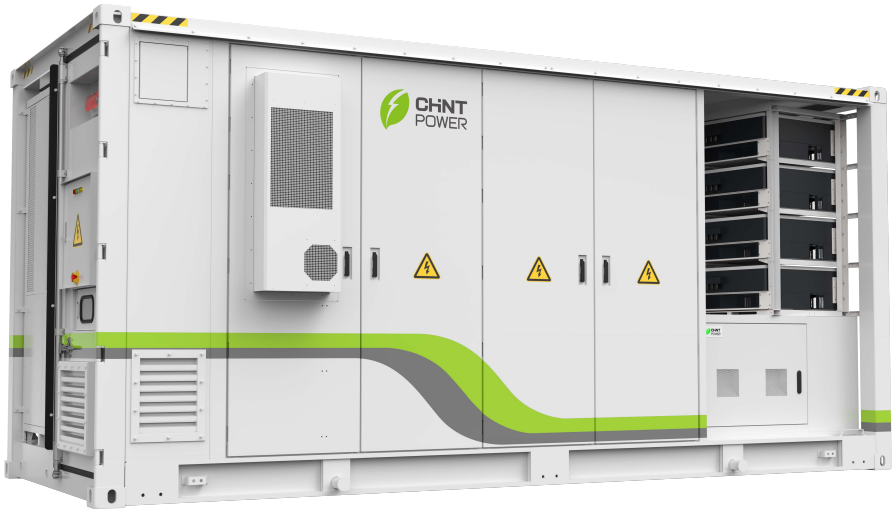
CPS ES-1.6MW/3.34MWh-EU

AC/DC Integrated Energy Storage System

User Manual



Shanghai Chint Power Systems Co., Ltd.

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Revision History

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1. Preface

This O&M Manual is applicable to the CPS ES-1.6MW/3.34MWh-EU AC/DC Integrated Energy Storage System (Hereinafter referred to as ESS) developed and produced by Shanghai Chint Power Systems Co., Ltd.

Important Note!

- Please keep this Manual by specially-assigned person.
- Please read this manual carefully and make sure that you fully understand all contents before performing any operation.

Main Content

This Manual contains how to operate ESS (e.g. instructions on how to conduct the commissioning and shutdown of the ESS properly), a maintenance plan for ESS, and handling and recycling considerations for system hardware. Therefore, please read this manual carefully before using this system and operate the energy storage system according to the method described in this manual, to avoid equipment damage or personal injury.

Target Reader

This manual is only applicable to authorized and qualified after-sales service engineers or authorized operators.

Copyright Restriction

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 O&M Manual from our official website www.chintpower.com.

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 energy storage system (ESS). 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. 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 when operating the battery:

- Do not smoke or use fire near the battery!
- Do not use organic solvents to clean the battery!
- Do not put the battery into the fire, or it may explode!
- Do not disassemble the battery, which contains electrolyte harmful to skin and eyes!
- Do not place tools or any metal parts on the top of the battery!
- Take off watches, rings and other metal accessories!
- Use tools with insulated handles to avoid accidental short circuit!
- Before connecting or disconnecting the terminal, please disconnect the charging power supply and load!
- Use proper lifting methods when handling batteries, and wear all appropriate safety clothes and equipment!
- Stay away from heat sources or any places that may generate sparks (such as circuit breakers and fuse boxes) for at least 0.5m!
- Avoid the risk of local overheating, such as direct sunlight on the battery rack!
- Batteries must be handled, transported, recycled or discarded in accordance with federal, state and local regulations!

Precautions for installation:

- Before installation, all personal protective equipment (PPE) required to supervise the installation process shall be in place, as shown in Schedule 2.
- Before installation, the installation personnel shall receive safety training and fill in the Safety Installation Training Record Form, as shown in Schedule 1.
- Unless proper power-off measures are taken, all power cables are considered to be electrified.
- Before installation, please cut off the power supply of the power grid and ensure that the battery is turned off.
- All battery racks must be grounded with good conductors to form a good grounding network.
- The fixing screws at the battery pole and the power interface of BMS high-voltage box are M8 external hexagon screws, and the tightening torque ranges from 19 to 24 N.m, which should be fixed with a torque wrench.
- 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. Equipment Warning Indications

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!** Electro Static discharge can damage electronic equipment. Therefore, correct handling procedures are necessary. Please wear an antistatic wrist strap grounded, and prevent Electro Static Discharge when touching the grounded surface near the equipment.
	**Dangerous voltage!** ESS 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. Therefore, please follow all safety procedures issued by manufacturers.

2.3. Safety Requirements for the Owner

The Owner must follow the following requirements:

- The personnel operating the energy storage system must be trained and qualified electrical workers, and other personnel are not allowed to operate the energy storage system, because improper or wrong operation may cause serious injury to the operator;
- The personnel operating the energy storage system should be fully familiar with the working principle of the energy storage system;
- The personnel operating the energy storage system should be fully familiar with this manual;
- The personnel operating the energy storage system should be fully familiar with the local electrical regulations and standards;
- Regularly check the safety equipment in the system (please refer to 8 Performance Maintenance) to ensure that the safety equipment is reliable;
- Any warning signs damaged or illegible on the equipment shall be replaced immediately;
- No inflammable and explosive articles are stored in or near the container;
- The ground where the energy storage system products are stored must be firm and reliable. Please refer to 4.4 Installation Requirements for Energy Storage System for foundation requirements;
- Transportation, installation and commissioning can only be carried out by professionals recognized by the manufacturer; otherwise, the quality assurance of the energy storage system is invalid.
- Before operating the energy storage system, evaluate the events that may lead to system danger and handle these events;
- This Manual describes the safety instructions in details. Working personnel shall read it carefully for full understanding;
- 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 ineffective;
- 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. Danger

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 ESS, 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 3.8 Grounding Wire.

2.4.2. Warnings

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 ESS. Locking and marking procedures must meet or exceed these requirements.

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 ESS:

- 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 ESS, 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 and still needs to be operated according to procedures during operation.

Please pay attention to the following warning signs inside and outside ESS container

Warning signs inside container

Please read the manual carefully

Warning

Electrical Danger

Recycle

Warning signs outside container

Protective grounding

Emergency stop

2.5. Terms and Definitions

Terms	Definitions
Battery PACK	Battery assembly consisting of battery cells connected in series, parallel, or both, with a pair of positive and negative output terminals, which should also include housings, management and protection components.
High-voltage box	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 disconnector
Battery cluster	Battery assembly that is connected by the battery PACKs 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	(Power Conversion System), which accepts the EMS or BMS requirements, and charges and discharges batteries.
BMS	(Battery Management System), used to detect the voltage, current, temperature and other parameter information of the battery and manage and control the state of the battery.
ESBMM	(Energy Storage Battery Management Module), the slave module in BMS, which is used to collect the voltage and temperature of single battery in the battery PACK, control fans, and achieve the balance management of battery.
ESBCM	(Energy Storage Battery Control Module), the main control module in BMS, 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	(Energy Storage Management Unit), the master control module in BMS, 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.

LEMS	(Local Energy Management System), local controller, which is used for managing the local equipment.
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 cabin
DC confluence unit	It mainly includes functions of the DC confluence part, and is arranged in the equipment cabin
Fire fighting component	It mainly includes the fire extinguishing gas cylinder, gas extinguishing controller and module control box, and is arranged in the equipment cabin
Thermal management system	Use a liquid cooler to adjust the battery temperature within an appropriate range, and uniformly control the temperature of each battery through liquid cooling pipelines and liquid cooling plates
Lighting system	Lighting lamps are arranged in the container
MSD	(Maintenance Switch Disconnector) Manual maintenance switch
Circulation	When the battery PACK is charged and discharged once as per the specified standard, it is considered as a cycle
Unit of measure	Unit of voltage: "V" (volt) Unit of current: "A" (ampere) Unit of power: "W" (watt) Unit of capacity: "Ah" (ampere-hour) Unit of energy: "Wh" (watt-hour) Unit of internal resistance: "mΩ" (milliOhm) Unit of temperature: "°C" (degree Celsius) Unit of length: "mm" (millimeter) Unit of time: "s" (second) Unit of frequency: "Hz" (Hertz) Unit of mass: "kg" (kilogram) Unit of force: "N" (Newton)

3. System Introduction

3.1. System Application

The CPS ES-1.6MW/3.34MWh-EU AC/DC integrated energy storage system (ESS) features a modular design and is widely used in MW-level energy storage systems for renewable energy integration, commercial and industrial (C&I) and utility applications. The energy storage system is mainly applicable to BCP (emergency power supply in case of accidents or disasters), peak-load shifting, PV self-generation and self-consumption, and VPP virtual grid or power grid dispatching system solutions to improve energy utilization efficiency and power quality. The energy storage system has the advantages of high efficiency, energy saving, environmental protection, high integration, convenient installation, standardized scheme, intelligent control, remote monitoring and easy operation. It is safe and reliable with stable performance and long service life.

3.2. System Functions

Intelligent management: The energy storage system is composed of large-capacity cells. It is an intelligent energy storage device that supports management, dispatching, grid connection, black start and facilitates transportation. Main components of the system include power converter system (hereinafter referred to as PCS), battery management system (hereinafter referred to as BMS) and large-scale battery array. PCS charges and discharges the battery group stably according to the battery state and working mode provided by EMS or BMS.

High reliability: BMS realizes automatic balancing, automatic patrol protection and power data request by monitoring batteries in real time, thus ensuring good operation of the batteries at all times. The black-start system is adopted to support the operation of energy storage station in case of power failure, thus overcoming the difficulty in power supply.

High flexibility: The energy storage system of the whole station can be configured flexibly according to users' requirements. It can be designed for grid-connected wind power/PV energy storage, off-grid energy storage, etc. It is a set of powerful, stable and reliable energy storage products with complete technical indicators.

3.3. System Description and Parameters

3.3.1. Scope of System Supply

- Battery cluster, BMS, PCS, low-voltage cabinet, connecting cable, communication cable, power supply equipment, communication equipment, protection equipment and complete temperature control, firefighting and other auxiliary systems to complete the installation and internal connection of the system.
- Debugging and site acceptance test on all items within the scope of supply
- Certification certificates or reports as required for all equipment within the scope of supply.

3.3.2. 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, power conversion system, low-voltage cabinet and the battery PACK. Detailed system notes are shown in the following figure:

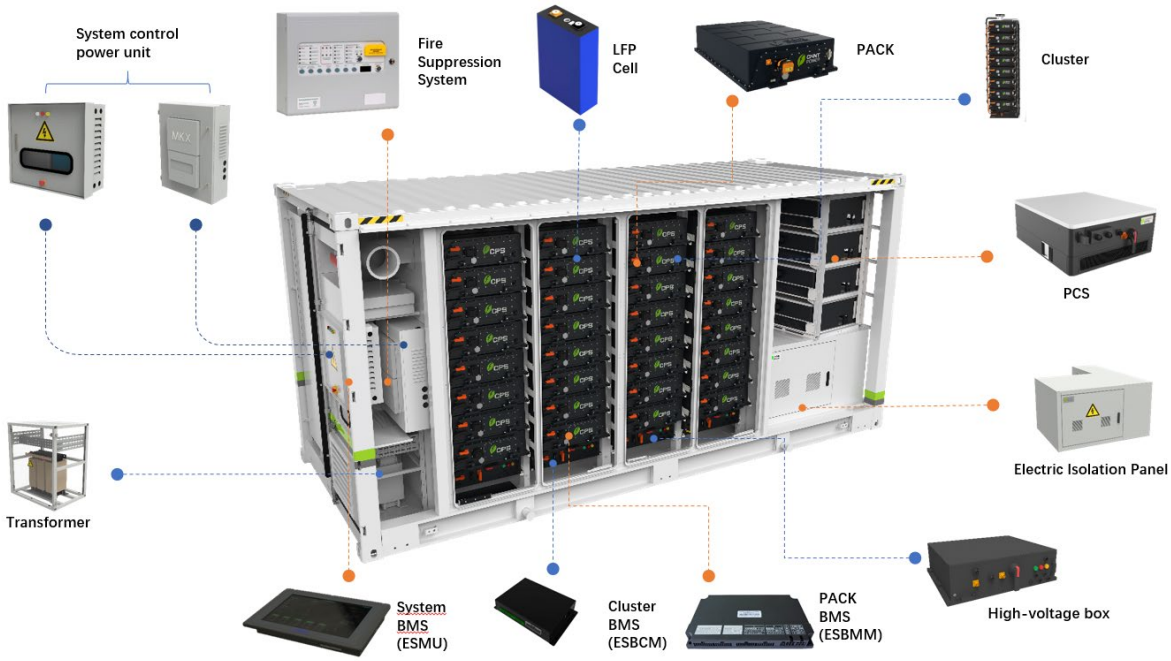


Figure 3- 1 Notes of System Components

3.3.3. 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)°C and humidity (55±20)%. See Table 3-1 for detailed parameters:

Table 3- 1 Detailed System Parameters

Item	Parameter	Condition
Cell capacity	314Ah	Standard charge and discharge
Serial/parallel mode	8P416S	N.A.
DC nominal voltage	1331.2V	N.A.
DC nominal capacity	3.34MWh	Standard charge and discharge
Overall size	6058*2438*2896mm	See drawings for details

Item	Parameter	Condition
Weight	＜33T	N.A.
Discharge cut-off voltage	1164.8V or any battery cell in the battery cluster reaches 2.8V	Temperature T > 0°C
Charge cut-off voltage	1497.6V or any battery cell in the battery cluster reaches 3.6V	N.A.
Rated charge/discharge current	157A*8	(25±2)°C
Communication mode	CAN, RS485, TCP/IP	N.A.
Operating temperature range	-30~45°C	N.A.
Storage temperature range	-30~60°C	N.A.
Service life of the product guaranteed under the operating condition	(25±5)°C	N.A.
System thermal management mode	Battery: liquid cooling; PCS: forced air cooling	N.A.
Fire protection system	Perfluorohexanone	It can be replaced with other gas extinguishing media according to customer's requirements and equipped with water spraying system
Protection grade	IP55	N.A.
Noise	80dB	80dB is the noise parameter under 35°C conditions, at a distance of 1m from the liquid cooler and a height of 1.7m above the ground.
Rated AC output power	8*200kW	
Maximum AC output power	8*200kVA	
Rated AC output voltage	800Vac	

Item	Parameter	Condition
Output voltage range *	-15%,+15%	
Rated output frequency	50/60Hz	
Output frequency range *	Adjustment range Rated frequency±1Hz	

3.4. System Architecture Diagram

3.4.1. Communication Architecture Diagram

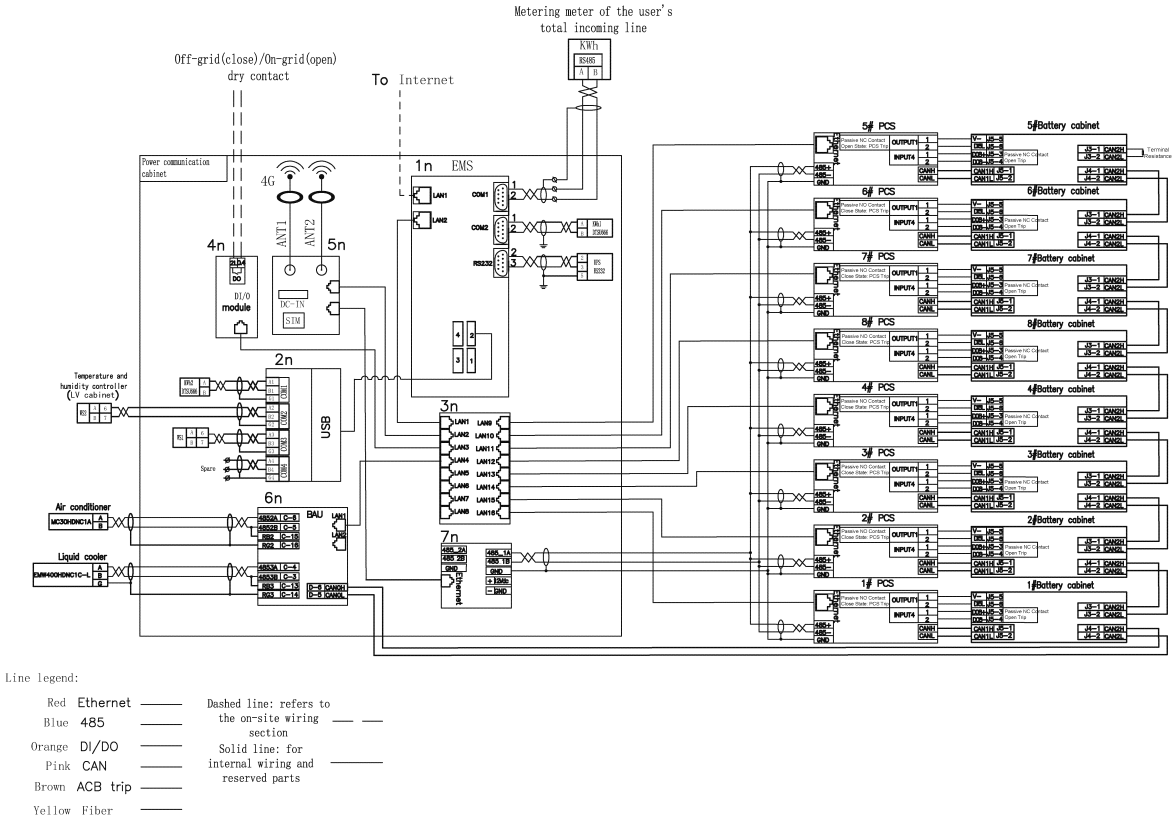


Figure 3- 2 System Communication Architecture

3.4.2. Electrical Architecture Diagram

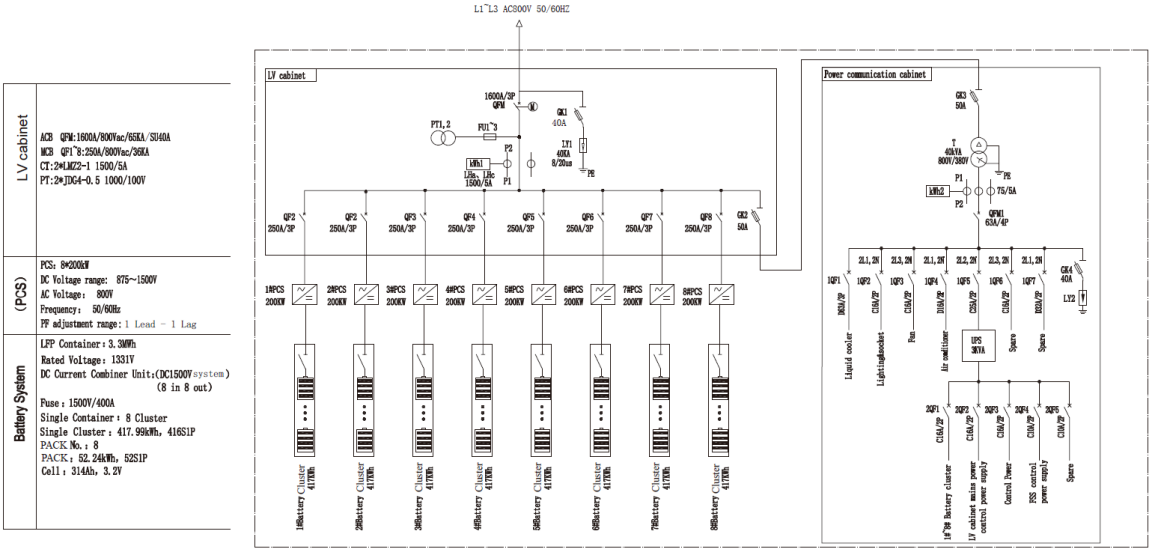


Figure 3- 3 System Electrical Architecture Diagram

3.4.3. Layout of System Equipment

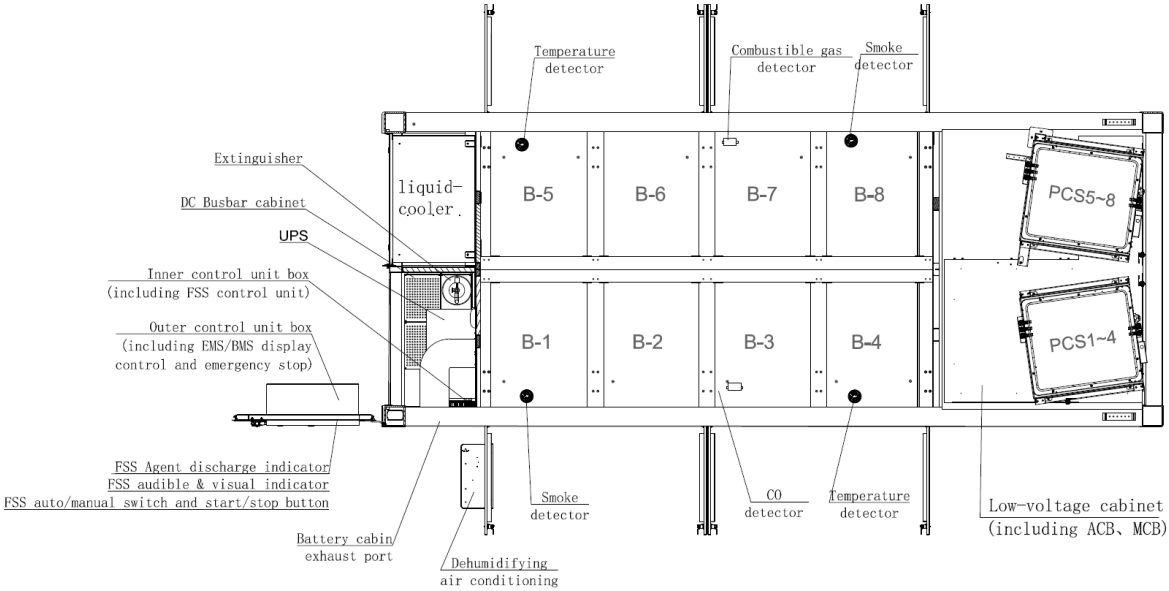
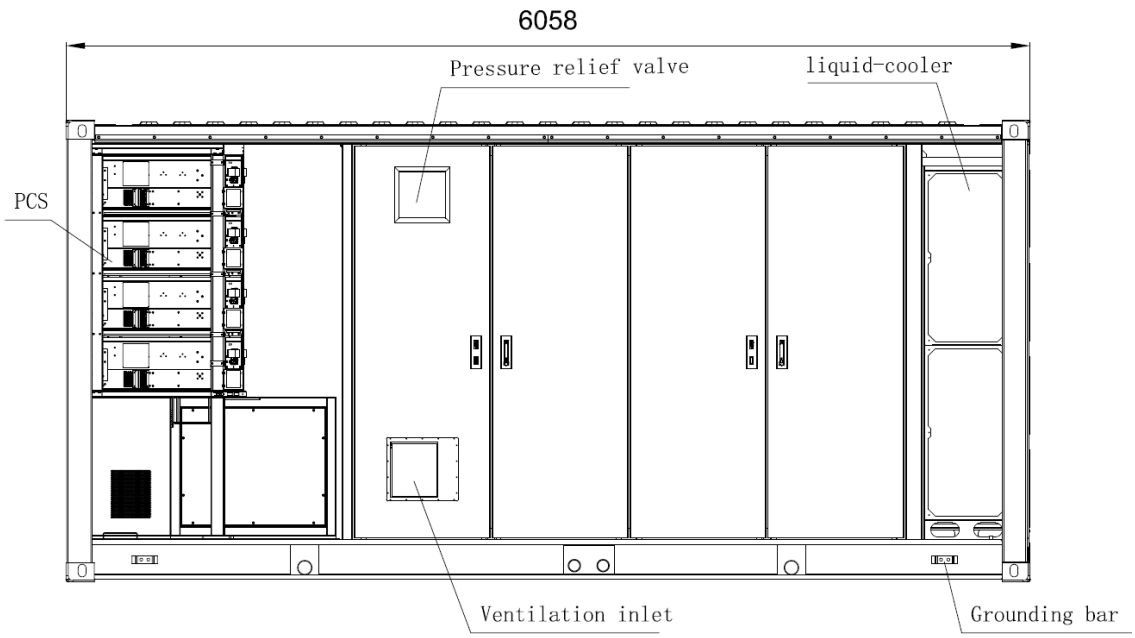


