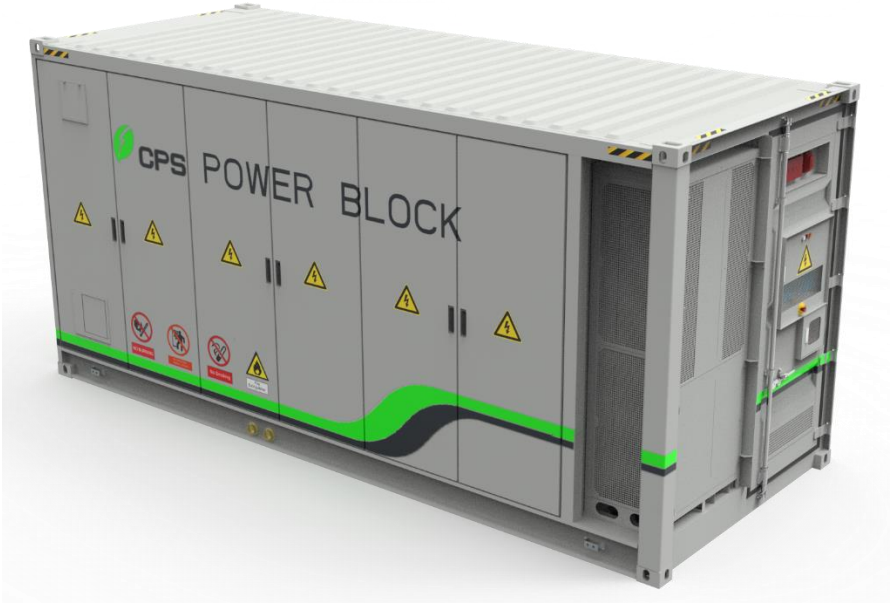
Power Block 2.0 Series CPS ES-5015KWH-US-M Liquid Cooling Battery Energy Storage System Installation Manual



Shanghai Chint Power Systems Co., Ltd.

Version 1.2 Jan 2024

Contents

1 Foreword

This Installation Manual is applicable to the Power Block 2.0 Series CPS ES-5015KWH-US-M Liquid Cooling Battery Energy Storage System (BESS) developed and produced by Shanghai Chint Power Systems Co., Ltd.

Main content

- This Manual includes instructions on how to operate BESS, such as how to install and debug BESS. Therefore, please read this Manual carefully before using this system and operate this system according to the method described in this Manual, to avoid equipment damage or personal injury.

Target readers

- This Manual is only applicable to authorized and qualified installation engineers or authorized operators.

Copyright restriction

- The contents of the Manual and the pictures and identifications used in the Manual belong to Shanghai Chint Power Systems Co., Ltd., and part or all of the contents shall not be reproduced publicly without written authorization.

Version upgrade

- Due to the update and improvement of products, the contents of the Manual will be updated, adjusted and revised accordingly, and the products purchased by users shall be subject to the physical objects. You can get the latest version of the Manual through the corresponding sales channels, or you can download the latest version of the Product User Manual from our official website www.chintpowersystems.com.

Important information!

- Please keep this Manual where you can get it, so that you can use it in case of emergency.
- Please read this Manual carefully and make sure that you fully understand all contents before performing any operation.

2 Safety Information Instruction

Obeying the following warnings, safety instructions and precautions can ensure safety, prolong the service life of products and prevent property losses.

The location of the system should be solved by effective equipment operation, design, specification and installation, so as to minimize the electrical hazard of personnel contact.

All electrical work shall be completed by qualified service personnel with appropriate training and authorization in accordance with the latest local electrical, building, fire protection and other codes, standards, regulations or public utility requirements applicable to installation, as well as relevant instructions and appropriate practices. If the installation is not carried out according to the safety instructions in this Manual, resulting in personal injury or equipment damage, the Company has the right not to assume responsibility and provide quality assurance.

The following precautions provide general safety guidelines when using or closing to BESS. The complete safety parameters and procedures are unique to each project and should be formulated by the customer or the final user according to the actual situation of the project.

Only authorized and fully trained electrical operators can operate the system. A clear, permanent and restricted access area should be set up around the system. According to the actual project location, local laws and applicable rules and regulations should be consulted to determine the requirements of the permit. If necessary, the housing should be properly marked before work.

2.1 Relevant warnings in this Manual

Please pay attention to several safety warning messages before reading the Manual, which are very important. Being familiar with them can make you safer in installation and operation.

Qualified operators:

- The operator must be fully familiar with all warnings and installation procedures described in the Installation Manual.
- Only qualified personnel who hold valid electrical knowledge certificates, meet specification requirements and safety standards, and have rich experience in various types of work can work on circuits and equipment.
- Only qualified personnel familiar with the battery and safety precautions can install and operate the battery. Do not let unauthorized personnel touch the battery.

Electrical safety operation:

- All live electrical work requires a live work permit. A qualified operator should release all stored electric power and verify that the equipment has been powered off and the proper locking/marking procedures have been carried out before starting electrical work.
- When working near the electrified overhead power cable, the boom, mast, crane and other equipment or their loads are never allowed to be within the evaluation distance limit from the power cable.
- Field electrical devices, even if considered temporary, must be planned and manufactured in an appropriate way, and materials and industrial electrical components must be used to ensure the normal operation of the equipment and the integrity of work.

Safe handling of batteries:

Please note that the battery has the risk of electric shock, including HV short-circuit current. Please observe all safety precautions as follows when operating the battery:

1) Do not smoke or use fire near the battery!
2) Do not use organic solvents to clean the battery!
3) Do not put the battery into the fire, or it may explode!
4) Do not disassemble the battery, which contains electrolyte harmful to skin and

eyes!

5) Do not place tools or any metal parts on the top of the battery!
6) Take off watches, rings and other metal accessories!
7) Use tools with insulated handles to avoid accidental short circuit!
8) Before connecting or disconnecting the terminal, please disconnect the charging power supply and load!
9) Use proper lifting methods when handling batteries, and wear all appropriate safety clothes and equipment!
10) Stay away from heat sources or any places that may generate sparks (such as circuit breakers and fuse boxes) for 0.5m!
11) Avoid the risk of local overheating, such as direct sunlight on the battery rack!
12) Batteries must be handled, transported, recycled or discarded in accordance with federal, state and local regulations!

Precautions for installation:

1) Before installation, all personal protective equipment (PPE) required to supervise the installation process shall be in place, as shown in Schedule 2.
2) Before installation, the installation personnel shall receive safety training and fill in the Safety Installation Training Record Form, as shown in Schedule 1.
3) Unless proper power-off measures are taken, all power cables are considered to be electrified.
4) Before installation, please cut off the power supply of the power grid and ensure that the battery is turned off.
5) All battery racks must be grounded with good conductors to form a good grounding network.
6) The fixing screws at the battery pole and the power interface of BMS (Battery Management System) battery protection unit are M8 external hexagon screws, and the tightening torque ranges from 19 to 24 N.m, which should be fixed with a torque wrench.
7) Before the electrical performance test, check whether the cable bolts and bronze bolts are loose. If loose, tighten them with a special tool.

2.2 Warnings on personnel and equipment

Symbol	Meaning
	**Warning - Electric shock hazard!** Do not touch the system connectors or terminals. Do not open the closed door unless proper locking/tag procedures and related training are carried out in accordance with local laws and regulations.
	**Warning - Arc flash hazard!** All electrical equipment has the risk of arc flash. Any equipment modification (such as opening the door) has serious risk of arc flash. Arc flash accidents can cause serious injuries. Therefore, appropriate training is required according to local regulations.
	**Warning - Fire hazard!** Fire may occur under certain fault conditions.
	**Attention - Sharp objects!** There are many sharp objects in most system components. Please note that it is easy to trigger the risk of serious injury when working around the equipment housing.
	**Attention - Electrostatic sensitivity!** Electrostatic discharge can damage electronic equipment. Therefore, correct handling procedures are necessary. Please wear an antistatic wrist strap grounded, and prevent electrostatic discharge when touching the grounded surface near the equipment.
	**Dangerous voltage!** BESS supports multiple power supplies. Even if the equipment is not running, there may be dangerous voltage. Please make sure that you fully understand the precautions and warnings in this Installation Manual. Failure to do so may lead to serious injury or death. Please follow all safety procedures issued by manufacturers.

2.3 Safety requirements for the Owner

The Owner must follow the following requirements:

1) The personnel operating the energy storage system must be trained and qualified electrical workers, otherwise they cannot operate the energy storage system. Improper or wrong operation may cause serious injury to the operator;
2) The personnel operating the energy storage system should be fully familiar with the working principle of the energy storage system;
3) The personnel operating the energy storage system should be fully familiar with this Manual;
4) The personnel operating the energy storage system should be fully familiar with the local electrical regulations and standards;
5) Regularly check the safety equipment in the system to ensure that the safety equipment is reliable;
6) Any warning signs damaged or illegible on the equipment shall be replaced immediately;
7) No inflammable and explosive articles are stored in or near the container;
8) The ground for storing energy storage system products must be solid and reliable;
9) Transportation, installation and debugging can only be carried out by professional personnel recognized by the manufacturer;
10) Before operating the energy storage system, evaluate the events that may lead to system danger and handle these events;
11) This Manual describes the safety instructions in details. Working personnel shall read it carefully for full understanding.
12) The software, housing and internal components of the equipment cannot be changed without the approval of the manufacturer; if they are changed without authorization, the quality assurance of energy storage system is invalid;
13) The sealing strip on the equipment shall not be damaged. If it is damaged, the quality assurance of the equipment will be invalid.

2.4 Locking/marking guidance

2.4.1 Hazard

Please always follow all applicable locking/marking procedures. Failure to follow the correct locking/marking procedure may result in serious injury or death.

When power is applied to battery energy storage system (BESS), dangerous voltage exists on some components. To prevent accidental death or injury, please don't touch any components in the housing unless there are special instructions. To reduce the risk of electric shock, please ensure that all equipment is reliably grounded. For more information, please refer to 3.1 battery system grounding.

2.4.2 Warning

The door of the container system must be kept closed unless it is necessary to enter the container. If possible, personnel should keep a safe distance from the housing when the equipment is powered on. Please always follow local/state and national locking/marking guidelines when working near BESS. Please lock out/mark out requirements that the procedure must meet or exceed.

Please follow all the guidelines put forward in the Chint safety document. Please complete the following regulations before entering the potentially dangerous area or operating BESS:

- Identify and wear protective clothing and shoes.
- Identify and isolate all power sources and stored energy sources.
- Use appropriate locking/marking equipment. When locking/marking BESS, don't touch anything in the container unless there are clear instructions in the working procedure.
- Complete site-specific locking/marking procedures and safety checklist before work.

2.4.3 General warning

- When powered on, this system has potential danger of electric shock, death and burn. Only authorized personnel who are fully familiar with the equipment and fully trained can install, operate or maintain the equipment.

- To avoid death, personal injury or product damage, please follow all safety procedures specified in EHS guidelines, and identify and isolate all power sources and stored energy sources.
- To minimize the risk of electric shock, death and burns, the approved grounding practices and procedures should be strictly observed.
- To avoid personal injury and equipment damage, aerial work personnel must abide by aerial work site regulations.
- To avoid personal injury or equipment damage caused by equipment failure, only properly trained personnel can modify any programmable machine.
- Please always ensure proper compliance with applicable standards and regulations.
- Certified equipment is used as a key component of the security system. Never assume that a safety-critical control loop is working properly.

Please pay attention to warning signs inside and outside BESS container.

Warning signs inside container

Read Manual carefully

Warning

Electric shock hazard

Recycle

Warning signs outside container

Protective earthing

Emergency shutdown

Fire Extinguisher

Warning Electricity

General Warning Sign

No Smoking

Accumulator Battery Room

3 System introductions

3.1 System scope of supply

- Cell, PACK, battery cluster, cabinet, connecting power cable, communication cable, power supply equipment, communication equipment, protection equipment and accessories, so as to complete the installation and internal connection of the system.
- All battery management system (BMS) modules and rack-level and system-level BMS cables and equipment.
- Packaging, supply, transportation to the site, transportation insurance, import duties and taxes (if applicable) and unloading at the place specified in the Agreement.
- Debugging and site acceptance test on all items within the scope of supply.
- Please refer to document list for all documents
- Certifications required for all equipment within the scope of supply.

3.1.1 System notes

This energy storage system consists of multiple energy storage components, each of which includes thermal management system, fire protection system, power distribution system, battery management system and the most important battery. Detailed system notes are shown in Fig. 3-1 below:

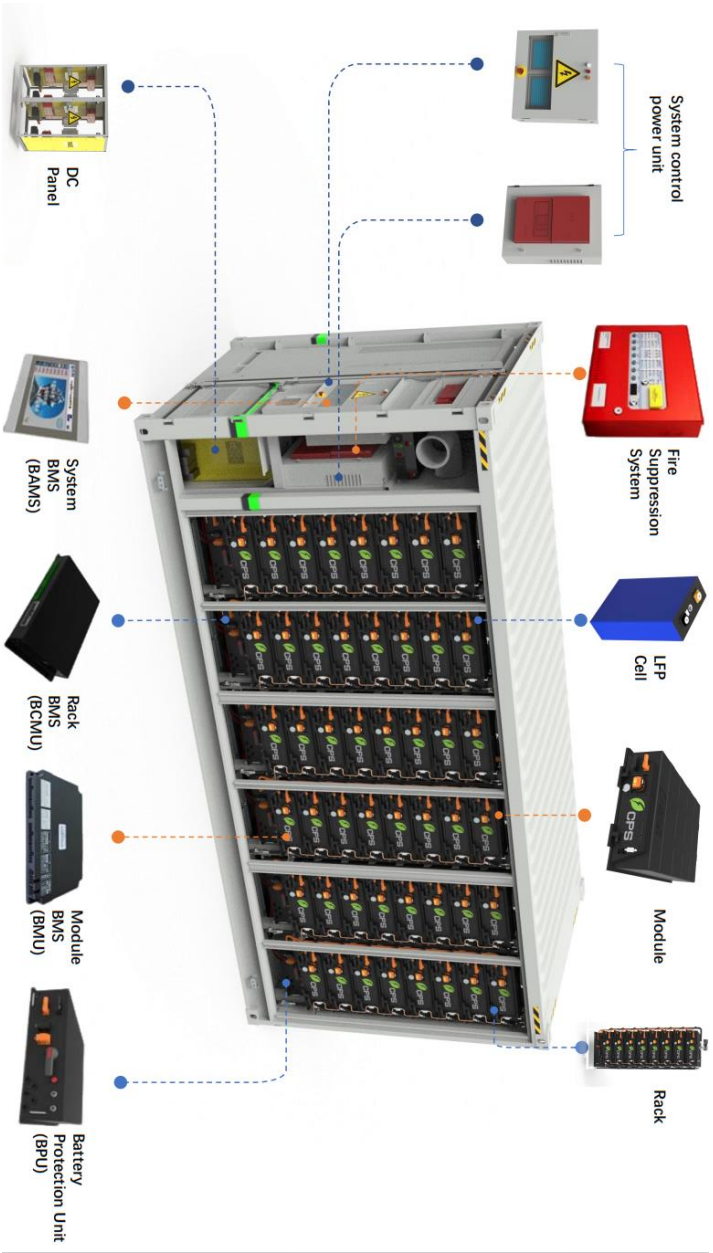


Fig. 3-1 Notes of System Components

3.1.2 Detailed system parameters

The technical parameters of this energy storage system are based on the test results of standard battery clusters at room temperature (25±2)℃ and humidity (55±20)%. See Table 3-1 for detailed parameters:

Table 3-1 Battery System Detailed Specifications

Item	Parameter	Condition
Cell capacity	314Ah	Standard charge and discharge CHG/DCHG rate. 0.5C
Serial/parallel mode	12P416S	N.A.
Nominal voltage	1331.2V	N.A.
Nominal capacity	5015.96kWh	Standard discharge
Overall dimension (L*W*H)	238.5 *114.0 * 96.0 (in) /6058 * 2896 * 2438 (mm)	See drawings for details
Weight	< 45T	Full load
Discharge cut-off voltage	1164.8V or any battery cell in the battery cluster reaches 2.8V	N.A.
Charge cut-off voltage	1497.6V or any battery cell in the battery cluster reaches 3.6V	N.A.
Rated charge /discharge current	157A	(25±2)℃
Communication mode	CAN, RS485, TCP/IP	N.A.
Operating temperature range	-25~50℃	N.A.
Storage temperature range	-30~60℃	N.A.
Service life of the product guaranteed under the operating condition	(25±5)℃	N.A.

