

CPS ES-125kW/261kWh-US CPS ES-62.5kW/261kWh-US C&I Energy Storage System User Manual



CHINT POWER SYSTEMS AMERICA CO., LTD.

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1 Preface

This Installation and Operation Manual is applicable to the CPS ES-125kW/261kWh-US & CPS ES-62.5kW/261kWh-US Commercial and Industrial Energy Storage System (C&I ESS) cabinets developed and produced by CHINT POWER SYSTEMS AMERICA CO., LTD (hereinafter referred to as "CPS").

IMPORTANT!



- Please read this user manual carefully before installation or operation. CPS reserves the right to refuse warranty claims for equipment damage if the user fails to install the product according to the instructions in this manual.
- Failure to follow these instructions and other relevant safety precautions may result in voiding of the product warranty and/or damage to the product or other property.

Main Content

This manual contains information on how to operate the C&I ESS cabinet (e.g. instructions on how to properly conduct the commissioning and shutdown of the cabinet), a maintenance plan for the C&I ESS, and handling and recycling considerations for the system hardware. Please read this manual carefully before using this system and operate the cabinet according to the methods described in this manual to avoid equipment damage or personal injury.

Audience

This manual is applicable to users, service engineers, installation and commissioning engineers, and other operators. It describes the composition of the system, unpacking inspection, power-on and power-off operations, daily inspection and maintenance items, and emergency response.

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Version

This manual is subject to change or modification without prior notice. The latest version of this manual can be acquired via our website www.chintpowersystems.com.

2 Important Safety Information

Adhering to the following warnings, safety instructions, and precautions can ensure safety, prolong the service life of the products, and prevent property loss/damage. The system design, specification, installation, and location should allow effective equipment operation and minimize electrical hazards. 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, CPS has the right to not assume responsibility.

The following precautions provide general safety guidelines for the C&I ESS cabinet. The complete safety parameters and procedures are unique to each project and should be formulated by the installer and/or final user for the specific 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. The project location local laws, applicable rules, and regulations must be considered to determine permit requirements. If necessary, the equipment housing should be properly labeled before operation.

2.1 Warnings in This Manual

Pay attention to the important safety warnings below before the installation and operation of this product. Being familiar with them can help ensure safe installation and operation.

Qualified personnel:

- The operator must be familiar with all warnings and installation procedures described in this manual.
- Only qualified personnel who have appropriate training and certifications, meet specification requirements and safety standards, and have experience with electrical systems can work on the 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 batteries.

Electrical safety during 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/marketing procedures have been carried out before starting electrical work.
- When working near electrified overhead power cables, the boom, mast, crane and other equipment or their loads are never allowed to be within the evaluated safe distance limit from the power cable.
- Field electrical devices, even if considered temporary, must be planned and manufactured appropriately, and materials and industrial electrical components must be used to ensure the normal operation of the equipment and integrity of the installation.

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 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 before operating the battery.
- Use tools with insulated handles to avoid accidental short circuit conditions.
- Before connecting or disconnecting the terminals, disconnect the charging power supply and load.
- Use proper lifting methods when handling batteries and wear appropriate safety clothes and equipment.
- Keep batteries at least 20in (0.5m) away from heat sources or any places that may generate sparks (such as circuit breakers and fuse boxes).
- Do not leave the enclosure door open and avoid exposure of batteries to environmental elements (e.g. humidity, water, direct sunlight, etc.).
- Batteries must be handled, transported, and recycled or discarded in accordance with federal, state and local regulations.

Precautions for installation:

- Before installation, all personal protective equipment (PPE) required for the installation process shall be in place, as shown in Annex 1 List of Personal Protective Equipment (PPE).
- Unless proper power-off measures are taken, all power cables are to be considered electrified.
- Before installation, disconnect the power supply of the power grid and ensure that the battery is turned off.
- All battery racks must be grounded with the necessary conductors to form a grounding network.
- Before the electrical performance test, check whether the cable bolts and bronze bolts are loose. If loose, tighten them with a torque wrench.
- Lightning protection measures of BESS system shall be implemented with reference to corresponding UL standards and specifications, otherwise BESS devices such as battery modules, inverters and power distribution facilities may be damaged by lightning

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! The systems components contain many sharp edges/objects. There is risk of serious injury when working around the equipment housing.
	Attention - Electrostatic sensitivity! Electrostatic discharge can damage electronic equipment. Therefore, correct handling procedures are necessary.
	Dangerous voltage! The C&I ESS cabinet 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 manual. Failure to do so may lead to serious injury or death. Therefore, please follow all safety procedures in this manual.

2.3 Safety Guidelines for the Owner

The owner must follow the following requirements:

- The personnel operating the energy storage system must be trained and qualified electrical workers. Improper operation may cause serious injury to the operator.
- The personnel operating the energy storage system must be fully familiar with this manual.
- The personnel operating the energy storage system must be fully familiar with the local electrical regulations and standards.
- Regularly check the ESS per the recommended maintenance guideline in this manual to ensure proper functionality.
- Any warning labels that are damaged or illegible on the equipment shall be replaced immediately.
- Do not store inflammable and explosive articles in or near the C&I ESS cabinet.
- The software, housing, and internal components of the ESS cannot be changed without CPS approval; changes without authorization may result in voiding of the warranty and/or damage to the product or other property.
- Always follow all applicable locking/marketing procedures per local safety regulations. Failure to follow the correct locking/marketing procedure may result in serious injury or death.
- The C&I ESS cabinet contains high voltage equipment with electrical hazards. Unqualified personnel are not allowed to touch any components. To reduce the risk of electric shock, ensure the ESS is reliably grounded per this manual.
- The cabinet door should be kept closed when it is powered on. Identify and isolate all power sources connected to the ESS cabinet before opening the cabinet doors and panels.
- When maintaining a liquid-cooled battery system, maintain the battery clusters sequentially. That is, when maintaining a specific battery cluster, only the corresponding battery compartment door of that cluster may be opened; it is strictly prohibited to open multiple battery compartment doors simultaneously (unless multiple clusters require simultaneous maintenance operations).
- During normal operation of the liquid-cooled battery system, opening battery compartment doors is not allowed. To open them, wait until the system operation is completed before performing operations and maintenance.
- After the liquid-cooled battery system maintenance is completed, the battery compartment doors should be closed immediately. After the doors are closed, the dehumidification air conditioner must first operate to control the humidity inside the compartment to 50% before the system can operate again.

Pay attention to the following warning signs inside and outside the C&I ESS cabinet:

Warning Signs Inside the C&I ESS Cabinet			
			
Please read the manual carefully	Warning	Electric shock hazard	Recycle
Warning Signs Outside the C&I Integrated Cabinet			
			
Arc Flash Warning	Emergency Shutdown	Fire Extinguisher	Warning: Electricity
			
General Warning Sign	Read Carefully	Unauthorized Disposal Prohibited	

Figure 2-1 Warning Signs

3 System Overview

The C&I ESS cabinet is a modular, all-in-one energy storage solution for commercial, industrial, and utility applications. Its integrated design simplifies installation, and a top explosion-proof feature enhances fire safety.

This system supports flexible 2 or 4-hour configurations, offering high energy density, superior cycle efficiency, and a long service life for reliable, long-term operation. It's ideal for back-up power, peak-load shifting, PV self-consumption, and grid dispatching solutions, improving overall energy efficiency and power quality. Characterized by high efficiency, energy conservation, environmental protection, and high integration, the C&I ESS cabinet features convenient installation, intelligent control, and remote monitoring. It ensures stable, safe, and reliable performance with a long operational life.