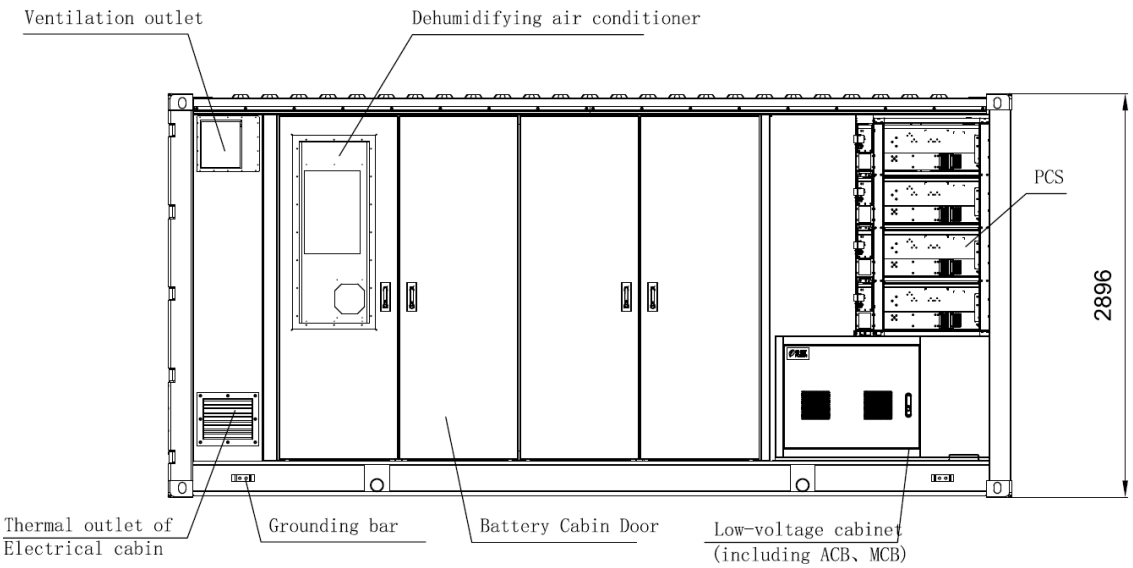
Figure 3- 4 Layout of Equipment in Energy Storage System

Description of each view of the system is as follows:



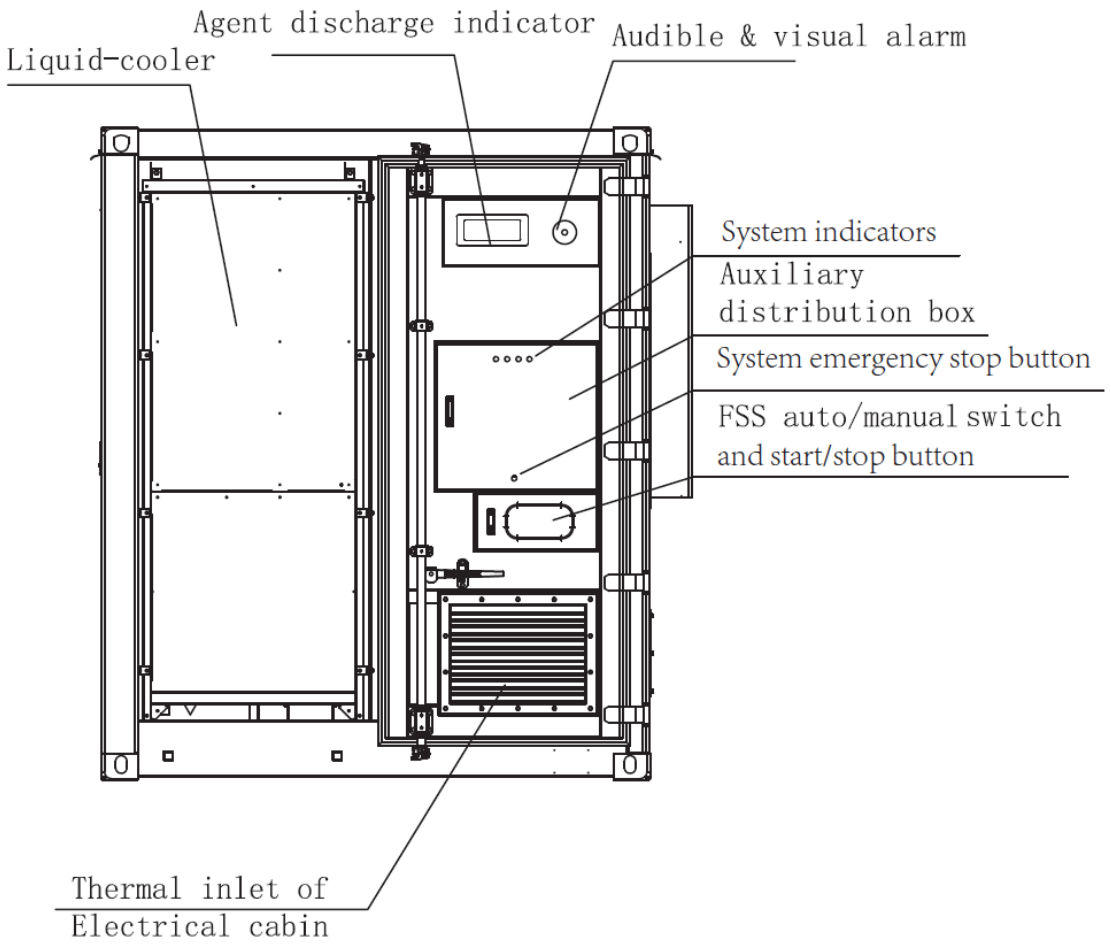
Front view:

- The front view of the container includes four battery flat doors;
- Below the left door of the battery compartment, an air intake system with a ventilation inlet is installed;
- A pressure relief valve is located in the top-left corner;
- The bottom and top of the container are equipped with lifting corner brackets for hoisting;
- Two grounding bars (one on the left and one on the right) are installed on the bottom side beam;
- PCS cabinet is arranged on the left side;
- A liquid cooler is arranged on the right side.



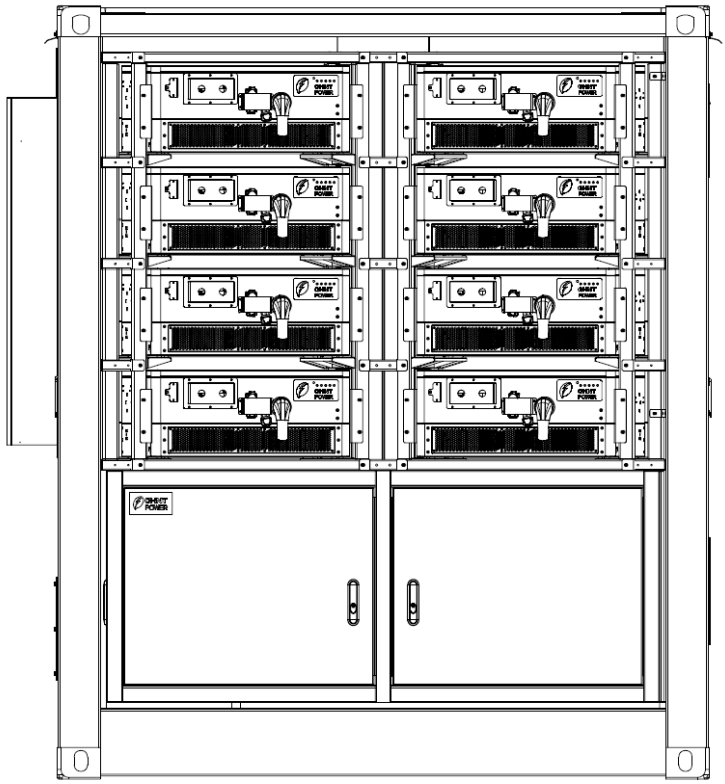
Rear view:

- The rear view of the container includes four battery flat doors;
- A ventilation outlet is arranged on the upper left side;
- Lifting corner brackets are arranged at the bottom and top of the container for hoisting;
- Two grounding bars (one on the left and one on the right) are arranged on the bottom side beam;
- At the lower left corner of the container, a thermal outlet of electrical cabin is reserved;
- A dehumidifying air conditioner is arranged on the left door of the battery compartment;
- PCS cabinet is arranged on the right side;
- Low-voltage cabinet is arranged on the right side.



Right view:

- The right view of the container contains a single-door;
- There are agent discharge indicator, audible and visual alarm, FSS auto/manual switch and system emergency stop button, system indicators on the right door of the container.



Left view:

- PCS and Low-voltage cabinet are arranged in the left view of the container.

3.4.4. Incoming and Outgoing Lines of the System

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 energy storage system is shown in the following figure.

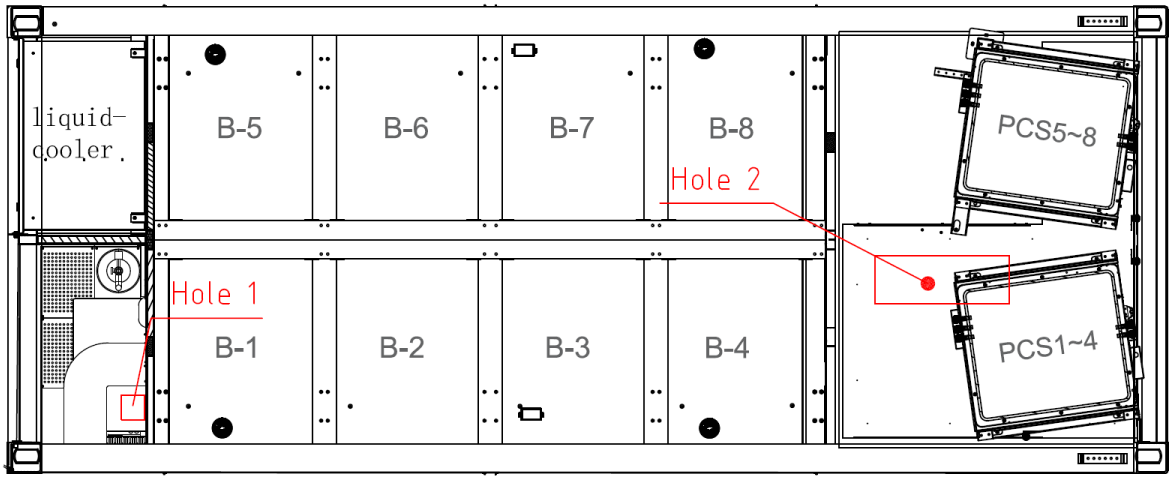


Figure 3- 5 Incoming and Outgoing Line Holes at the Bottom of Container

The function of each hole is as follows:

No.	Name	Description
Hole-1	Communication cable port	The communication cable is connected to LEMS and other equipment through this hole.
Hole-2	AC 800V cable port	Through this hole, the 800V AC cable of the power grid enters the system.

3.4.5. Nameplate of Energy Storage System

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

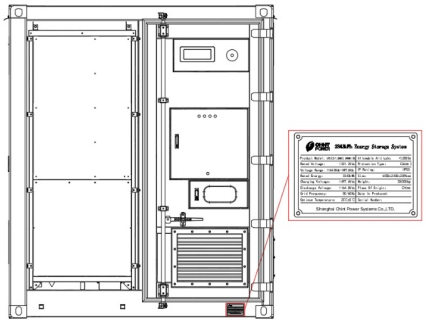


Figure 3- 6 Position of Energy Storage System Nameplate

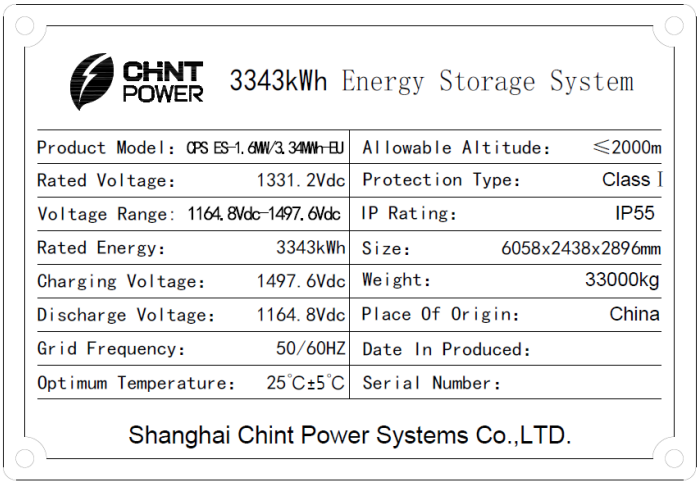


Figure 3- 7 Energy Storage System Nameplate

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 Specifications:

- 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);
- Operating temperature.

Warning:

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

3.5. Battery Cluster

The liquid-cooled battery cluster is mainly composed of battery PACKs, high-voltage box, cabinets and BMS. The BMS adopts 3-level architecture, and the hardware consists of ESBMM, ESBCM and ESMU. ESBMM is pre-installed on the battery panel, ESBCM in the high-voltage box and ESMU in the equipment compartment.

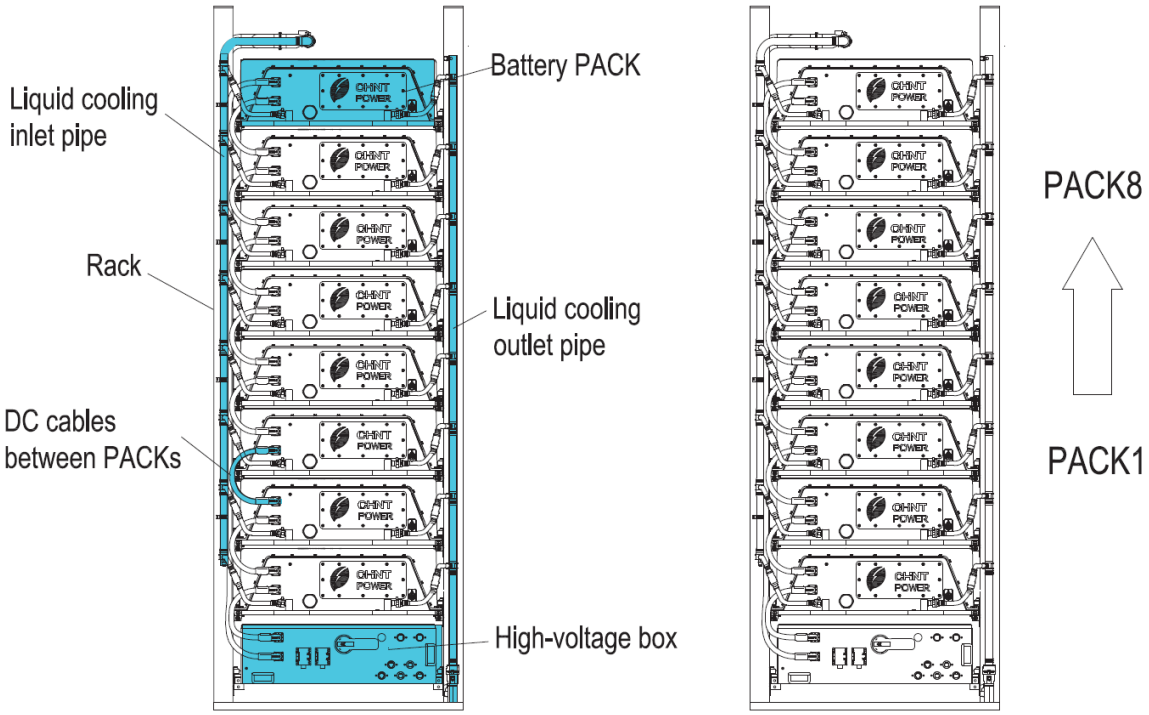


Figure 3- 8 Schematic Diagram for Connection of Battery Cluster

3.5.1. Battery PACK

The battery PACK consists of lithium iron phosphate battery cell 1P52S. The upper of the battery PACK is positive and the lower is negative, as shown below:

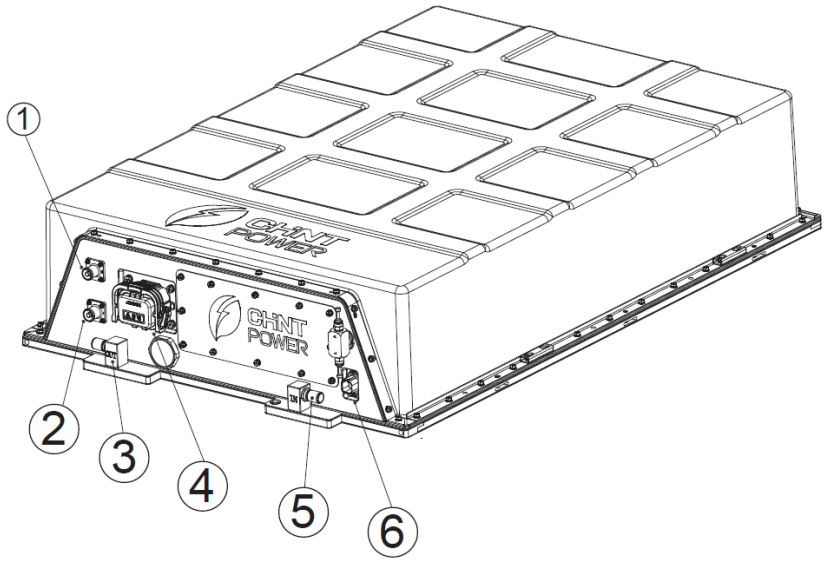


Figure 3- 9 Battery PACK

Table 3- 2 Components of Battery PACK

S/N	Name
1	Positive (+) wiring terminal
2	Negative (-) wiring terminal
3	Liquid cooling outlet
4	MSD
5	Liquid cooling inlet
6	Communication interface

3.5.2. High-voltage Box

The high-voltage box consists of protection components and ESBCM. The layout of the high-voltage box is shown in the following figure:

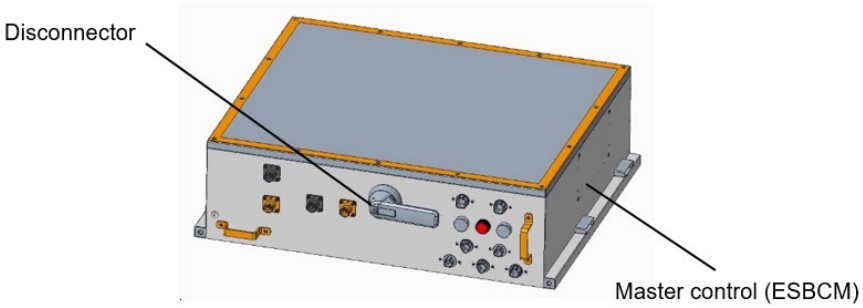
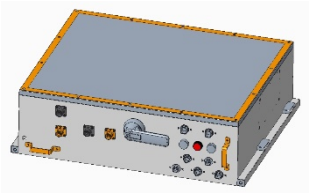


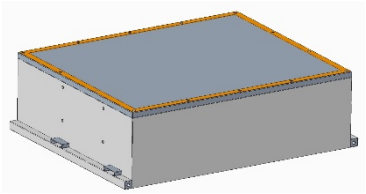
Figure 3- 10 High-voltage Box

The following figures show the front and rear views of the high-voltage box and integrated ESBCM

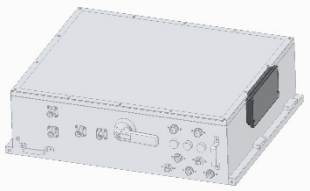
Front view of high-voltage box



Rear view of high-voltage box



Front view with ESBCM integration



Rear view with ESBCM integration

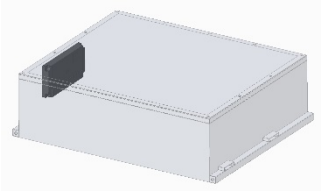


Figure 3- 11 Front and rear views of high-voltage box and integrated ESBCM

The following figure shows the interfaces of high-voltage box:

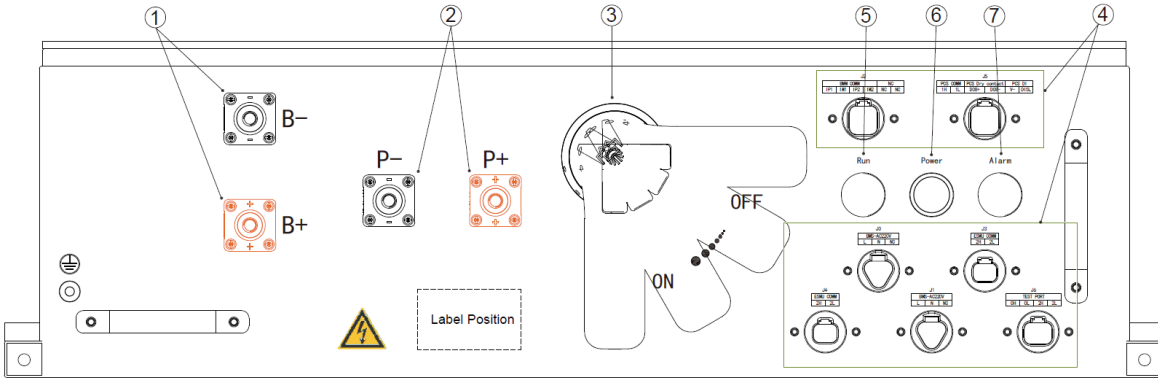


Figure 3- 12 High-voltage Box

Table 3- 3 Definition of High-voltage Box

S/N	Definition	Description
1	Battery cluster plug	DC cable connection plug of battery PACK
2	PCS plug	PCS DC cable connection plug
3	Disconnector switch	Battery cluster switch at DC side
4	Power supply and communication input/output interfaces of high-voltage box	Refer to Table 3- 4 for the definitions of power supply and communication input/output interfaces.
5	Run indicator	Indicating the high-voltage box is running
6	Power button	Press to supply the control power
7	Alarm indicator	Indicating there is failure in the high-voltage box

The high-voltage box is connected to the battery cluster through "B+" and "B-" terminals, and connected to the copper busbar through "P+" and "P-" terminals on the front of high-voltage box. The schematic diagram of high-voltage box interface is shown in the following figure, and the definitions of power supply and communication input/output interfaces are shown in Table 3- 4:

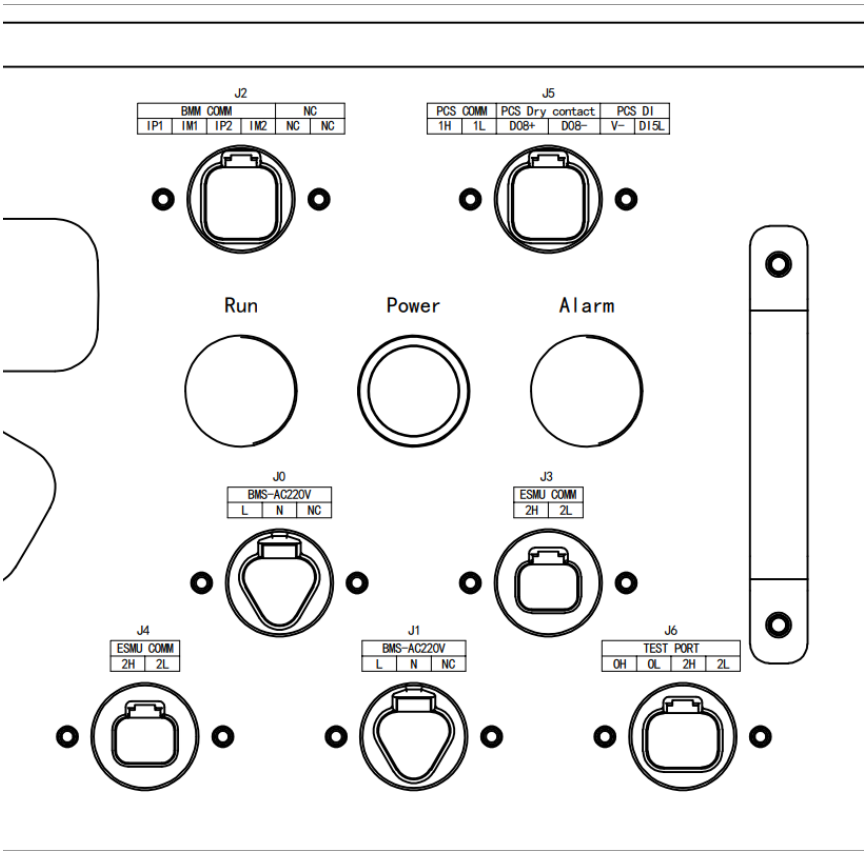


Figure 3- 13 Power Supply and Communication Input/Output Interfaces of High-voltage Box

Table 3- 4 Definition of Power Supply and Communication Input/Output Interfaces of High-voltage Box

Name	Function definition	Definition	Function description	Remarks
J0/J1	BMS-AC220V	L	External AC220V power input to supply power for BMS switch inside the high-voltage box	
		N		
		NC		
J2	ESBMM COMM	IP1	Daisy-chain communication	To IP2/IM2 of the first ESBMM
		IM1	Daisy-chain communication	
		IP2	Daisy-chain communication	To IP2/IM2 of the last ESBMM
		IM2	Daisy-chain communication	
	NC	NC	Reserved	
		NC	Reserved	
J3	ESMU COMM	2H	Daisy-chain communication	Connect to the previous 2H/2L of ESMU
		2L	Daisy-chain communication	
J4	ESMU COMM	2H	Daisy-chain communication	Connect to the next 2H/2L of ESMU
		2L	Daisy-chain communication	
J5	PCS COMM	1H	Communication with PCS	
		1L		
	PCS Dry Contact	D08+	It is used for fault transmission from BMS to PCS, serious fault output, passive normally closed, and disconnection in case of abnormality (PCS tripping)	
		D08-		
	PCS DI	V-	Used for fault transmission from PCS to BMS, passive normally open node, closed in case of fault (PCS tripping)	
		DI5L		
J6	1	0H	Intranet commissioning port	
	2	0L		

Name	Function definition	Definition	Function description	Remarks
	3	2H	External network commissioning port	
	4	2L		

3.6. BMS System

The BMS adopts 3-level architecture, and the hardware consists of ESBMM, ESBCM and ESMU. The installation positions of BMS components are as follows:

Table 3- 5 Installation Positions of BMS Components

Equipment level	Equipment name	Installation position	Function
Level 1, PACK level	ESBMM	In the PACK maintenance panel	Check the voltage and temperature information of cells in the PACK
Level 2, battery cluster level	ESBCM	In the high-voltage box	Carry out data collection, analysis and decision-making and cluster level protection; upload the information to ESMU
Level 3, system level	ESMU	In the equipment compartment	Collect the information of each ESBCM and communicate with LEMS and SCADA

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

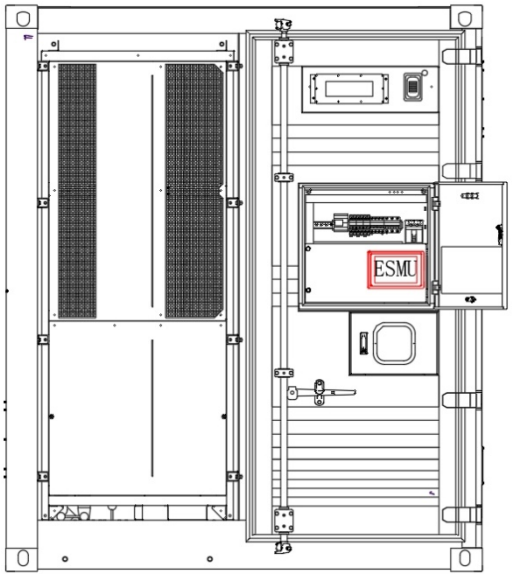


Figure 3- 14 ESMU Installation Position

The diagram of ESMU interface is shown as below:

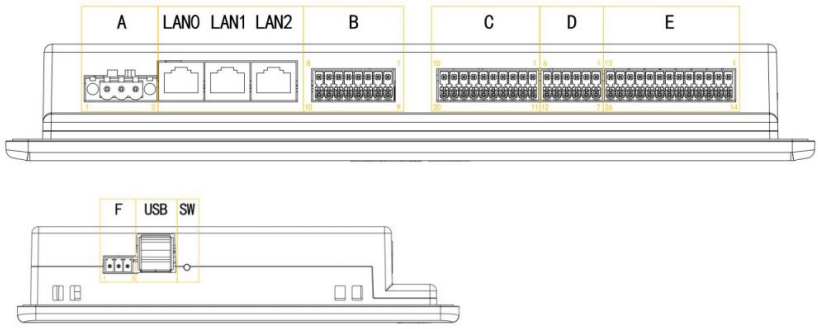


Figure 3- 15 ESMU Interface

In the interface distribution of ESMU, interface A is the power port, and LAN is the Ethernet communication port. Interfaces B, C, D, E and F are communication ports, USB is the port for exporting data and importing upgrade programs, and SW is the auxiliary firmware button.

ESMU has 11 pairs of output dry contact interfaces, which are located on all pins of interface E.

Interfaces of ESMU are defined as follows:

Table 3- 6 Definition of ESMU Interfaces

Port	S/N	Port definition	Function description	Recommended application	Remarks
A	1	V+	Positive input of power supply	Power input	
	2	V-	Negative input of power supply		
	3	PE	System GND		
LAN	-	LAN0	100M/1000M Ethernet port	LEMS	
	-	LAN1	100M/1000M Ethernet port	LEMS	
	-	LAN2	10M/100M Ethernet port	ESBCM	
B	8	VDD	DI isolated power output positive pole	DI power supply	

Port	S/N	Port definition	Function description	Recommended application	Remarks
	16	VSS	DI isolated power output positive pole		
	7	DI1H	High significant digital detection	Level II fire alarm signal	
	15	DI2H	High significant digital detection	Reserved	
	6	DI3H	High significant digital detection	Tripping signal	
	14	DI4H	High significant digital detection	Emergency stop signal	
	5	DI5H	High significant digital detection	Reserved	
	13	DI6H	High significant digital detection	High concentration trip signal	
	4	DI7L	Low significant digital detection	Reserved	
	12	DI8L	Low significant digital detection	Reserved	
	3	DI9L	Low significant digital detection	Reserved	
	11	DI10L	Low significant digital detection	Reserved	
	2	DI11L	Low significant digital detection	Reserved	
	10	DI12L	Low significant digital detection	Reserved	
	1/9	DI0+/DI0-	AC (220Vac 50Hz) detection	Reserved	

Port	S/N	Port definition	Function description	Recommended application	Remarks
C	10/9	0A/0B	0#RS485	Reserved	
	8/7	1A/1B	1#RS485	Reserved	
	6/5	2A/2B	2#RS485	Dehumidification A/C communication	Reserved
	4/3	3A/3B	3#RS485	Liquid cooler unit communication	
	2/1	4A/4B	4#RS485	IO expansion module communication	Reserved
	19/17/15/13/11	RB0~RB4	RS485 terminal resistor; if RB is suspended, there is no internal resistance 120R; if RB and xB (0B/1B, etc.) are short-circuited, there is an internal resistance 120R	-	
	20/18/16/14/12/10	RG0~RG4	Grounding point of the shielding layer of each RS485, suspended by default	-	
D	6/5	0H/0L	0#CAN	Reserved	
	4/3	1H/1L	1#CAN	Reserved	
	2/1	2H/2L	2#CAN	Reserved	
	11/9/7	RL0/RL1/RL2	CAN terminal resistor; if RL is suspended, there is no internal resistance 120R; if	-	

Port	S/N	Port definition	Function description	Recommended application	Remarks
			RL and xL (0L/1L/2L) are short-circuited, there is an internal resistance 120R		
	12/10/8	CG0/CG1/CG2	Grounding point of the shielding layer of each CAN, suspended by default	-	
E	13/26	D0+/D0-	0# normally open dry contact output	Reserved	
	12/25	D1+/D1-	1# normally open dry contact output	Reserved	
	11/24	D2+/D2-	2# normally open dry contact output	Reserved	
	10/23	D3+/D3-	3# normally open dry contact output	Reserved	
	9/22	D4+/D4-	4# normally open dry contact output	Reserved	
	8/21	D5+/D5-	5# normally open dry contact output	Reserved	
	7/20	D6+/D6-	6# normally open dry contact output	Reserved	
	6/19	D7+/D7-	7# normally open dry contact output	System fault signal output	
	5/18	D8+/D8-	8# normally open dry contact output	System protection tripping output	
	4/17	D9+/D9-	9# normally open dry contact output	Reserved	

Port	S/N	Port definition	Function description	Recommended application	Remarks
	3/16	D10+/D10-	10# normally open dry contact output	Reserved	
	2/14	NO11/COM	11# normally open dry contact output	Reserved	
	15/14	NO11/COM	11# normally closed dry contact output		
F	1	TX	RS232 sending port	Internal debugging	
	2	RX	RS232 receiving port		
	3	GND	RS232 reference ground		
USB	1	USB1	USB Type A (firmware upgrade port)	-	
	2	USB0	USB Type A	-	
-	-	SW	Auxiliary firmware button	-	

3.7. LEMS System

The Local Energy Management System (LEMS) is the energy dispatching and management center of the energy storage system. As the brain of the energy storage system, LEMS is mainly responsible for collecting all BMS data, PCS data and grid-connected side data, sending control instructions to each part, controlling the operation of the whole energy storage system, and reasonably arranging the work of the PCS. The system can run automatically according to the preset charging and discharging time, power and operation mode. It can also accept dispatching instructions for operation.

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

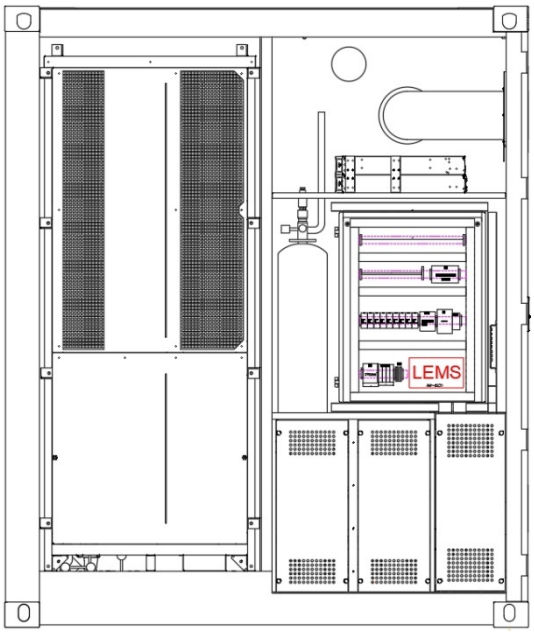


Figure 3- 16 LEMS Installation Position

3.7.1. LEMS Control System Diagram

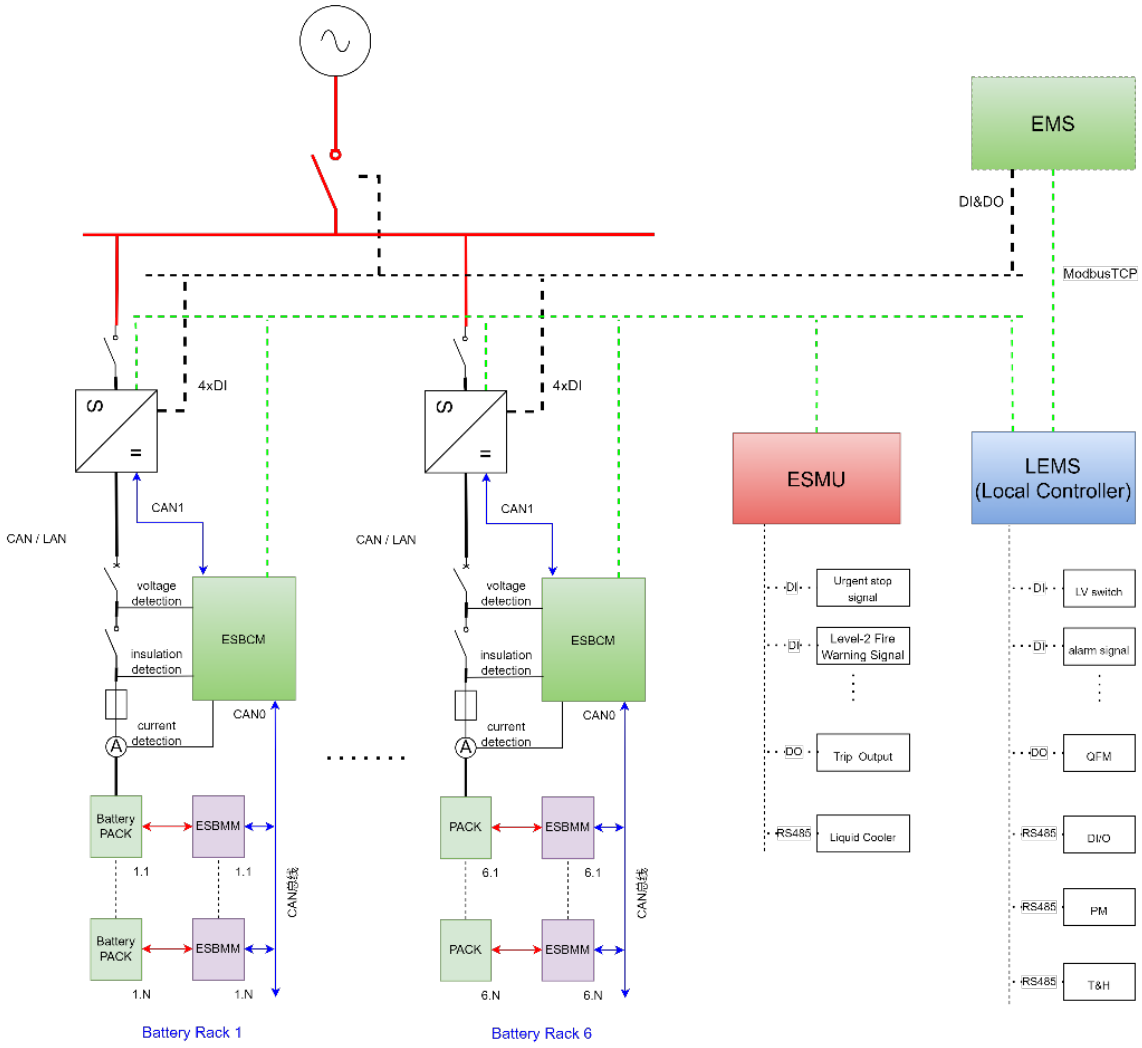


Figure 3- 17 EMS Control System Diagram

3.7.2. System Functions

The system is applicable to microgrid systems including energy storage, PV and load (including important loads and general loads). It has the functions of maximizing PV output, suppressing load demand peak, dispatching peak-valley electric energy and preventing power reverse flow.

- Maximizing PV utilization rate

  This LEMS can maximize the PV power generation by monitoring the power generation and consumption in the microgrid. When the PV power generation in the microgrid is greater than the total load consumption, LEMS can store the extra electric quantity in the energy storage system and release it when the microgrid load increases to complete the time shift of PV energy and maximize the PV utilization rate.

- Suppressing load demand peak

  LEMS can use energy storage to suppress internal load fluctuations. When the load power still

exceeds the set demand limit when PV power is involved in output, LEMS controls energy storage output to suppress excess demand and increase the economy of microgrid.

- PV anti-reverse flow

  For the microgrid without surplus power for grid connection, this LEMS provides anti-reverse flow control function. When it is detected that the microgrid energy is lower than the anti-reverse flow early warning value, LEMS will avoid reverse flow by adjusting the energy storage and PV in advance.

- As backup power supply for important loads

  When the system dispatching option of this LEMS is selected as backup, it shall be ensured that the energy storage SOC is not lower than the backup power SOC set by the system during the operation of LEMS to ensure that the important load can be provided with backup power when the microgrid is off-grid.

- Peak-load shifting

  In this LEMS, the strategy can be set in different periods. The time shift of PV energy is set to fully charge the stored energy during the valley period of electricity price, and the peak-load shifting is set at the peak of electricity price to release the stored energy, so as to realize the function of peak-load shifting.

- Microgrid status monitoring

  This LEMS can access the control page by logging in to the operation platform set up on the local network, obtain the working status of PV and energy storage in real time, and switch between off-grid and grid-connected mode. This LEMS can also send basic operation information to a third-party platform for data display.

3.7.3. Communication Connection

If LEMS is used as the main controller of the system, it has the following requirements for different application scenarios:

- For pure energy storage application, grid-connected meter needs to be connected;
- For optical storage application, when it is necessary to control the PV inverter, it needs to be connected to the grid-connected meter and PV inverter;
- For pure off-grid application, PV inverter needs to be connected;

LEMS also supports ModbusTCP protocol to access the third-party dispatching & cloud platform. If necessary, it can be connected to LAN1 network port of LEMS host.

3.8. Grounding Wire

3.8.1. Specifications of 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- 7 Specifications of Grounding Wire

Specifications of grounding wire	Grounding position	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)			

3.8.2. Electrical connection

Before leaving the factory, the electrical connection between equipment in the container has been completed. On the site, wiring is required between external equipment and the container, including grounding, high voltage side wiring and communication wiring.

Grounding includes equipotential bonding inside the container and grounding of external grounding points.

3.8.2.1. Internal grounding

In the container, except that 200kW PCS is not installed before leaving the factory, all other equipments shall be subject to equipotential connection and uniformly connected to grounding copper bar.

3.8.2.2. External grounding

For the convenience of grounding, there are 2 grounding points on each side outside the container, totaling four grounding points.

For on-site cable connection, four grounding points are designed, as shown in the following figure. One of two or two grounding points can be reliably connected according to the actual situation on site. At least one point needs to be connected to meet the grounding requirements, and the external grounding points can be grounded in the following two ways.