Item	Parameter	Condition
System thermal management mode	Liquid cooling	N.A.
Fire protection system	FM200	It can be replaced with other gas extinguishing chemicals according to customer's requirements and optional equipped with water spraying system.
IP rating	IP54	N.A.
Noise	80dB	A distance of 1 m, 1.7 m high, 35°C

3.1.3 System communication architecture diagram

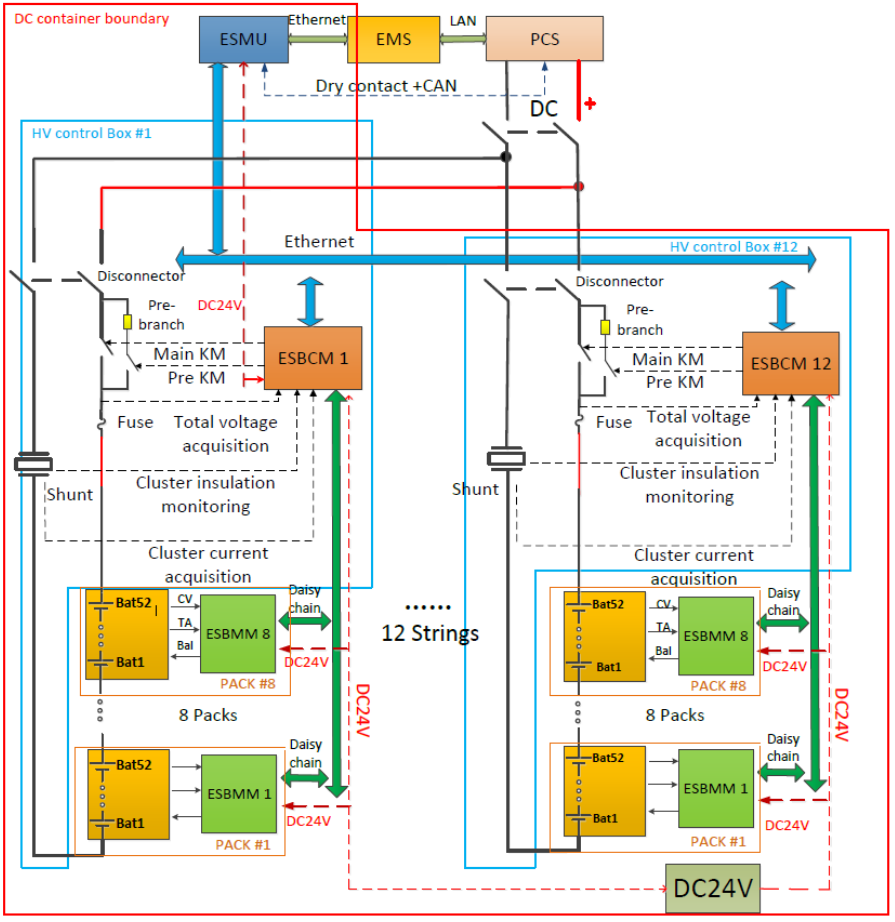


Fig. 3-2 System Communication Architecture

3.1.4 Electrical architecture diagram

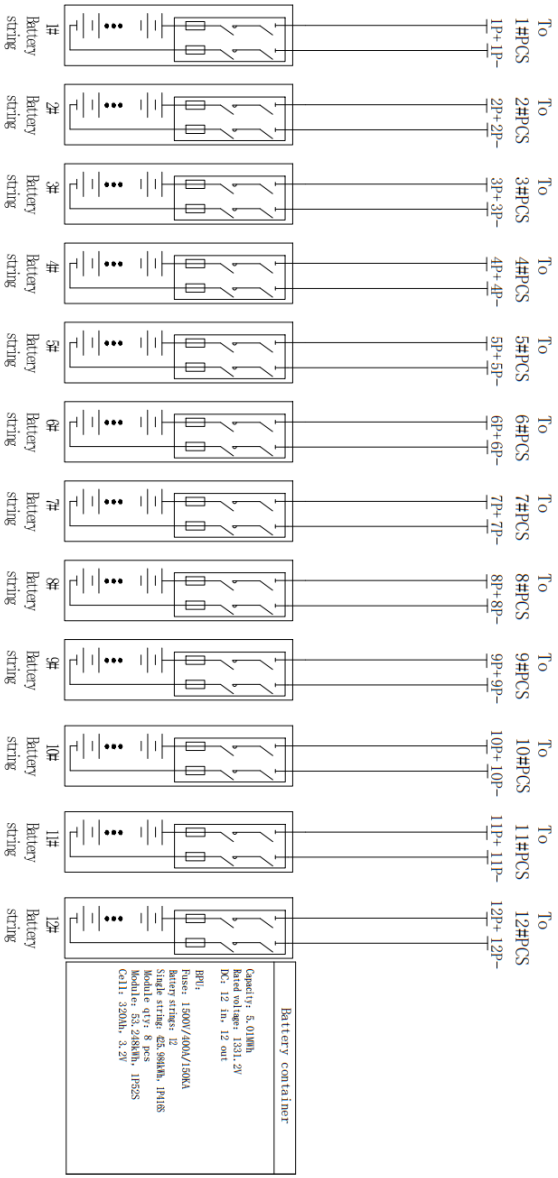


Fig. 3-3 System Electrical Architecture

3.1.5 Arrangement of system equipment

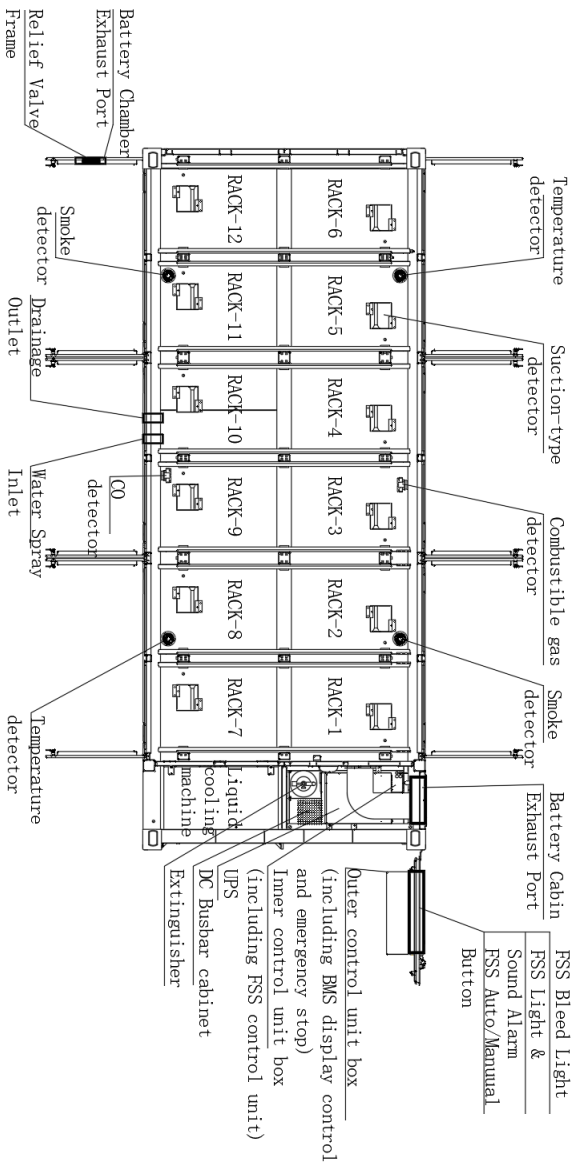
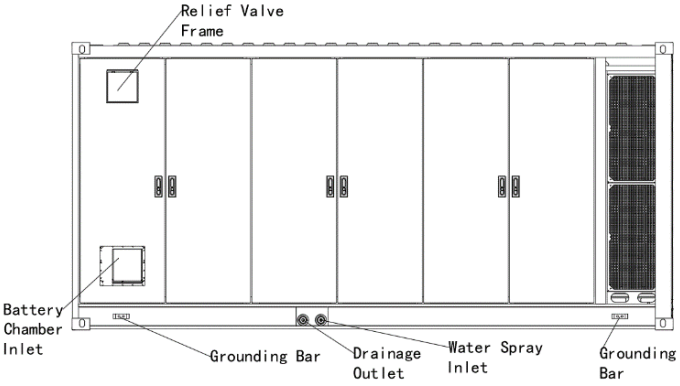
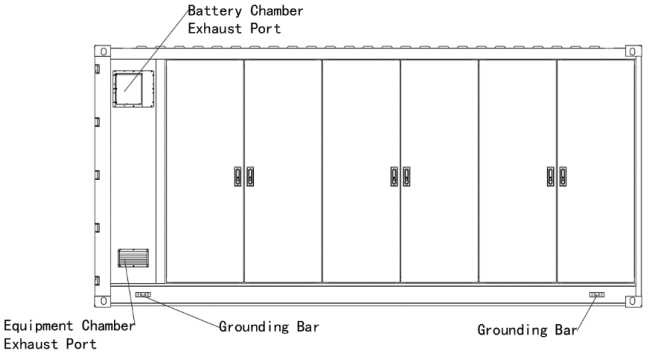


Fig. 3-4 Equipment Arrangement in Energy Storage System

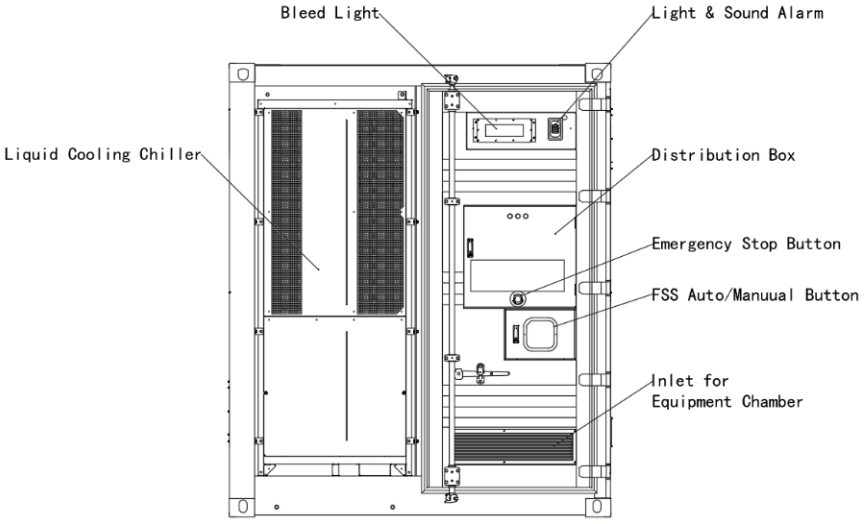
Description of each view of the system is as follows:



Front view: 1. The front view of the container includes three pairs of double-leaf folding doors; 2. An air inlet system is arranged below the left door; a pressure relief valve is arranged at the upper left corner; 3. There are 2 corner fittings at the bottom of the container for lifting; 4. The external grounding point of the container is located at the lower right corner of the front view.

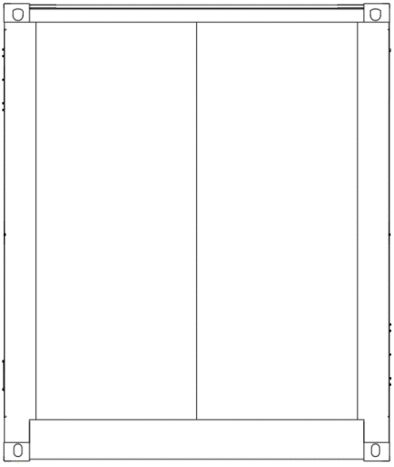


Rear view: 1. The rear view of the container includes three pairs of double-leaf folding doors; 2. An exhaust system is arranged at the upper left side;
3. There are two corner fittings at the bottom of the container, which can be used for lifting; 4. The external grounding point of the container is in the lower right corner of the front view. 5. A heat dissipation vent of the equipment compartment is reserved at the lower left corner of the container.



Left view:

1. The left view of the container includes a single-leaf door; 2. The right door is equipped with fire-fighting deflation indicator, audible and visual alarm, fire manual/automatic starter and system emergency stop button.



Right view:

1. No equipment or openings are arranged in the right view of the container;

3.1.6 Design of system incoming and outgoing lines

In order to facilitate the on-site cable connection, all cables between the internal equipment of the energy storage system should be connected before leaving the factory.

Cables of the energy storage system and external equipment should be routed through the bottom of the container. All cables entering and leaving the energy storage system should be properly protected, such as cable pipes, which need to be protected from rodents. After the cables are connected, all cable entrances shall be sealed with fireproof mud or other appropriate materials.

The cable access hole at the bottom of the battery cabinet of the energy storage system is shown in Fig. 3-5 below.

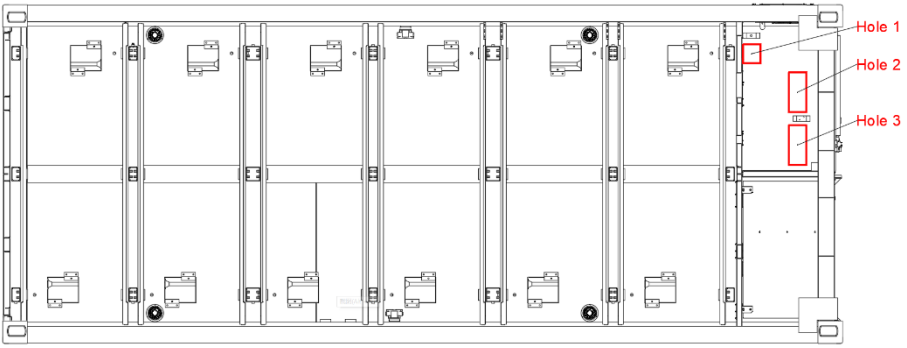


Fig. 3-5 Schematic Diagram of Incoming and Outgoing Line Holes at the Bottom of Container Equipment Compartment

The function of each hole is as follows:

No.	Name	Description
Hole-1	Communication/power supply cable port	Communication cable is connected with PCS, EMS (Energy Management System) and other equipment through this hole, and power supply cable is connected with auxiliary control power supply equipment.
Hole-2/ Hole-3	DC side output cable port	Connect with the DC side input power cable of PCS compartment through this hole.

3.1.7 Nameplate of energy storage system

Users can identify the energy storage system products through the nameplate, which is located in the lower left corner of the end door of the battery container, as shown in Fig. 3-6, and the detailed nameplate information is shown in Fig. 3-7.

