to any wires during connection, as this can compromise the integrity of their insulation.
- All DC input cables must be identical in specification and material composition. Similarly, the three-phase AC output cables must be uniform in both specification and material.
- The exclusive use of flame-retardant certified cables is mandatory.
- Keep a sufficient distance between the cables and the heat-generating components, to prevent the cable insulation layer from aging or getting damaged due to high temperature.
- After completing each connection, check carefully to make sure that the connection is correct and secure. If the connection is insufficient or the contact surface oxidizes, it can also cause excessive heat, which may lead to fire and combustion.
- Adopt necessary auxiliary measures to reduce the stress applied to cables and wires.
- According to the actual environmental conditions for heat dissipation of the cables laid on-site, select cables with appropriate cross-sectional areas.
- Select communication cables equipped with corresponding shielding protection functions according to the requirements of WOLONG ESS.

- Secure the power cables and the communication cables separately. Ensure a minimum safety space between the lines of strong and weak electricity to avoid electromagnetic interference.
- Check that the connection between the wiring terminal and the copper bar is free of any trapped heat-shrink tubing. Any such material must be removed immediately to prevent potential poor contact or thermal damage.

NOTICE

The cables used should comply with the requirements of local laws and regulations.

- The cable color in figures is for reference only, please select cables according to local standards.

Crimp OT/DT terminals

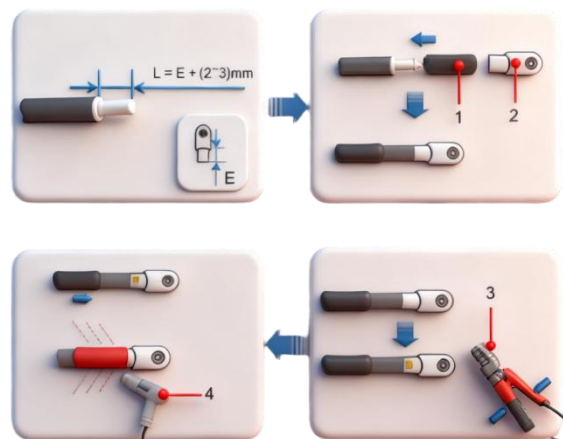


Figure 31 The diagram of crimp OT/DT terminals

Table 29 Crimp components description

No.	Description
1	Heat shrink tubing
2	OT/DT terminal
3	Hydraulic pliers
4	Heat gun

5.3.3. Copper Wire Connection

The connection sequence of wiring parts is shown in the follow figure.

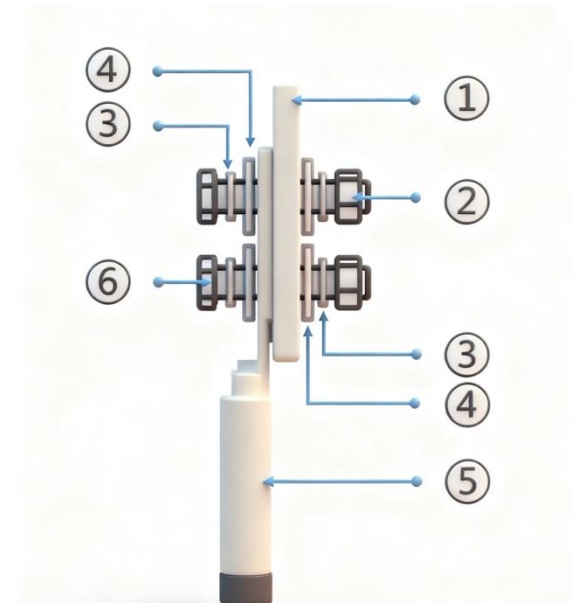


Figure 32 Copper cable terminal connection

Table 30 The copper wire connection components description

No.	Name	No.	Name
①	Copper bus bar	④	Flat washer
②	Nut	⑤	Copper connection terminal
③	Spring washer	⑥	Bolt

⚠ DANGER

- Fasteners on the product and terminals must be torqued to specification with calibrated tools and marked accordingly. Failure to do so can cause equipment damage (voiding the warranty) or create a poor connection that risks fire or combustion.
- When making electrical connections, avoid subjecting wires to any tension or pulling force, as this can compromise the integrity of the insulation.

📢 NOTICE

- Bolt fastening should be firm and reliable, and the exposed wire buckle should not be less than 2 buckles.
- Use screws of an appropriate length for wiring. The screw should protrude 2-3 threads (approximately 3mm) through the mounting hole in the copper bar. Using overly long screws may compromise insulation performance or even cause short circuits.

5.3.4. Cable Entry Design

The cables between the battery container and external equipment are routed from the bottom of the battery container. All cables must be properly protected, such as through conduit installation, to prevent rodents from damaging the cables. After the wiring is completed, the inlet and outlet holes should be tightly sealed with fireproof mud or other suitable materials. The cable inlet and outlet holes on bottom of the battery container are shown in the figure below.



Figure 33 The diagram of cable entry hole

Table 31 Cable entry description

No.	Description
A	Communication cable hole
B	Power cable hole

NOTICE

If you need to pre-bury the wire pipe in the inlet area during construction, please contact WOLONG for confirmation of the specific location.

NOTICE

After wiring is completed, be sure to use fireproof/waterproof materials such as fireproof mud to seal the gaps between the cables and the openings to prevent the entry of foreign objects or moisture, which may affect the normal operation of the product in the long term!