- Use M12 bolts to connect the grounding cable to the external grounding point, and 50mm^2 to 95mm^2 cables are recommended

Phase	Sectional area of cable	Bolt	Torque
GND	50mm²~95mm²	M12	25N.m

- Weld the grounding steel sheet on the external grounding point, and carry out anti-corrosion treatment after welding

Phase	Material	Method	Process
GND	Flat steel	Welding	Anti-corrosion

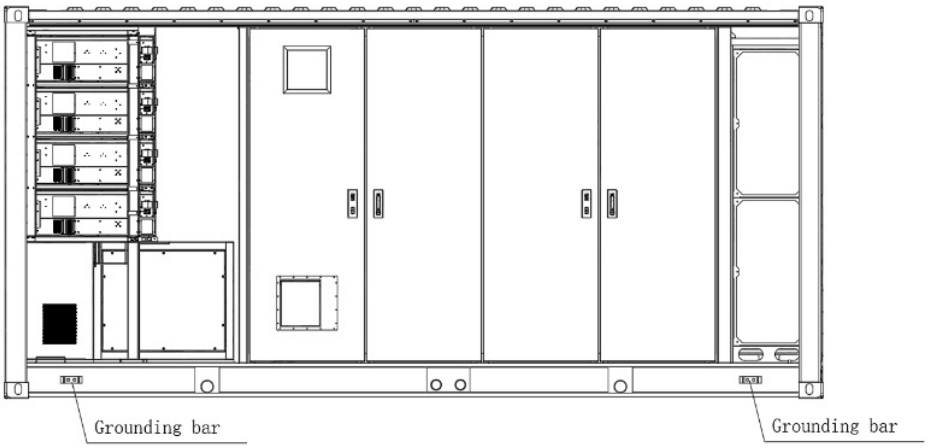
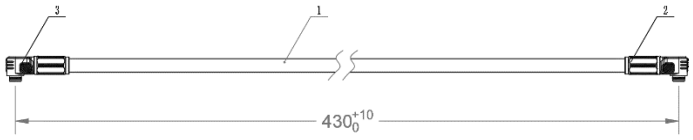
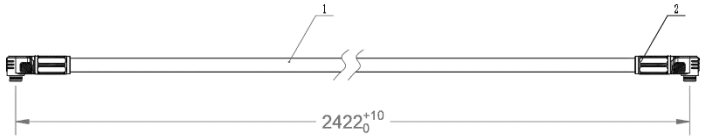
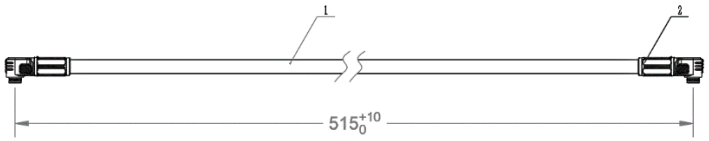
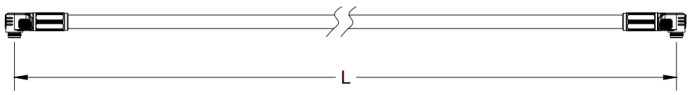


Figure 3- 18 Grounding bar

3.9. Battery Connection Cable

The copper bar is used to connect the battery PACK in series to form a complete battery cluster, which is finally connected to the high-voltage box.

Table 3- 8 Specifications of Copper Bar

S/N	Specification of connecting cable
1	Used for connection between upper and lower PACKs 
2	Used for connection between the PACK total positive and the high-voltage box total positive 
3	Used for connection between the PACK main negative and the high-voltage box main negative 
4	Schematic diagram of cables from total positive and total negative of high-voltage box to DC confluence 

3.10. Power Conversion System (PCS)

The power conversion system is a conversion device between the grid and battery, which can charge and discharge the battery. It can invert DC power from the battery to AC power that can be connected to the grid and rectify AC power from the grid to DC power that can be charged into the battery. The power conversion system can be used in grid-connected mode or off-grid mode.

200kW/200kVA, 1500Vdc PCS for Europe is applicable to CPS ES-1.6MW/3.34MWh-EU AC/DC Integrated Energy Storage System.

Figure 3- 19 PCS

The key features of the 200kW PCS are as follows:

- Integrated DC disconnect switch
- Protection functions for enhanced reliability and safety
- Full power capacity up to 45°C. IP66 outdoor rated
- Integrated DC-DC bi-directional converter
- Standard 5-year warranty with extension to 20 years. Rack mountable up to 1MW
- Wide DC voltage range, suitable for different batteries. Modular design, easy for maintenance

The topological graph of the power conversion system is detailed as follows:

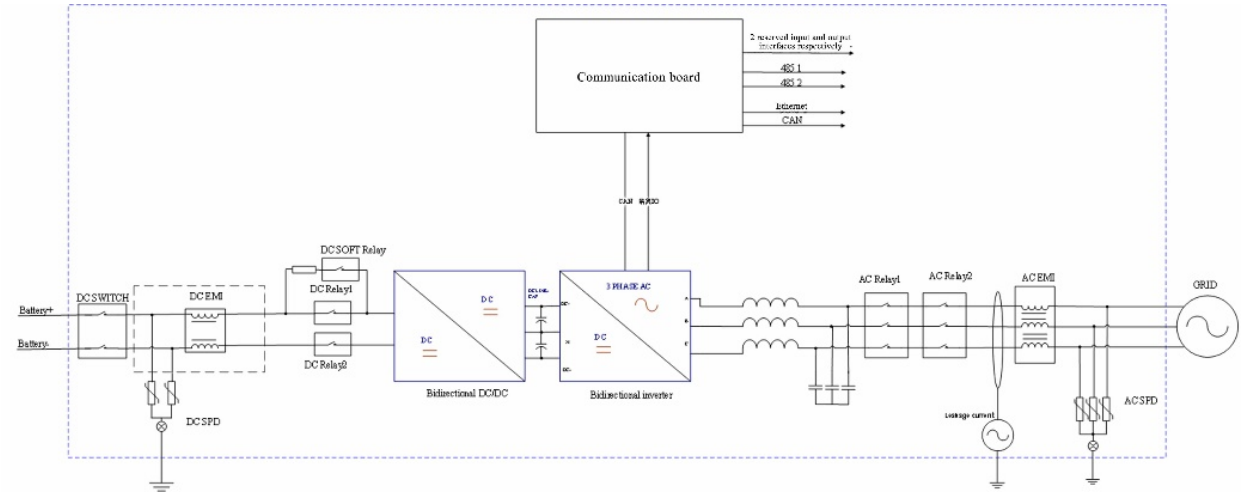


Figure 3- 20 Topological graph of PCS

Refer to the following table for the specifications of 200kW PCS:

Table 3- 9 Specifications of PCS

Model Name	CPS ECB200KTL
DC Input	
Max. DC Input Voltage	1500V
Min. DC Input Voltage	875V
Operating DC input Voltage Range	950-1500V (45°C)
Max. DC Input Current	218A
Max. DC Input Power	207kW
DC Disconnection Type	Load-rated DC Switch
DC Surge Protection	Type II
AC Output	
Rated AC Output Power @ PF>0.99	200kVA / 200kW @ 45°C 170kVA / 170kW @ 50°C
Rated Output Voltage	800Vac
Output Voltage Range	704-880Vac
Grid Connection Type	3-Phase / PE

Max. AC Output Current @ 800Vac	145A
Nominal Grid Frequency	50 /60Hz
Adjustable Reactive Power	-100 % – 100 %
AC Current THD	< 3 % (at nominal power)
DC Current Injection	< 0.5 % Inom.
Max. OCPD Rating	285A
AC Surge Protection	Type II
System and Performance	
Max. Efficiency	98.0%
CEC Efficiency	97.0%
Stand-by Consumption	<30W
Environment	
Enclosure Protection Degree	IP66
Cooling Method	Variable speed cooling fans
Operating Temperature Range	-30°C to +60°C (derating from +45°C)
Operating Humidity	0 to 100%
Operating Altitude	3000m (no derating)
Display and Communication	
User Interface and Display	LED indicators
PCS Inverter Monitoring	CAN / Ethernet / RS485
Modbus Data Mapping	SunSpec / CPS
Mechanical	

Dimensions (WxHxD)	750 x 332 x 850mm
Weight	120kg
AC Termination	Right Angle Plug (Wire range: 85~107mm² , Plugs not supplied)
DC Termination	Right Angle Plug (Wire range: 107mm² , Plugs not supplied)
Safety	
Certifications and Standards	IEC 62109-1/2,IEC 62477-1, IEC 62040-1,IEC 61000-6-2/4
Selectable Grid Standard	EN 50549
Smart-Grid Features	Volt-Ride Thru, Freq-Ride Thru, Ramp-Rate, PF, Volt-Var, Freq-Watt, Volt-Watt
Protection Functions	
Black Start	Yes
Reverse Polarity Protection	Yes
Overvoltage Protection	Yes
Grid Monitoring	Yes
Ground Fault Monitoring	Yes
Active/Reactive Power Response Time	<100mSec.

4. Preparations

The following items are required before continuing operation and maintenance of the liquid-cooled energy storage system (ESS).

4.1. Personnel Requirements

All personnel engaged in installation activities should be trained and have relevant experience in Chint ESS. 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 (PPE) 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 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. Transportation and Delivery

4.3.1. 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 hoisted 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 and bolting 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:

- Length × width × height: 6058mm×2438mm×2896mm
- Gross weight: about 33000 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 hoisting and transportation area, so as to avoid accidents.
- In addition, when the energy storage system is placed on the ground:
  1. Handle with care when placing. The energy storage system should not be dragged or pushed on any surface.
  2. 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.

4.3.2. Hoisting

Warning:

- During the whole process of hoisting 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 hoisting operation should be stopped.

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

- Site safety must be ensured during hoisting.
- During hoisting and installation, there shall be professionals on site to command the whole process.
- See the hoisting schematic diagram below for the sling used, hoisting angle and hoisting 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 adjusted appropriately according to the actual requirements on site.
- During the whole hoisting process, the energy storage system must be stable and not skewed.
- Please use the four rings of the energy storage system to hoist the energy storage system.
- Take all necessary auxiliary measures to ensure the safe and smooth hoisting 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 circle A in the inner layer indicates the working range of the crane. When the crane is working, no one is allowed to stand within the circle B. The radius of circle B shall be at least 10m!

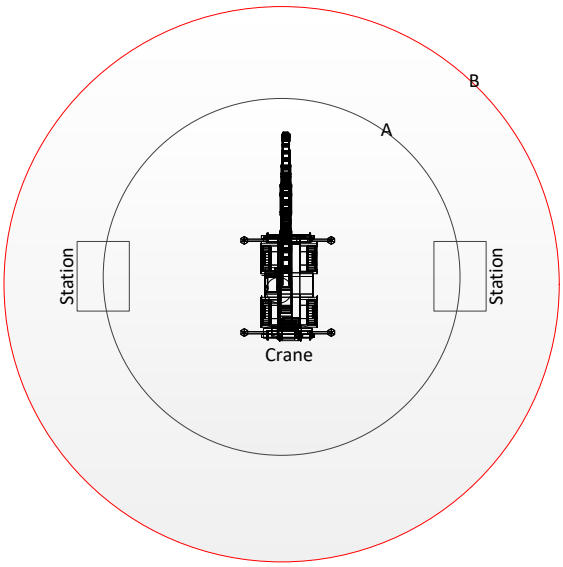


Figure 4- 1 Lifting Energy Storage System

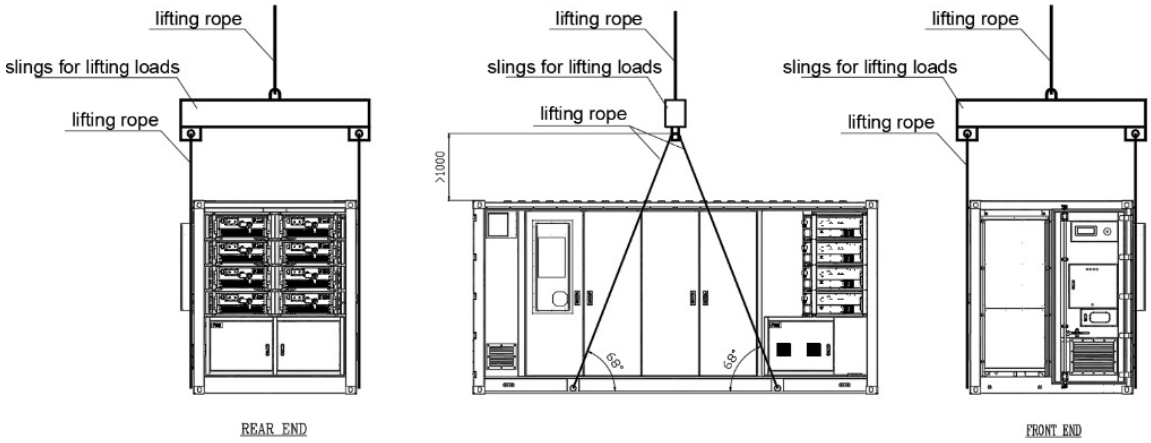


Figure 4- 2 Reference Diagram for Lifting Energy Storage System

Technical requirements:

1. Recommended lifting scheme: The lifting point is diagonal lifting, and the distance between the lifting appliance and the container top is more than 1m;
2. The force applied by the lifting rope to the lifting point of the container shall have an included angle greater than 68° with the horizontal plane;
3. Lifting speed ≤5 m/min;
4. The container shall be protected during hoisting, especially the place where the lifting rope is in contact with the container;
5. Overall dimensions of container: 6058mm*2438mm*2896mm;
6. Estimated total weight of container: 33 tons;
7. Sufficient safety factors shall be considered by professional lifting companies for lifting appliances and ropes.

The spacing requirements of the energy storage system are as follows (note: the reserved distance does not include the space required for maintenance and disassembly tools, such as forklifts):

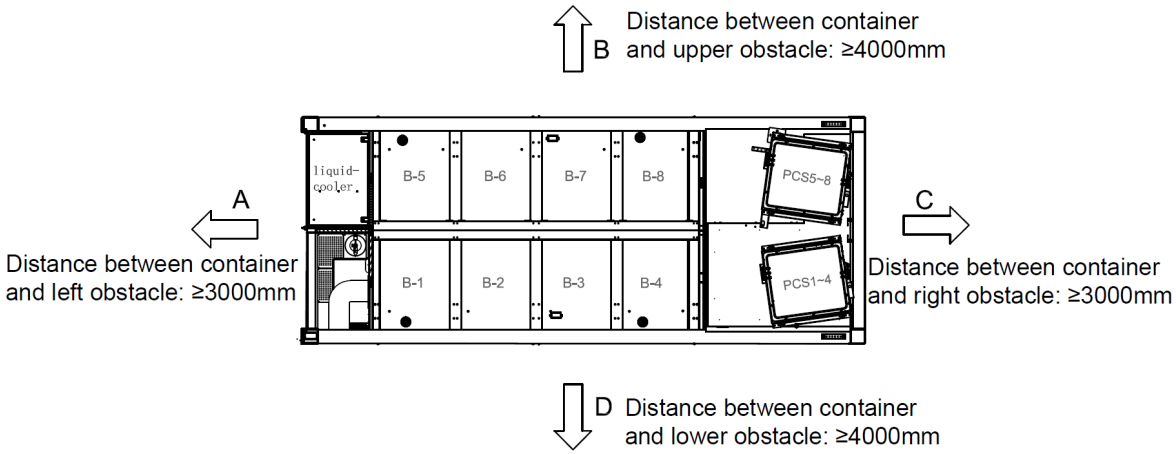


Figure 4- 3 Spacing requirements

4.4. Installation Requirements for Energy Storage System

The energy storage system shall be installed on the structure supported by cement foundation or channel steel. It is necessary to ensure that the foundation is smooth, solid, safe and reliable, and has sufficient bearing capacity. The foundation surface is strictly forbidden to sag or tilt.

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 (see the Position of Supporting Points for details):

Unit: mm

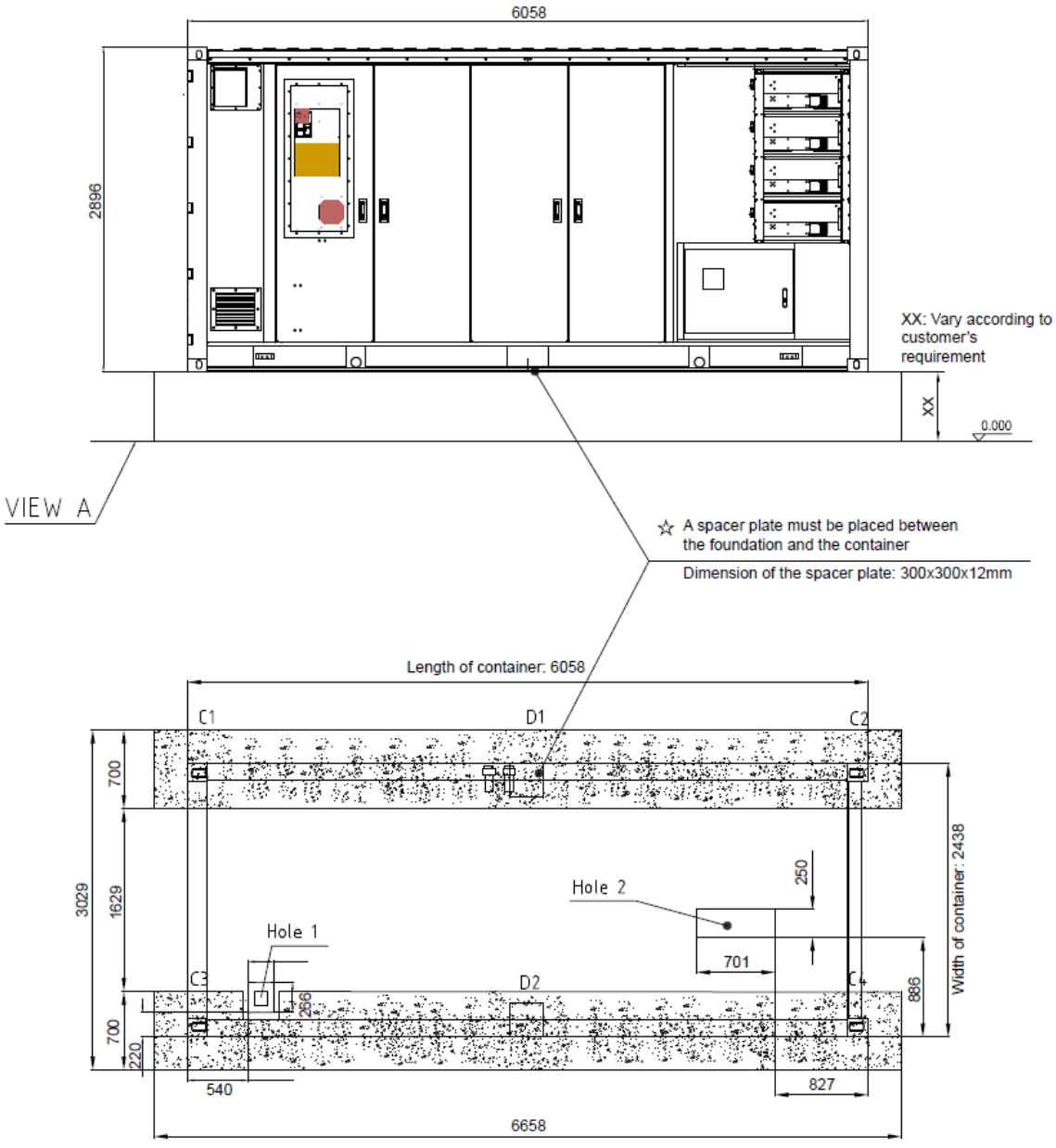


Figure 4- 4 Position of Supporting Points of Energy Storage System

Technical description:

1. Hole 1: communication cable inlet and outlet holes of the ESS;
2. Hole 2: AC 800V cable inlet and outlet holes of the ESS;
3. This foundation support point drawing serves as a reference for customer foundational design. Note that this is a pre-designed foundation support point drawing, subject to subsequent detailed design；
4. The base level of container foundation should be above the horizon and above the maximum precipitation height of the project；
5. The container is fully loaded with equipment and battery PACKs, with a maximum total weight of about 35 tons. Sufficient strength should be considered for the foundation, and the load of C1~C4 and D1~D2 at each support point of the foundation should be greater than 9 tons;
6. The datum plane of the whole foundation is controlled within ±2mm;
7. Before placing the container on the foundation, place the gasket plate strictly according to the position shown. The spacer plate is in the packing accessories inside the container. If the gasket plate is not placed onsite, the container door may fail to open and close properly after the container is filled with battery PACKs, or the structure may become permanently deformed beyond repair.

4.5. System Inspection

4.5.1. Container Overview

Table 4- 1 Overview and Inspection Records of Container

<table>
<tr><td>Specification</td><td colspan="8"></td></tr>
<tr><td>Dimensions</td><td colspan="8"></td></tr>
<tr><td>Weights and loads</td><td colspan="8"></td></tr>
<tr><td rowspan="2">Container appearance</td><td colspan="4">Side</td><td colspan="4">Front</td></tr>
<tr><td colspan="4"></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Interior equipment</td><td>Battery</td><td>High-voltage box</td><td>Dehumidi-fying A/C unit</td><td>Liquid cooler and pipeline</td><td>Fire detection and alarm system</td><td>Power distribution system</td><td>PCS</td><td>Low-voltage cabinet</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

4.5.2. Safety Inspection

The energy storage system involves high voltage and strong current. No one is allowed to operate the machine without a professional. Operators shall improve their sense of safety and vigilance, and wear personal protective equipment at any time, especially insulating gloves. When the equipment is running, it shall not be closed or opened without authorization. In case of an accident, the operator needs to quickly disconnect the main circuit breaker and immediately respond to the relevant responsible person.

Pay attention to the weather conditions and improve the awareness of safe operation in rainy days. Check the working environment where the energy storage system is located to ensure cleanliness. Check whether the firefighting equipment is well maintained and whether the escape routes are clear.

Ensure that the energy storage system has no insulation fault, and the insulation resistance of all buses to ground is not less than 2.5MΩ specified in the national standard.