3.1 Terms and Definitions

Table 3-1 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	Equipment for protection and control during charging and discharging of the battery cluster. Consists of the cluster-level battery management unit, relay, fuse, power resistor and disconnect.
Battery cluster	Battery assembly that is connected by the battery pack in series and can run independently after being connected with a PCS 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, or bi-directional ESS inverter, for charging and discharging the battery.
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 the 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 the battery.
ESBCM	Energy Storage Battery Control Module, the main control module in the 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 the 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 the 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 the 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 the 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. The EMS is not included in the ESS cabinet.
LEMS	Local Energy Management System, local controller, which is used for managing the local equipment.
Distribution box	Equipment used to supply power to the system communication components and system equipment and is arranged in the equipment compartment.
Fire protection system	Includes aerosol, detector, audible and visual alarm, etc., which are arranged in the battery compartment.
Thermal management system	Uses a liquid cooling unit to adjust the battery temperature within an appropriate range, and uniformly controls the temperature of each battery through liquid cooling pipelines and liquid cooling plates.
Cycle	When the battery pack is charged and discharged once as per the specified standard, it is considered a cycle.
MSD	Manual Service Disconnect

3.2 System Description & Parameters

3.2.1 Key System Components

The key components of the C&I ESS cabinet include five battery packs, the battery management system (BMS), the PCS bi-directional inverter(s), the LEMS, thermal management system, fire protection system, power distribution system, and other auxiliary equipment. Detailed component locations are shown in the following figures:

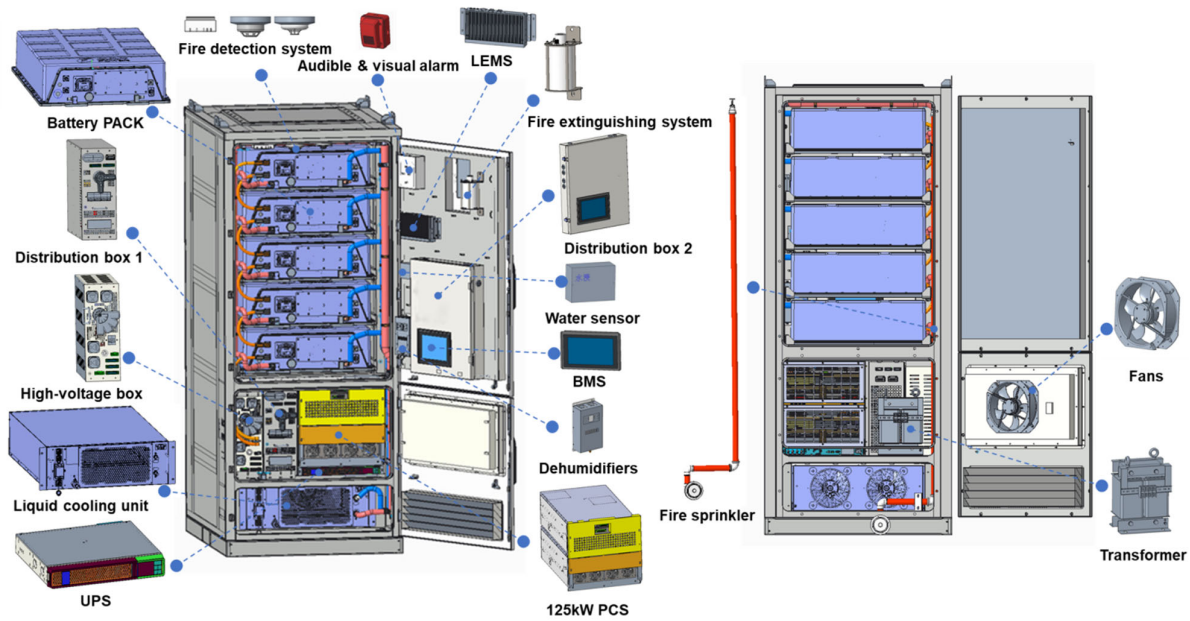


Figure 3-1 Location of System Components (62.5kW/261kWh model)

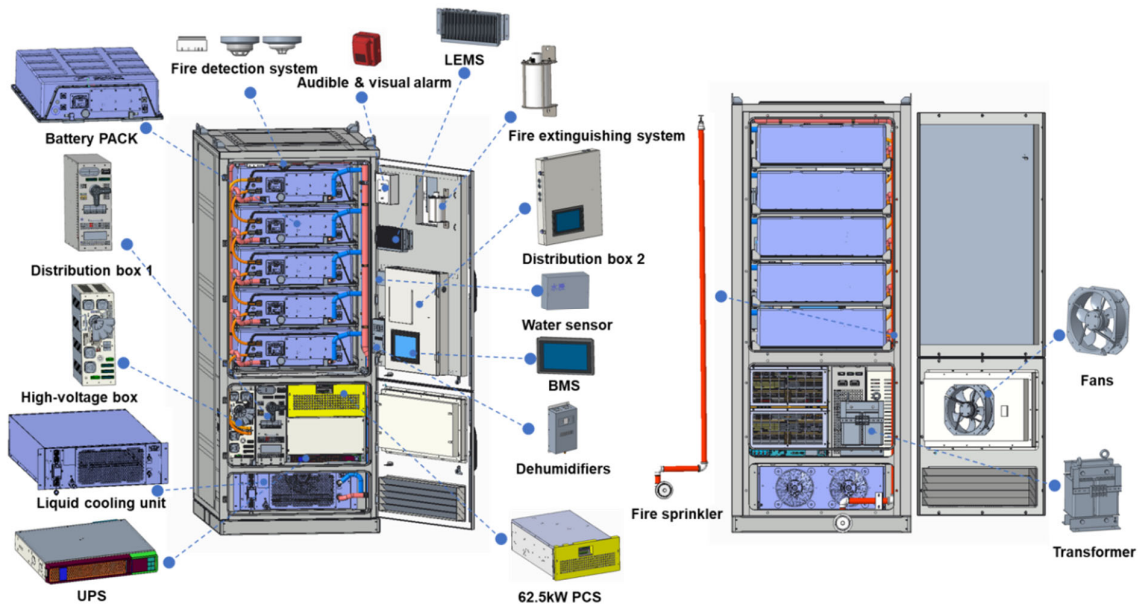


Figure 3-2 Location of System Components (125kW/261kWh model)

A 125kW/261kWh system is used below for illustration purposes.