5.4. Ground Connection

The internal grounding of the battery container has been completed before delivery, and the external grounding of the battery container needs to be completed at the project site.

The battery container is grounded through external ground points. For the convenience of on-site cable connection, two grounding points have been designed outside the cabinet.

NOTICE

The battery container must be double grounded, with both grounding points reliably grounded.

The grounding method must strictly follow local standards and regulations.

NOTICE

- Before grounding, the surrounding area of the grounding point thread and the surface of the grounding point should be cleaned to a clean state to avoid affecting the grounding performance.
- After grounding, the entire grounding point area needs to be treated with anti-corrosion measures to prevent rusting of the grounding point.

There are two grounding methods: fixing by welding with grounding flat steel and fixing with grounding cable. For the location of the grounding point, please refer to “Container Appearance”.

Method A - Grounding Flat Steel

Welding hot-dip galvanized flat steel to the grounding point (flat steel to container lap area 50 mm × 80mm). After completion, apply anti-corrosion treatment to the exposed flat steel.

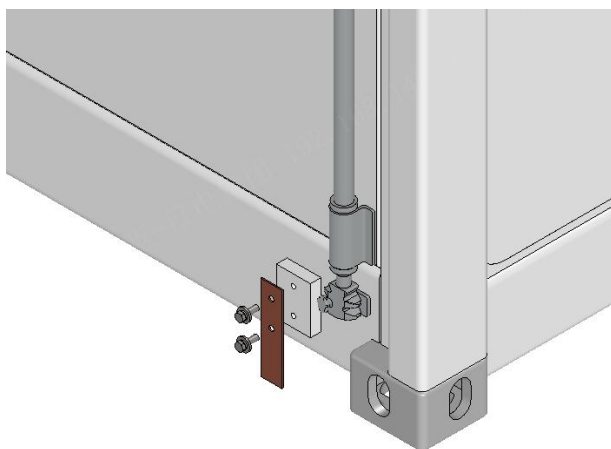


Figure 34 The diagram of grounding use grounding flat steel

Method B - Grounding Cable

It is recommended to use grounding cables of $70 \text{ mm}^2 \sim 95 \text{ mm}^2$ to ensure a reliable connection between the battery grounding point and the system grounding point.

NOTICE

The recommended size of the grounding cable is half the cross-sectional area of the phase conductor, and the grounding cable must be the same conductor as the phase conductor.

Please refer to section 5.3.3 for the specific steps of crimping DT terminals and cable preparation. Use grounding cables to reliably connect the external grounding point of the box to the system grounding point. After completion, use M12 bolts to tighten.

Crimp DT terminals, please refer to “5.3.2 Prepare Cables” for detailed steps. Use grounding cables to ensure a reliable connection between the container’s two grounding points and the system grounding points. When finished, tighten them with M12 bolts.

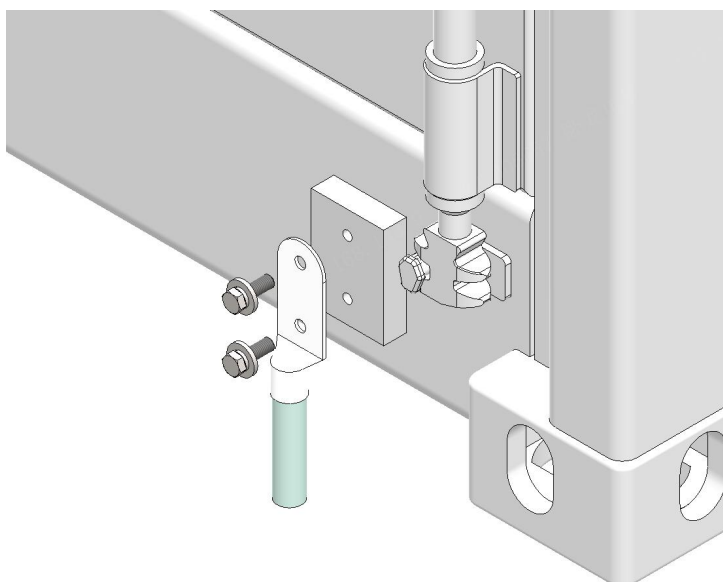


Figure 35 The diagram of grounding use grounding cable

WARNING

- Regardless of whether a grounding flat steel or grounding cable method is used, after completing the grounding connection, it is necessary to complete anti-corrosion protection to the bare metal layer in addition to the grounding fixed point.
- The shielding layer of the power cable should be properly grounded.
- The shielding layer of the communication cable should be properly grounded.
- The external grounding connection should be performed according to the actual on-site conditions and the instructions of the plant personnel.

- After completing the ground connection, the grounding resistance must be measured and shall be no more than 4Ω. The specific grounding resistance requirements must comply with the relevant national/local standards and regulations.
- Please contact the relevant staff if you have any questions when performing grounding connection. Failure to follow the installation instructions, or private installation or modification, may lead to safety accidents or equipment damage. WOLONG is not responsible for any damages caused by this.

5.5. AC Power Cable Connection

⚠ WARNING

Check the cable insulation according to the local regulations before connecting the DC input cables.

The main power AC circuit connection port location is shown in the figure below, connect from the Circuit Breaker Room of the battery container to the Power Distribution Room side of the user.