Check the connection points of various wires to ensure that they are firmly connected. Refer to the national standards for details, and visually check the electrical safety clearance between the electrodes of the power line. See the following table for details:

Table 4- 2 Allowable Values of Electrical Clearance and Creepage Distance

Rated line voltage/kV	Electrical clearance/mm	Creepage distance/ram
0.38 (0.4)	8	12 (max)
0.66 (0.69)	10	20 (max)
3 (3.5)	36	75 (max)

4.5.3. Check Equipment Status

- Check whether the internal wiring of the distribution box is loose, and control the power supply within the normal voltage range (AC198V~AC235V).
- Check whether the BMS display and control screen is normal, whether the total voltage (DC 1164.8V~1497.6V) of each battery cluster and the voltage (DC 2.8V~3.6V) of each battery cell are normal, and ensure that the BMS connection is normal.
- Check whether the equipment in the battery system runs normally according to the drawings, and visually check whether the power lines and communication lines of each sub-unit of BMS are connected correctly.
- Check whether the display screen of the liquid cooler works normally and whether there is alarm information on the display screen. If any, refer to Chapter 7 for troubleshooting.
- Check whether the fire controller works normally and whether there is alarm information on the display screen of the controller. If any, refer to Chapter 7 for troubleshooting.

4.5.4. Test Records

Every CHINT ESS has been inspected and tested before leaving the factory. After the final installation of the ESS, the system undergoes another safety review before being shipped to the customer for system operation. The system shall be subject to a visual inspection to ensure its continuous safe operation throughout its service life.

Please record the visual inspection and make a record of the inspection. The inspection record is as follows:

Table 4- 3 Visual Inspection Record

Time	Inspection category	Detailed description	Remarks

5. Emergency Disposal Procedures

5.1. First Aid Measures

Measures to be taken in case of leakage or overflow of electrolyte and other substances

In the event of electrolyte or other material leakage, evacuate the area immediately. Provide maximum ventilation to remove harmful objects or gases. Wipe it clean with a cloth, dispose of it in a plastic bag, and then put it into a tin can to allow the battery to cool and vaporize. Avoid skin and eye contact or inhalation of vapors, or remove spilled liquid with absorbent and incinerate. First aid measures for different parts are as follows:

- **First aid for eyes:** Flush eyes with plenty of water for at least 15 minutes, lift the upper and lower eyelids occasionally, and seek medical assistance at the same time.
- **First aid for skin**: Take off the contaminated clothes, wash your skin with plenty of water or take a shower for 15 minutes and seek medical assistance at the same time.
- **First aid for accidental inhalation:** Move from the leakage area to a place with fresh air, and use oxygen if possible.
- **First aid for accidental ingestion**: Drink milk or water immediately to induce the patient to vomit, and seek medical advice immediately if the patient loses consciousness.

5.2. Fire Risk Assessment

5.2.1. General Principles

The principle of CHINT is to protect all people, including employees, customers and contractors, from potential injuries and health damage that may be caused by work activities. CHINT will provide and maintain a safe and healthy working environment, equipment and work system for all employees, and provide them with the information, training and supervision they need for this purpose.

CHINT will attach great importance to health and safety, and comply with all statutory requirements.

5.2.2. Management System

The fire safety management plan is included in the "health and safety" document. It will confirm that a fire risk assessment has been completed to ensure adequate fire safety and will be reviewed where necessary.

Any deficiencies identified during the fire risk assessment process will be prioritized and corrected accordingly. CHINT shall determine the safety protection and preventive measures for fire control, and the customer is responsible for notifying other persons in charge.

- Ensure these recommendations are implemented and communicated to other employees
- Ensure coordination between the remaining responsible persons
- Fire safety shall be an agenda item in the weekly end-user manager meetings.

5.2.3. General Overview

The equipment installed in this system mainly includes batteries, BMS, protection systems (such as disconnectors, fuses, DC contactors, etc.), fire protection systems, thermal management systems, cabinets, cables and PCS.

The fire resistance time of the container body reaches 90 minutes, which meets the fire protection requirements of EN1364-1. The container is equipped with perfluorohexanone automatic detection, alarm and fire extinguishing system, and the whole set of fire protection system meets the regulations and certification requirements of the project site. There are alarm bells and audible and visual alarms inside and outside the container. The fire alarm can be noticed immediately when the container door is opened or closed.

The container is a non-walk-in form, and anyone can quickly escape from the 20-foot container.

5.2.4. Classification of Fire Sources

Table 5- 1 Nature and Types of Fire Sources

S/N	Fire risk	Detailed description	Countermeasures
1	Internal short circuit	Danger of low battery voltage, overheating and battery bulging	Manufacturing process: two internal short-circuit tests before insertion of the panels into the battery box and a double check during quality control after assembly of the cells; The system is certified by UL 9540, and the rack is certified by IEC 62619, UL 1973 and EMC safety test.
2	External fire source	If the temperature exceeds 130°C, there is a risk of battery failure and fire	The container body is provided with a fireproof insulation layer, as long as it is ensured that the container is kept away from fire and heat sources
3	External heat source		
4	External short circuit	During the installation process, or if the fuse is not properly installed, there may be risks of external short circuits, arc flashes, and fire	Install screws according to the Installation Instruction Manual and check them thoroughly to ensure tightness
5	Screw looseness	Excessive contact resistance, and heating at the connection and cable	
6	Overcharge	This can only occur if the system does not capture a BMS fault, protection, parameter error or communication failure	The system conforms to UL1973 standard and has a software/hardware dual protection system with low risk
7	Over-discharge		

5.2.5. Fire Risk Deduction

Consideration is given to five aspects: parts safety, battery cell safety, electrical safety (BMS), mechanical safety and environmental safety.

- Parts and components safety

Table 5- 2 Compliance of Parts and Components with UL Standards

S/N	Name of parts	Compliant standard No.
1	Plastic parts	UL 94-V0
2	Fuse	UL 248
4	Relay	UL 61810
5	BMS	UL 991, UL1998
6	Anti-corrosion	UL 50E

- Battery cell safety

The battery design complies with UL1642, IEC62133, UN38.3 and other standards.

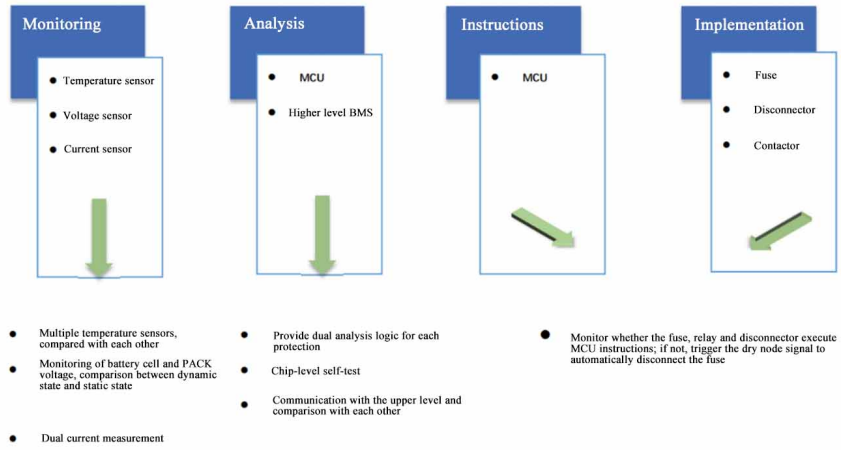
- Electrical Safety

Table 5- 3 Protection Threshold (Reference)

BMS functions	Detailed description	Parameter
Single cell overcharge	Overcharge voltage protection threshold	3.65V
	Overcharge protection delay time	3s
Overdischarge of single battery cell	Overdischarge voltage protection threshold	2.50V
	Overdischarge protection delay time	3s
	Discharge recovery voltage threshold	3.0V
Overcharge of PACK	Overcharge voltage protection threshold	189.8 V
	Overcharge protection delay time	3s
	Overcharge recovery voltage threshold	182 V

Overdischarge of PACK	Overdischarge voltage protection threshold	130 V
	Overdischarge protection delay time	3s
	Discharge recovery voltage threshold	156 V
Overcurrent protection	Discharge overcurrent protection delay time 1	5s
	Discharge overcurrent protection threshold	See the alarm threshold table for details
	Discharge overcurrent protection delay time 2	500±50ms
	Overcurrent protection for charging	See the alarm threshold table for details
Short circuit	Short-circuit protection	-
	Protection condition	Short circuit of load
	Conditions for recovery	Load disconnect
Over-temperature protection	Charging high-temperature protection	55°C
	Charging temperature recovery	45°C
	Discharge high-temperature protection	55°C
	Discharging temperature recovery	45°C
	Charging low-temperature protection	0°C
	Charging temperature recovery	5°C
	Discharge low-temperature protection	-20°C
	Discharging temperature recovery	0°C

Dual protection mechanism



- Mechanical safety

Comply with UN38.3 standard and pass static pressure, impact, dropping, installation and other tests.

- Environment safety

Preventive measures: temperature monitoring, UL94-V0 material, metal housing, safety valve design, BMS high temperature protection, etc.

5.2.6. Fire Protection System

- Fire detection

"Smoke detectors" and "heat detectors" are installed and connected to the "audible and visual alarm" through "signal input/output modules".

When the sensitivity of smoke exceeds 2.5%/m, or when the temperature rises above 10°C per minute, the system may consider that there is a fire risk and will trigger an "audible and visual alarm" from the local alarm system. At the same time, it is reported to the background monitoring system for remote notification.

- Fire alarm system

There is a manual/electrical fire alarm system including automatic smoke detectors. When activated, it will warn all people who are close to the container.

Audible and visual alarms are installed indoors and outdoors, so that people entering or leaving the container can immediately notice the fire alarm.

- Fire extinguishing system

A sufficient number of fire extinguishers of the correct type are arranged throughout the container system. They are adequate for the risks inside the container and are checked regularly every 6 months.

BMS starts to protect the system and cut off all power supplies. All fans and air conditioners will stop working to prevent fresh air from entering the container. When the internal pressure is 1MPa greater than the external pressure, the pressure relief valve of the container will open.

Perfluorohexanone is harmless to humans.

5.2.7. Identification of Fire Hazards

- Ignition sources

There is no obvious ignition source in the whole container system environment, and smoking is prohibited in the container;

- Combustion raw materials

There is no fuel and no large amount of paper; only some paper for maintenance records.

- Working process

No process poses a serious fire hazard.

5.3. Emergency Measures

Safe assembly point - to be defined by end customer

Actions to be taken after discovery of a fire:

- Use the nearest fire alarm call point to sound an alarm
- Report to the safe assembly point
- Call the fire brigade with mobile phone (after leaving the container)
- Liaise with the fire brigade upon their arrival
- Even with confidence, do not attempt to handle small fires
- Don't put yourself in danger of fire

Actions to be taken on hearing the alarm:

- Report to the safe assembly point
- Fire brigade calls from mobile phones (after leaving the building)
- Liaise with the fire brigade upon their arrival

Visitor:

- Ensure that all visitors and contractors are directed to the safe assembly point
- Assist in the evacuation of any disabled person if necessary

The energy storage system must be installed on a cement foundation or a structure supported by channel steel, with the surface made of flame-retardant materials. The foundation shall be smooth, solid, safe and reliable, and has sufficient bearing capacity. The foundation surface shall not be sunk or inclined.

6. Operation Procedure

6.1. Operating Procedures for Containers

1. Turn on the control power supply inside the external distribution box (BMS, switching power supply, lighting, liquid cooler, fire fighting, etc.), as shown in the following figure:

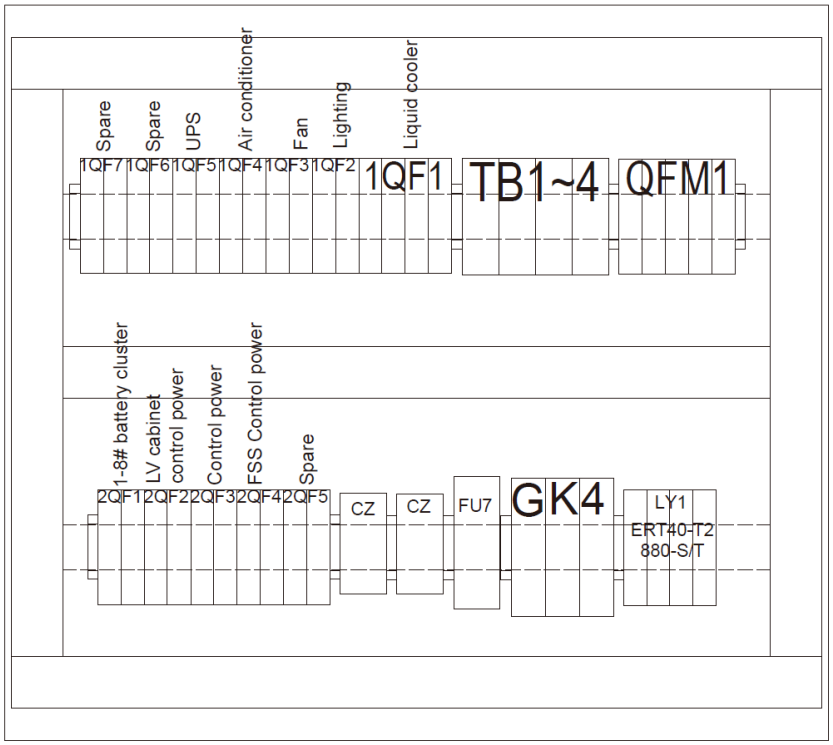


Figure 6- 1 Internal Arrangement of Distribution Box

2. Turn on the power supply of the control panel in the equipment compartment, connect the system circuit through touch screen operation, and turn on the balance function.

Figure 6- 2 Installation of BMS Display and Control

6.2. EMS System Operating Procedure

6.2.1. BMS System Architecture

Chint strongly recommends that BMS be configured and commissioned by authorized factory representatives, otherwise it is not within the scope of warranty.

Multiple system-level ESMUs can communicate with the EMS via Modbus TCP. 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:

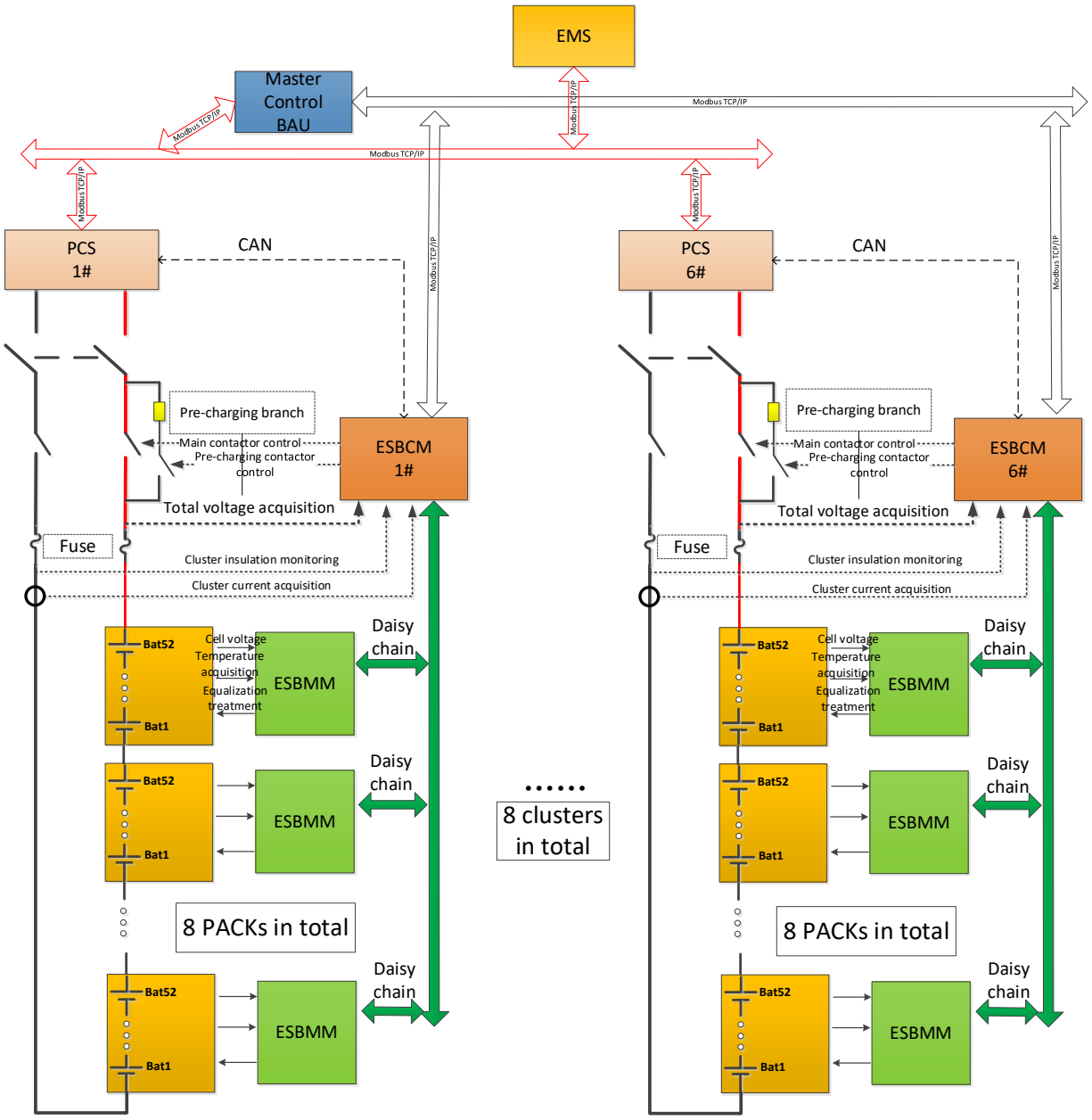


Figure 6- 3 BMS System Architecture

6.2.2. Preparation for System Configuration

Before system configuration, the following materials shall be prepared:

- Communication cable: for CAN/RS485 connection
- Adapter: matching commissioning port connector of high-voltage compartment
- CAN box: USB-to-CAN tool for PC
- RS485 tool: USB-to-RS485 tool for PC
- Software: BMS upper computer, CAN Test, serial port tool, etc.
- Standard network cable: connected to ESMU for communication with PC
- Laptop: Operating system with Windows 7 SP1 or higher installed

6.2.3. BMS Configuration

WARNING:

- In the battery cluster, ESBMM address will be automatically assigned without separate configuration.
- When replacing the ESBMM, disconnect the AC power supply and circuit breaker of the high-voltage compartment.
- After replacing the ESBMM, restore it according to the normal power-on process.

Step 1: ID information of ESBMM

When the system installation is completed or ESBMM is replaced, there is no need to actively allocate the address of ESBMM because the communication mode in the battery cluster is daisy chain.

Step 2: Upload CAN data

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

ESBCM can collect the data of all ESBMMs, and ESBMM can also update the data to ESBCM through daisy chain.

The ESBCM communicates with the master ESMU via Modbus TCP.

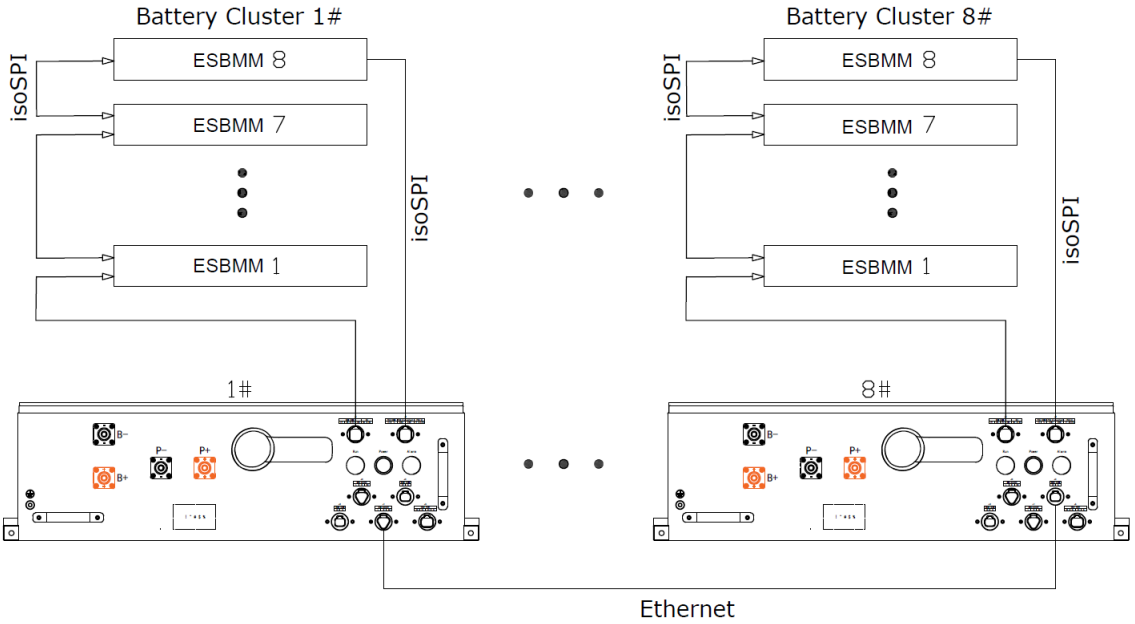


Figure 6- 4 Communication Architecture of Multiple ESBCMs

Step 3: Upgrade software online

The internal software logic of ESBMM is realized by ESBCM, and no software upgrade is required. All ESBCM software can be upgraded via the ESMU by using a USB drive for possible updates of the BMS.

6.2.4. ESMU Configuration

Step 1: Enter the parameter setting page

On the main interface, enter the system parameter settings by clicking the MENU button in the upper right corner - Parameter settings - System Parameters. When accessing the settings page for the first time, authorization information is required. The default username is admin, and the default password is 123456.