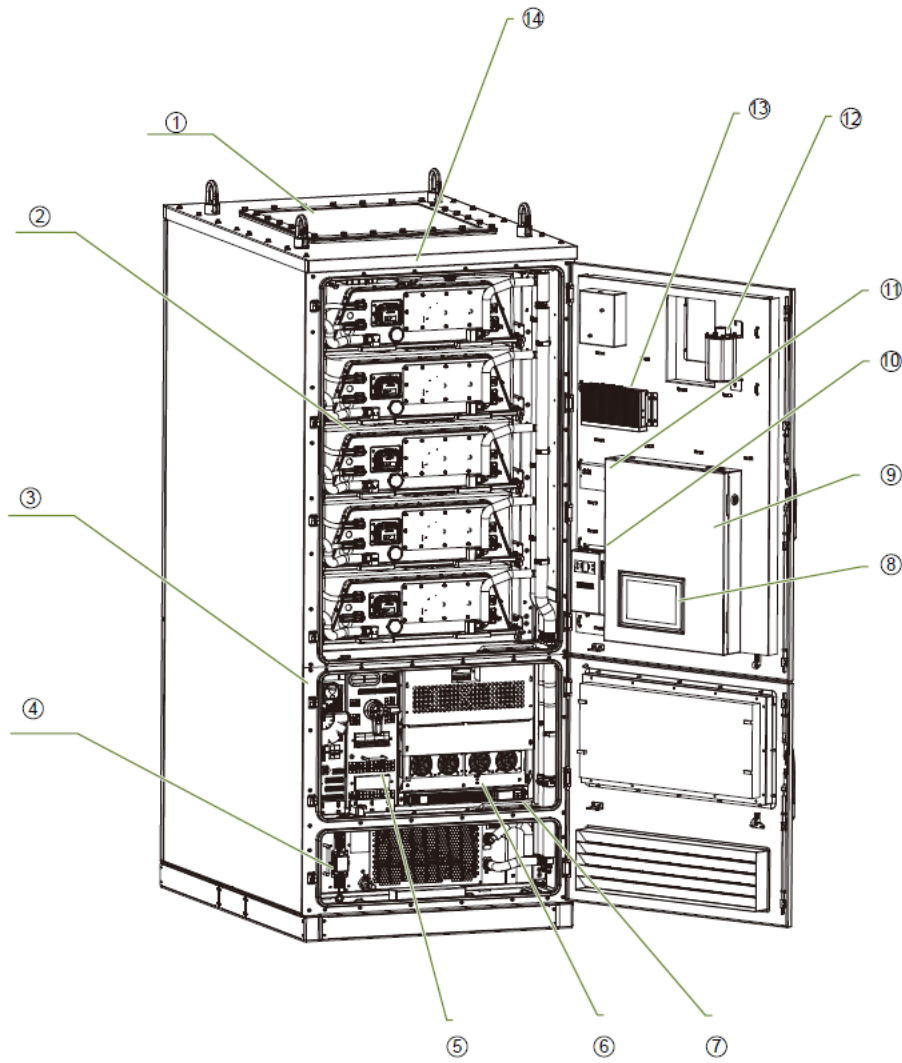


Figure 3-3a Front View of 125kW/26kWh Cabinet

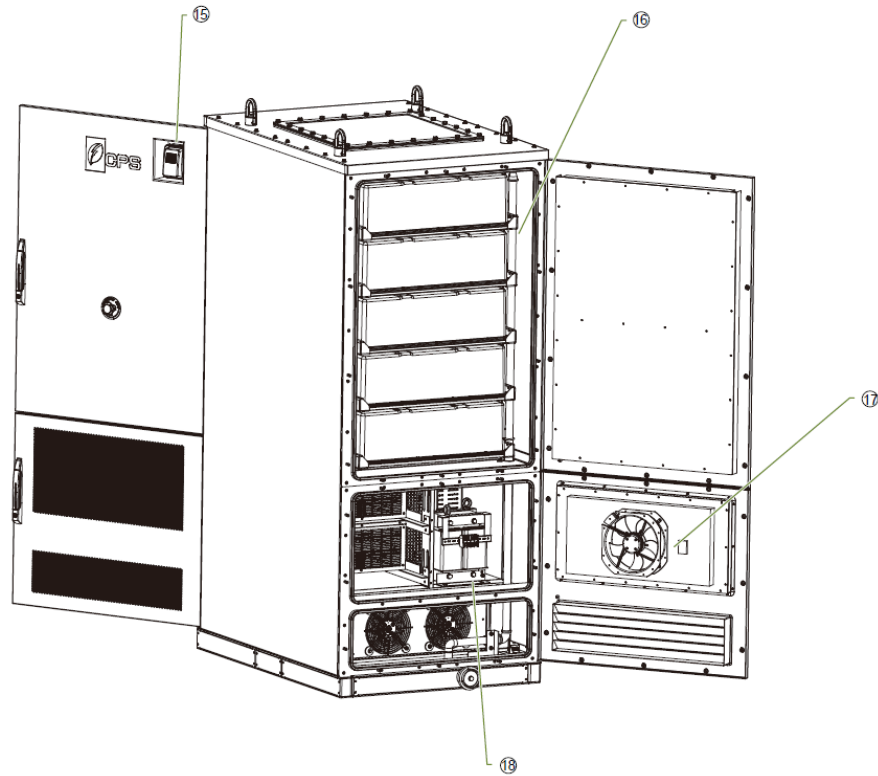
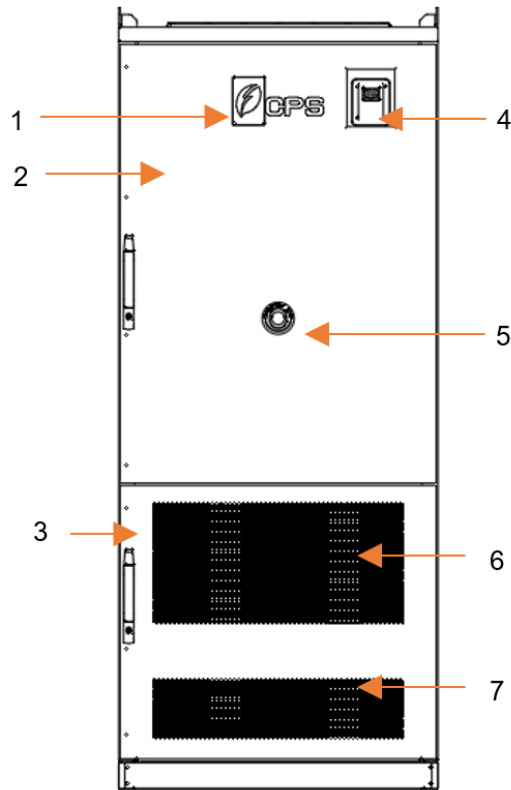