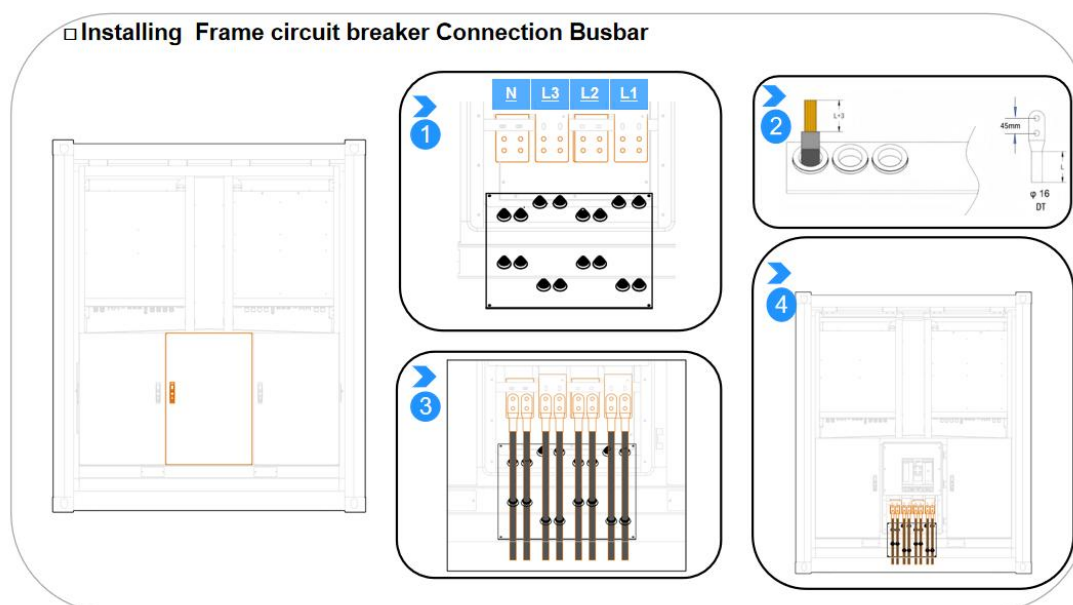


Figure 36 The figure of the main power DC circuit wiring location

Table 32 The main power DC circuit terminal description

Mark	Terminal location	Description	Recommended cable specification
L1	Circuit Breaker Room of the battery container	Connected to L1 port of the user's power distribution room	Each phase has 4 inputs, 300mm ² , DTG2-300, and bolt
L2	Circuit Breaker Room of the battery container	Connected to L2 port of the user's power distribution room	

Mark	Terminal location	Description	Recommended cable specification
L3	Circuit Breaker Room of the battery container	Connected to L3 port of the user's power distribution room	hole pitch 45 mm, hole size $\phi 16$
N	Circuit Breaker Room of the battery container	Connected to N port of the user's power distribution room	

NOTICE

Strictly follow the correct location to connect cables.

5.6. Control Room Communication Cable Connection

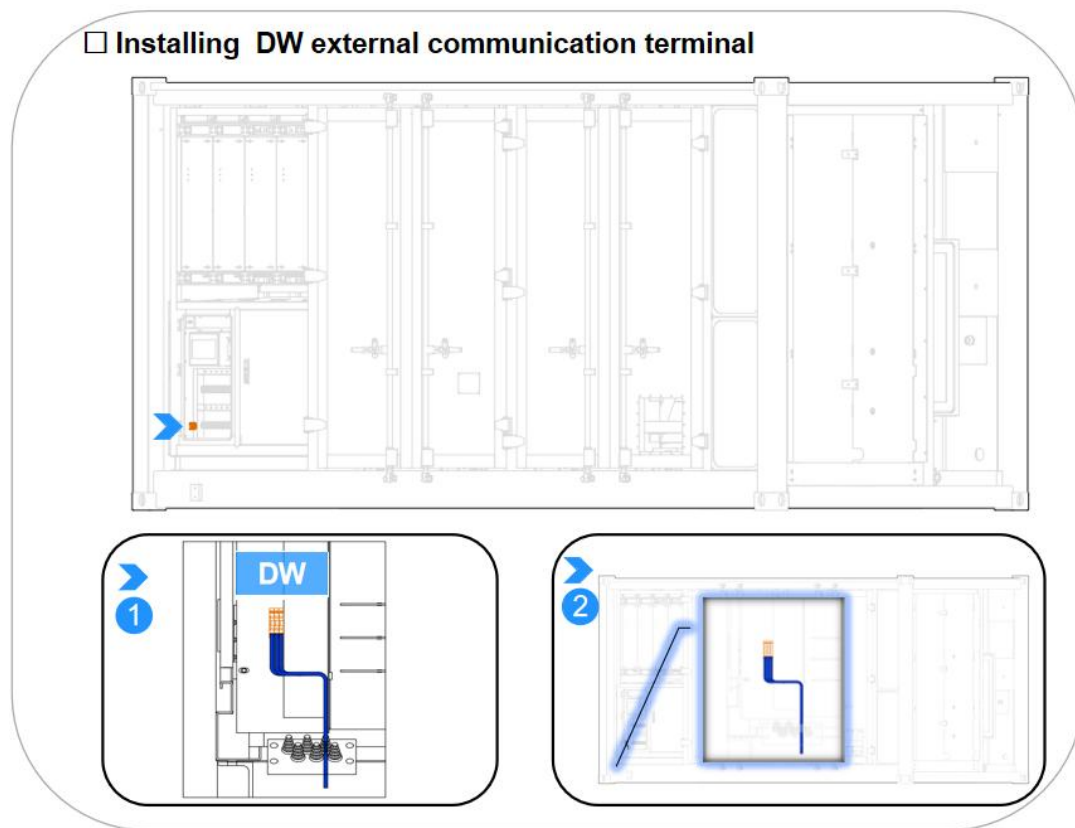


Figure 37 The diagram of the communication location terminal

Table 33 Communication cable connection description

Mark	Terminal location	Description	Recommended cable specification
DW-1/ DW-2	DW terminal inside the Control Room	Connected to PV inverter of the user by RS485	1.5 mm ² Armored shielded twisted pair cable, dual-core
DW-5/ DW-6	DW terminal inside the Control Room	Connected to PV inverter of the user by CAN	