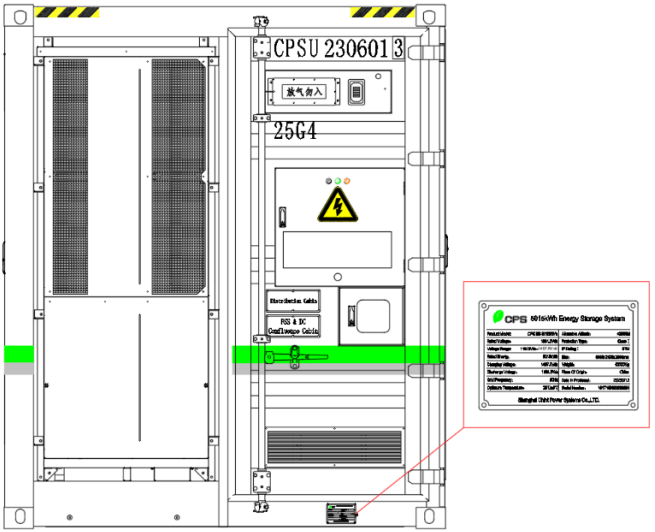


Fig. 3-6 Position of Energy Storage System Nameplate

CPS 5015kWh Energy Storage System

Product Model:	CPS ES-5015KWh	Allowable Altitude:	≤2000M
Rated Voltage:	1331.2Vdc	Protection Type:	Class I
Voltage Range:	1164.8Vdc–1497.6Vdc	IP Rating：	IP54
Rated Energy:	5015kWh	Size:	6058x2438x2896mm
Charging Voltage:	1497.6Vdc	Weight:	43000Kg
Discharge Voltage:	1164.8Vdc	Place Of Origin:	China
Grid Frequency:	60Hz	Date In Produced:	20230712
Optimum Temperature:	25℃±5℃	Serial Number:	1617150623280001

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Fig. 3-7 Schematic Diagram of Energy Storage System Nameplate

The information contained in the nameplate includes:

(a). Product name, specification and model;

(b). Name and trademark of the manufacturer;

(c). Factory number (identified by serial number) and date of manufacture;

(d). Technical parameters:

- System operating parameters: Rated output voltage (V), rated output current (A), rated capacity (kWh), rated working frequency (Hz), etc.
- Hardware parameters: Altitude (M), size (mm) and weight (kg);
- Use temperature.

Warning:

The parameters on the nameplate of the energy storage system are very important, and it is forbidden to destroy or remove them.

3.2 Battery cluster

The liquid cooling battery cluster is mainly composed of battery module (also PACK), battery protection unit, cabinet and BMS. BMS adopts a 3-level architecture, and the hardware consists of ESBMM (Electric Storage Battery Management Module), ESBCM (Electric Storage Battery Control Module) and ESMU (Electric Storage Management unit). ESBMM is pre-installed on the battery panel, ESBCM in the battery protection unit and ESMU in the equipment compartment.

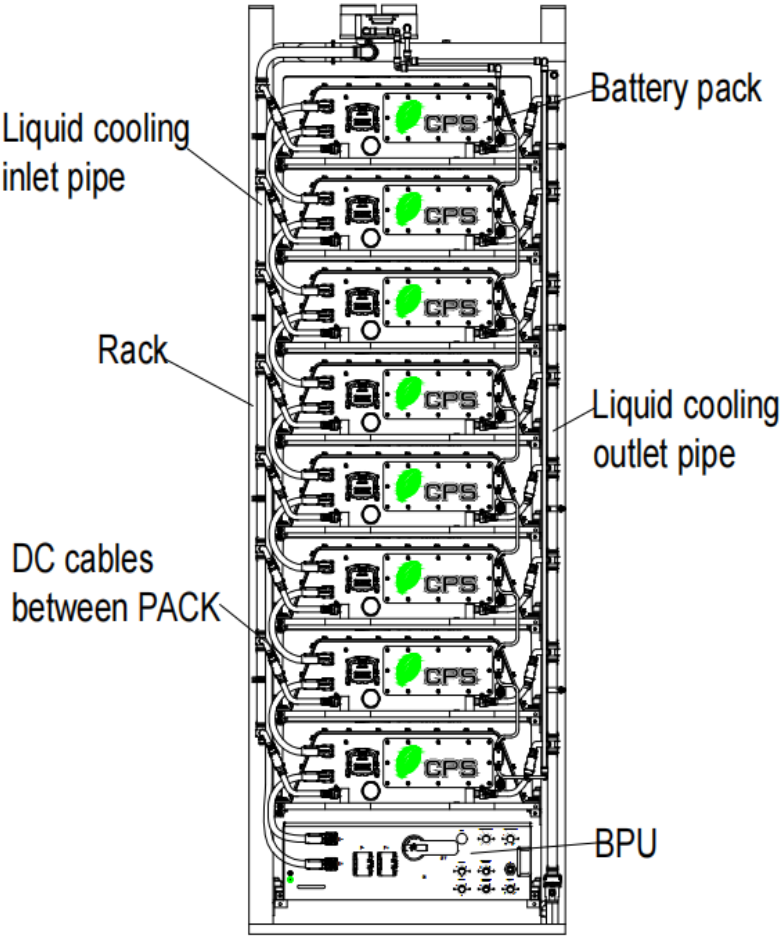


Fig. 3-8 Schematic Diagram for Connection of Battery Cluster

3.2.1 PACK

PACK consists of lithium iron phosphate battery cell 1P52S. The corresponding plugs and sockets of positive and negative power cables are orange and black, as shown below:

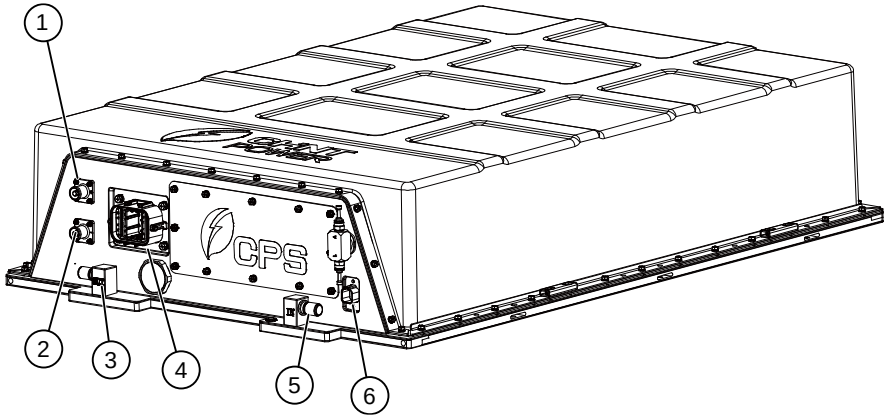


Fig. 3-9 sockets of positive and negative power cables

No.	Name
1	Positive power cable interface
2	Negative power cable interface
3	Coolant outlet port
4	MSD
5	Coolant inlet port
6	Communication cable interface

3.2.2 Battery protection unit

The disconnect switch and ESBCM of battery protection unit are shown as below:

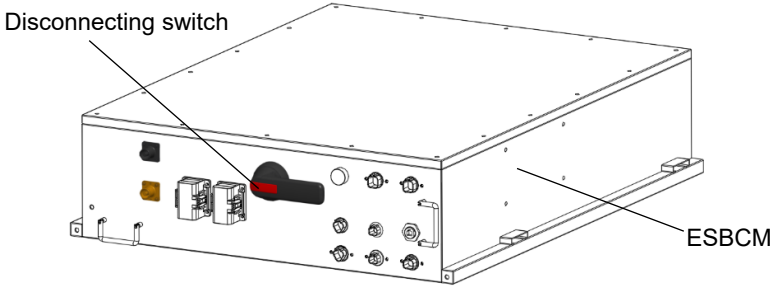


Fig. 3-10 Battery protection unit

The battery protection unit is connected to PACK in the battery cluster through "B+"

and "B-" sockets, and connected to the copper bus bar through "P+" and "P-" terminals. The schematic diagram of battery protection unit interface is shown below.

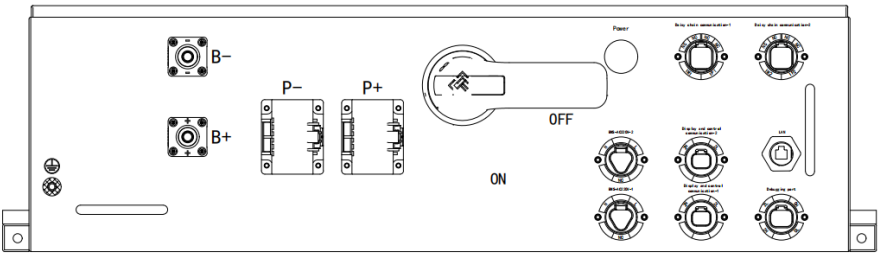


Fig. 3-11 Battery protection unit Interface

Detailed views of power supply and communication input/output interfaces on the battery protection unit are shown in the following figure:

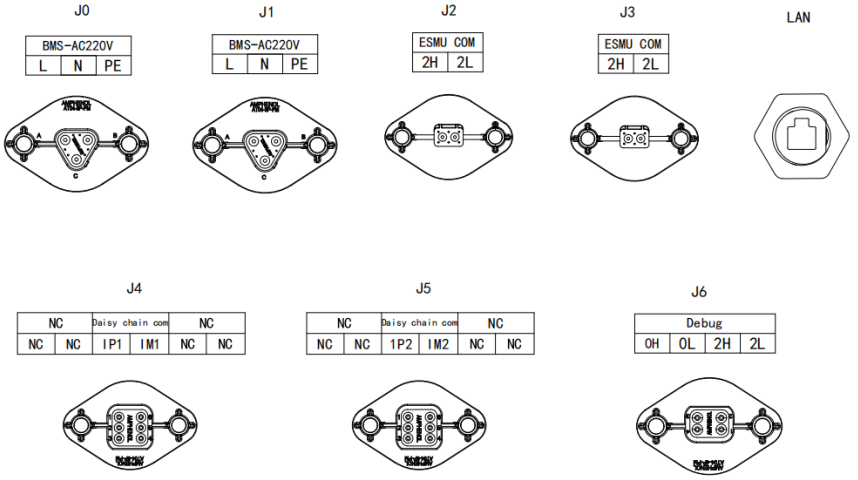


Fig. 3-12 power supply and communication input/output interfaces

Definitions of Power Supply and Communication Input/Output Interfaces of Battery protection unit, please refer to the following table.

Table 3-2 Definition of Power Supply and Communication Input/Output Interfaces

Port name	No.	Definition	Function description	Remarks
BMS-AC220V port J0/J1	1	L	External AC230V power input, supplying power to BMS switching power supply inside the battery protection unit	
	2	N		
	3	PE	Suspended	
Display control communication port J2/J3	1	2H	Communication between master control and display control in battery protection unit, CAN-H	Daisy Chain
	2	2L	Communication between master control and display control in battery protection unit, CAN-L	
Display control communication port J4	1	NC	Reserved	
	2	NC	Reserved	
	3	IP1	Daisy-chain communication	To IP2/IM2 of the last ESBMM
	4	IM1	Daisy-chain communication	

Port name	No.	Definition	Function description	Remarks
	5	NC	Reserved	
	6	NC	Reserved	
Display control communication port J5	1	NC	Reserved	
	2	NC	Reserved	
	3	IP1	Daisy-chain communication	To IP2/IM2 of the first ESBMM
	4	IM1	Daisy-chain communication	
	5	NC	Reserved	
	6	NC	Reserved	
Debugging interface J6	1	0H	Intranet debugging interface	
	2	0L		
	3	2H	Extranet debugging interface	
	4	2L		
LAN			Used for connection between the ESBCM to the ESMU	

3.3 BMS system

BMS adopts a 3-level architecture, its hardware consists of ESBMM, ESBCM and ESMU. Their installation positions are described as the following table:

Table 3-3 Installation Positions of BMS Components

Level	Name	Position	Function
Level 1, PACK level	ESBMM	Inside the PACK's maintenance panel	Check voltage and temperature information of battery cells in PACK
Level 2, battery cluster level	ESBCM	In battery protection unit	Carry out data collection, analysis and decision-making and cluster level protection; upload the information to ESMU;
Level 3, system level	ESMU	In equipment compartment	Collect the information of each ESBCM and communicate with EMS and SCADA (supervisory control and data acquisition)

The schematic diagram of the installation position of ESMU in the equipment compartment is as follows:

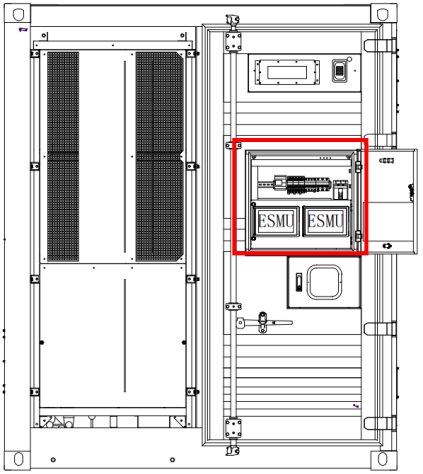


Fig. 3-13 Installation Position of ESMU

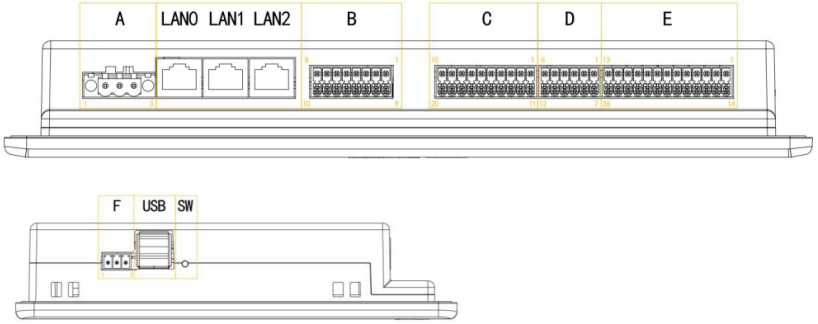


Fig. 3-14 Schematic Diagram of ESMU Interface

ESMU has eight interfaces. Interface A is the power port, and LAN is the Ethernet communication port. Interfaces B, C, D, E and F are communication ports, and USB is the port for exporting data and importing upgrade programs.

ESMU has 11 pairs of output dry contact interfaces located on all pins of interface E. In the conventional design, we only introduce two input dry contact lines. Two wires of each dry contact are connected to the input interface of the PCS dry contact. When the BMS is normal, the ESMU dry contact outputs a closed signal, and when the BMS fails, the ESMU output is open-circuited.