Figure 3-3b Back View of 125kW/261kWh Cabinet

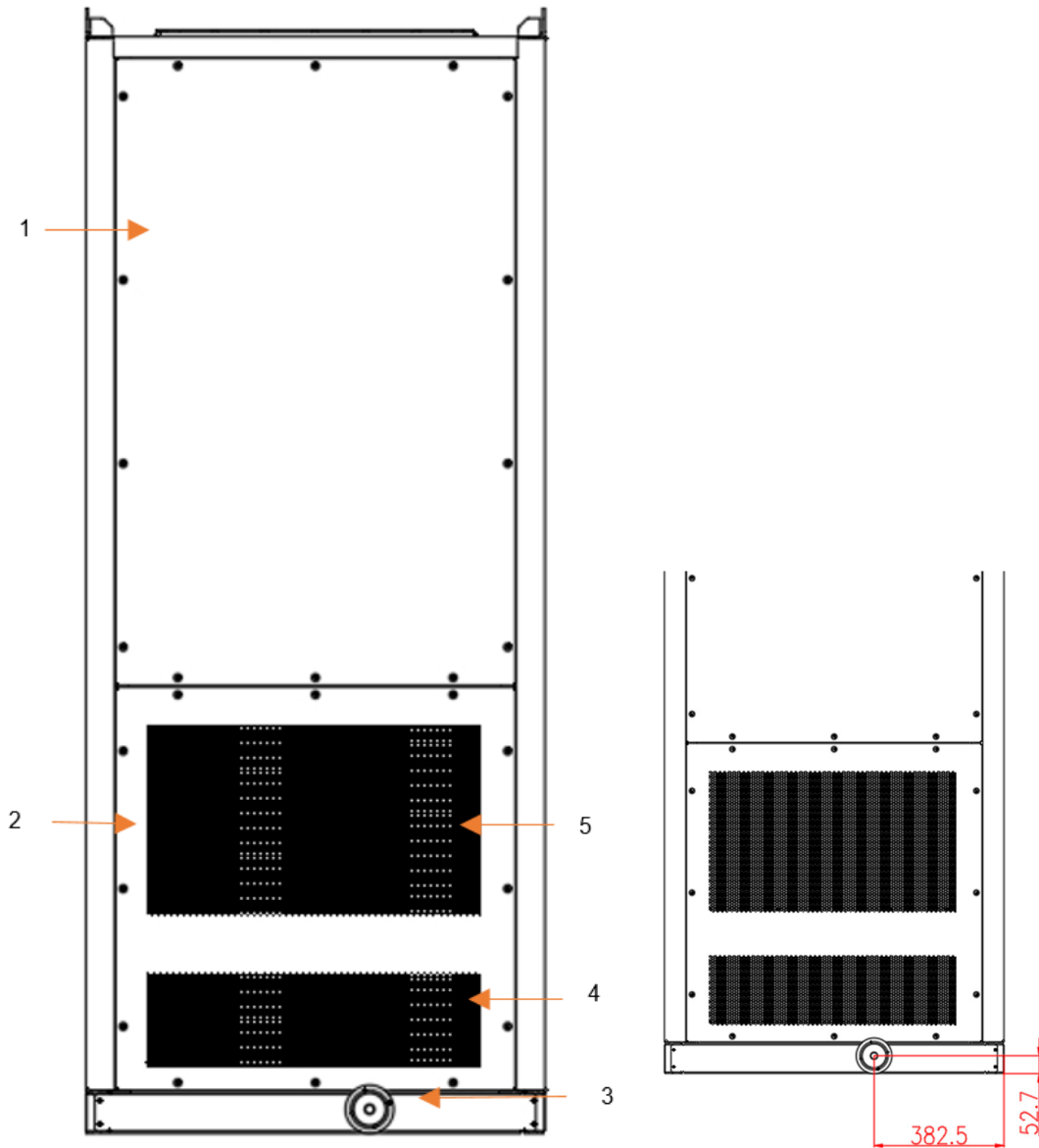
No.	Name	No.	Name
1	Explosion vent valves	10	Dehumidifiers
2	Battery pack	11	Water sensor
3	High voltage box	12	Fire extinguishing device
4	Liquid cooling unit	13	LEMS
5	Distribution box 1	14	Combustible gas detector, Smoke detector, Temperature detector
6	PCS	15	Sound and light alarms
7	UPS	16	Fire sprinkler
8	BMS	17	Fans
9	Distribution box 2	18	Transformer

Description of each view of the system is shown as follows:



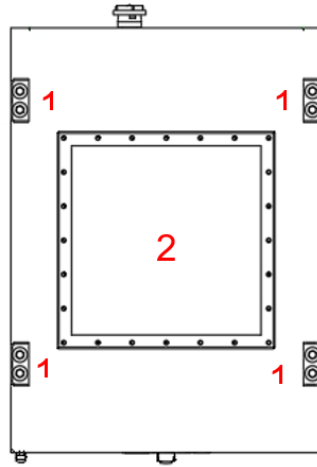
Front view

1. Status indicator with CPS logo
2. Door of battery compartment
3. Door of electrical equipment compartment
4. Audible and visual alarm indicators triggered by fire detection system
5. Emergency Power Off button
6. Front cabinet door air intake grille (for PCS area)
7. Front cabinet door air intake grille (for liquid cooling unit area)



Rear view:

1. Battery compartment backplate
2. Equipment compartment backplate
3. Water fire suppression interface (optional); threaded connection with NPT DN65 specification. If the customer's water spray interface differs, a corresponding adapter is required. Using the water fire suppression interface is optional according to local fire authority's requirements. It is recommended that customers consider water fire suppression integration during initial installation and complete the connection between external pipelines and the fire interface before system commissioning. (In case of fire, personnel can control the valve remotely.)
4. Liquid cooling unit area air outlet
5. PCS area air outlet

**Top view**

1. 4 lifting rings, arranged on the top of the integrated cabinet to facilitate on-site lifting;
2. Explosion relief panel, used for product explosion relief.

3.2.2 System Specificalton

The technical parameters of this product are based on the test results of standard battery clusters at room temperature (25±2)°C and humidity (55±20)%. See the following table for detailed parameters.

Model Name	CPS ES-62.5kW/261kWh-US	CPS ES-125kW/261kWh-US
DC Parameters		
Battery cell	LFP 314 Ah	
Battery capacity	261 kWh	
Module configuration	1P52S	
Rack configuration	1P260S	
Rated voltage	832 V	
Operating voltage range	750-936 V	
Maximum charge/discharge rate	0.5 C	
Overcurrent protection	Yes	
AC Parameters		
Rated AC output power	62.5 kW	125 kW
Rated output voltage	480 Vac	
Grid voltage range	422-528 Vac	
Maximum continuous AC current	75 A	150 A
Nominal grid frequency	60 Hz	
Grid frequency range	55-65 Hz	
Adjustable reactive power	0.8 leading to 0.8 lagging	
AC current TRD	< 3% (IEEE 519 compliant)	
DC current injection	< 0.5%	
Maximum efficiency (PCS)	98.10%	
CEC efficiency (PCS)	97.50%	
AC connection	3 phase, 3 wire	
Equipment Specifications		
Dimensions (W × H × D)	39.61 × 95.43 × 55.20 in (1006 × 2424 × 1402 mm)	
Weight	5803 lb (2632 kg)	5920 lb (2685 kg)
Cooling method	PCS: air cooling Batteries: liquid cooling	
Operating temperature range	-13°F to 131°F, derating at 113°F (-25°C to 55°C, derating at 45°C)	
Operating humidity	0-95%, non-condensing	
Operating altitude	≤ 9842.5 ft, derating from 6561.7 ft (≤ 3000 m, derating from 2000 m)	
Ingress protection degree	IP54	
Anti-corrosion level	C3	
Fire suppression	NFPA 68 compliant (flammable gas detection, temperature sensing, smoke detection, aerosol spray)	
Shockproof rating	Zone 4	
Lifting provisions	Forklift slots and lifting rings	
Communication & Certifications		
Communication interface	Ethernet / CAN	
Communication protocol	Modbus-TCP	
System certifications	UL 9540	
PCS inverter certifications	UL 1741-CRD, UL 1741-SA/SB Ed.3, CSIP, CSA-22.2 NO.107.1-16, IEEE 1547, FCC	
Battery compliance	UL 1973, UL 9540A, NFPA 855, NFPA 68, UN 38.3	