Mark	Terminal location	Description	Recommended cable specification
DW-9/ DW-10	DW terminal inside the Control Room	Connected to meter of the user by RS485	

Connection Procedure

Step 1 Route the cable through the entry hole into the wiring compartment and mark the phase sequence.

Step 2 Use wire strippers to remove the cable sheath, exposing the copper core.

Step 3 After crimping the terminal, secure it to the terminal hole with a tightening torque of 1–2 N·m.

Step 4 Upon completing the connection, gently pull the cable to ensure sufficient slack remains.

■ End

5.7. Control Room Ethernet Communication Connection

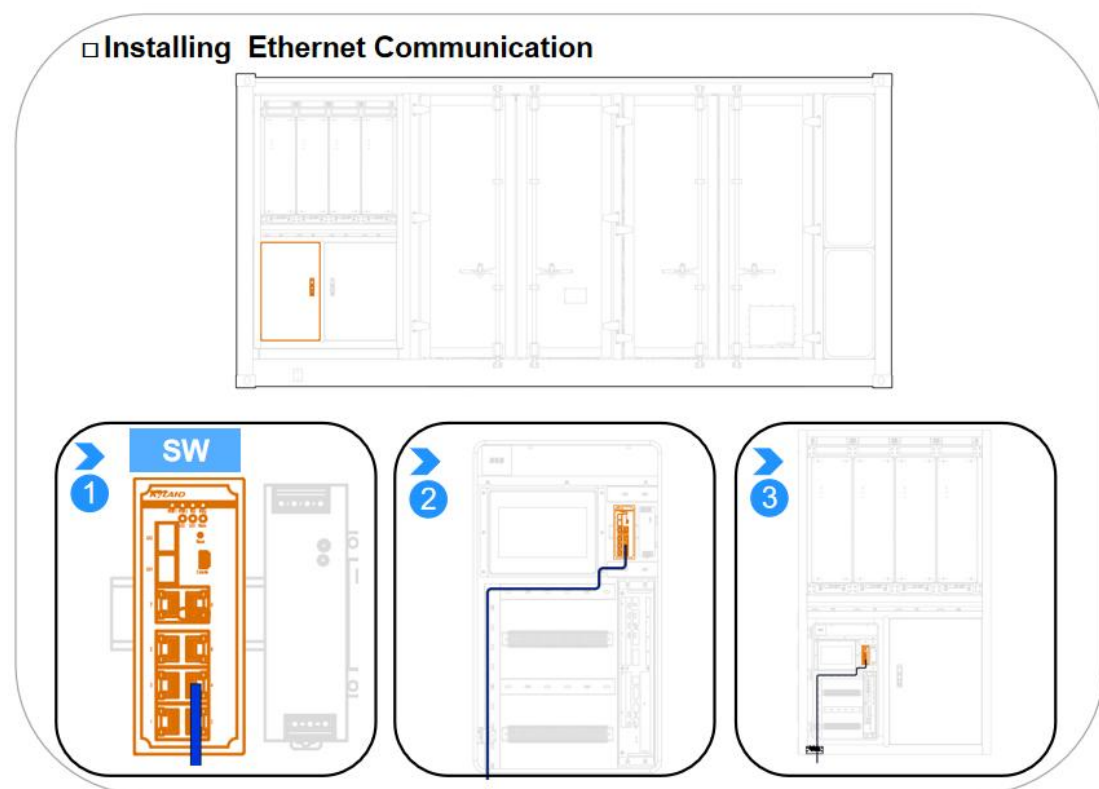


Figure 38 The diagram of the Ethernet communication connection

Table 34 Ethernet communication connection description

Mark	Terminal location	Description	Recommended cable specification
SW	Ethernet Switch inside the Control Room	Connected to the EMS system	CAT5e S/FTP

Connection Procedure

Step 1 Lead the CAT5e S/FTP cable into the battery container control box wiring area through the inlet hole.

Step 2 Connect the Ethernet port to external devices.

■ End

5.8. Post-wiring Operations

Check the wiring thoroughly and carefully when all electrical connections have been completed. In addition, perform the following operations:

- Check all air inlets and outlets for blockage.
- Check that all connections are correct after wiring, and be sure to use fireproof/waterproof materials such as fireproof mud to seal the gaps between the cables and the openings to prevent the entry of rodents or moisture, which may affect the normal operation of the product in the long term!
- Ensure the space between cable connectors in the wiring area meets the safety requirements.
- Put all protective covers back in place firmly.

WARNING

- Moisture may enter if the product is not properly sealed.
- Rodents may enter if the product is not properly sealed.



NOTE

After wiring is complete, the desiccant must not be removed before the power-up phase.