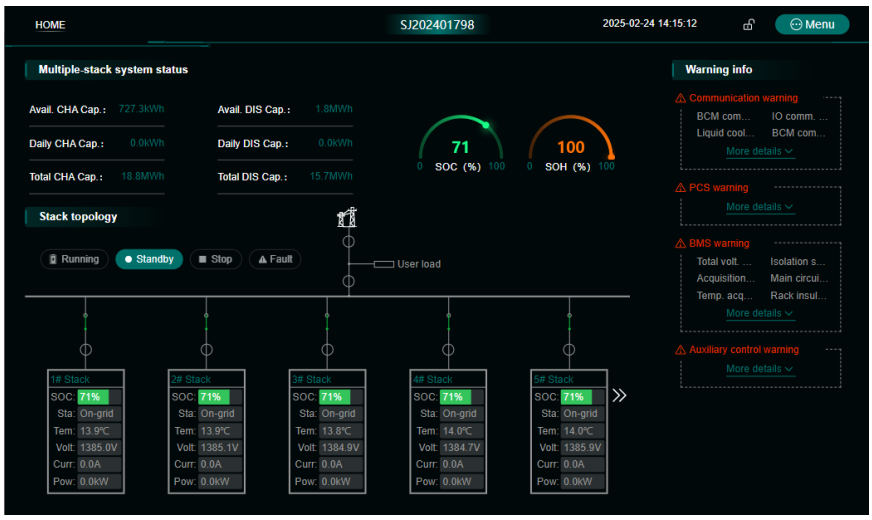


Figure 6- 5 Homepage (for reference)

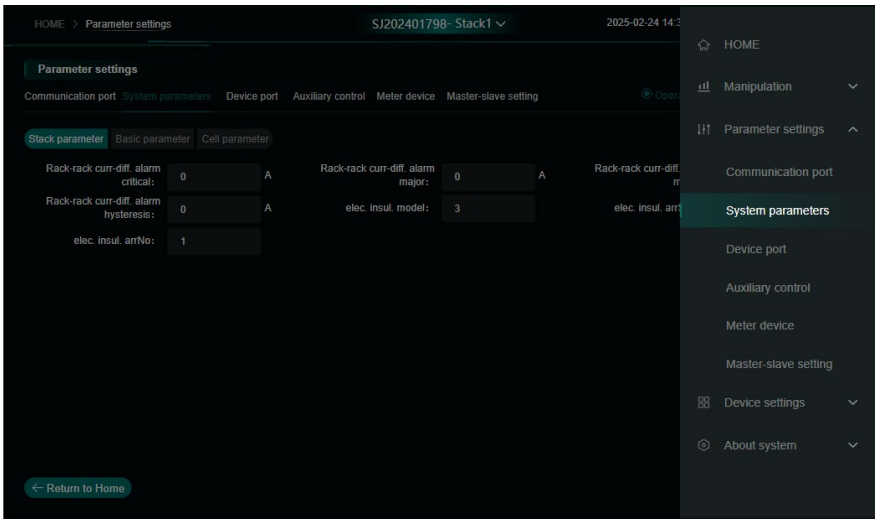


Figure 6- 6 Display of System Parameters on HMI (for reference)

Step 2: Enter the parameter setting page

Click "Basic Parameter" to enter the battery cluster parameter setting page.

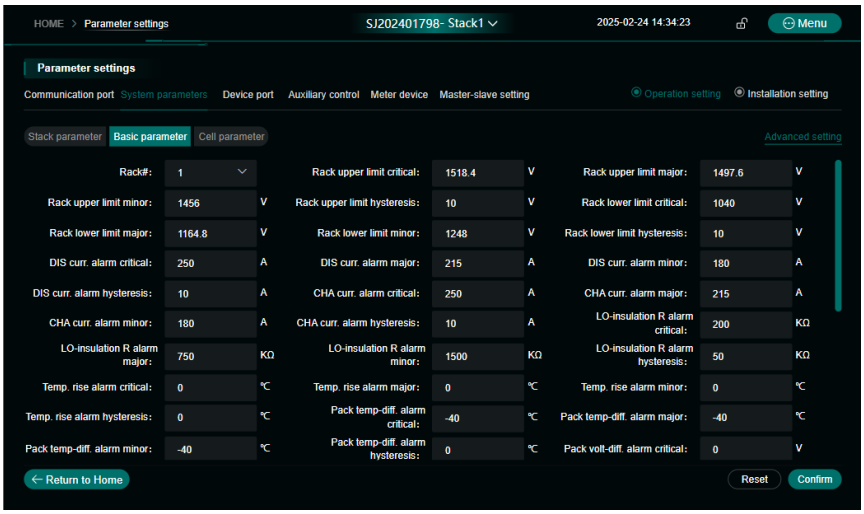


Figure 6- 7 Battery Cluster Parameter Page

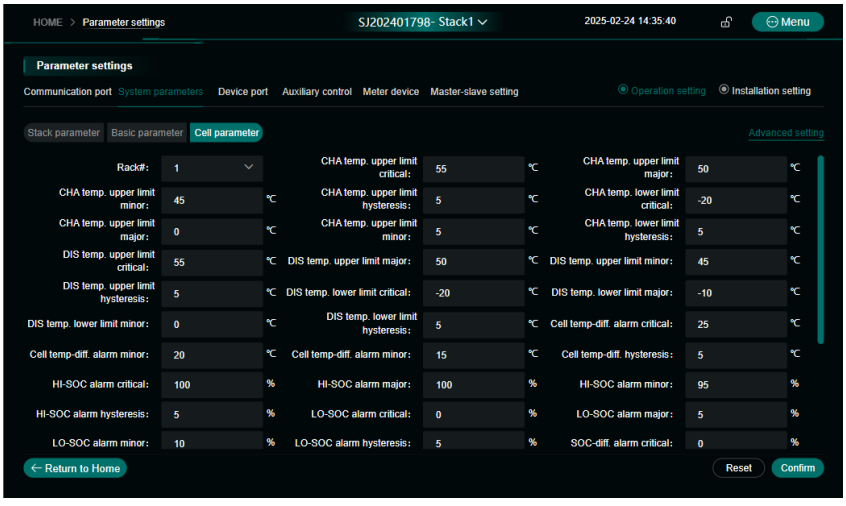


Figure 6- 8 Battery Cell Parameter Setting Page

6.2.5. Configuration of Network Interface

Through the system setting (Parameter Settings) of ESMU interface, enter the communication port setting (Communication Port), and set with reference to the factory parameters of the system.

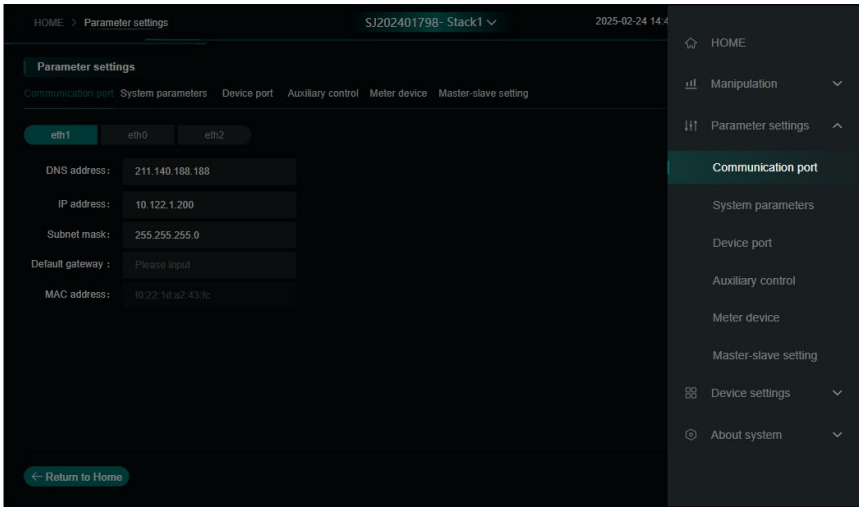


Figure 6- 9 Configuration of Network Interface

6.2.6. Typical Protection Policy

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

- Source of protection signal
  - Module/unit information based on BMS analysis and triggered alarms
  - BMS hardware fault
  - Abnormal communication within BMS or with EMS/PCS
- EMS/PCS turns off the inverter
- If the inverter is not turned off after 3-5 s, BMS activates the hardwired signal to turn off it
- If the inverter is not turned off after 5 s, BMS disconnects the battery by turning on the contactor

6.3. Operating Procedures for PCS

6.3.1. Inspection before Power-on

In order to ensure the safety of system commissioning process, the following contents must be checked before the system is powered on:

Foreign matter inspection:

Check whether there are foreign matters inside the power conversion system, such as missing screws, cables and tools.

Switch state check:

Make sure that the main circuit breaker (or grid incoming circuit breaker) switch is off.

When the power conversion system uses internal UPS, it shall be ensured that the forced start switch of UPS is off.

When the power conversion system uses an external UPS, it shall be ensured that the switch of the external UPS supplying power to the power conversion system is off.

Other switches in the power conversion system are closed.

Table 6- 1 Power wiring inspection

Inspection item	Inspection requirements
Whether the converter is reliably grounded	The grounding resistance is measured to be less than 0.1 Ω
Whether the AC wiring is short-circuited	Measure with a multimeter
Whether the DC wiring is short-circuited	Measure with a multimeter

6.3.2. PCS Commissioning

See Chapter 5 of the User Manual of Power Conversion System for details.

6.3.3. Home Screen Operations

See Chapter 6 of the User Manual of Power Conversion System for details.

6.4. Operating Procedures for Low-voltage Cabinet

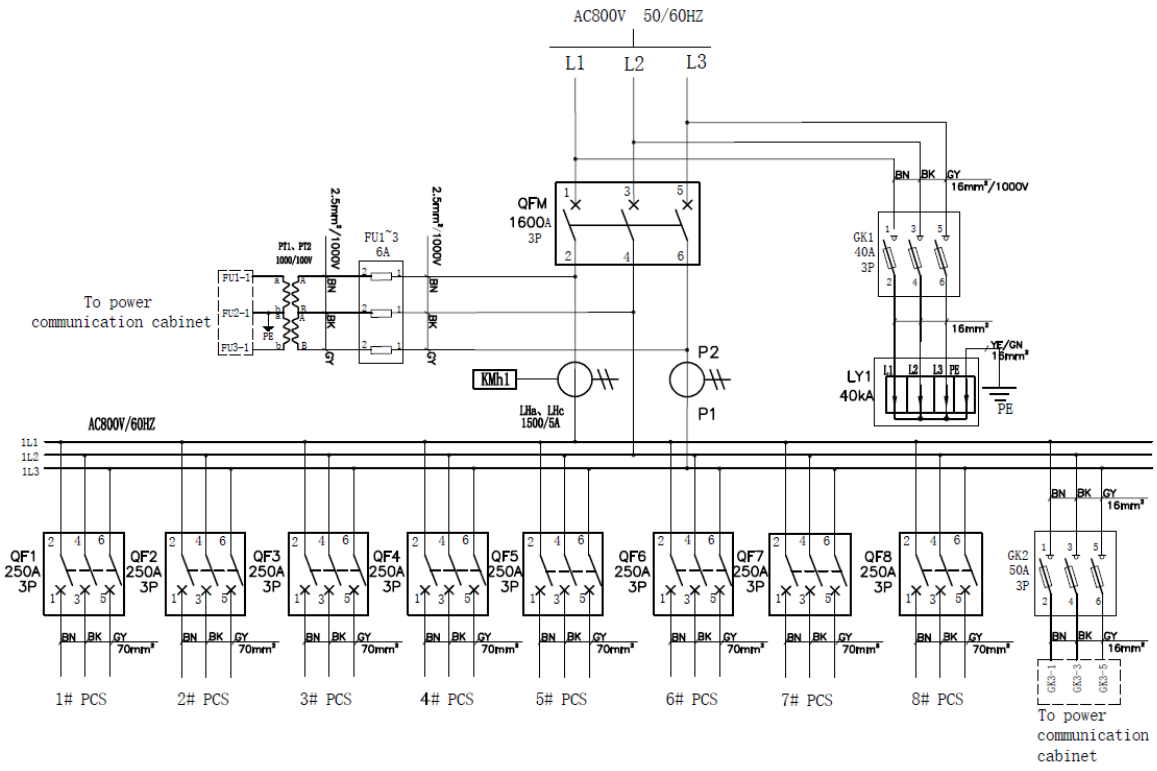


Figure 6- 10 Primary Diagram of Low-voltage Cabinet

6.4.1. Power Transmission Operation

Preparations before the first use:

- Carefully check whether the circuit breaker is consistent with the technical data required for operating power lines.
- Check components such as circuit breakers, removable units and insulating parts.
- Check whether the main grounding bar and the grounding bar are reliably connected.
- Remove all foreign matters in the switch cabinet, such as tools and surplus materials; clean the switch cabinet and wipe off grease or dust on insulating parts with a clean, soft and dry cloth.

6.5. Equipment Power-on and Power-off Operation

After the wiring is completed, the system can be powered on and off according to the following procedures.

6.5.1. Power-on Operation Process

1. Press and hold the ON button of UPS in the power distribution unit for 3 seconds, and hear a "beep". Then press and hold it for another 3 seconds, and hear a "beep". The UPS power indicator light is on, the PL1 red indicator light (as shown in the right view in 3.4.3 Layout of System Equipment) is on, and the control circuit power supply is normal;

Figure 6- 11 UPS Layout

2. Connect the 2QF1~4 miniature circuit breakers, connect 1QF5 to supply power to UPS, and press the power button in high-voltage box (as shown in Figure 3- 12);

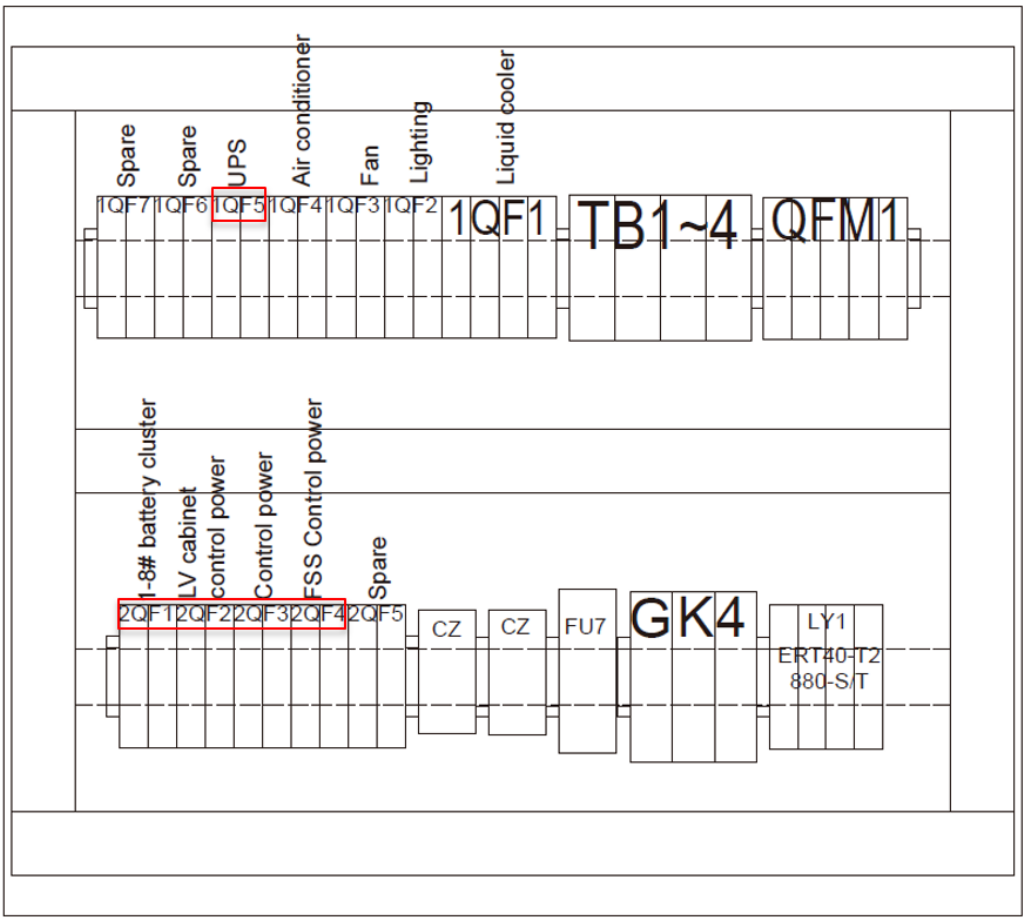
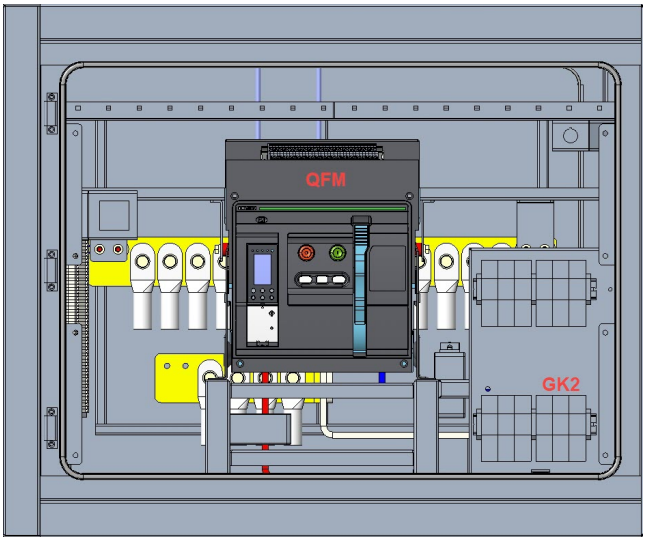


Figure 6- 12 Distribution Room

3. Connect QFM air circuit breaker, GK2 fuse switch, GK3, QFM1 and GK4, and 1QF1~5 in the power distribution unit successively;



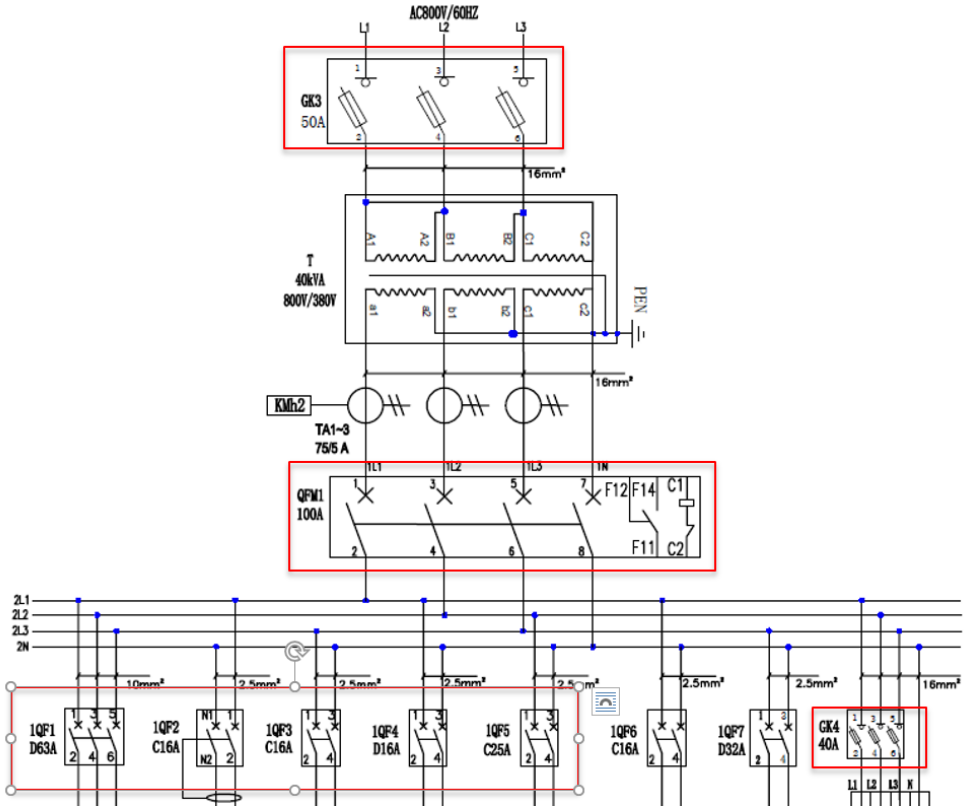


Figure 6- 13 QFM and GK2

4. Connect the low-voltage cabinet QF1~8;

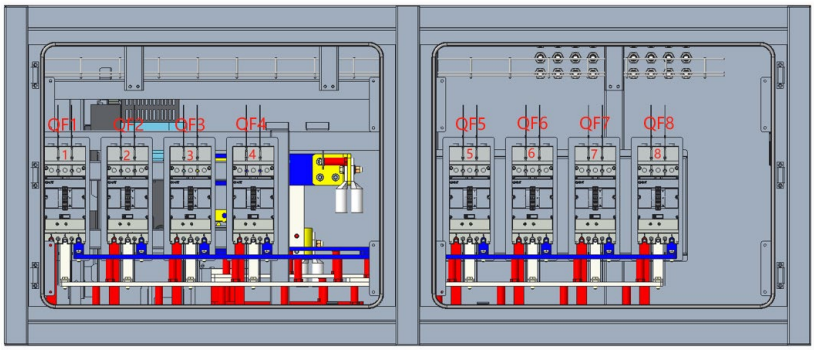


Figure 6- 14 Low-voltage cabinet QF1~8

5. Connect the switches at DC side of PCSs #1 ~ #8 of high-voltage box;
6. Operate the EMS display screen and log in with password to start up or shut down, charge and discharge the PCS;

6.5.2. Power-off Operation Procedure

1. Operate EMS display screen, log in with password, set PCS power to 0, and then set PCS shutdown;
2. Disconnect QFM1 and miniature circuit breakers 1QF1~1QF7 in the power distribution unit successively as shown in Figure 6- 15;
3. Disconnect the miniature circuit breakers 2QF1~2QF5 below UPS in the power distribution unit successively as shown in Figure 6- 15;

4. Press and hold the UPS OFF button for 3 seconds to shut down the UPS, as shown in Figure 6- 11.

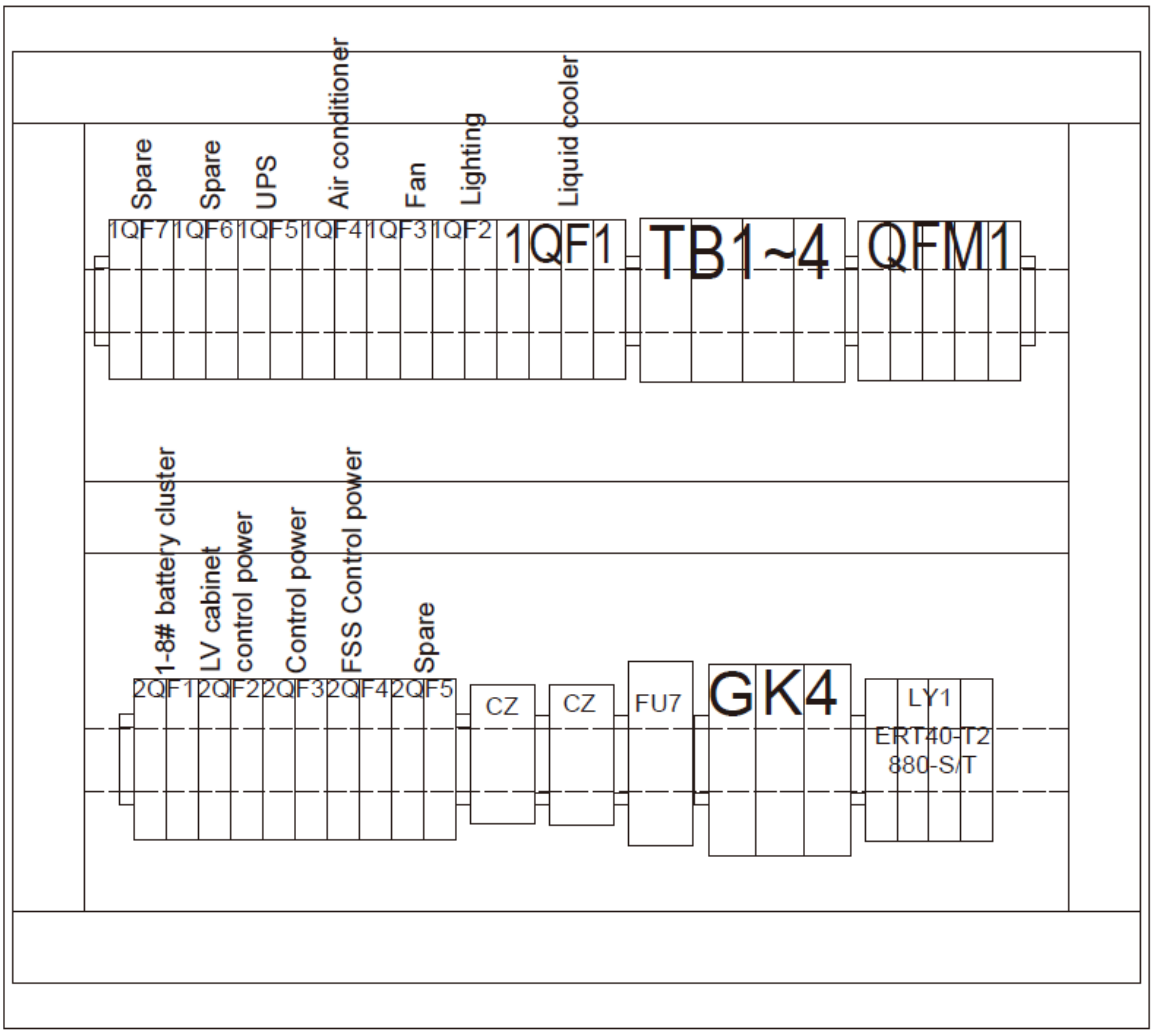


Figure 6- 15 Internal arrangement of power distribution unit

7. Troubleshooting

ESS is a high-voltage DC system, which can only be operated by qualified and authorized personnel!