Several interfaces of ESMU are defined as follows:

Table 3-4 Definition of ESMU Interfaces

Port name	No.	Definition	Function	Use
A	1	V+	Positive input of power supply	Power input
	2	V-	Negative input of power supply	
	3	PE	System ground	
LAN	-	LAN0	100M/1000M Ethernet	EMS
	-	LAN1	100M/1000M Ethernet	EMS
	-	LAN2	10M/100M Ethernet	ESBCM
B	8	VDD	Output positive electrode of DI isolated power supply	DI power supply
	16	VSS	Output positive electrode of DI isolated power supply	
	7	DI1H	Detects a high level (24V) is effective	Emergency stop
	15	DI2H	Detects a high level (24V) is effective	Circuit breaker closing feedback
	6	DI3H	Detects a high level (24V) is effective	Remote/local
	14	DI4H	Detects a high level (24V) is effective	Fire alert
	5	DI5H	Detects a high level (24V) is effective	Fire alarm
	13	DI6H	Detects a high level (24V) is effective	Fire spraying operation

Port name	No.	Definition	Function	Use
	4	DI7L	Detects a low level(24V-) is effective	Access control
	12	DI8L	Detects a low level(24V-) is effective	Water immersion
	3	DI9L	Detects a low level(24V-) is effective	Fuse
	11	DI10L	Detects a low level(24V-) is effective	Travel switch
	2	DI11L	Detects a low level(24V-) is effective	DC lightning arrester fault signal
	10	DI12L	Detects a low level(24V-) is effective	AC circuit breaker feedback
	1/9	DI0+/DI0-	AC (220Vac 50Hz) detection	AC detection
C	10/9	0A/0B	0#RS485	PCS
	8/7	1A/1B	1#RS485	Air conditioner
	6/5	2A/2B	2#RS485	Liquid cooling
	4/3	3A/3B	3#RS485	Temperature and humidity, fire protection, water immersion, dehumidification, etc.
	2/1	4A/4B	4#RS485	Meter/EMS/IO expansion

Port name	No.	Definition	Function	Use
				module
	19/17/15/13/11	RB0~RB4	RS485 terminal resistance; if RB is suspended, there is no internal resistor 120R; if RB is short-circuited to xB (0B/1B, etc.), there is an internal resistor 120R	-
	20/18/16/14/12/10	RG0~RG4	Shielding grounding point of each RS485, suspended by default	-
D	6/5	0H/0L	0#CAN	ESBCM
	4/3	1H/1L	1#CAN	PCS
	2/1	2H/2L	2#CAN	Fire alarm control panel
	11/9/7	RL0/RL1/RL2	CAN terminal resistance; if RL is suspended, there is no internal resistor 120R; if RL is short-circuited to xL (0L/1L/2L), there is an internal resistor 120R	-
	12/10/8	CG0/CG1/CG2	Shielding grounding point of each CAN, suspended by default	-
E	13/26	D0+/D0-	0# normally open dry contact output	PCS dry contact

Port name	No.	Definition	Function	Use
	12/25	D1+/D1-	1# normally open dry contact output	Fault indicator
	11/24	D2+/D2-	2# normally open dry contact output	Power-driven opening/shunt tripping
	10/23	D3+/D3-	3# normally open dry contact output	Power-driven closing signal
	9/22	D4+/D4-	4# normally open dry contact output	Power distribution breaking (fire protection action or fire alarm)
	8/21	D5+/D5-	5# normally open dry contact output	Thermal runaway state
	7/20	D6+/D6-	6# normally open dry contact output	Fans for gas discharge in containers
	6/19	D7+/D7-	7# normally open dry contact output	Reserved for Grade II
	5/18	D8+/D8-	8# normally open dry contact output	Reserved for Grade II
	4/17	D9+/D9-	9# normally open dry contact output	Reserved for Grade III
	3/16	D10+/D10-	10# normally open dry contact output	Reserved for Grade III
	2/14	NO11/COM	11# normally open dry contact output	Reserved for Grade III
	15/14	NO11/COM	11# normally closed dry	

Port name	No.	Definition	Function	Use
			contact output	
F	1	TX	RS232 sending port	Internal debugging
	2	RX	RS232 receiving port	
	3	GND	RS232 reference ground	
USB	1	USB1	USB TypeA (firmware upgrade port)	-
	2	USB0	USB TypeA	-
-	-	SW	Auxiliary firmware button	-

3.4 Grounding wire

In order to reduce and eliminate the electrical noise in the system and prevent the danger of electric shock, it is necessary to ground the system. Grounding methods and requirements will vary according to specific projects and system configuration. All grounding methods shall comply with Article 250 of NEC.

Grounding wire shall be at least 16mm², with M8 or M10 ring terminal; the specifications are as follows:

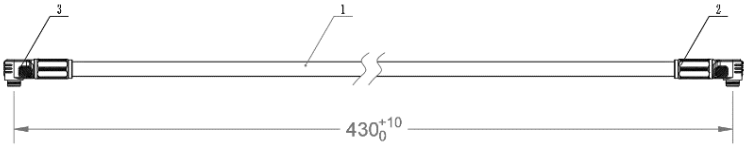
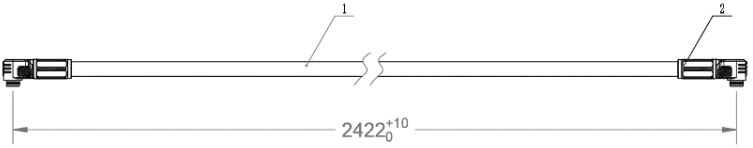
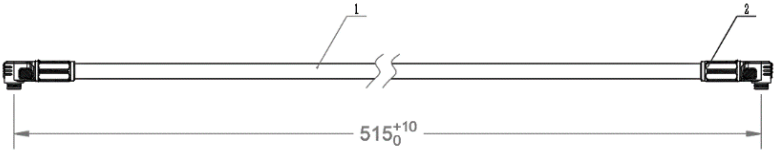
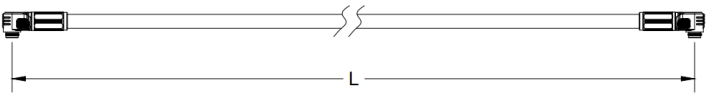
Table 3-5 Specifications of Grounding Wire

Grounding wire Specification	Grounding screw	Screw specification	Screw hardness	Screw pitch	Screw material
16mm²	Conventional grounding	M8*14L	HRC32 Grade 8.8	1.25mm (0.05in)	SS304
16mm²	Rack grounding	M10*30L			
25mm²	Multi-cluster rack grounding	M10*25L (Side)			

3.5 Connect power cable between battery PACK

The power cable is used to connect the battery PACK in series to form a complete battery cluster, which is finally connected to the battery protection unit.

Table 3-6 Specifications of Connecting cable

No.	Specification of connecting cable
1	Connect between upper and lower PACKs 
2	Connect between the positive socket of PACK and B+ socket of battery protection unit. Positive socket part number: ESP-250A-70-OR-00; Negative socket part number: ESP-250A-70-BK-00. 
3	Connect between the negative socket of PACK and B- socket of battery protection unit. The conductor size: 2/0 AWG. 
4	Connect from P+、P- terminal of battery protection unit to DC output 

4 Preparations

Before installing BESS equipment, the following items should be prepared

4.1 Personnel requirements

All personnel engaged in installation activities should be trained and have relevant experience in Chint BESS. Individuals should meet all training prerequisites and must complete systematic training. These personnel include:

- Service personnel who perform any installation work within the scope of work of the Owner specified in this document.
- The Owner's representative who performs any installation work within the scope of work of the Owner specified in this document.

4.2 Personal protective equipment and tools

Warning:

- Do not wear watches, rings, jewelry or other metal objects.
- Wear a helmet correctly before entering the construction site to protect your head.
- Wear insulating gloves and safety shoes.
- Use tools with good insulation to prevent accidental electric shock or short circuit.

Before operation and installation, the technical service engineer shall prepare personal protective equipment (PPE) and tools. As shown in the safety instructions earlier in this Manual, basic PPE is required. Before any installation activities, check the condition of PPE and confirm its availability.

The recommended tools and equipment are listed in the following table. See Annex 3 for details. Confirm that all equipment is calibrated through the approved calibration procedure and that the calibration has not expired. Due to the different scope and scale of project construction involved in each project, the types and quantities of required items should be different according to the actual situation.

4.3 Documents

Before installation, all relevant documents, such as contracts, technical agreements, shipping lists and installation drawings, should be collected, and ensured in the final version. These electronic project documents should be handed over to the document management department for archiving.

Technical service personnel should make all preparations before installation and know the initial installation status of the system. The battery has been installed and fixed in the factory, so just check and fill in the battery system installation checklist in turn according to the following steps.

Table 4-1 Installation Checklist of Battery System

No.	Steps	Inspection item	Record
1	Preparation	1.1 Ensure the correctness of project data and documents, including packing list and drawings.	
		1.2 Ensure that required PPE, tools and equipment are available.	
2	Product delivery	2.1 Confirm the installation date	
		2.2 Confirm the unloading site conditions and unloading methods.	
		2.3 Delivery: Partial shipment is allowed/Partial shipment is not allowed and relevant parties are informed.	
3	Product arrival	3.1 Unloader: Buyer/ Contractor/Seller	
		3.2 Count the number of accessory boxes	
4	Unpacking inspection	4.1 Check whether the file package in the accessory box is complete.	
		4.2 Ensure that cables, screws, bolts and other accessories are complete	
		4.3 Re-seal the accessory box	
		4.4 Complete receipt for arrival inspection	
5	Check before installation	5.1 Ensure that the installation site meets the installation conditions.	

No.	Steps	Inspection item	Record
		5.2 Train the installation personnel and complete the Safety Installation Training Record Form	
6	Battery cluster system inspection	6.1 Check the appearance of the battery for no damage or leakage.	
		6.2 Check whether the battery on the battery rack is fixed and loose.	
7	Battery installation process training	7.1 Train installation workers and emphasize the importance of safety precautions for battery replacement and installation.	
		7.2 Train installation workers to transport batteries in a correct way (terminals up).	
		7.3 Train installation workers to correctly place the battery in an order.	
		7.4 Check the open circuit voltage of the battery (the original inspection items can be postponed according to the site conditions).	
8	Cable connection	8.1 Ensure that the battery is connected correctly according to the correct steps.	
		8.2 Train the installation personnel and emphasize the risks and dangers of incorrect installation.	
		8.3 Ensure that the installation tools are well insulated.	
		8.4 The installation personnel shall ensure that the battery pole area is clean and tidy.	
		8.5 When connecting one end of PACK, conduct the insulation protection of the connector at the other end.	
		8.6 Conduct simple wiring installation training for installation personnel.	
		8.7 Special installation personnel are responsible for the complicated parts of battery connection.	

No.	Steps	Inspection item	Record
		8.8 Supervise the connection of cells in the same cluster in a single row.	
		8.9 Supervise the connection of main positive and main negative with specific cables	
		8.10 Supervise the connection of the cables in the "safe area" after the voltage test.	
		8.11 The installation personnel shall ensure that all cable connectors are plugged in place.	
		8.12 Check whether all cable connectors are plugged firmly to ensure that the connector locking structure has been opened (necessary inspection items, which can be postponed according to site conditions).	
9	Connection of liquid cooling triode	9.1 Ensure that the incoming/outgoing liquid cooling triodes are plugged in place with the interfaces of the liquid cooling plate.	
		9.2 Ensure that the incoming/outgoing liquid cooling diodes are installed in accurate positions and fastened.	
		9.3 Make sure that there is no leakage at each connector on the incoming/outgoing liquid cooling primary, secondary and tertiary pipeline paths, and the pipelines are covered with thermal insulation cotton.	
10	Inspection of integrity of positive and negative logos and numbers	10.1 Check the serial number sequence of each battery.	
		10.2 Battery stickers should be neat, clean and tidy.	
		10.3 Check whether the positive/negative logos of the battery are complete and clear.	
11	Delivery of	11.1 Provide relevant documents, such as user	

No.	Steps	Inspection item	Record
	documents	manuals and certificates.	
		11.2 Other document requirements	
	Remarks		
	After the above inspection items are completed, please tick in the inspection record, and then go to the next inspection item.		
	Please underline this part.		

4.4 Transportation and delivery

4.4.1 Transportation conditions

The internal equipment of the energy storage system has been installed and fixed before leaving the factory, and the whole system can be transported. The energy storage system can be lifted and transported with a crane;

The energy storage system is transported to the power station site by the freight company, and the site management personnel of the power station will be contacted in advance to negotiate and arrange the specific delivery and unloading. The transportation after delivery and unloading needs to be completed by the power station site construction personnel.

Warning:

During the transportation, loading and unloading of the energy storage system, the operation safety regulations of the country/region where the project is located must be observed.

- All instruments used during transportation need to be maintained.
- All personnel engaged in loading, unloading as well as bolting and tightening should receive corresponding training, especially safety training.

Note:

Please always keep in mind the mechanical parameters of the energy storage system during transportation and loading and unloading.

Battery container:

- L×W×H: 6,058mm×2,438mm×2,896mm
- Gross weight: about 45,000 kg

The transportation and movement of energy storage system shall at least meet the following conditions:

- The doors of the energy storage system are locked.
- According to the site conditions, the appropriate means of transport should be selected, usually a crane. The means of transport used must have sufficient bearing capacity.

- If it is necessary to move on a slope, etc., additional traction devices may be required.
- All obstacles that exist or may exist during moving should be removed, such as trees and cables.
- The energy storage system should be transported and moved under better weather conditions as far as possible.
- Warning signs or warning belts must be set up to prevent non-working personnel from entering the lifting and transportation area, so as to avoid accidents.
- In addition, when the energy storage system is placed on the ground,
- Handle with care when placing. The energy storage system should not be dragged or pushed on any surface.
- The energy storage system should be placed on the solid and flat ground, with good drainage and no obstacles and protrusions, and supported only by the base.

4.4.2 Lifting

Warning:

- During the whole process of lifting the energy storage system, the safety operation regulations of the crane must be strictly followed.
- It is forbidden to stand within 10m of the operation area. In particular, it is forbidden to stand under the lifting arm and the lifted or moved machine to avoid casualties.
- In case of bad weather conditions, such as heavy rain, fog and strong wind, the lifting operation should be stopped.

When lifting the energy storage system, at least the following requirements shall be met:

- Site safety must be ensured during lifting.
- During the lifting and installation operations, there should be professionals on site to command the whole process.

- See the lifting schematic diagram below for the sling used, lifting angle and lifting speed.
- The crane shall have sufficient arm length and radius of rotation.
- Ensure that all sling joints are safe and reliable, and all slings connected with lifting rings are of equal length.
- The length of the sling can be properly adjusted according to the actual requirements of the site.
- During the whole lifting process, the energy storage system must be stable and not skewed.
- Please use the four rings of the energy storage system to lift the energy storage system.
- Take all necessary auxiliary measures to ensure the safe and smooth lifting of the energy storage system.

Fig. 4-1 shows the crane operation schematic diagram of the energy storage system during lifting. In the figure, the dotted circle in the inner layer indicates the working range of the crane. When the crane is working, it is forbidden to stand in the solid circle on the outer layer.