3.2.3 System Structure Diagrams

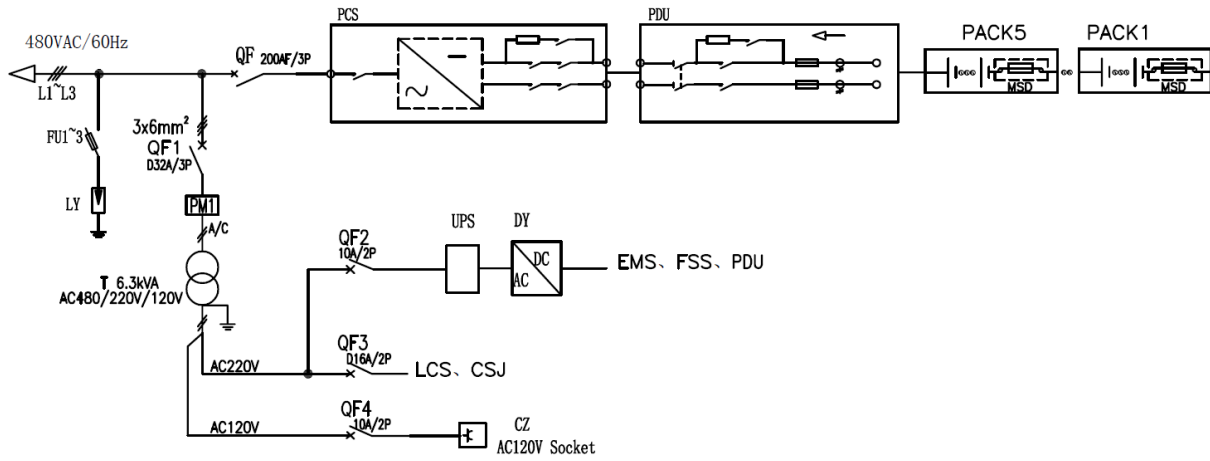


Figure 3-4 Electrical Architecture Diagram

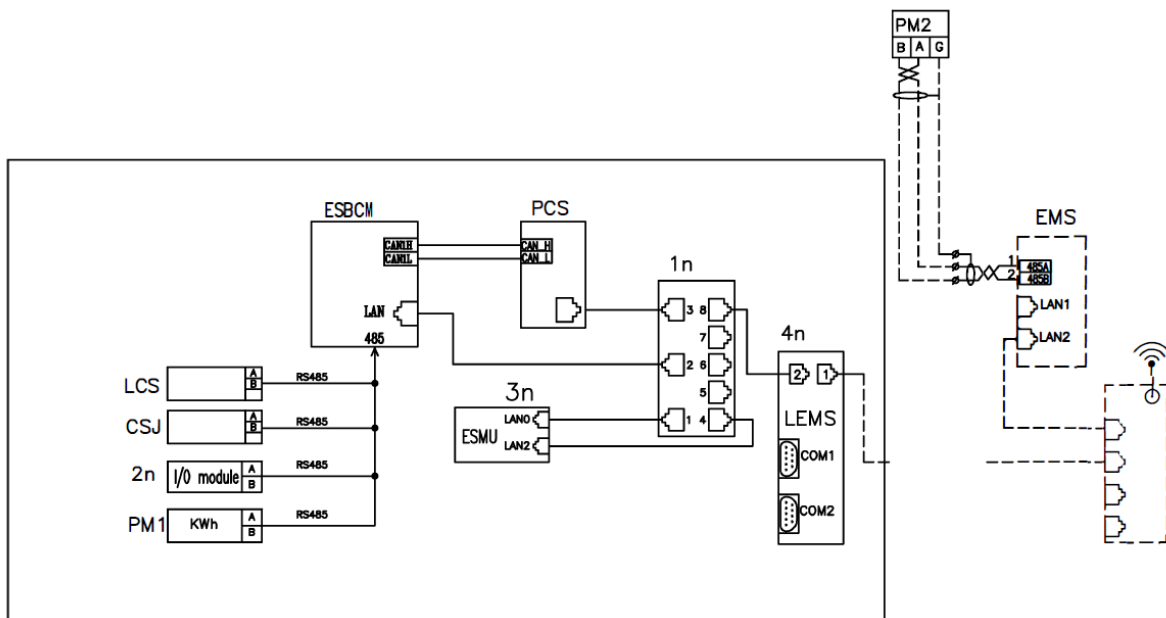


Figure 3-5 System Communication Architecture (the EMS is not included in the ESS)

3.2.4 Nameplate of Energy Storage System

Users can identify the products through the nameplate, which is located in the lower right corner of the front door of the cabinet enclosure, as shown in Figure 3-2. The detailed nameplate information is shown in Figure 3-.

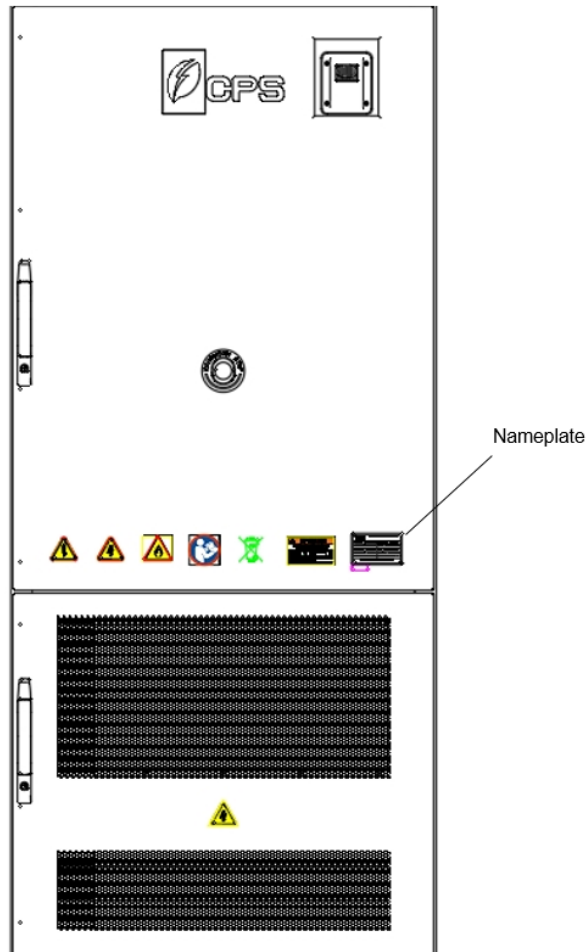


Figure 3-2 Position of Energy Storage System Nameplate

 261kWh Energy Storage System	
Product Model: CPS ES-125kW/261kWh-US	Allowable Altitude: ≤2000m
Rated Voltage: 832Vdc	Protection Type: Class I
Voltage Range: 728Vdc-936Vdc	IP Rating: NEMA 3R
Rated Energy: 261kWh	Size: 1000x1405x2450mm
Charging Voltage: 936Vdc	Weight: 2685kg±50kg
Discharge Voltage: 728Vdc	Place Of Origin: China
Grid Frequency: 60Hz	Optimum Temperature: 25°C±5°C
Shanghai Chint Power Systems CO., LTD.	

Figure 3-3a 125kW/261kWh ESS Nameplate

 261kWh Energy Storage System		
Product Model:	CPS ES-62.5kW/261kWh-US	Allowable Altitude: $\leq 2000\text{m}$
Rated Voltage:	832Vdc	Protection Type: Class I
Voltage Range:	728Vdc-936Vdc	IP Rating: NEMA 3R
Rated Energy:	261kWh	Size: 1000x1405x2450mm
Charging Voltage:	936Vdc	Weight: 2632kg $\pm$ 50kg
Discharge Voltage:	728Vdc	Place Of Origin: China
Grid Frequency:	60Hz	Optimum Temperature: 25°C $\pm$ 5°C
Shanghai Chint Power Systems CO., LTD.		

Figure 3-7b 62.5kW/261kWh ESS Nameplate

The information contained in the nameplate includes:

- Product name, specification and model;
- Name and trademark of the manufacturer;
- Technical parameters:
 - System operating parameters: Rated output voltage (V), rated capacity (kWh), rated working frequency (Hz), etc.
 - Hardware parameters: Allowable Altitude (m), size (mm) and weight (kg);
 - Optimum 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.