Make sure to check the inverter and all cables of BMS for correct connection and settings,

Check the ESS system for normal startup.

Common system product faults involve the following equipment: BMS, battery and cable, liquid cooler and pipeline, PCS and dehumidifier. For detailed fault causes and troubleshooting of each equipment, refer to Annex 4 Instructions for Alarm and Troubleshooting.

8. Performance Maintenance

The operation and maintenance of battery, liquid cooler, fire protection and PCS must be carried out by qualified and authorized personnel.

For some maintenance items, the system must be shut down first.

The system which has been running for more than six months or does not run for a long time shall receive a safety maintenance, and corresponding records shall be kept. The specific items are as follows:

- Check whether the safety door, main door and battery cabinet door of the container can be opened normally, and ensure that the environment inside and outside the container is clean and tidy;
- Check whether the fire extinguishing system can give an alarm and start normally, and whether there is fire protection equipment around the container for emergency use in case of accidents;
- Check whether each power line is insulated abnormally, whether the electrical safety clearance reaches the safety standard, and whether the wiring bolts are loose;
- Check whether the electrical components are normal and whether the power supply doors can be disconnected effectively.
- For detailed maintenance requirements of each equipment, refer to Annex 5 System Maintenance Instructions for details.

9. Quality Assurance

9.1. Waiver of Liability

1. The warranty period of the product has expired;
2. The equipment serial number cannot be provided or is unclear;
3. Product damage during transportation/storage/handling;
4. Misuse, abuse, willful damage, negligent or accidental damage;
5. Improper testing, operation, maintenance or installation by the customer, including but not limited to:
   - Failure to meet the system requirements for safe operating environment or external power parameters provided in writing;
   - Failure to operate the covered product in accordance with its operating manual or user guide;
   - Relocate and install the system in case of non-compliance with Chint power requirements;
   - Unsafe grid environment or chemical environment or other conditions of similar nature;
   - Direct fault caused by wrong voltage or power system;
   - Unauthorized dismantling of the product or unauthorized alteration of the product software;
6. The customer entrusts the installation and maintenance personnel not designated by the Company to install, maintain or disassemble the product;
7. Equipment damage caused by violation of safety warnings contained in the product manual and relevant statutory safety specifications;
8. Equipment damage due to the operating environment beyond that specified in the product manual or failure to install, use and maintain the product according to the requirements of the product manual;
9. Force majeure events (including but not limited to acts of the public enemy, acts of governmental authorities or domestic or foreign agencies, sabotage, riots, fires, floods, typhoons, explosions or other catastrophes, epidemics or quarantine restrictions, labour disturbances or shortages, accidents, freight embargoes or any other events beyond the control of the Company);
10. Lightning protection measures are not taken or not standardized (lightning protection measures of PV system shall be implemented with reference to corresponding IEC standards and specifications, otherwise PV devices such as modules, inverters and power distribution facilities may be damaged by lightning);
11. Other circumstances that are not within the scope of the Company's after-sales warranty.

9.2. Quality Terms (Warranty Terms)

1. For products that fail during the warranty period, our company will repair or replace with new products free of charge.
2. The customer must show the invoice and date of purchase. In addition, the product shall carry a legible

logo for warranty service; otherwise, our company shall have the right to refuse to provide quality assurance.

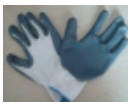
3. The replaced unqualified products shall be returned to us.
4. It is necessary to provide reasonable time for our company to overhaul the equipment.
5. For further warranty terms, please refer to the standard warranty terms applicable at the time of purchase.

Annex 1. Safety Training Record Form

Customer name		Training place	
Training purpose		Tel.	
Trainer		Training time	
Training contents			
Basic requirements	1) Wear labor protection articles 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	1) Do not make the battery short-circuited. 2) Do not use the wire rope as a means of transportation. 3) Do not pull the battery terminal forcibly. 4) 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	1) Check each battery visually and find defects in time. 2) Place the battery in strict accordance with the supervisor's instructions. Note the terminal position 3) Handle with care to ensure the personal safety and not damage the battery.		
Battery connection	1) Insulate the wrench and other metal tools to prevent short circuit when falling. 2) The supervisor should pay strict attention to the battery connection to avoid short circuit. 3) Make sure that all the bolts on the battery are tightened.		
Battery body	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.

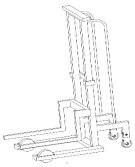
Annex 2. List of Personal Protective Equipment (PPE)

No.	Category	Sample	Quantity	Requirement	Remarks
1	Safety helmet			Wear a helmet correctly before entering the construction site to protect your head. The helmet shall meet the requirements of GB 2811-2007 *Safety Helmet*	
2	Electrician's clothes			Service personnel on site shall wear electrician's clothes.	
3	Protective shoes			Wear protective shoes during battery transportation and installation. Service personnel on site shall wear protective shoes	
4	Insulating gloves			Maintenance personnel on site shall wear insulating gloves	
5	Surgical mask			Service personnel on site need to wear surgical masks	

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

Annex 3. List of Tools

S/N	Name	Material	Specification	Sample	Quantity	Remarks	Calibration date	Term of validity
1	Laptop				2	Important tool		
2	Tape measure	Steel	5 m		1	Important tool		
3	Wrench (Insulation)	Stainless steel	1 complete set		1	Important tool		
4	Socket wrench (Insulation)	Stainless steel	1 complete set		1	Important tool		
5	Insulated torque wrench	Stainless steel	1 complete set		2	Important tool		
6	Screwdriver	Stainless steel	1 complete set		1	Important tool		
7	Gradiometer (Level gauge)	Aluminum alloy	1000mm		1	Important tool		
8	Electric wrench				1	Important tool		
9	Electric drill				1	Important tool		

S/N	Name	Material	Specification	Sample	Quantity	Remarks	Calibration date	Term of validity
10	Multimeter				1	Important tool		
11	Battery tester		HIOKI 3564		1	Important tool		
12	Forklift				1	Important tool		

Annex 4. Instructions for Alarm and Troubleshooting

System alarm and handling:

- Alarm handling of battery, liquid cooler, firefighting and other equipment must be carried out by qualified and authorized personnel.
- For some alarm processing items, the system must be shut down first.
- This energy storage system product is a high-voltage DC system, which can only be operated by qualified and authorized personnel!
- Make sure to check the inverter and all cables of BMS for correct connection and settings,
- Before troubleshooting, check whether the energy storage system can be started normally.

1 Operating Procedures for Power-off of Equipment

For specific operating procedures, please refer to 6.5 Equipment Power-on and Power-off Operation.

2 BMS Alarm and Handling

Annex 4 Table 1 BMS alarm and handling

Description of alarm	Alarm level	Fault causes	Handling suggestions
High monomer SOC (mild)	Level 1	Prompt for high system capacity	No processing is required
High monomer SOC (moderate)	Level 1	Full system reminder	No processing is required
Cell/Battery PACK/total voltage overvoltage (mild)	Level 1	Prompt for high system capacity	No processing is required
Cell/Battery PACK/total voltage overvoltage (moderate)	Level 1	Prompt for full system capacity	No processing is required
Cell/Battery PACK/total voltage overvoltage (severe)	Level 2	Abnormal communication of system PCS is abnormal (no response to charging prohibited) BMS is abnormal (charging prohibited not executed)	Check the PCS status Check the communication status between BMS and PCS

Cell/Battery PACK/total voltage under voltage (mild)	Level 1	Prompt for low system capacity	No processing is required
Cell/Battery PACK/total voltage under voltage (moderate)	Level 1	Prompt for system capacity emptying	There is no need to handle it. Pay attention to the system strategy and recharge in time
Cell/Battery PACK/total voltage under voltage (severe)	Level 2	Abnormal communication of system PCS is abnormal (no response to discharging prohibited) BMS is abnormal (discharging prohibited not executed)	Check the PCS status Check the communication status between BMS and PCS
High charging/discharging temperature (mild)	Level 1	System cell temperature too high	Check the working state of liquid cooler
Low charging/discharging temperature (mild)	Level 1	System cell temperature too low	Check the working state of liquid cooler
High charging/discharging temperature (moderate/severe)	Level 2	Abnormal temperature control system or abnormal battery cell	Check the working state of liquid cooler Check the battery state Contact the manufacturer for maintenance
Low charging/discharging temperature (moderate/severe)	Level 2	Abnormal temperature control system or abnormal battery cell	Check the working state of liquid cooler Check the battery state Contact the manufacturer for maintenance
Charging prohibited	Level 1	System full and charging prohibited alarm	No processing is required

Discharging prohibited	Level 1	System emptying and discharging prohibited alarm	No processing is required
ESBMM communication fault	Level 2	Abnormal communication of battery PACK	Check whether the communication harness between battery PACK is abnormal Check whether the communication between high-voltage box and battery PACK is abnormal Restart the high-voltage compartment Contact the manufacturer for maintenance
Insulation resistance mild/moderate/severe	Level 2	There may be electric leakage on the DC side of the system There may be insulation damage on the DC side of the system The humidity in the system is too high	Check the DC cable Check the ambient humidity Check the working state of dehumidifier Contact the manufacturer for maintenance
Low/high combustible gas concentration	Level 2	There is combustible gas in the battery box	Contact the manufacturer for maintenance
Level I fire alarm	Level 2	Abnormality in the battery box	Contact the manufacturer for help
Level II fire alarm	Level 2	There may be a fire risk in the battery box	Contact the manufacturer for help Cut off the AC source Prepare fire extinguishing media (fire hydrants, etc.) Contact the fire department for help

Faulty intake/exhaust valve	Level 2	There are foreign matters in the intake/exhaust valve Faulty intake/exhaust valve	Check the intake/exhaust valve for foreign matters Check whether the intake/exhaust valve is abnormal Contact the manufacturer for maintenance and replacement
Communication of dehumidifier is lost	Level 2	Abnormal communication between dehumidifier and BMS	Check the status of dehumidifier Check the communication harness between dehumidifier and BMS Restart the system Contact the manufacturer for maintenance
I/O device communication is lost	Level 2	Abnormal communication between I/O equipment and BMS	Check the status of I/O equipment Check the communication harness between I/O equipment and BMS Reboot system Contact the manufacturer for maintenance
Communication loss of liquid cooler	Level 2	Abnormal communication between liquid cooler and BMS	Check the status of liquid cooler Check the communication harness between the liquid cooler and BMS Reboot system Contact the manufacturer for maintenance

3 Troubleshooting of BMS

Annex 4 Table 2 Faults and Solutions

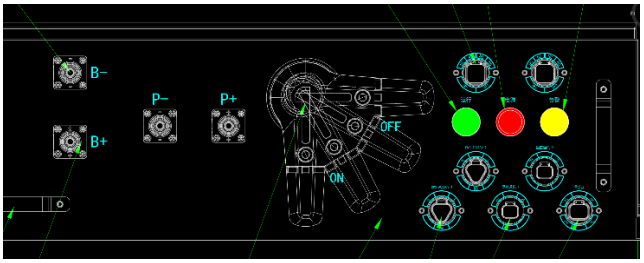
S/N	Fault	Solution
1	The display console cannot work normally after being turned on	Record the phenomenon and restart the power supply.
2	No data can be obtained on the display and control screen	Check whether the BMS cable is connected and whether the IP address of the battery cluster is set correctly.
3	The contactor on the display and control interface cannot be closed	Check whether the voltage difference between battery clusters is greater than 5V. At this time, BMS will start the protection program.
4	Total voltage of a single battery cluster is too low, and ESBCM is disconnected	Check whether the 24V line of ESBCM is connected correctly; replace the ESBCM module and check whether it returns to normal.
5	Abnormal voltage sampling of battery cell	Remove the battery PACK, and check whether the sampling fuse is blown; replace the ESBMM module, and check whether the module returns to normal.
6	ESMMU does not perform equalization function	Remove the battery PACK, and check whether the sampling fuse is blown; replace the ESMMU module, and check whether the module returns to normal.
7	The display console shows that the total voltage of the rack is normal, but there is no current or three times the current during charging and discharging	Check whether the contact resistance of Rack circuit increases; check whether the battery PACK is fastened; check whether the fuse at DC confluence is damaged; check whether the internal resistance of battery PACK rises and whether the voltage is within the normal range.

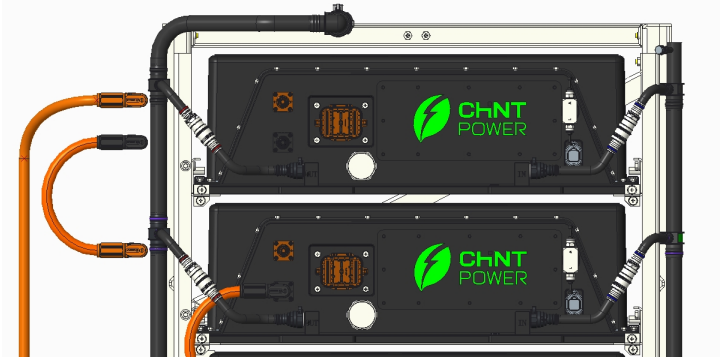
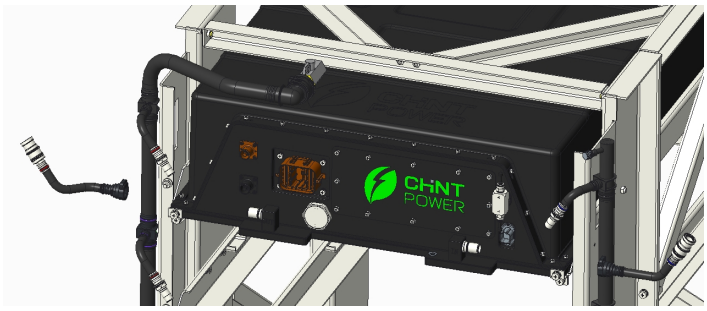
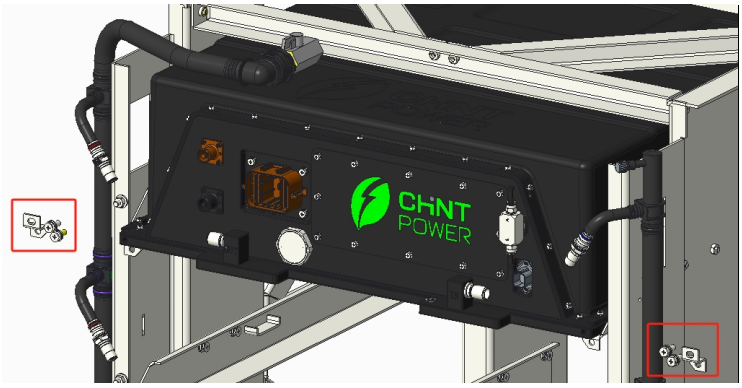
4 Battery PACK Replacement

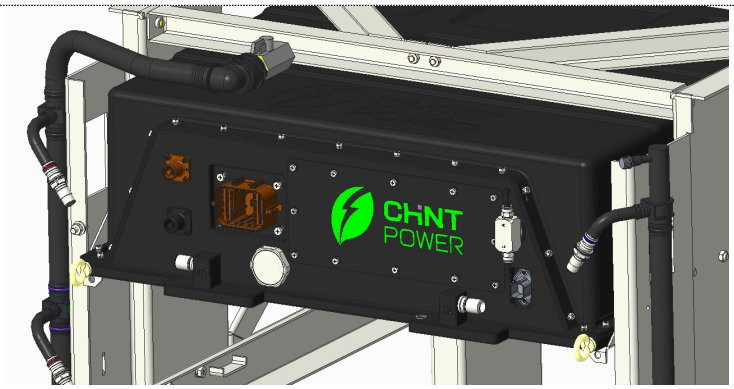
Warning:

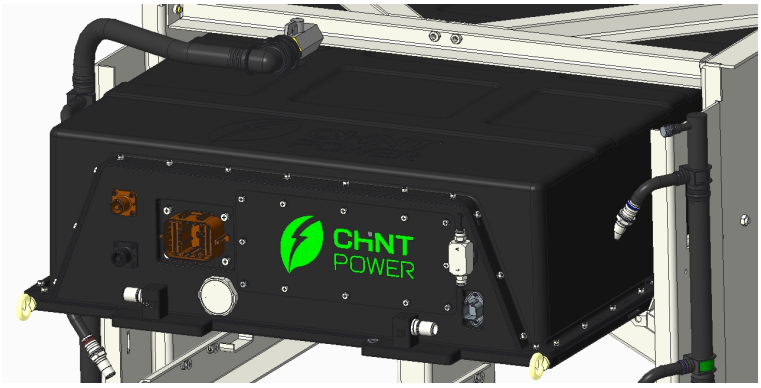
- This battery unit is a high-voltage DC system, which can only be operated by qualified and authorized personnel.
- Before replacing the main components, the main circuit of the battery cluster under maintenance must be cut off first.
- All repairs and replacement of components shall only be carried out by qualified personnel, and only approved materials, parts and components may be used for replacement.

Please refer to the following steps for replacing the battery PACK:

S/N	Operation steps
1)	Disconnect the DC side of PCS
2)	Turn off the BMS system, disconnect the disconnector and ensure that the high-voltage box is OFF (as shown in the figure below) 
3)	Locate the faulty battery PACK Locate the faulty battery PACK and pull out the MSD. As shown below: 
4)	Remove connecting cables, communication harnesses and other components Remove the cable and communication plug, close the valve of liquid cooling pipeline, remove the pipe joint, drain the coolant, and place the removed parts in the designated position. As shown in the following figure:

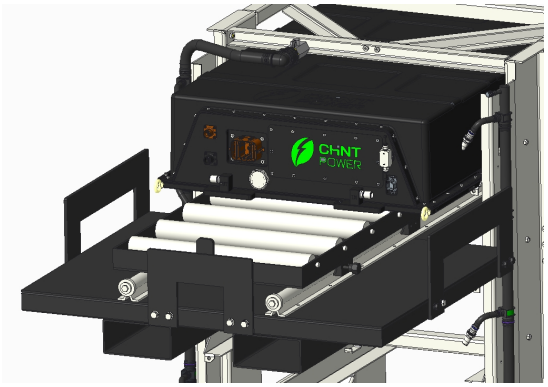
	 
5)	Remove the battery PACK fixing screws Remove the 4 screws fixed on battery PACK side beam, and place them at the specified position. As shown in the following figure: 
6)	Pull the battery PACK out of the battery rack Use a wrist strap or special tool to fix it on the threaded hole of the battery PACK side beam as shown in the figure, and pull it outward for about 50cm. Protective measures shall be taken during handling to prevent falling of personnel or battery PACK. As shown in the following figure:





7) Place the battery PACK on the lifting tool

Move the special forklift with roller workbench or platform to the bottom of the target battery PACK, move the battery PACK to the platform, and pull all battery PACKs out of the rack. As shown in the following figure:



	
8)	Install a new battery PACK and reconnect the system according to the Installation Manual. Precautions for replacement of a new battery PACK are as follows: 1. Before installing the new battery PACK, please verify whether the capacity of the battery PACK matches the system: if they match, proceed with direct replacement; if they do not match, consult a battery engineer. 2. After the installation of the new battery PACK, power on the system, and then confirm the status information of the target battery PACK through the display and control interface to determine if the fault has been resolved or proceed with the next step of operation. In case of other abnormal information, please contact professionals or the manufacturer for handling.