Locking Cabinet Doors

Step 1 Reinstall the protection cover of the wiring area in the reverse order of removal.

Step 2 Lock the cabinet door, pull out the key, and store it securely.

■ End

 NOTICE

- When closing the door, make sure that the seal around the container door does not curl.
- Inspect the cabinet door seals to ensure they are intact, preventing external dust and moisture from entering and affecting equipment operation.

6. Battery Connection

6.1. Precautions

To prevent personal injury, property damage, and to maximize the product's service life, it is essential to carefully read and adhere to all safety instructions provided in this manual during installation and operation.

Improper or incorrect use may result in:

- A threat to the life and personal safety of the operator or third parties;
- Damage to the energy storage system or other property of the operator or third party.



- The safety guidelines contained in this manual are not exhaustive and must be applied with consideration of actual site-specific conditions.
- WOLONG ESS cannot be held responsible for any losses resulting from the failure to adhere to these precautions.

WARNING

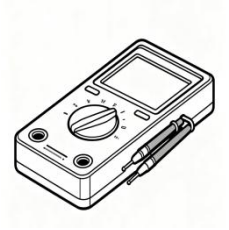
- When installing this high-voltage device, compliance with all applicable regulations and local safety codes is mandatory.
 - Please observe the regulations on the correct use of tools and personal protective equipment.
 - All connections require explicit and definitive guidance. Under no circumstances should any work be performed based on assumption or uncertainty.
 - Use only tools that feature a certified insulating protective coating.
-
- Connecting cables should meet the voltage and current requirements.
 - All connectors must be safe and reliable to avoid loosening or virtual contact. The connectors must be corrosion-resistant, wear-resistant and earthquake-resistance.
 - All connections must comply with the requirements of relevant national standards to prevent arc discharge in any form.
 - All internal battery connections must be fitted with anti-vibration and anti-loosening devices. Temperature, voltage, and current sensors require secure and reliable connections to prevent issues of loosening, aging, or physical crushing.
 - During the connection process, any type of short circuits should be prevented.

- It is forbidden that operators perform connection without wearing protective equipment.
- Key connections must be correct, reliable (without loosening) and in good contact, without short-circuits.
- All the finished connections must be measured and confirmed one by one.
- All connections must not be in contact with the casing or other components or short-circuited.
- If there are other uncertain factors, please contact the after-sales technicians of WOLONG ESS before any operation.

6.2. Cable Connection

Step 1 Wear insulating shoes and high-voltage gloves before connecting power cables.

Tool preparation

 Safety glasses	 Insulated shoes	 Screwdriver
 Insulated gloves	 Watches Galore	 Connecting cable

Step 2 Before connecting the power cables between battery packs, ensure that switch QF on the high voltage box is in the “OFF” position.

The figure of power cable connection between battery packs inside battery rack

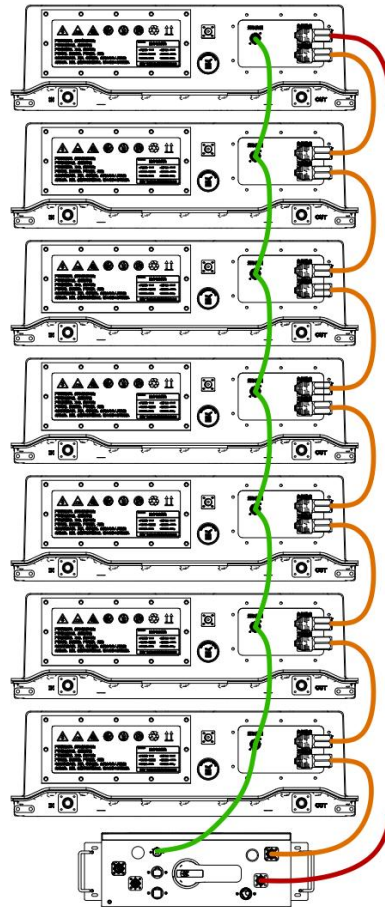


Figure 39 The diagram of battery pack connection

Step 3: Connect the power cables between packs. Taking Rack 1 # as an example, if the power cables between packs are already connected, skip this step.

- 1 Connect R1-1-BAT- to R1-2-BAT+ ;
- 2 Connect R1-2-BAT- to R1-3-BAT+ ;
- 3 Connect R1-3-BAT- to R1-4-BAT+ ;
- 4 Connect R1-4-BAT- to R1-5-BAT+ ;
- 5 Connect R1-5-BAT- to R1-6-BAT+ ;
- 6 Connect R1-6-BAT- to R1-7-BAT+ ;
- 7 Connect R1-1-BAT+ to high voltage box B+ ;
- 8 Connect R1-7-BAT- to high voltage box B- ;

■ End

Each battery rack power cable requires one cable to be connected on site, as shown in the figure.