3.3 BMS System

The BMS adopts a 3-level architecture, with hardware consisting of the ESBMM, ESBCM and ESMU. The information from ESBMM is aggregated at the ESBCM, and then uploaded to the ESMU for system level management. The locations of the BMS components are as follows:

Table 3-1 BMS Component Locations

Equipment level	Equipment name	Location	Function
Level 1, battery pack level	ESBMM	In the battery pack maintenance panel	Checks the voltage and temperature information of cells in the battery pack
Level 2, battery cluster level	ESBCM	In the high-voltage box	Data collection, analysis, protection and decision making for cluster level
Level 3, system level	ESMU	On the cabinet door	Collects the information of each ESBCM and communicates with LEMS and SCADA

The ESMU location in the equipment compartment is as follows:

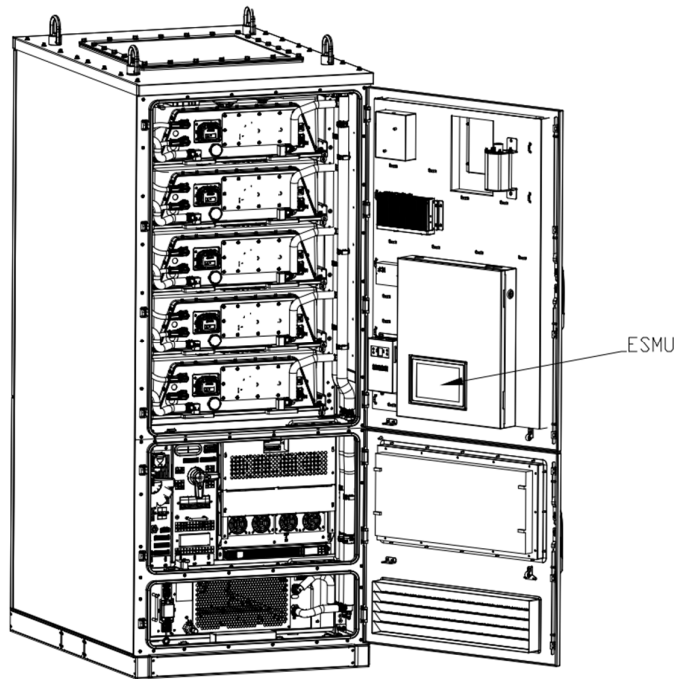


Figure 3-8 ESMU Location

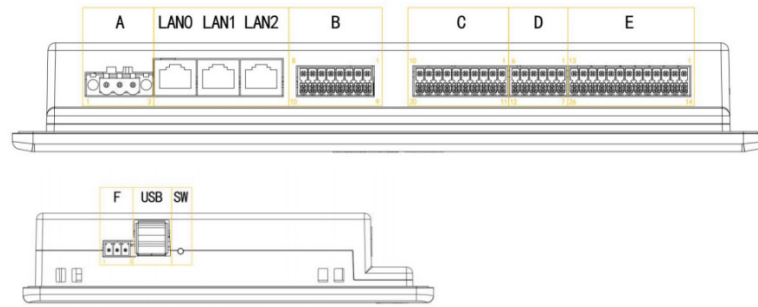


Figure 3-9 ESMU Interface

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

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

If the BMS system fails, the ESMU will output a dry contact closing signal and connect it to the PCS input dry contact to realize failure linkage and protect the ESS.

The interfaces of the ESMU are defined as follows.

Table 3-2 Definition of ESMU Interfaces

Port name	S/N	Port definition	Function description	Recommended use	Note
A	1	V+	Positive input of power supply	Power input	
	2	V-	Negative input of power supply		
	3	PE	System ground		
LAN	-	LAN0	100M/1000M Ethernet	LEMS	
	-	LAN1	100M/1000M Ethernet	LEMS	
	-	LAN2	10M/100M Ethernet port	ESBCM	

3.4 Bidirectional Energy Storage Inverter

The bidirectional energy storage inverter, or power conversion system (PCS), is a conversion device between the grid and battery, which can charge and discharge the battery. The PCS can be used in grid-connected mode or off-grid mode.

The PCS adopts a single-stage topology, and the DC voltage input range is 750-1100V. The high-level PCS topology is shown below:

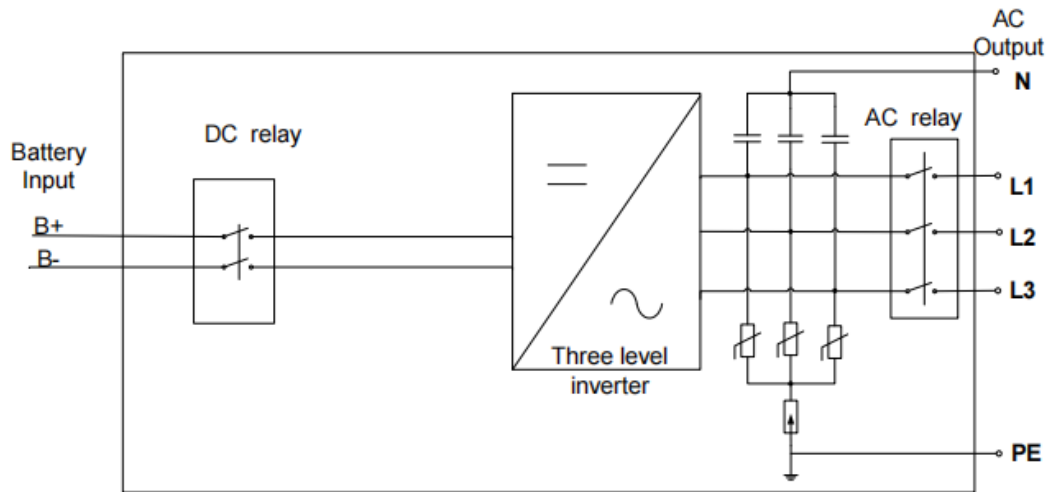


Figure 3-4 Power Conversion System Topology

3.5 Battery System

The liquid cooling battery system is mainly composed of the battery pack, high-voltage box, supporting frame and the BMS. The BMS adopts a 3-level architecture, which consists of the ESBMM, ESBCM and ESMU. The ESBMM is located on the battery panel, the ESBCM is in the high-voltage box, and the ESMU is on the cabinet door.

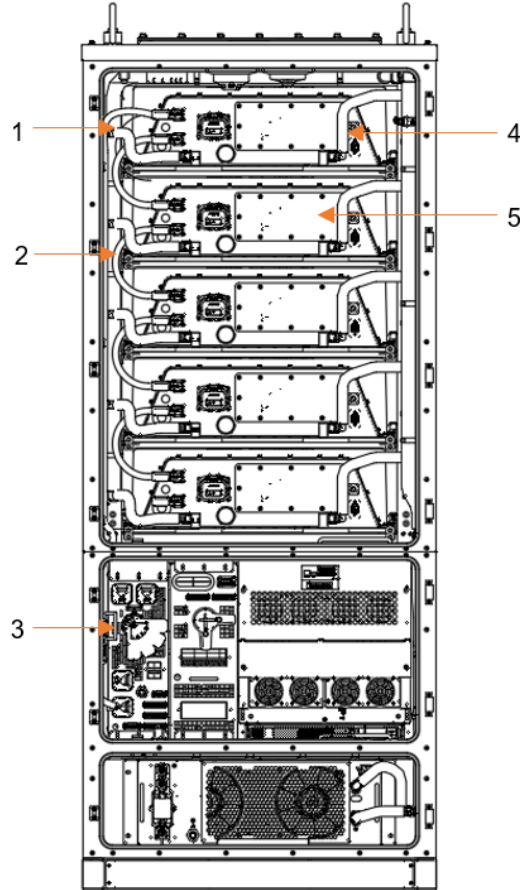


Figure 3-5 Battery Cluster Components

No.	Name
1	Liquid cooling return pipe
2	Battery connection cable
3	High-voltage box
4	Liquid cooling inlet pipe
5	Battery pack

3.5.1 Battery Pack

The battery pack consists of lithium iron phosphate battery cells in a 1P52S configuration.