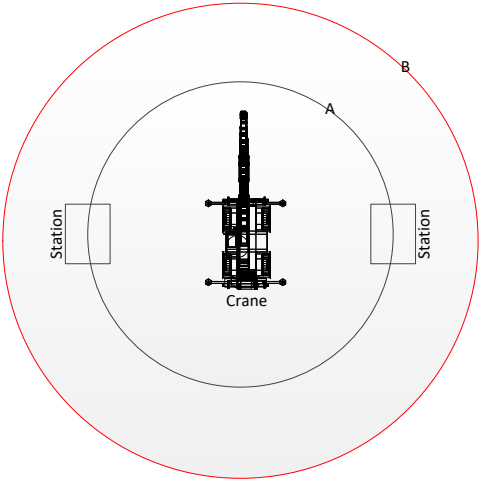
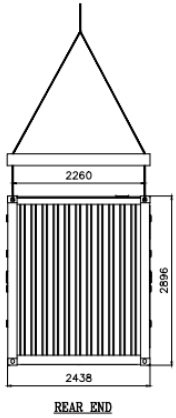
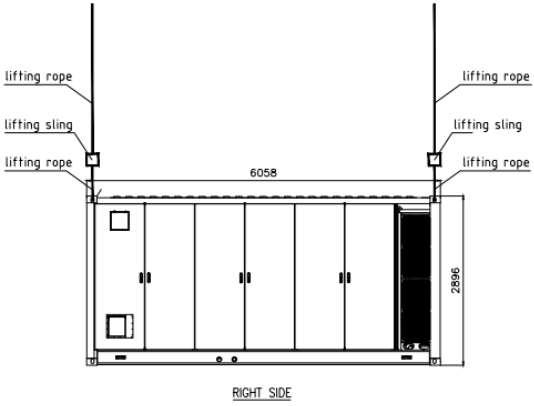


Fig. 4-1 Schematic Diagram of Lifting Energy Storage System



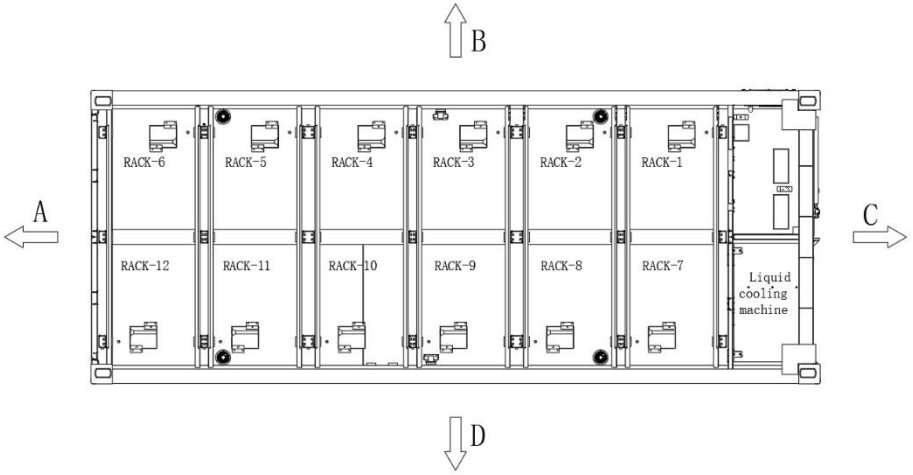


Technical requirements:

1. Recommended lifting scheme: Vertical lifting at both ends;
2. The force applied by the lifting equipment on the corner of the container should be vertical and upward;
3. The lifting speed should not exceed 5 meters per minute;
4. Protection measures should be taken for the container during lifting, especially at the areas where the lifting rope contacts with the box body.
5. The external dimensions of the container are as follows: 6058mm x2438mm x2896mm.
6. The estimated total weight of the container is 42 ton.
7. Professional lifting companies should consider sufficient safety factors for the lifting equipment and ropes.

Fig. 4-2 Reference Diagram for Lifting Energy Storage System

4.5 Installation requirements for energy storage system



The installation clearance requirement for 5MW BESS is as follows:

A	Distance from container to left object：≥0 mm
B	Distance from container to upper object：≥1500 mm
C	Distance from container to right object：≥2000 mm
D	Distance from container to front object：≥2000 mm

The energy storage system shall be installed on the structure supported by cement foundation or channel steel. It is necessary to make sure that the foundation is smooth, solid, safe and reliable, and has sufficient bearing capacity. The foundation surface shall not be sunk or inclined.

The energy storage system can be welded with the foundation steel plate, or in other ways with the same connection firmness.

The number of supporting points of the energy storage system on the foundation, the supporting unit bearing capacity and the installation position of the base plate are shown in the following figure:

Technical specification:

1. This foundation drawing is only used as a reference for customer to design the foundation;
2. The foundation base plane of the container needs to be higher than the horizon

and above the maximum precipitation height of the project site;

3. This project involves fully loaded containers with equipment and battery modules, with a maximum total weight of approximately 42 tons. The foundation requires sufficient strength, and the load on each support point C1-C4 and D1-D2 should be greater than 10.5 tons;
4. The flatness of the entire foundation base plane should be controlled within ± 2mm；
5. Prior to placing the container on the foundation, it is strictly necessary to place the subplate at the position shown in the drawing. The subplate is included in the packaging accessories of the container. If the subplate is not placed at the designed location, after the container is fully loaded with battery modules, it may cause the side door of the container to be unable to open normally or lead to permanent deformation that cannot be repaired, even if structural repair is required. Please strictly comply with this requirement.

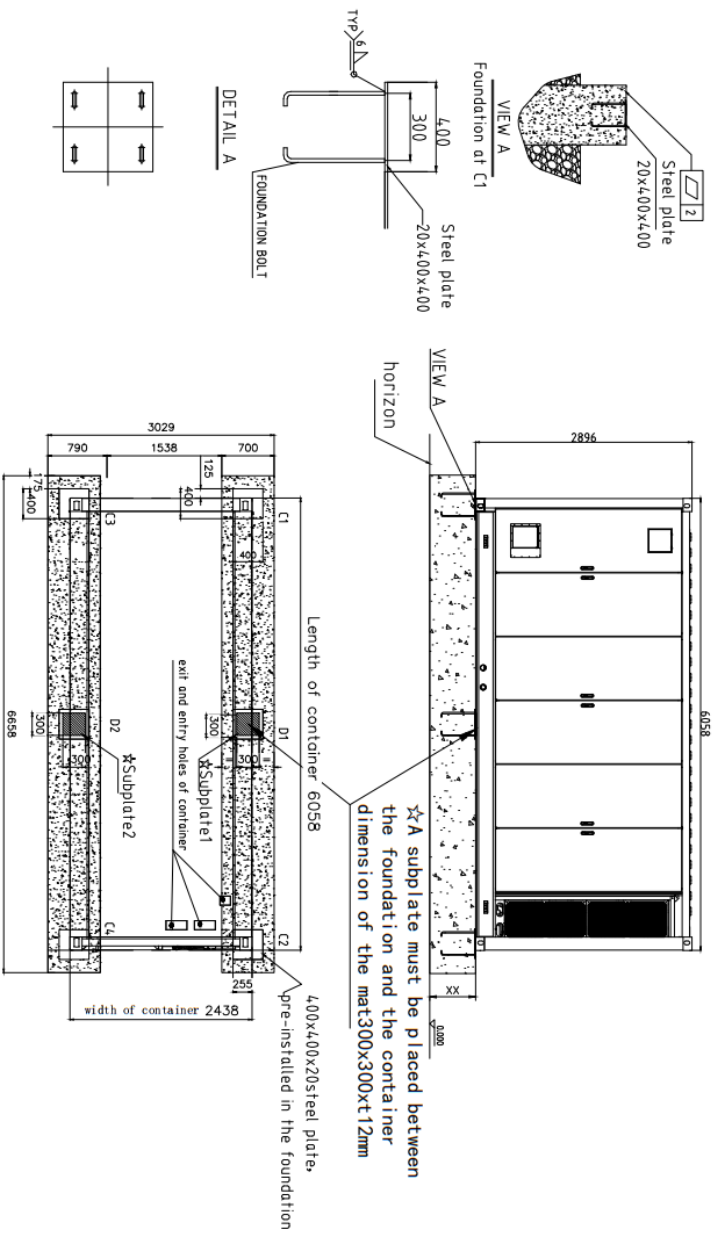


Fig. 4-3 Supporting Points of Energy Storage System

4.6 Unpacking

Warning:

- Do not wear watches, rings, jewelry or other metal objects.
- Wear insulating gloves and safety shoes.
- Store in a dust-free place, with humidity not exceeding 60% and temperature not exceeding 23℃±5℃.
- Avoid direct sunlight.

Please check the following parts when unpacking. Quantity is based on 12 clusters of racks and 96 battery PACK installation parts.

Table 4-2 List of Cable Accessories

S/N	Description	No.	Qty.	Remarks
1	Upper and lower connecting cables	6.0302.2102A0	84pcs	For upper and lower batteries
2	Main positive cable	6.0302.2103A0	12pcs	For battery total positive and battery protection unit total positive
3	Main negative cable	6.0302.2104A0	12pcs	For battery main negative and battery protection unit main negative
4	Communication between batteries and power supply communication	6.0302.2113A0	1 Set	For communication and power supply between battery packs, from battery packs to battery protection units
5	Inter-cluster communication and power supply communication	6.0302.2115A0	1 Set	Used for communication and power supply between battery clusters

4.7 Checking

The installation personnel shall make records according to the checklist after unpacking. After unpacking, check the following items, fill in the Goods Receipt, and sign it by the customer (customer representative) and the installation personnel. If any defects are found during the inspection, please contact the After-sales Service Department of Chint to solve the problem.

Table 4-3 Inspection of Battery Cluster Modules

Module name	Inspection item
Battery PACK	• Use the battery tester to test voltage and internal resistance • Whether the outside is damaged • Whether the screws are missing or bulging • Whether the paint peels off
Battery protection unit	• Whether the outside is damaged • Whether the screws are missing or bulging • Whether the paint peels off
ESMU	• Whether the outside is damaged • Whether the screws are missing or bulging • Whether the paint peels off
Accessories	• Qty. • Specification

Note: If there are a large number of accessories, please make a spot check. In order to ensure the safety of connecting accessories, all accessory boxes containing connecting accessories should be resealed after inspection, and the required accessories should be taken out until the battery needs to be connected.

5 General Installation

5.1 Installation time

The estimated time required for battery cluster installation is shown in the following table.

Table 5-1 Time Required for Installation of Single Cluster Battery Accessories

Step	Operation content		Estimated time (hour: minute)
1	Unpacking		00:15
2	Checking		00:15
3	Accessory installation	Connecting cable	00:30
		Inter-battery communication harness	00:30
		Installation of liquid cooling pipeline	00:30
		Inter-cluster communication/power supply harness	00:30
		BMS configuration	02:00

5.2 General principles of installation

Instructions:

Please read the following installation sequence carefully before installation.

- Ensure that the battery protection unit is always at the bottom layer; meanwhile, the handle of disconnecting switch of the battery protection unit needs to be in "OFF" state;
- The configuration of single cluster battery will be different for different projects. The following figure shows an example of a standard battery cluster;
- A battery cluster instruction is provided to clarify the understanding of the complete material.

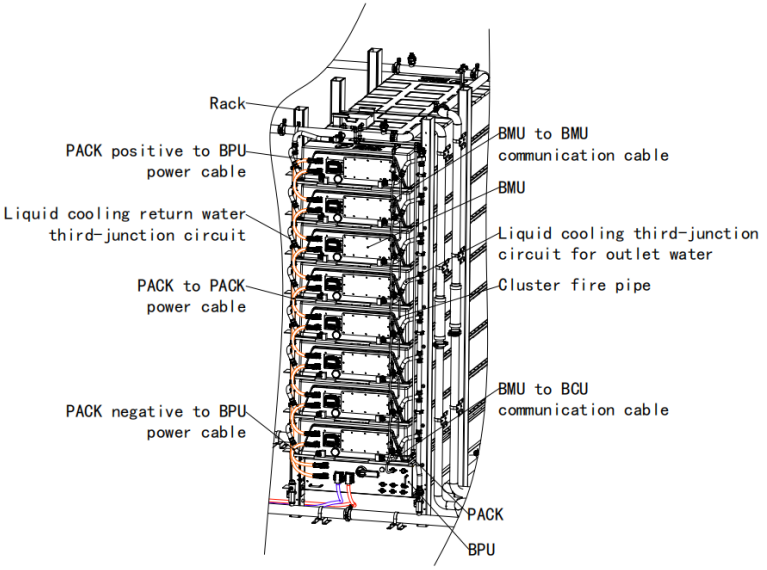


Fig. 5-1 Systemic Description of Battery Cluster Mounting Materials

In the standard battery cluster configuration, all the battery PACKs have the same structure and configuration, all their positive and negative poles are the same. In addition, all batteries have been installed in place when the system is delivered, so it is only necessary to connect the cables in series. The battery arrangement sequence is shown in the following figure:

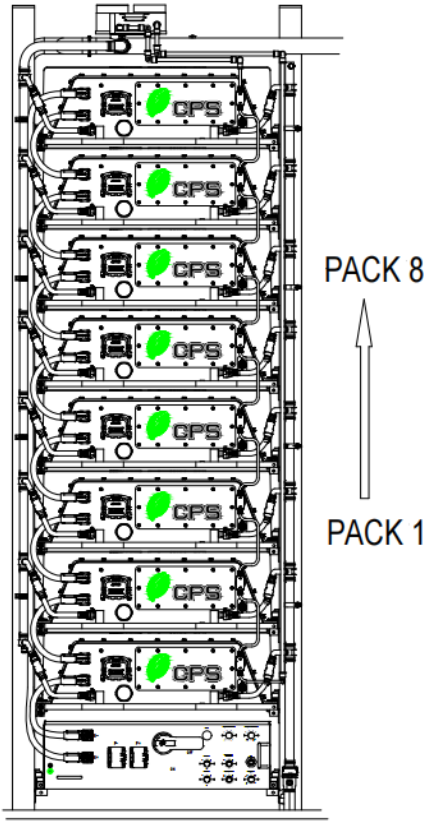


Fig. 5-2 Battery Sequence

6 Connection of Power Cables

6.1 Safety instructions

Warning:

- Please operate carefully to avoid short circuit of the positive and negative poles of battery PACK.
- Take extra care to prevent the positive and negative terminals from touching any position other than the predetermined installation point.
- When installing cables, install only the positive and negative electrodes of corresponding two PACKs first.
- After the power cable of each module PACK is installed, check whether the cable connector is plugged in place.
- Ensure that the battery protection unit disconnecting switch is in the "OFF" position.
- Ensure that there is no 120/220VAC auxiliary control power input in the battery protection unit.
- The tightening torque of M10 screw at the terminal of battery protection unit is 12~15Nm.

After the cables between batteries and between battery and battery protection unit are connected, the whole battery cluster forms a complete path. Installation steps of cables are shown in the following figure:

1. Make sure that the disconnect switch of battery protection unit is in "OFF" state, i.e. the red handle of disconnect switch is in the horizontal direction.

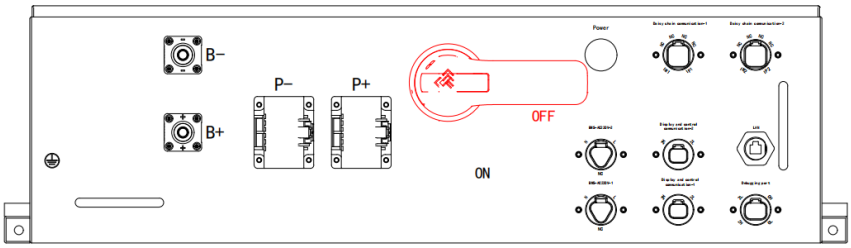


Fig. 6-1 disconnect switch of battery protection unit

2. Connect plugs of main negative cable to negative socket of 1# battery PACK and B- socket of the battery protection unit (sockets have the same color with plugs). If a "click" sound is heard, it indicates that they are plugged in place.

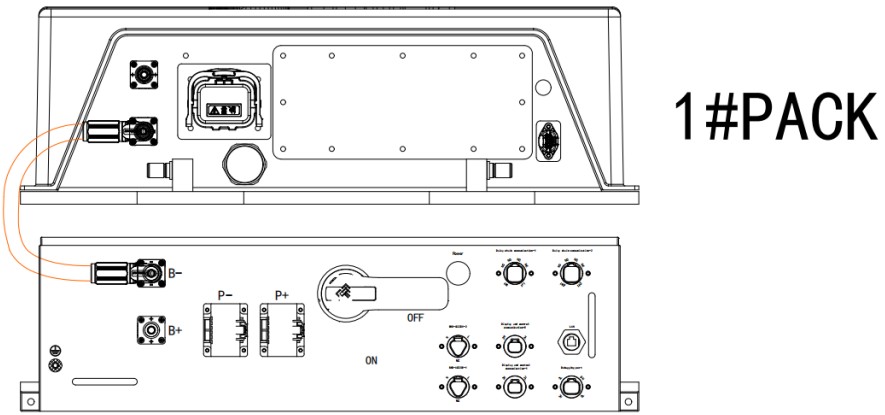


Fig. 6-2 Insert the cable plugs to negative sockets

3. Connect plugs of main positive cable to positive socket of 8# battery PACK and B+ socket of the battery protection unit (sockets have the same color with plugs). If a "click" sound is heard, it indicates that they are plugged in place.