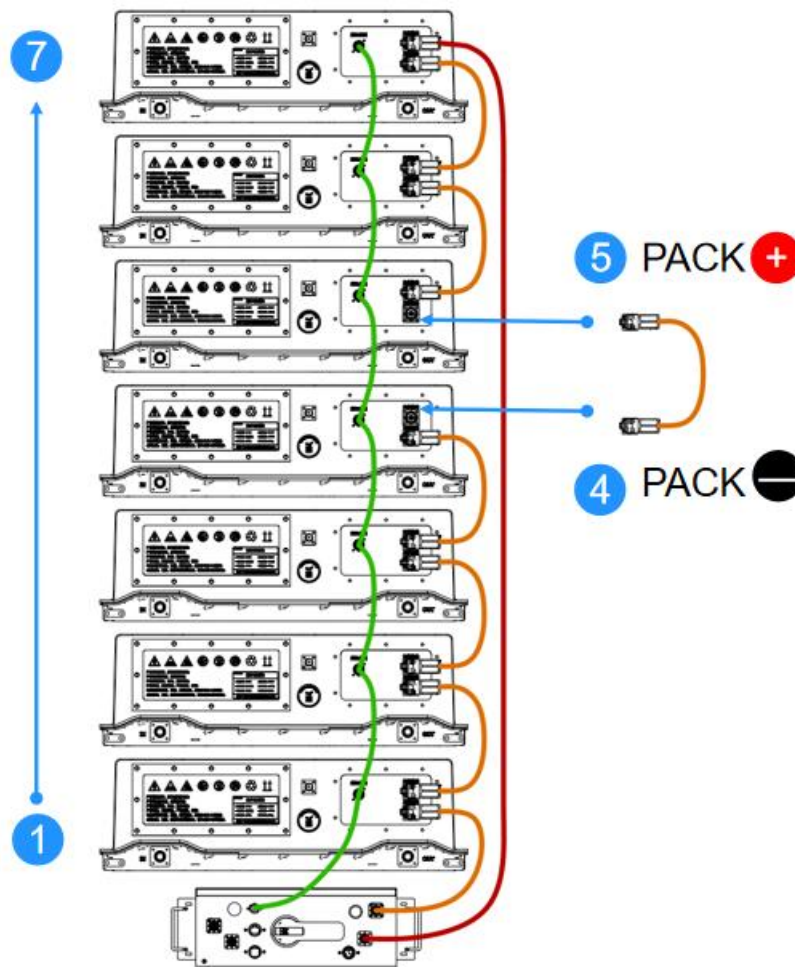


Figure 40 The diagram of battery pack connection

NOTE

- After the on-site construction and installation steps are completed and the system enters the debugging stage, the connecting cables of the 4th PACK negative terminal and the 5th PACK positive terminal in each battery rack need to be plugged and connected.

WARNING

- When the aviation plug is plugged tightly, it will make a “click” sound. Make sure the aviation plug is plugged in tightly.
- The positive pole of the aviation plug needs to be inserted into the positive base, and the negative pole needs to be inserted into the negative pole base. The positive pole is orange, and the negative pole is black. When the aviation plug is plugged tightly, it will make a “click” sound.

7. Powering up and Shutdown

7.1. Power-on Operation

WARNING

- The battery container can only be put into operation after confirmation by a professional and approved by the local power department.
- Following a downtime exceeding two months, a startup inspection must be performed on the battery container. Verify that the system communication is stable, the battery voltage is within the specified operating range, and all key components are fully functional.

7.1.1. Inspection Before Power-on

Check the following items carefully before powering up the equipment.

- Accidental contact with live terminals may result in fatal electric shock!
- Ensure that the AC switch of PCS is in the disconnected state.
- Access to the power grid must be approved by relevant departments and comply with all electrical safety regulations and directives.
- When connecting to the AC power grid, the user AC side circuit breaker or switch must be disconnected to ensure that there is no voltage at the contact terminals.
- The AC output inside the equipment is not grounded.

7.1.2. Powering on Steps

Step 1 Preparation

- Check all power/communication cable connection between the BESS and upper switch / EMS.
- Close the protection breaker switch QF1~QF7 in the Circuit Breaker Room.
- Close the switch **QF** of the #1-#7 high voltage box (Switch to the “ON” state).
- Ensure the container emergency stop button is in reset status.

Step 2 System power-on

- **Power on the AC main power circuit:** Close the AC circuit main breaker switch **QF0** in the Circuit Breaker Room
- **Power on the auxiliary power supply:** Close the main switch **QF9** of the auxiliary power supply system in the Power Distribution Room, then close the following switches in sequence:

QF10: Liquid Cooling Unit protection switch

QF11: Control room air conditioner protection switch

QF12: Secondary power supply protection switch for Control Room

QF13: Battery room air conditioner protection switch

QF14: Socket protection switch

- **Start up the UPS:** Close the protection switch **QF15** of the UPS, then press the power button of the UPS device to ensure that the UPS is put into normal operation.
- **Start up the Fire Suppression System:** Close the protection switch **QF16** of the Fire Suppression System, power on the Fire Suppression System.
- **Power on the battery system:** Close the protection switch **QF17** of the High Voltage Box, then press the “ON/OFF” button on the High Voltage Box #1-#7, complete battery system power up.

Step 3 Operation Mode Setting

Command Operation Path: Issue control commands such as power-on, power-off, charging, and discharging to the PCS via dedicated software on the touchscreen.

On-grid mode select: directly select "on-grid mode" (the default grid connected operation mode of the system).

Off-grid mode operation:

Prerequisite: Before selecting the off-grid mode, ensure that the system is disconnected from the power grid.

Follow the startup procedure described above.

Mode selection: Switch to “Off-Grid Mode” in the touchscreen software and confirm.

Startup and Regulation: After startup, discharge power will automatically adjust based on actual load size.

■ End

WARNING

If one circuit breaker trips during power-on process, suspend closing other circuit breakers and immediately check whether a short circuit occurs to downstream loads of the tripped circuit breaker.