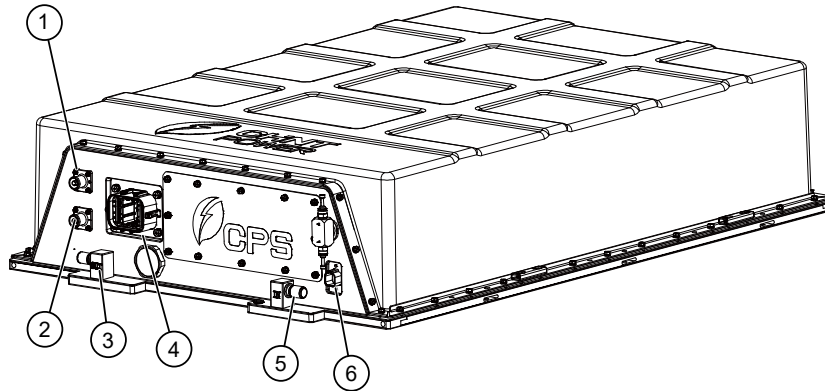


Figure 3-6 Battery Pack

Table 3-3 Battery Pack Components

Item	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 devices and the ESBCM. The layout of the high-voltage box is shown in the following figure:

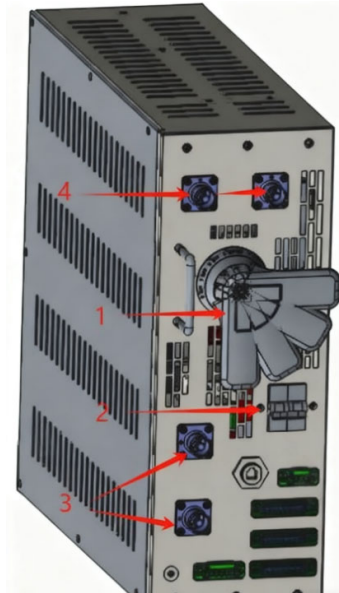


Figure 3-7 High-voltage box

Table 3-4 Main Interfaces of High-voltage box

Item	Definition	Function description
1	Disconnect	Battery cluster switch at DC side
2	Micro switch	Secondary signal power supply switch of high-voltage box
3	Battery cluster plug	DC cable connection plug of battery pack
4	PCS plug	PCS DC cable connection plug

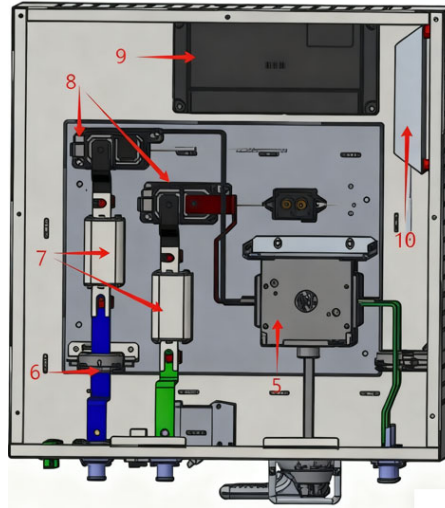


Figure 3-8 Internal View of High-voltage box

Table 3-5 Interior Components of High-voltage box

Item	Definition	Function description
5	Disconnect	Battery cluster switch at DC side
6	Hall sensor	Battery cluster current measurement at DC side
7	Fuse	Battery cluster fuse at DC side
8	DC relay	Battery cluster relay at DC side
9	Master control (ESBCM)	Battery cluster energy management module
10	Pre-charging Resistor	Opening and closing pre-charging resistor of high-voltage box

The high-voltage box is connected to the battery through the "B+" and "B-" terminals and connected to the DC side of the PCS through "P+" and "P-" terminals on the front of the control box. The high-voltage box interface is shown in Figure 3-15, and the descriptions of the power supply and communication input/output interfaces are shown in the following table:

Table 3-6 Power Supply and Communication Input/Output Interfaces of High-voltage box

Port name	S/N	Definition	Function description	Note
BMS-DC24V port J1	1	V+	External DC24V power input to supply power for internal components of high-voltage box	
	2	V+		
	3	/		
ESBMM communication port J2	1	IP1	Daisy-chain communication	To IP2/IM2 of the last ESBMM
	2	IM1	Daisy-chain communication	
	3	IP2	Daisy-chain communication	To the first ESBMM IP2/IM2
	4	IM2	Daisy-chain communication	

Port name	S/N	Definition	Function description	Note
	5	/		
Communication port J3	1	CAN-2H	Reserved	
	2	CAN-2L		
	3	CAN-0H	Reserved	
	4	CAN-0L		
	5	CAN-1H	PCS communication	
	6	CAN-1L		
	7	RS485-A	Liquid cooling unit/IO module/Dehumidifier communication/Meter	Daisy-chained
	8	RS485-B		
ESBCM DI port J4	1	DI2H	Standby	
	2	DI4H	Standby	
	3	V1+	Standby	
	4	DI5L	Standby	
	5	DI7+	PCS fault feedback	
	6	DI7-		
	7	DI8+	Standby	
	8	DI8-	Standby	
ESBCM DO port J4	1	D04L	Red light	
	2	D05L	Green light	
	3	D06L	Standby	
	4	V2+	24V+	
	5	DO7+	Standby	
	6	DO7-		
	7	DO8+	Standby	
	8	DO8-	Standby	
RJ45	1	LAN	Display control communication	



3.6 Local Controller (LEMS) System

The Local Controller is the energy dispatching and management center of the energy storage system. The LEMS communicates with the external EMS, collects all BMS data, PCS data and grid-connected side data, sends control instructions to each part, controls the operation of the whole energy storage system, and arranges the work of the PCS. The system can run automatically according to the preset charging and discharging time, power and operation modes. It can also accept dispatching instructions for operation.