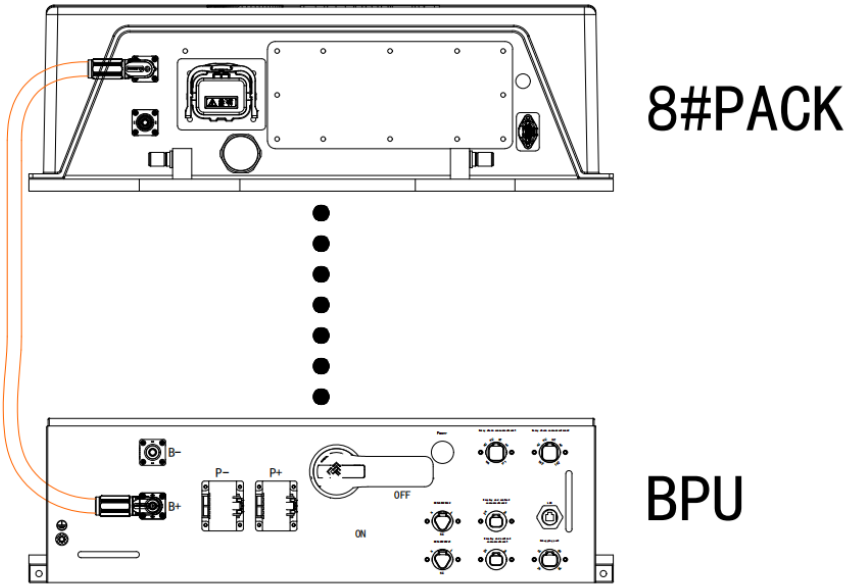


Fig. 6-3 Insert the cable plugs to positive sockets

4. Connect plugs of PACK connecting cable into the negative socket of 8# battery PACK and the positive socket of 7# battery PACK (sockets have the same color with plugs). If a "click" sound is heard, it indicates that they are inserted in place.

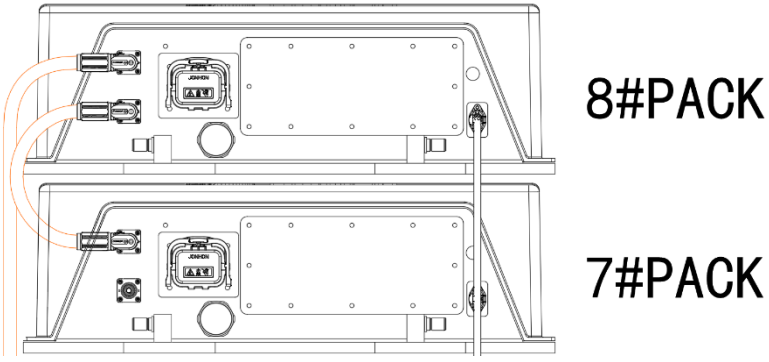


Fig. 6-4 Insert the cable plug into the negative socket

5. Repeat step 4 and install it downward in turn until inserting the cable plug into the negative socket of 2# battery PACK and the positive socket of 1# battery PACK.

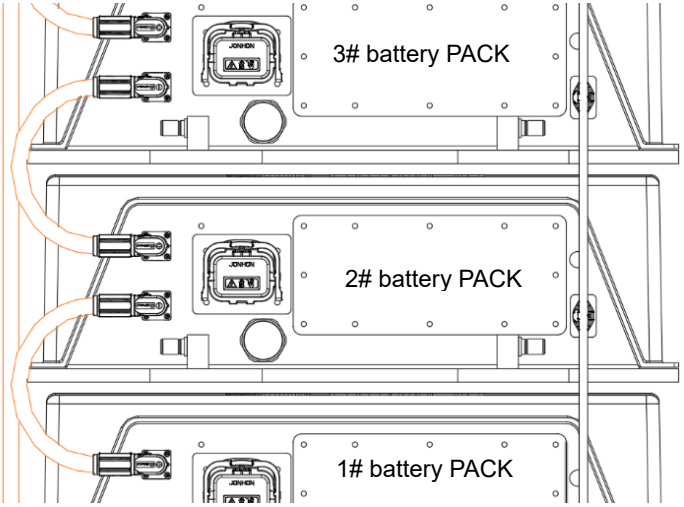


Fig. 6-5 install it downward in turn

6.2 Installation of communication harness

6.2.1 Harness installation between battery protection unit and battery PACK, and between PACK and PACK

Warning:

- Use signal cables that meet the following specifications.
- Do not plug both ends of the harness into the same "battery PACK".

The specifications of the signal cables connected between the battery protection unit and PACK are as follows, the connector pinout can be found from the back of the battery pack:

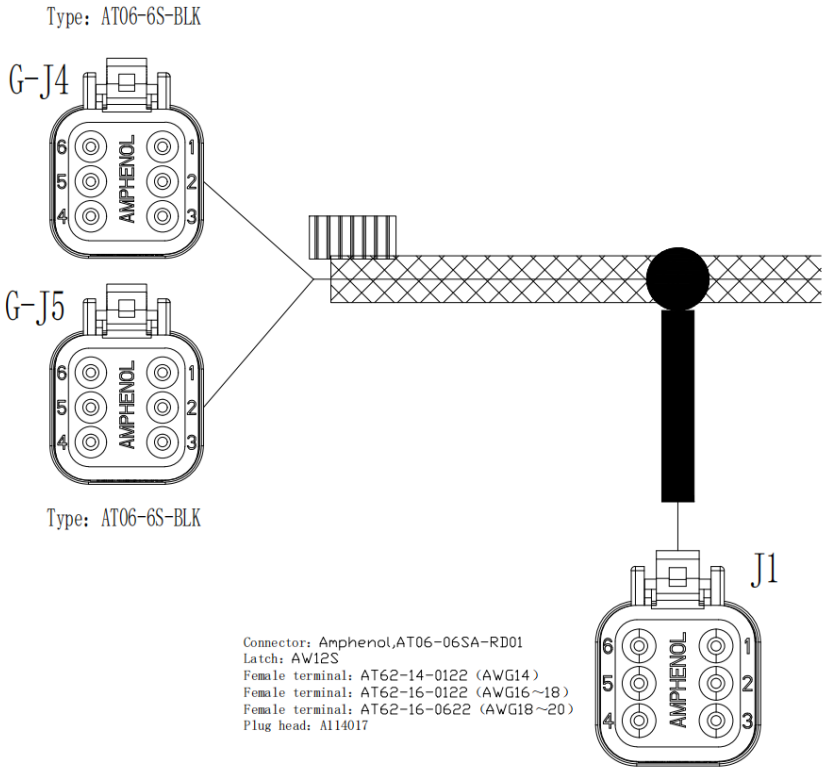
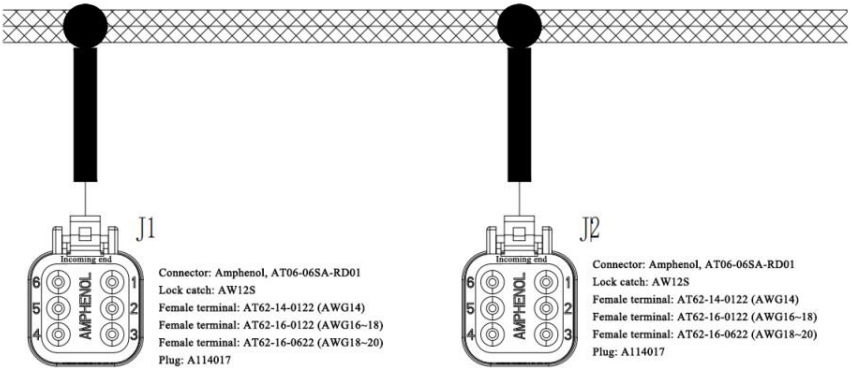


Figure 6-6 Communication Harness Plug-Socket Between ESBCM and ESBMM



J1-1	J1-2	J1-3	J1-4	J1-5	J1-6	J2-1	J2-2	J2-3	J2-4	J2-5	J2-6
IM1	IM2	Res	IP1	IP2	Res.	IM1	IM2	Res	IP1	IP2	Res.

Figure 6-7 Communication Harness Plug-Socket Between ESBMMs and Definitions

Installation steps of Communication/power Supply Harness Between Battery protection unit and ESBMM and Between ESBMMs are as below:

1. Connect the communication/power supply harness between the ESBCM communication port of battery protection unit and communication port of #1 battery PACK.

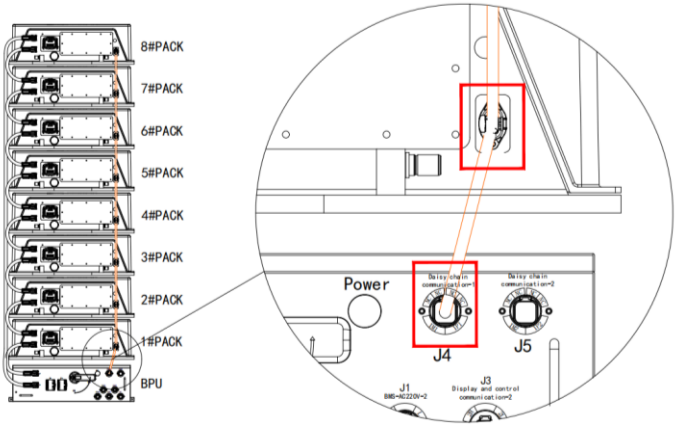


Figure 6-8a Connect the communication/power supply harness

2. Connect the communication/power supply harness between communication port of #1 battery PACK and communication port of #2 battery PACK.

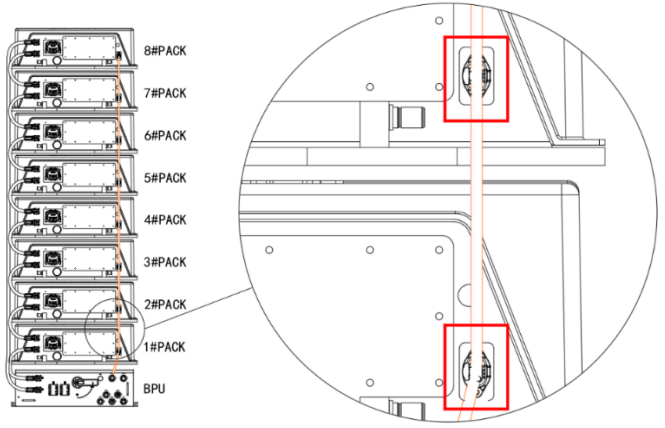


Figure 6-8b Connect the communication/power supply harness

3. Connect the communication/power supply harness between communication ports of PACKs in the cluster

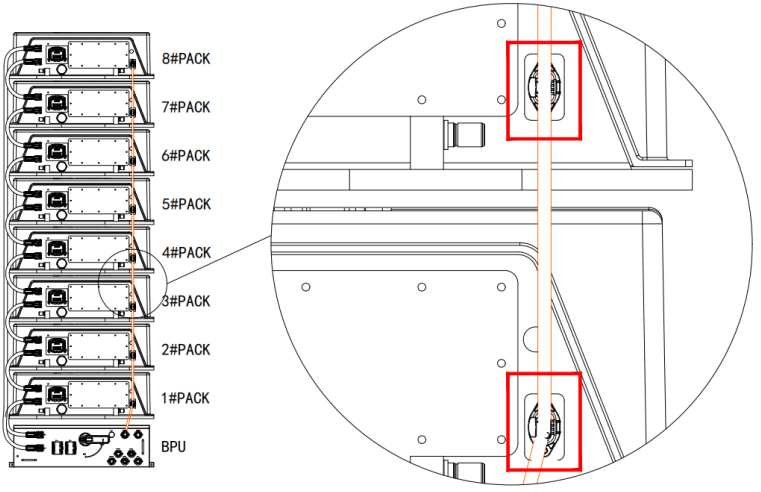


Figure 6-8c Connect the communication/power supply harness

6.3 Installation of battery protection unit power supply cable

Warning:

Use power supply cables that meet the following specifications.

Specifications of power supply cables are shown in the following context:

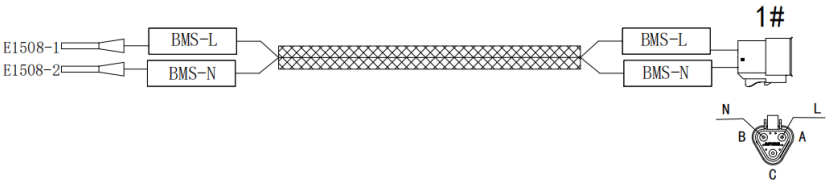


Figure 6-11 Main power supply to 1# cluster power supply harness

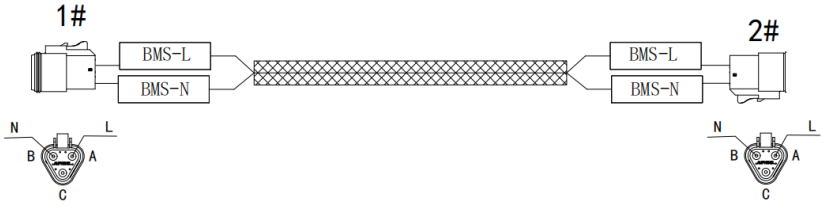


Figure 6-12 Inter-cluster power supply harness

Connect the power supply harness of battery protection unit in the order of battery cluster as below.

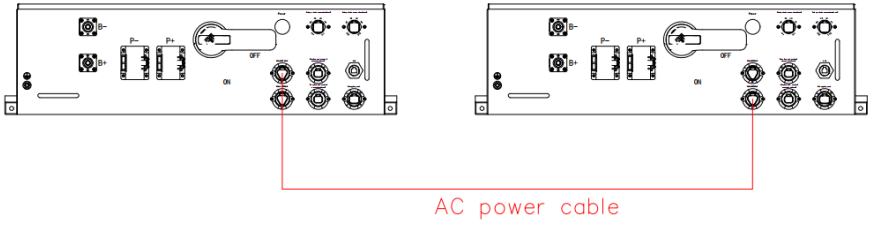


Figure 6-13 Installation Diagram of Power Supply Harness

6.4 AC input debugging

Warning:

After the above harness is installed, check the bolt fastening, screw fastening torque, high-voltage power cable connection, battery connection and battery protection unit connection by sampling.

After the battery system is installed, turn on the AC input power of BMS before turning on the BMS. Debugging of AC input of battery protection unit in accordance with the following steps:

1. Before connecting the AC input auxiliary power supply of the battery protection unit, ensure that the handle of disconnecting switch is in the "OFF" position.