5 Troubleshooting of Liquid Cooler

Warning:

- Liquid cooler is specialized equipment and may only be operated by qualified and authorized personnel.
- The power supply and communication must be cut off before replacing the main components.
- All repairs and replacement of components shall only be carried out by qualified personnel, and only approved materials, parts and components may be used for replacement.

Annex 4 Table 3 Fault Analysis of Liquid Cooler

Symptom	Possible cause	Check item or handling method
External circulation fan not working	The water chilling unit is not powered on	Check whether there is electricity at the power input end of water chilling unit.
	The circuit breaker tripped due to lightning stroke	Check whether the circuit breaker inside the water chilling unit is closed.
	Abnormal power input of water chilling unit (such as overvoltage or undervoltage of power supply)	Confirm whether there is any corresponding alarm in the water chilling unit, and if so, handle it according to the instructions of the water chiller.
	The fan is stuck	Check whether the fan is stuck by foreign matters.
	Loose terminal	Check whether the butt terminal of fan is loose.
	Compressor not started	Refer to the handling method for compressor not started in the instructions of water chilling unit
	Control panel fault	Replace the control panel. Refer to the instructions of water chilling unit to replace the control panel
	Fan failure	Replace the fan. Refer to the instructions of water chilling unit to replace the external circulation fan
Abnormal sound of external circulation fan	Fan bearing worn	Replace the fan. Refer to the instructions of water chilling unit to replace the fan.
	The fan blades scratch other objects	Check whether there is interference between cables and fan blades.

Symptom	Possible cause	Check item or handling method
Compressor not started	Power supply not turned on (standby)	Check the main power switch and the operation display interface to see whether the compressor is started.
	Loose circuit connection	Tighten the circuit connector.
	Circuit open or short	Check for open or short circuits and repair the main power supply.
	Frequency converter fault	Replace the inverter.
	The control panel is damaged	Replace the control panel. Refer to the instructions of water chilling unit to replace the control panel.
	Compressor motor fault	Replace the compressor
Compressor not working	No cooling demand	Check the outlet temperature and the output status of the compressor on the display screen interface. Check whether it is in refrigeration state on the operation interface.
	Shutdown delay	When a compressor is in its normal state, it has the shortest downtime. If the temperature rises again to the startup point during this period, the compressor will still start with a delay.
High exhaust pressure	Condenser blocked by dirt	Clean the condenser with compressed air or a vacuum cleaner equipped with brush head.
	External circulation fan not working	Refer to the table above.
Internal circulating water pump does not start	The compressor is not powered on (in standby state)	Check the main power switch and the operation display interface to see whether the compressor is started.
	Loose circuit connection	Tighten the circuit connector.
	Fault of the frequency converter of the water pump	Replace the frequency converter of the water pump.
	Self-protection of water pump due to no coolant	Check whether there is coolant in the circulation system. If not, replenish it.
	Pump body fault	Replace the water pump. Replace the water pump according to the instructions of water chilling unit.
The electric heating pipe does not work	No heating demand	Check whether the outlet temperature and heating set point are set reasonably.

Symptom	Possible cause	Check item or handling method
	Loose circuit connection	Tighten the circuit connector.
	Overheat protection for electric heater	After waiting for a period of time, restart the electric heater and observe whether it works normally.
	Electric heater fault	Replace the electric heater if necessary. Replace the heater and circulating water pump with reference to the instructions of water chilling unit.
The automatic topping up pump does not work	Topping up pump fault	Replace the automatic topping up pump.
	Topping up pump is stuck	Check whether there are foreign matters in the topping up tank, and remove them if any. If the topping up pump is damaged, please replace it.
	Loose terminal	Check whether the butt terminal of topping up pump is loose.
Abnormal sound of automatic topping up pump during operation	Axial wear of the topping up pump	Replace the automatic topping up pump.
	The fixing screws of the topping up pump are loose	Fasten the screws.

6 PCS Troubleshooting

Warning:

- Wear insulating shoes and gloves before performing maintenance work.
- Direct contact with live parts is strictly prohibited.
- There is no emergency stop for the distributed PCS panel. Before maintenance, make sure that the following equipment has been powered off.

1. Ensure that the incoming line at AC side of energy storage converter is disconnected from the power grid, and the incoming line at DC side is disconnected from the battery.
2. Make sure that the UPS is turned off.
3. Ensure that all I/O terminals have no output voltage.
4. Wait for at least 20 minutes after power-off to ensure that the bus capacitor and LRC filter capacitor are fully discharged.
5. Open the cabinet door, measure the incoming copper bars at AC side and DC side respectively with a multimeter to ensure that there is no voltage before operating the energy storage converter.
6. Wear anti-static gloves when operating the single board.

In order to make the system operate more reliably, minimize the number of shutdowns and reduce the impact on the whole machine system, this chapter classifies the faults according to their severity. the following table shows the difference in response to faults of different levels:

Annex 4 Table 4 PCS Fault Grade

Name		**Grading (fault response)**	**Grade code**
Normal		None	0
Alarm	alarm	Only alarms issued, no action taken and no reset required	2
	Suspend operation	Alarms issued; suspend response control actions; no reset required	4
AC-side under frequency	Load reduction and shutdown	Load reduction and shutdown. Continue to operate after reset	8
Over-frequency at AC side	Emergency stop	Stop without load reduction, and continue to operate after reset	11
AC side voltage imbalance	Disable Running	Shutdown without load reduction, or no response to any control action. The control panel must be powered off and reset. Such as DSP RAM self-check error, etc.	14

Annex 4 Table 5 PCS Fault Analysis

Fault name	Interpretation	Event handling
Undervoltage at AC side	The voltage at AC side is lower than the set undervoltage threshold	/
Overvoltage at AC side	The voltage at AC side is higher than the set overvoltage threshold	
AC-side underfrequency	The frequency at AC side is lower than the set underfrequency threshold	
Over-frequency at AC side	The frequency at AC side is higher than the set overfrequency threshold	/
AC side voltage imbalance	The voltage unbalance at AC side is higher than the set threshold	/
Reverse phase sequence at AC side	Reverse phase sequence of power grid	Check and change the wiring sequence of cables at AC side of energy storage converter
Islanding protection	Islanding of power grid	/
Busbar voltage discharging timeout	Busbar voltage discharge time exceeds the set value	Check the wiring of busbar discharge board and replace it
AC circuit breaker fault	Abnormal closing/opening of AC circuit breaker	Check whether the drive or feedback circuit is abnormal, and whether the circuit breaker is abnormal
Lightning arrester circuit fault	Damage of AC lightning arrester or DC lightning arrester	Check and replace the damaged AC or DC lightning arrester
Abnormal EMS communication	Abnormal communication between energy storage converter and EMS	Check the communication connection between energy storage converter and EMS
Fan blocking	The fan is blocked	Check whether the fan is blocked by foreign matters or replace it with a new one
Fan disconnection	The fan is disconnected	Check the fan wiring or replace it with a new fan

Fault of module driving power supply	Abnormal driving power supply of module	Check the driving power supply and the driver board
Power module NTC temperature sampling disconnection	The module temperature is less than the disconnection judgment threshold	Check whether the NTC of the module is reliably connected
Module overtemperature	Module temperature is greater than the upper limit of allowable temperature	Check whether the module temperature detection line is reliably connected, and check whether the energy storage converter is blocked. Clean and replace the new dust screen
Module hardware overcurrent	Hardware overcurrent in a phase of the module	Contact our customer service personnel for handling
Module Vce	A tube of the module reports VCE fault	Contact our customer service personnel for handling

7 Troubleshooting of Dehumidifying Air Conditioner

Warning:

- Dehumidifying air conditioner is specialized equipment and may only be operated by qualified and authorized personnel.
- The power supply and communication must be cut off before replacing the main components.
- All repairs and replacement of components shall only be carried out by qualified personnel, and only approved materials and parts may be used for replacement.

Symptom	**Possible cause**	**Check item or handling method**
Internal circulating fan does not start	The return air temperature is low and the energy-saving operation mode is activated	In the running settings, if the internal fan stop point is set to the cooling point, the internal fan will not stop.
	Main power supply failure	Check the rated voltage of the input AC power phase to ensure whether the AC power supply fails or exceeds the range of 220V±15%

Symptom	Possible cause	Check item or handling method
	The fan is stuck	Check whether the fan is stuck by foreign matters.
	Loose terminal	Check whether the butt terminal of fan is loose.
The fan can run but the control function does not work	Relay does not act	Check whether the relay is faulty.
		Check the relay coil for AC voltage. If there is voltage, replace the control board.
Abnormal fan sound	Fan bearing worn	Replace the fan.
	The fan blades scratch other objects	Check whether there is interference between cables and fan blades.
Compressor not working	No cooling demand	Check the outlet temperature and the output status of the compressor on the display screen interface. Check whether it is in refrigeration state on the operation interface.
	Built-in temperature protection of the compressor	Check whether the relay contact has 220V AC.
	High voltage switch disconnected	Refer to the contents in excessively high exhaust pressure.
	Shutdown delay	When a compressor is in its normal state, it has the shortest downtime. If the temperature rises again to the startup point during this period, the compressor will still start with a delay.
High exhaust pressure	Condenser blocked by dirt	Clean the condenser with compressed air or a vacuum cleaner equipped with brush head.
	External circulation fan not working	Refer to the table above.
Compressor noise is too loud	Refrigerant returned in compressor	Check the suction overheat.

Symptom	Possible cause	Check item or handling method
	Bearing wear due to loss of lubricating oil	Replace the compressor.
	The support of compressor or piping is loose	Tighten the fixing clip.
	Fracture of connecting rod, valve or other rotating gear	Replace the compressor.
The compressor operates intermittently and cyclically	Sensor fault	Check the display for sensor fault alarms.
	Insufficient refrigerant in the system	Check for leaks, repair the leak or add refrigerant.
Tripping or cyclic operation of compressor protector	Excessively high exhaust pressure	Replace the automatic topping up pump.
Frequent voltage alarm	Power supply failure	Check the external input power supply.
	Circuit sensor fault	Replace the circuit board.

8 Spare Parts

In order to ensure the daily operation and maintenance of the energy storage system, a list of spare parts shall be kept in mind during minor repairs and minor installation maintenance. In the early stage of the project, it is necessary to communicate with the customer to clarify the list of spare parts. Spare parts can be purchased by the customer and kept as inventory, which will not be listed in this document for the time being.

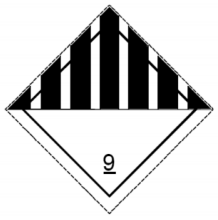
9 System Processing

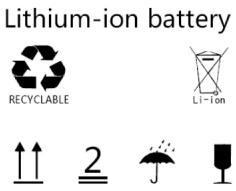
The manner in which the energy storage system is decommissioned and disposed of at the end of its useful life should be the responsibility of the owner of the system, and be consistent with local codes or requirements for waste disposal or recycling.

The decommissioning and disposal of lithium ion batteries shall be carried out in accordance with the following provisions:

If the battery is physically damaged, smoked, burned or, has reached the end of its life, the following instructions shall be noted:

- Keep the battery stationary for 24 hours to ensure there are no further hazards;
- Use appropriate temperature measuring tools (such as a thermometer) to check if the battery temperature is higher than the ambient temperature;
- Wear insulating gloves when moving the battery PACK;
- The battery PACK shall be externally insulated during transportation;
- Make sure that the disconnector of high-voltage box is turned off;
- Ensure that original plastic covers are provided at the battery output terminals for protection/insulation;
- Put the battery PACK into a plastic bag;
- Fix the battery PACK to avoid further vibration and impact;
- Prevent the battery PACK from being wet by rain or water.





Annex 5. System Maintenance Instructions

Warning:

- The operation and maintenance of battery, liquid cooler, fire protection and PCS must be carried out by qualified and authorized personnel.
- For some maintenance items, the system must be shut down first.

The system which has been running for more than six months or does not run for a long time shall receive a safety maintenance, and corresponding records shall be kept. The specific items are as follows:

- Check whether the safety door, main door and battery cabinet door of the container can be opened normally, and ensure that the environment inside and outside the container is clean and tidy;
- Check whether the fire extinguishing system can give an alarm and start normally, and whether there is fire protection equipment around the integrated cabinet for emergency use in case of accidents;
- Check whether each power line is insulated abnormally, whether the electrical safety clearance reaches the safety standard, and whether the wiring bolts are loose;
- Check whether the electrical components are normal and whether the power supply doors can be disconnected effectively.

1 Operating procedures for power-off of equipment

For specific operating procedures, please refer to 6.5 Equipment Power-on and Power-off Operation.

2 Battery maintenance procedure

Annex 4 Table 6 Battery Maintenance Procedure

Maintenance frequency	Category	Maintenance content	Remarks
Quarterly	Voltage inspection	Check the battery unit voltage through the monitoring system. Check whether the unit voltage is abnormal. For example, the voltage of a single battery is too high or too low.	
	SOC inspection	Check the SOC of the battery unit through the monitoring system. Check whether the SOC of battery pack is abnormal.	
	Cable inspection	Visually inspect all cables of the battery unit. Check the cable for breakage, aging and looseness.	

	Balance check	Leaving the battery uncharged for a long time can cause the battery pack to become unbalanced. Solution: carry out balanced maintenance every 3 months (charge it to full charge), which is automatically completed by the communication between the unit and external equipment under normal circumstances.	
	Output relay inspection	Under low load conditions (low current), the control output relay is switched OFF and ON, and a clicking sound is heard from the relay, which indicates that the relay can properly disconnect and connect.	
	Inspection of historical records	Analyze the historical records to check whether there are accidents (alarms and protections) and analyze their causes.	
Every 6 months	Dust inspection	Keep the battery compartment clean.	
	Temperature	Measure and record the ambient temperature in the battery compartment.	
	Appearance	Check the appearance cleanliness of each battery; check terminals and terminal covers for damage or overheating.	
	Voltage	Check the battery unit voltage through the monitoring system. Check whether the unit voltage is abnormal. For example, the voltage of a single battery is too high or too low.	
	Shutdown and maintenance	Some system functions need to be maintained during the network management restart. It is recommended to perform the following operation: Maintain the system every 6 months.	
Year	Iteration	Repeat the quarterly maintenance and inspection.	
	Tightness inspection	Check whether the cable joints are loose and tighten them every year.	
	Discharge test	Carry out a discharge test with the accurate load once a year, and the discharge amount is 30-40% of rated capacity. After three years of operation, conduct the 80% DOD capacity test per year. Before the discharge test, the ESS system shall be fully charged.	

Annex 4 Table 7 Record of Capacity Test Results

S/N	Discharge current	Discharge time	System capacity	SOH

3 Maintenance Procedure for Liquid Cooler

Annex 4 Table 8 Maintenance Procedure of Liquid Cooler

Frequency	Category	Maintenance standard	Test method	Treatment method
Quarterly	Appearance of the unit	The unit is clean and free of dust and dirt;	Visual inspection	Remove dust and dirt from the unit with a brush or cotton cloth 10 minute after power failure.
	Reliability of fan operation	The fan is free from dust, and there are no obstructions at the air outlet	Visual inspection	Clean the dust on the fan with a brush 10 minute after power failure. Clear the obstacles at the air outlet.
	Condenser cleaning	The condenser is not blocked by dust and foreign matters	Visual inspection	Clean the condenser with compressed air or a vacuum cleaner equipped with a brush 10 minute after power failure.
		The fin is free of serious bending deformation	Visual inspection	Calibrate with tools such as fin comb after power failure for 10 minute.
Once half a year	Reliability of power cables and terminals on the wiring panel	No looseness of wires and wiring terminals	Visual inspection	Tighten the loose cable with a screwdriver 10 minute after power failure.
		Electrical cables are free of aging, damage, abnormal heating and other abnormalities	Visual inspection	Replace the power cable 10 minute after power failure.
		Wiring panel is free of dust	Visual inspection	Clean the dust with a brush 10 minute after power failure.
	Reliable operation of the fan	The fan blades are not damaged, and the fan rotates smoothly without abnormal sound	Visual inspection	Fasten the fan after power failure for 10 minutes, and check whether there are internal cables interfering with the rotation of the fan. If the fan is faulty, replace it.
	Coolant	The concentration meets the requirements of range; PH and each electrolyte concentration meet the requirements No dirt, sediment and algae	Coolant detector Visual inspection	Replace the coolant after 10 minutes of power failure.

4 Fire Protection Maintenance Procedure

Annex 4 Table 8 Fire Protection Maintenance Procedure

Frequency	Category	Maintenance content	Remarks
Routine	Signboard inspection	Check the warning signs in the protection area, including those of manual starter, emergency stop switch and manual/automatic change-over switch (emergency maintenance switch), and confirm that they are all in their original positions, firmly installed and not damaged.	
	Control panel	Check the control panel and confirm that it works normally. If there is a fault signal on the control panel, notify the professional company responsible for maintenance to check.	
	Control switch	Check whether the hand-pull starter, emergency stop switch and manual/automatic changeover switch are in their original positions and in normal working condition.	
	Gas extinguishing steel cylinder	Check whether the electromagnetic starter of selector valve, the starter connector and the emergency mechanical startup are in normal working condition; Check that the pressure switch is firmly installed and in normal working condition; Check whether the pressure gauge of each steel cylinder is in the green normal pressure area; Check whether the electromagnetic starter, starter connector and emergency mechanical startup of each active steel cylinder are in normal working condition.	
Monthly	Iteration	Repeat the contents of routine maintenance and inspection.	
	Seal tightness of equipment	Check whether all equipment to maintain the tightness of the protection area is in good condition. Among these, interlocking devices such as fire dampers shall undergo an interlocking test every six months.	
	Steel cylinder	The pressure of the steel cylinder shall be tested with a pressure gauge every six months to check whether the indication of the pressure gauge on the cylinder head valve is accurate; Before pressure measurement, the electromagnetic starter, emergency mechanical starter and high-pressure release hose shall be removed from the cylinder head valve; After the pressure measurement is completed, the control panel is confirmed to be functioning properly, and then the relevant equipment shall be installed back on the cylinder head valve.	
Year	Iteration	Repeat the monthly maintenance and inspection.	

	Integrity of the protected area	Investigate whether the protected area is consistent with the originally designed system protection area and whether the integrity of the protected area is damaged.	
	Spray head/nozzle	Check all nozzles to confirm that they are in their original positions, and the pressure relief device is in its original position and has the same size and opening diameter as originally designed. Check the nozzles for corrosion and damage, and confirm that they are not blocked inside or outside.	
	Pipe	Check the condition of the pipe network, and confirm that the pipe network is fastened on the support and all pipe fittings and fasteners are firmly connected. A pipeline purging scheme shall be formulated according to the actual situation on site.	
	Cylinder support	Inspect all steel cylinder supports to verify that all steel cylinders are securely mounted on the rack. Check for corroded, damaged or missing parts.	
	High-pressure release hose	Check the condition of all high pressure release hoses of the steel cylinder. Look for signs of structural problems such as wear or aging, and verify that all hose connections are secure and intact.	
	Starter	Check whether the electromagnetic starter and mechanical starter function well.	
	Control panel	Check the control panel for modification, corrosion or damage. Test the control panel according to the corresponding control panel operation manual.	
	Detector	Check all detectors to make sure that they are in their proper positions, clean and undamaged. Each detector shall be tested in accordance with the commissioning requirements. If necessary, the sensitivity of each detector shall be tested according to the regulations of the detector manufacturer.	
	Each warning indicator	Check each buzzer, flashing light and alarm bell. Check the alarm condition and verify that it can operate correctly when powered on. Reset the alarm circuit after each alarm device is tested.	
	Operation mode	A simulation test shall be carried out for the whole system according to three operation modes, and all tests shall meet the requirements of system commissioning.	

Annex 4 Table 9 Fire Protection Maintenance Record

S/N	Equipment name	Phenomenon description	Maintenance personnel	Date of maintenance

5 PCS Maintenance Procedure

Annex 4 Table 10 PCS Maintenance Procedure

Frequency	Category	Maintenance content	Remarks
Routine	Cooling fan	Regularly maintain the cooling fan and heat dissipation channel of the energy storage converter, and clean up dust and sundries to ensure normal operation of the system	
Quarterly	Cleaning	The dust screen must be cleaned for each routine maintenance. If necessary, please contact our company to purchase the dust screen for replacement. If the operating environment is harsh, such as desert areas, the maintenance period shall be shortened. It is not recommended to clean the dust inside the energy storage converter directly with a broom, which is easy to cause fly dust. It is recommended to use vacuum cleaners to absorb dust.	
Year	Capacitor	If the energy storage converter does not operate for a long time, it is recommended to power it on at least once a year and keep it energized for one hour to ensure the good electrical performance of the capacitor	

Note:

- For detailed maintenance steps, please refer to the User Manual of Energy Storage Converter.

- After the maintenance is completed, check against the maintenance list one by one to ensure that there are no omissions in the maintenance items. Confirm that the above maintenance process is correct, and this maintenance is completed.

Annex 4 Table 11 PCS Maintenance Record

S/N	Equipment name	Phenomenon description	Maintenance personnel	Date of maintenance

6 Maintenance Procedure for Dehumidifying Air Conditioner

Annex 4 Table 12 Maintenance Procedure of Liquid Cooler

Frequency	Category	Maintenance standard	Test method	Treatment method
Once half a year	Condenser	Check the cleanliness of condenser	Visual inspection	Clean the condenser with compressed air.
Year	Reliable operation of the fan	The fan blades are not damaged, and the fan rotates smoothly without abnormal sound	Visual inspection	Fasten the fan after power failure for 10 minutes, and check whether there are internal cables interfering with the rotation of the fan. If the fan is faulty, replace it.
	Wiring	Check for looseness	Visual inspection	Check whether the wiring is loose after 10 minutes of power failure

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