7.2. Shutdown

7.2.1. Planned Powering off

Planned powering off status is the planned scheduled powering off of a facility due to the need for overhaul, testing, and maintenance.

Preparation for shut down: Control the software of the energy storage system to shut down the system and disconnect the Transformer Container from the power grid or disconnect the upper switch.

NOTICE

The emergency stop button is reserved for fault conditions or emergencies only. For all routine shutdowns, utilize the "Shutdown" command within the WEB system. In a genuine emergency, activate the emergency stop button directly to ensure an immediate halt of the equipment.

- **Step 1** - When the system needs to be shut down, click on the "Control Command Shutdown" command in the host computer software, and the corresponding BESS will complete the shutdown.
- **Step 2** - Open the breaker **QF16** of the Fire Suppression System, open the breaker **QF17** of the High Voltage Box.
- **Step 3** - Open the breaker **QF15** of the UPS, then press the stop button of the UPS device to ensure that the UPS is turned off.
- **Step 4** - Auxiliary Power Supply system power off, open the following breaker in sequence:
 - QF10: Liquid Cooling Unit protection switch
 - QF11: Control room air conditioner protection switch
 - QF12: Secondary power supply protection switch for Control Room
 - QF13: Battery room air conditioner protection switch
 - QF14: Socket protection switchClose the main switch **QF9** of the Auxiliary Power Supply system.
- **Step 5** - Open the AC main circuit breaker **QF0**.
- **Step 6** - Open the upper circuit breaker on the user side.

I End

 DANGER

- After the battery container is powered off, the batteries still carry voltage and some components will still be hot, do not touch its internal components!

7.2.2. Unplanned (Emergency) Shutdown

- Fire incident:

Contact local fire department professionals.

- Unplanned outage (shutdown due to faults):

Please contact WOLONG ESS.

8. Troubleshooting

8.1.Overview

The common faults and troubleshooting refer to “Verification Methods”. If problems cannot be resolved according to this manual, please contact WOLONG ESS. The following information is needed in order to provide you the best assistance:

- The SN, the manufacture date, and the software version of the equipment.
- The model and configuration of the equipment.
- Brief fault description
- Pictures of the fault site, if allowed.

DANGER

- The grounding cable must be grounded well, otherwise, fatal electric shock may occur to the operators!

8.2. Verification Methods

Common faults

➤ An alarm without a level indicates that when an alarm occurs, some devices are already damaged or have lost their functionality, and there is no need for an alarm level to distinguish the severity.

Table 35 Fault description and solution

No.	Fault Description	Reason	Solution
1	The system is not working	1. The working voltage is abnormal.	1. Confirm whether the working voltage is within the normal voltage range 2. No power supply 3.Maintenance by professional technicians
2	BAMS screen displays fault information	1. Overcharge, overdischarge or undervoltage 2. Overtemperature 3. Communication interrupted	1. Check the parameter settings of battery protection 2. Disconnect the charger or stop battery power supply 3. Check the communication interface
3	Communication fault between BAMS and BCMU is displayed on BAMS screen	1. BCMU is not working 2. BMU address error 3. Communication lines connection abnormally	1. Check if the 24V power supply of BCMU is normal 2. Check if the BAMS communication interface and BCMU CAN0 terminal are loose or detached

No.	Fault Description	Reason	Solution
4	Communication fault between BMU and BCMU	1.BMU is not working 2.BMU address error 3.The communication line is not connected properly 4.BMU terminal resistance not applied	1. Check if the 24V power supply of BCMU is normal 2. Check if the communication interface of BMU and the CAN1 terminal of BCMU are loose or detached 3. Use a multimeter to measure whether the resistance between communication lines L and H is around 30-120 Ω
5	The screen display voltage is zero (multiple battery cells or continuous 2 battery cells)	The voltage cable is not properly connected	Check whether the voltage test harness is properly connected
6	Partial battery cell voltage display abnormality	The voltage acquisition line is not connected correctly	Check and reconnect the voltage acquisition line
7	The current is shown as positive during discharge and as negative during charge	Current sensor acquisition line connection error	Reconnect the current sensor acquisition line as required
8	No current display	The current sensor acquisition line is not connected correctly	Check and reconnect the current acquisition line
9	During dynamic operation, the current display is inaccurate	The current sensor parameter do not match	Check whether the parameters of the current sensor on the BAMS display are configured correctly
10	BAMS display is not working	BAMS display power supply port has no supply voltage	1 Check if the cabinet is powered 2 Check whether the power supply line between the DC24V switch power supply and the BAMS display is connected correctly

➤ The alarm classification is as follows:

➤ There are three levels of alarms, namely Level 1 alarm, Level 2 alarm, and Level 3 alarm, used to distinguish the severity of the alarm. Level 1 alarm (low severity), Level 2 alarm (moderate severity), and Level 3 alarm (high severity).