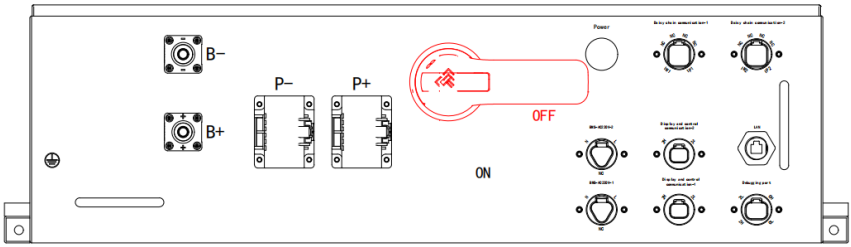


Figure 6-14 handle of disconnecting switch is in the "OFF" position

2. Turn the handle of disconnecting switch to ON.

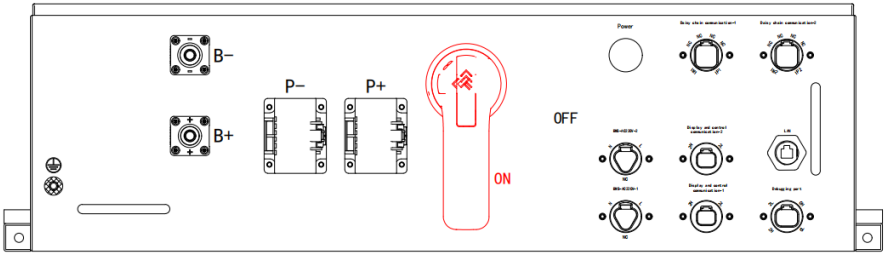


Figure 6-15 Turn the handle of disconnecting switch to ON

3. Check the color of the indicator: If the indicator lights up as red, it indicates that the power supply of the battery protection unit is normal. If the indicator is not on, it indicates that the power supply of the battery protection unit is abnormal.

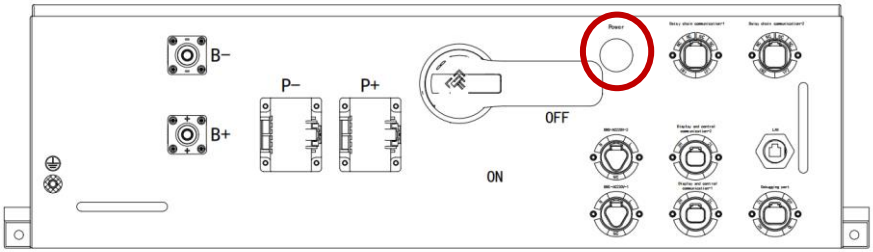


Figure 6-16 Check the color of the indicator

6.5 Installation of liquid cooling pipeline

Warning:

Install the liquid cooling pipe according to the following table.

Note: When the normal system is shipped, the primary, secondary and tertiary liquid cooling pipelines have been installed.

6.5.1 Install secondary and tertiary inlet pipelines in the cluster

Install secondary and tertiary inlet pipelines in the cluster in accordance with the following steps:

1. The main bodies of the secondary and tertiary pipes have been assembled when leaving the factory. The secondary pipe connector pasted with a blue label is connected to the male connector of the primary pipe pasted with a blue label. It is necessary to confirm that the lock of the connector has been clamped into the connector groove and cannot be pulled out.

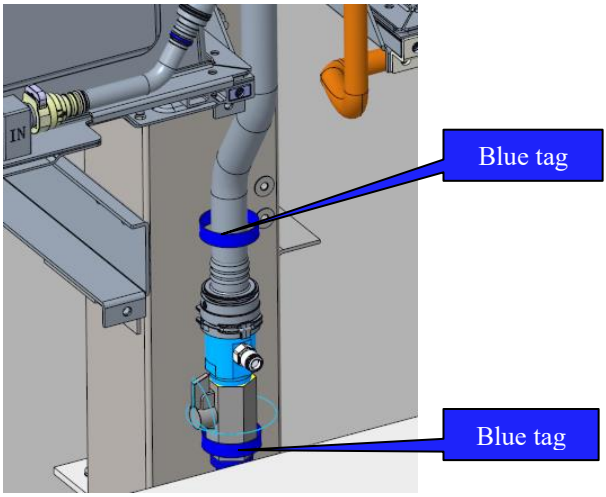


Fig. 6-17 Connect secondary pipe connector to male connector of primary pipe

2. Connect the tertiary inlet pipe connector to the male connector of the battery packs from #1 PACK to #8 PACK in turn, and fasten the clips. A "click" sound shall be heard to confirm that the connector is fastened and cannot be pulled out.

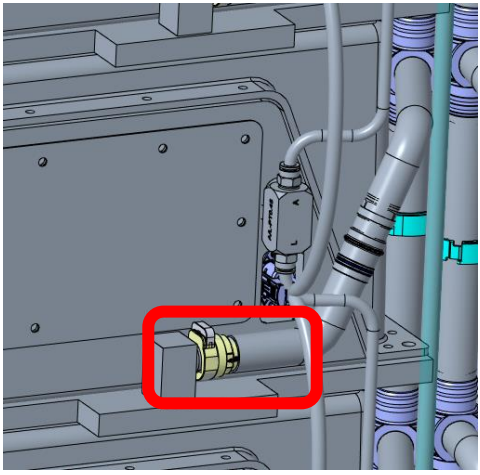


Fig. 6-18 Connect tertiary inlet pipe connector to male connector of battery packs

3. Each secondary inlet pipeline is fixed to the inner hole of the sheet metal part with 4 plastic pipe clamps. The pipe clamp needs to reduce the inner diameter to clamp the pipeline and to be inserted into the hole of fixing the sheet metal part, making sure that there is no loose insertion.

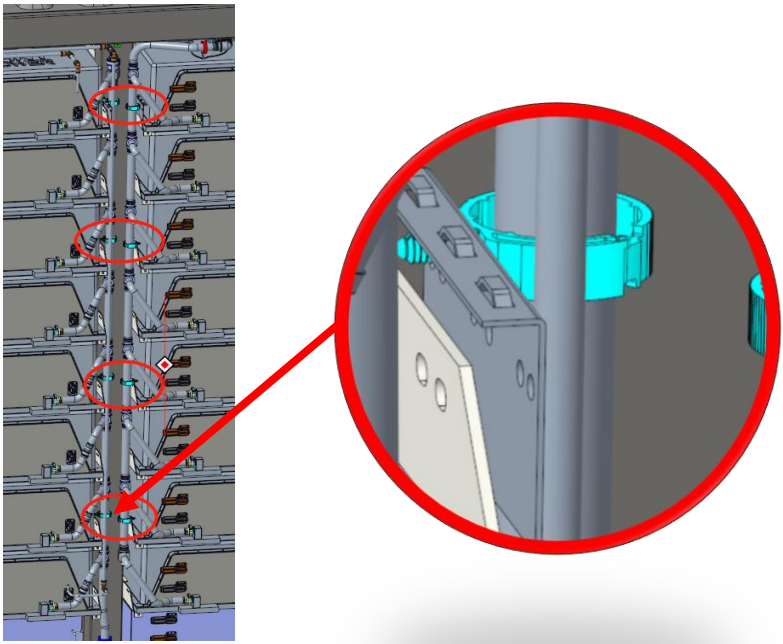


Fig. 6-19 Fix secondary inlet pipeline to the inner hole of the sheet metal part

6.5.2 Install secondary and tertiary outlet pipelines in the cluster

1. The secondary and tertiary pipes have been assembled when leaving the factory. The secondary pipe connector pasted with a red label is connected to the male connector of the primary pipe pasted with a red label. It is necessary to confirm that the lock of the connector has been clamped into the connector groove and cannot be pulled out.

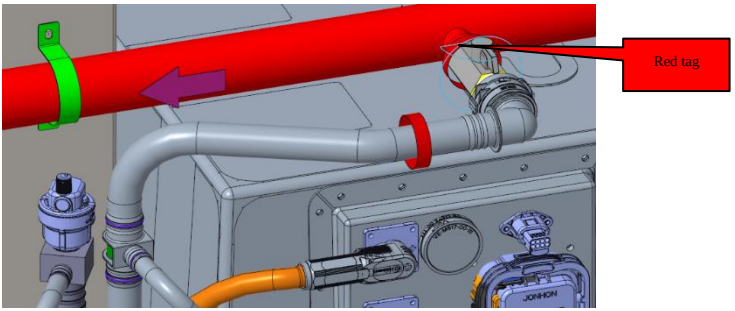


Fig. 6-20 connect secondary pipe connector to male connector of primary pipe

2. Connect the tertiary outlet pipe connector to the male connector of the battery packs from #1 PACK to #8 PACK in turn, and fasten the clips. A "click" sound shall be heard to confirm that the connector is fastened and cannot be pulled out.

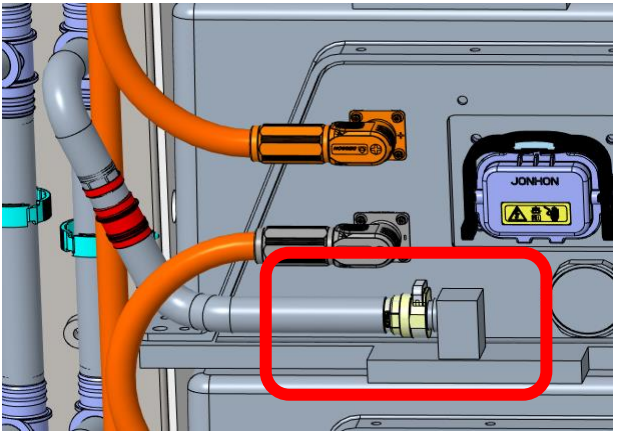


Fig. 6-21 Connect tertiary outlet pipe connector to male connector of battery packs

3. Each secondary outlet pipeline is fixed to the inner hole of the sheet metal part

with 4 plastic pipe clamps. The pipe clamp needs to reduce the inner diameter to clamp the pipeline and to be inserted into the hole of fixing the sheet metal part, making sure that there is no loose insertion.

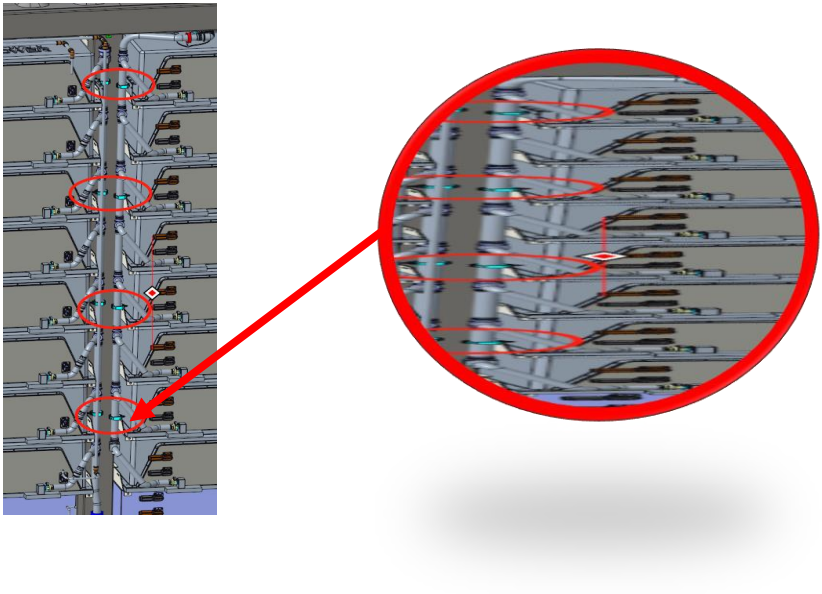


Fig. 6-22 Fix each secondary outlet pipeline to inner hole of sheet metal part

6.5.3 Install MSD on PACK panel

1. Make sure that the battery protection unit disconnecting switch is in "OFF" state

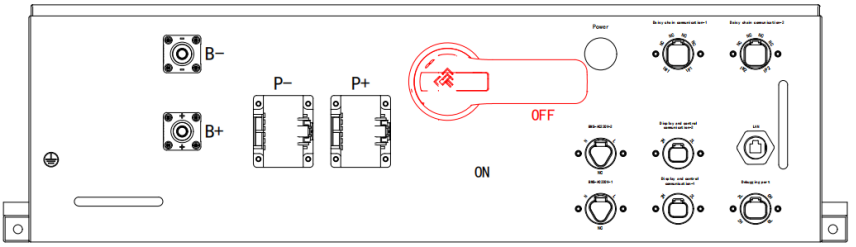


Fig. 6-23 Make sure disconnecting switch is in "OFF" state

2. Align the upper cover handle of the maintenance switch vertically with the base guide groove on 8# PACK panel and push it in. Rotate the handle after pushing in. After hearing a "click" sound, push in the secondary lock.

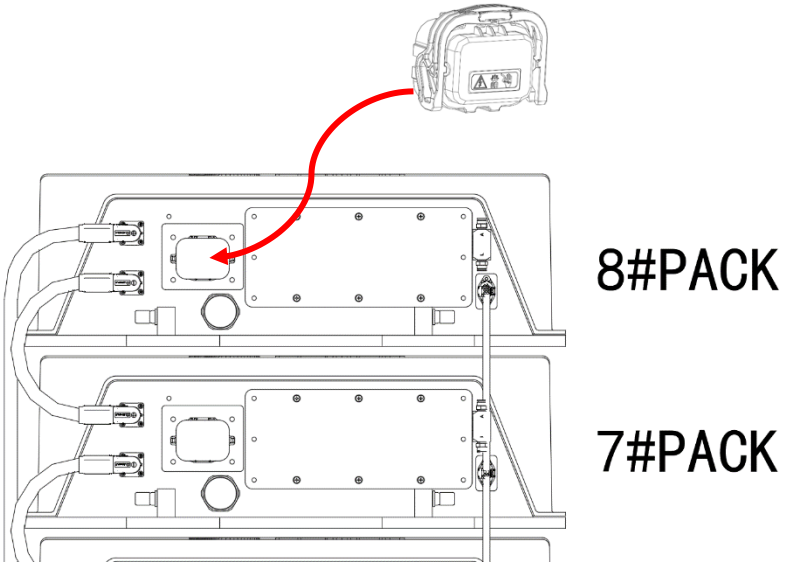


Fig. 6-24 push in upper cover handle of the maintenance switch

3. Repeat step 2 to install MSD on the remaining PACKs in turn until 1# battery PACK is installed.

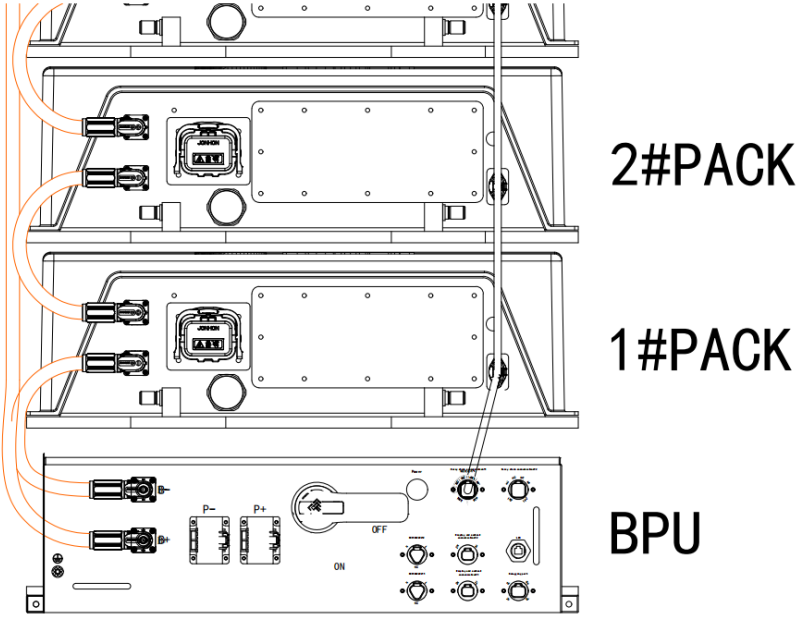


Fig. 6-25 install MSD on the remaining PACKs in turn

7 BMS System Configuration

7.1 BMS system architecture

CHINT strongly recommends that authorized factory representatives configure and debug BMS.

Multiple system-level ESMU can communicate with EMS through Ethernet /ModbusTCP. ESMU does not communicate with each other and should be treated as an independent subsystem. EMS identifies different ESMU by IP address. The sample architecture is as follows:

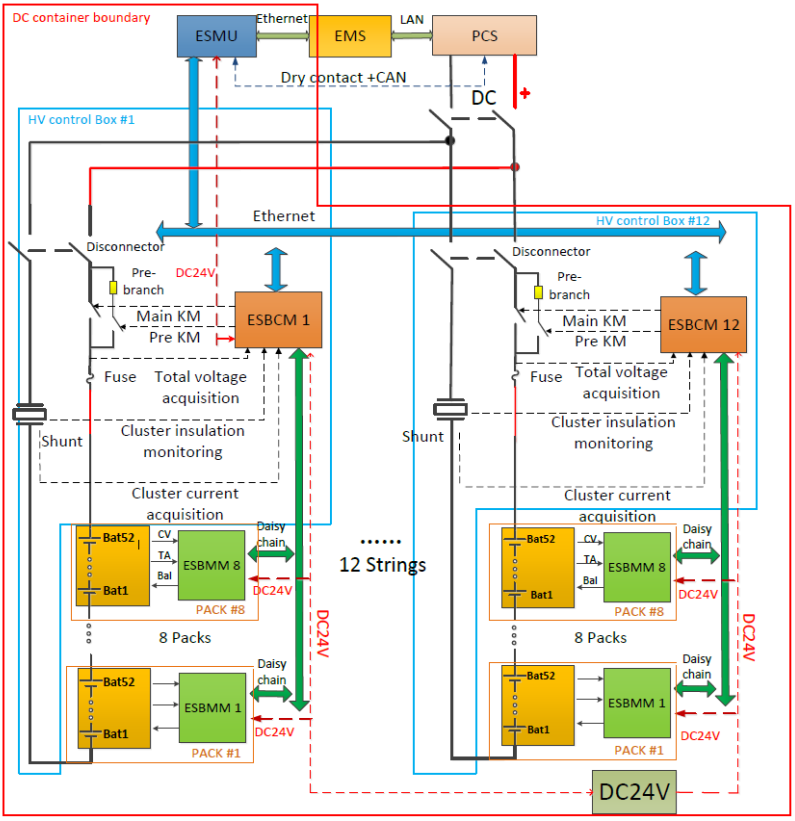


Fig. 7-1 BMS System Architecture

7.2 System configuration preparation

Before system configuration, the following materials shall be prepared:

- BMS communication cable: Used for direct connection of CAN, it is a debugging communication line for BMS system debugging
- Adapter: the tool used is USB to 485
- RJ45 connector: Used to connect the battery protection unit
- D-SUB head on CAN to 485 adapter (Brand: ZLG, Model: USBCAN-2E-U)
- CAN to 485 adapter, V2
- Standard network cable: Connect to ESMU to realize ModbusTCP communication
- Laptop: Operating system with Windows 7 SP1 or higher installed

7.3 BMS System Configuration

Warning:

- If multiple battery clusters are installed, the ESBMM address is automatically assigned.
- When configuring ESBMM, disconnect the DC power line of the battery protection unit and turn off all other ESBMMs.
- After configuring all ESBMMs, reconnect all DC power cables of battery protection units.

7.3.1 ID information of ESBMM

After the system is installed or ESBMM is replaced, there is no need to actively allocate ESBMM address because the daisy-chain communication mode is adopted in the battery cluster.

7.3.2 CAN data uploading

As shown in the figure below, all ESBMMs communicate with ESBCM through daisy chain. Each ESBMM has a unique ID on the battery rack and has the function of address assignment.

ESBCM can collect data from all ESBMMs, and ESBMM can also update data and alerts to ESBCM through a daisy chain.

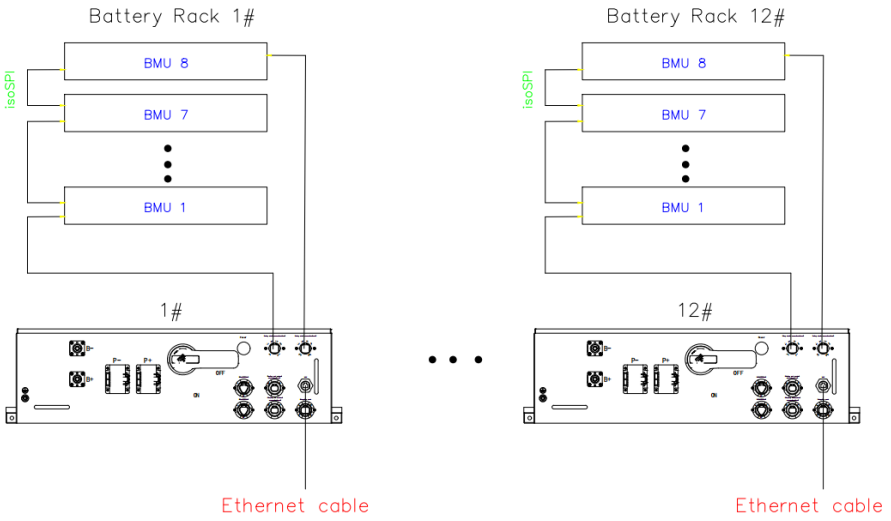


Fig. 7-2 Communication Architecture of Multiple ESBCMs

7.3.3 Software upgrading

The internal software of ESBMM can be upgraded through the daisy chain. In order to simplify the upgrading process, BMS can upgrade all ESBMM software through daisy-chain communication. Software upgrading can be finished easily just by importing latest procedures via ESMU.

7.4 BAMS configuration

7.4.1 Display all information on display screen

On the main interface, there are the voltage value, current value, SOC value and working state of each battery cluster, as well as the total voltage and current of the battery system.

Click " AI info" button to see main information, such as the real time charge or discharge power, temperature, current, SOC and alarm etc.

Fig. 7-3 Display of Multi-cluster Parameters on HMI (for reference)

Click "Cell info" on the top right side of the page to display the voltage of each battery, temperature at each position, alarm/fault information, etc.

Fig. 7-4 Display of Single Cluster Parameters on HMI (for reference)

7.4.2 Parallel connection of battery cluster

Considering the circulating current and other faults when multiple battery clusters are connected in parallel, a self-check process has been configured for the BMS program before parallel connection. If the self-check process is completed and no faults are found, the system will automatically connect to the grid; If there is a battery cluster connection failure, the page will display a warning message, and EMS can obtain the failure information through communication.

During operation, if there is a problem with certain cluster of batteries, program will disconnect. The running interface is shown in the following figure:

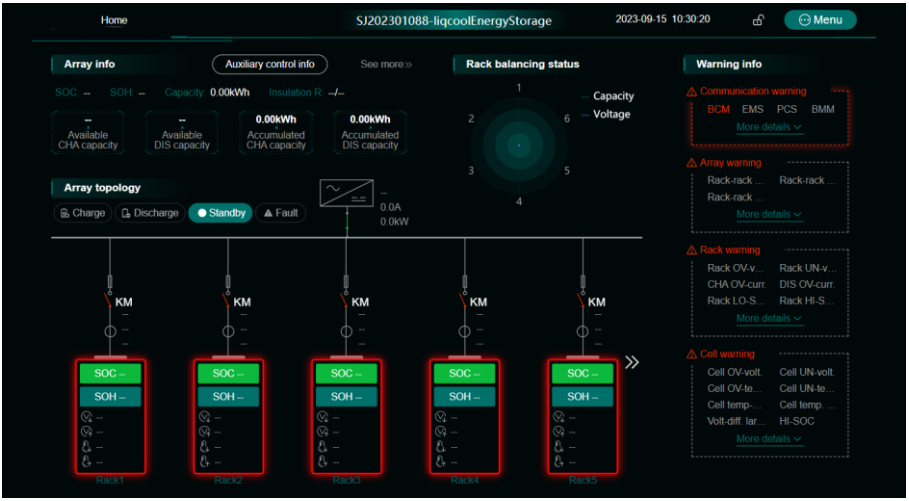


Fig. 7-5 Operating Interface of Grid Connection of Battery Cluster (for reference)

7.5 Configuration of network interface

After installation, wiring and configuration are completed, connect the Ethernet cable to ESMU, communicate through MODBUS, and check whether the system BMS provides the correct data.

The default IP address is: 192.168.1.199 (which may vary in different systems).

Port No.: 502

7.6 Typical protection policy

The basic protection policy is summarized as follows (which may vary according to the specific requirements of the application):

1. Source of protection signal
   - Module/unit information based on BMS analysis and triggered alarms
   - BMS hardware fault
   - Communication problems within BMS or with EMS/PCS
   - BMS sends signals to PCS/EMS through Modbus.
2. EMS/PCS turns off the inverter
3. If the inverter is not turned off after 3-5s, BMS activates the hardwired signal to turn off it
4. If the inverter is not turned off after 5s, BMS disconnects the battery by turning on the contactor

8 Annex

Annex 1 Safety Training Record Form

Customer name		Training place	
Training purpose		Contact no.	
Trainer		Training time	
Training contents			
Basic requirements	1) Wear PPE before entering the site. 2) Installation personnel on site shall not use metal accessories (i.e. watches and necklaces). 3) Special types of construction projects must be carried out by the holder within his/her scope of work.		
Battery handling	4) Do not make the battery short-circuited. 5) Do not use the wire rope as a means of transportation. 6) Do not pull the battery terminal forcibly. 7) Handle with care. Avoid the strong impact and vibration. Do not place the battery upside down. Do not throw the battery. Do not expose the battery to the sun and rain.		
Battery installation	8) Check each battery visually and find defects in time. 9) Place the battery in strict accordance with the supervisor's instructions. Note the terminal position. 10) Handle with care to ensure the personal safety and not damage the battery.		
Battery connection	11) Insulate the wrench and other metal tools to prevent short circuit when falling. 12) The supervisor should pay strict attention to the battery connection to avoid short circuit. 13) Make sure that all the bolts on the battery are tightened.		
Overall	1) Install a protective cover on the cable in time. 2) Clearly mark on the battery: Electrified Equipment 3) Do not construct around the battery pack. If it is inevitable, wrap the battery pack with the insulating plastic cloth before construction, so as not to damage it.		
Signature			
If the above requirements can be met, please sign here:			

Note: If an accident occurs due to improper operations, the Company does not assume any responsibility.

Annex 2 List of Personal Protective Equipment (PPE)

No.	Category	Sample	QTY	Requirements	Notes
1	Safety helmet			Your hard hats must meet one of the two types: TYPE I: Protects the top of the head; TYPE 2: Protects both the top and the sides of the head. Your hard hats must meet with one of the three classes: CLASS G: These are general hard hats rated for 2,200 volts. CLASS E: These are electrical hard hats rated for 20,000 volts. CLASS C: These are conductive hard hats, and they do not offer electrical protection at all1) Wear a helmet correctly before entering the construction site to protect your head. 2) The helmet shall meet the requirements of GB 2811-2007 Safety Helmet.	

No.	Category	Sample	QTY	Requirements	Notes
2	Electrician clothes			Service personnel on site shall wear electrician’s clothes.	
3	Protective shoes			1) Wear protective shoes during battery transportation and installation. 2) Service personnel on site shall wear protective shoes.	
4	Insulating gloves-480V ac			Maintenance personnel on site shall wear insulating gloves.	
5	Insulating gloves-1500V dc			Maintenance personnel on site shall wear insulating gloves.	
6	Masks			Service personnel on site shall wear masks	

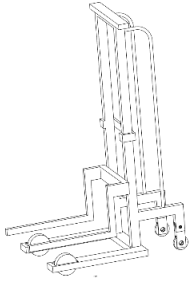
Note: Other types of PPE and their corresponding quantity depend on the requirements on site.

Annex 3 List of Tools

No.	Name	Material	Spec.	Sample	Qty.	Calibrate date	validity
1	Laptop				2		
2	Tape measure	Steel	5m		1		
3	Wrench (insulated)	Stainless steel	1 set		1		

No.	Name	Material	Spec.	Sample	Qty.	Calibrate date	validity
4	Socket wrench (Insulation)	Stainless steel	1 set		1		
5	Insulated torque wrench	Stainless steel	1 set		2		
6	Screwdriver	Stainless steel	1 set		1		
7	Gradiometer (Gradienter)	Aluminum alloy	1000mm		1		

No.	Name	Material	Spec.	Sample	Qty.	Calibrate date	validity
8	Electric wrench				1		
9	Electric drill				1		
10	Multimeter- DC 2000V				1		

No.	Name	Material	Spec.	Sample	Qty.	Calibrate date	validity
11	Battery tester		HIOKI 3564		1		
12	Lift truck				1		

Annex 4 Terms and Definitions

Battery module	Battery assembly consisting of battery cells connected in series, parallel or both and having only a pair of positive and negative output terminals, which should also include housings, management and protection components
Battery protection unit	It is used for the protection and control during charging and discharging of battery cluster, and consists of the cluster-level battery management unit, relay, fuse, power resistor and disconnecting switch.
Battery cluster	Battery assembly that is connected by the battery modules in series and can run independently after being connected with an energy storage converter and ancillary facilities, which shall also include the battery management system, monitoring and protection circuit, electrical and communication interfaces and other components.
PCS/inverter	Bidirectional converter, which accepts the EMS or BMS requirements, and charges and discharges batteries. Refer to debugging steps for specific operation and introduction
BMS	Battery Management System, which is used to detect the voltage, current, temperature and other parameter information of the battery and manage and control the state of the battery. Refer to introduction of BMS system
ESBMM	Electric Storage Battery Management Module, which is used to collect the voltage and temperature of single battery in the module, control fans, and achieve the balance management of battery
ESBCM	Electric Storage Battery Control Module, which enables the real-time monitoring of battery cluster parameters, fault handling, SOC/SOH estimation, insulation detection, alarm display, remote monitoring, relay control, equalization algorithm, and collection of total voltage and main loop current, communication with ESBMM in the system BMS, and communication with the master control module and uploading of real-time battery data
ESMU	Electric Storage Management unit, which communicates with the main control module to query the information inside the module, and summarizes the information of multiple battery clusters; communicates with HMI to query on the corresponding HMI; communicates with the background to query in the corresponding

	background; communicates with PCS to control the charging and discharging of PCS; and inputs and outputs dry contacts as required, and communicates with air conditioning, fire protection and other system equipment as required.	
EMS	Energy management system of the whole power station, which is used for dispatching, monitoring and management of the whole power station.	
Auxiliary control distribution box	It is mainly used to supply power to the system communication components and system equipment, and is arranged in the equipment compartment.	
DC confluence unit	It mainly includes functions of the DC confluence part, and is arranged in the equipment compartment.	
Fire protection component	It mainly includes the fire-fighting gas extinguishing cylinder, gas extinguishing controller and module control box, and is arranged in the equipment compartment.	
Thermal management system	The internal temperature of the container is controlled within an appropriate range by using a liquid cooling air conditioner, and the temperature of each battery is uniformly controlled through the battery rack channel and battery module channel	
Lighting system	Lighting lamps are arranged in the container.	
Cycle	When the battery or module is charged and discharged once as per the specified standard, it is considered as a cycle.	
Unit of measurement	Unit of voltage: "V" (volt) current: "A" (ampere) capacity: "Ah" (Ampere-Hour) energy: "Wh" (Watt-Hour) internal resistance: "mΩ" (milliOhm) temperature: "℃" (degree Celsius)	length: "mm" (millimeter) time: "s" (second) frequency: "Hz" (Hertz) mass: "kg" (kilogram) force: "N" (Newton) power: "W" (watt)

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