Table 36 BA alarm status and troubleshooting advice

No.	BA Alarm Status	BMS Status	Reason	Troubleshooting advice
1	Charging Current Upper Limit Alarm	Standby	The actual charging current exceeds the set range value	Current overcurrent, stop running to eliminate the fault
2	Discharging Current Upper Limit Alarm	Standby	The actual discharging current exceeds the set range value	Current overcurrent, stop running to eliminate the fault

No.	BA Alarm Status	BMS Status	Reason	Troubleshooting advice
3	Charging Temperature Upper Limit Alarm	Charging prohibited	The actual temperature exceeds the set range value	Lowering the temperature to within the range value can eliminate the fault
4	Discharging Temperature Upper Limit Alarm	Discharging prohibited	The actual discharging temperature exceeds the set range value	Lowering the temperature to within the range value can eliminate the fault
5	Communication fault between BMU and BCMU	Fault	Poor or disconnected communication cable contact (battery voltage of at least 12 cells is---); BCMU device malfunction; power or communication cable disconnected	Connect the communication cable; replace the device; restart the device
6	Group Voltage Upper Limit Protection	Fault	The actual group voltage exceeds the set range value	After shutdown, the voltage drops back to within the range and can be restored
7	Group Voltage Lower Limit Protection	Fault	The actual group voltage is below the set range value	After shutdown, the voltage drops back to within the range and can be restored
8	Cell Voltage Upper Limit Protection	Fault	The actual voltage exceeds the set range value	After shutdown, the voltage drops back to within the range and can be restored
9	Cell Voltage Lower Limit Protection	Fault	The actual voltage is below the set range value	After shutdown, the voltage drops back to within the range and can be restored
10	Charging Current Upper Limit Protection	Fault	The actual current exceeds the set range value	Current overcurrent, stop running to eliminate the fault
11	Discharging Current Upper Limit Protection	Fault	The actual current exceeds the set range value	Current overcurrent, stop running to eliminate the fault
12	Charging Temperature Upper Limit Protection	Fault	The actual temperature exceeds the set range value	Reduce the temperature to within the range value or increase the temperature range value
13	Discharging Temperature Upper Limit Protection	Fault	The actual temperature exceeds the set range value	Reduce the temperature to within the range value or increase the temperature range value
14	Environmental Temperature Upper Limit Protection	Fault	The actual environmental temperature exceeds the set range value	Reduce the temperature to within the range value or increase the temperature range value
15	Communication fault between BCMU and BAMS	Fault	BCMU equipment malfunction (operational indicator light not illuminated); power supply cable or communication cable disconnected;	Replace the equipment; reconnect the power supply or communication cable; it may recover automatically.
16	Contactor (normally closed) disconnected	Fault	There is a protective alarm generated; Poor or damaged contact of the contactor feedback line; The contactor is damaged;	Eliminating protection alarms and restoring alarms; After replacing the contactor, it can be restored;

No.	BA Alarm Status	BMS Status	Reason	Troubleshooting advice
17	No signal in the background; BAMS network port light is off	/	The BAMS network port light is off; the network cable is loose.	Unplug and re-plug the network port

9. Routine Maintenance

Please refer to the operation and maintenance manual for specific routine maintenance content.

10. Appendix

10.1. Abbreviations

Table 37 Abbreviations

Full Name	Abbreviation
Battery Energy Storage System	BESS
Energy Storage System	ESS
Energy Management System	EMS
Power Conversion System	PCS
Liquid Cooling System	LCS
Battery Module	PACK
Battery Rack	RACK
Battery Management Unit	BMU
Battery Cluster Management Unit	BCMUE
Battery System Management Unit	BSMU
Battery Management System	BMS

10.2.Tightening Torques

Table 38 Tightening torques

Bolt(Male Component of nut and bolt)	Torque(N-m)	Bolt(Male component of nut and bolt)	Torque(N-m)
M3 Series	1.2	M8 Series	22~30
M4 Series	3	M10 Series	45~59

Bolt(Male Component of nut and bolt)	Torque(N-m)	Bolt(Male component of nut and bolt)	Torque(N-m)
M5 Series	5.9	M12 Series	78~104
M6 Series	9~12	M16 Series	119~140

- The specified torque values in the table are applicable to bolt and nut assemblies only, and are not valid for riveted fasteners. Appropriate torque for such cases must be determined based on actual conditions.
- Cables must be properly anchored at a suitable point to minimize mechanical stress on the cable lugs.

10.3.Quality Assurance

During the warranty period, any product faults will be addressed by WOLONG ESS through free repair or replacement with a new unit.

Evidence

The validation of the quality guarantee during the warranty period is contingent upon the customer presenting the original purchase invoice with a clear purchase date. Furthermore, the product's trademark must remain intact and fully legible. Failure to meet these conditions grants WOLONG ESS the right to refuse the guarantee claim.

Conditions

- The customer shall give WOLONG ESS a reasonable period to repair the faulty components.
- After replacement, unqualified products shall be processed by WOLONG ESS.

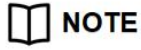
Exclusion of Liability

Warranty is void under the following circumstances:

- Expiration of the free warranty for the machine or any part.
- Damage sustained in transit.
- Incorrect installation, refitting, or misuse of the device.
- Operation in environments harsher than those specified in this manual.
- Faults caused by installation, repair, modification, or disassembly by a third party not affiliated with WOLONG ESS.
- Failures resulting from the application of non-standard or non-genuine WOLONG ESS components or software.
- Installation or use outside the boundaries set by applicable international standards.

- Damage arising from unavoidable natural events.

For products deemed faulty under the aforementioned conditions, any maintenance requested by the customer is subject to a charge, as determined by WOLONG ESS.



Product data such as product dimensions are subject to change without prior notice. The latest documentation from WOLONG ESS should take precedence in case of any deviation.

10.4.Contact Information

In case of questions about this product, please contact WOLONG ESS. The following information is needed in order to provide you the best assistance:

- Device model
- Device serial number
- Fault code/name
- Brief description of the fault