The location of the LEMS in the electrical compartment is as follows:

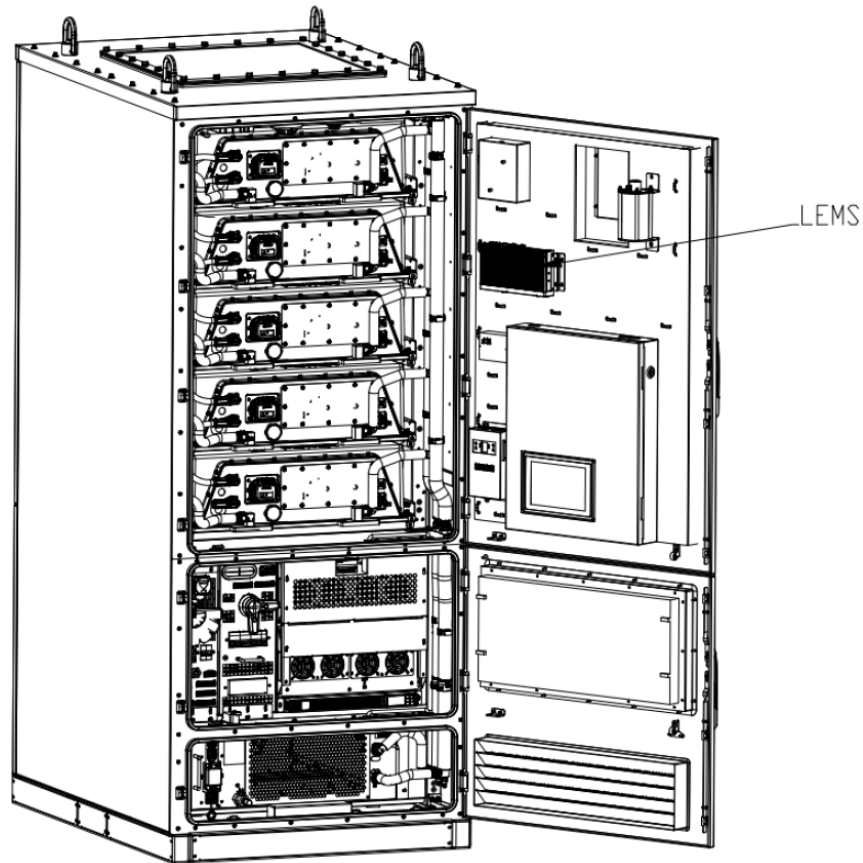


Figure 3-10 LEMS Location

3.6.1 LEMS Control System Diagram

The following figure provides an illustration of the energy storage system control framework with the LEMS:

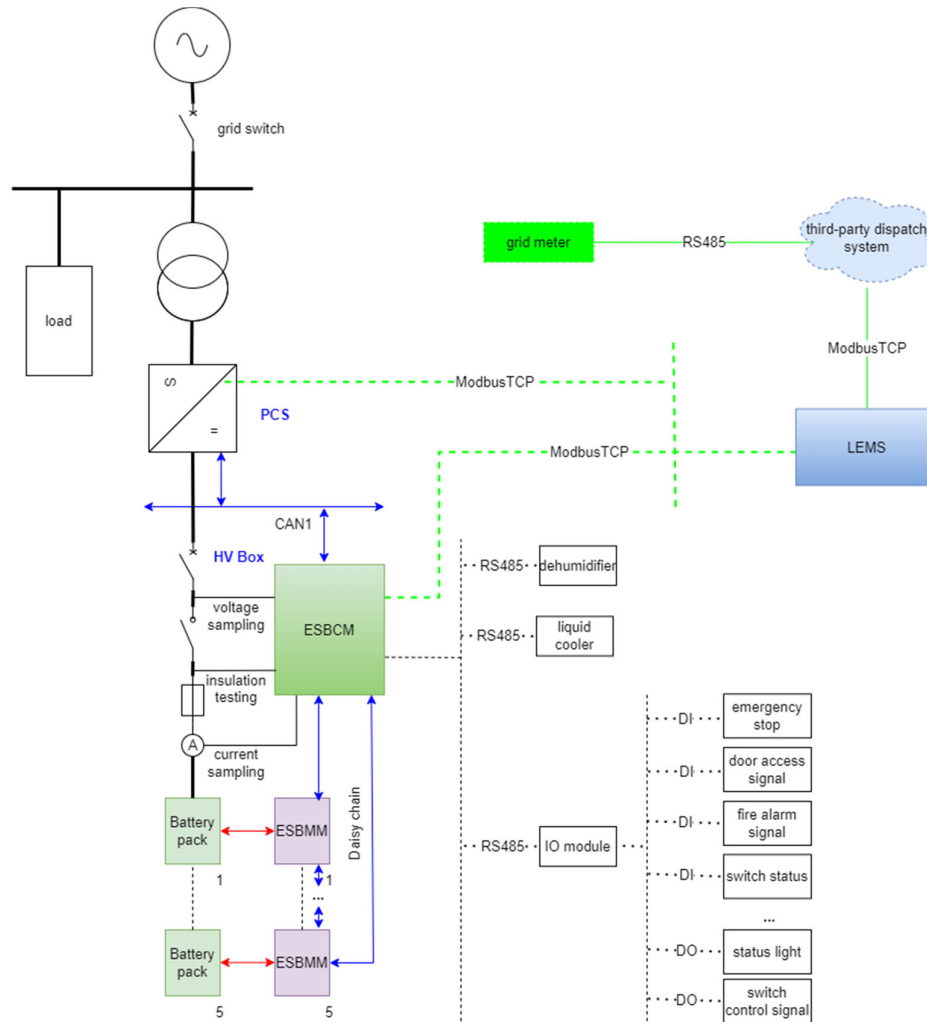


Figure 3-11 LEMS Control System Diagram

The LEMS operates under the control of the external EMS, which handles the system-wide monitoring, optimization, and dispatch decisions. The LEMS functions as an execution layer for energy storage operations, responding to EMS commands and controlling the charging/discharging of the battery through the PCS and BMS, to realize key applications such as PV utilization maximization, load peak shaving, anti-reverse flow control, critical load backup, and time-of-use optimization. Additionally, the LEMS complies with SunSpec protocol for interoperability.

3.7 Fire Protection System

3.7.1 Overview

The cabinet enclosure is rated 60 minutes for fire resistance. The container is equipped with automatic detection, alarming, and an aerosol fire extinguishing system.

3.7.2 Fire Risk Mitigation

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

- Parts and components safety

Table 3-11 Compliance of Parts and Components with UL Standards

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

- Battery cell safety

The battery is designed according to UL 1973, UL 9540A, NFPA 855, NFPA 68, UN 38.3 standards.

- Electrical safety

Table 3-12 Protection Thresholds (Default)

BMS function	Detailed description	Parameters
Single cell overcharge	Overcharge voltage protection threshold	3.65V
	Overcharge protection delay time	3s
Single cell over-discharge	Over-discharge voltage protection threshold	2.50V
	Over-discharge protection delay time	3s
	Discharge recovery voltage threshold	3.0V
Overcharge of battery pack	Overcharge voltage protection threshold	189.8 V
	Overcharge protection delay time	3s
	Overcharge recovery voltage threshold	182 V
Overdischarge of battery pack	Over-discharge voltage protection threshold	130 V
	Over-discharge 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
	Charge overcurrent protection	See the alarm threshold table for details

Short circuit	Short-circuit protection	-
	Protection condition	Load short circuit
	Recovery condition	Load disconnection
Over-temperature protection	Charge overtemperature protection	55°C
	Charge temperature recovery	45°C
	Discharge overtemperature protection	55°C
	Discharge temperature recovery	45°C
	Charge undertemperature protection	0°C
	Charge temperature recovery	5°C
	Discharge low-temperature protection	-20°C
	Discharge temperature recovery	0°C

- Dual protection mechanism (See table below)

Monitor	Analysis	Command	Execution
• Temperature sensor: multiple temperature sensors compared with each other. • Voltage sensor: monitor the voltage of cells and packs and compare them through dynamic and static tests. • Current sensor: current double measurement.	• MCU: has chip-level self-check and provides dual analysis logic for each protection. • Higher level BMS: communicates with upper level and compares with each other.	• MCU: monitors whether the fuse, relay, and disconnecter execute MCU instructions; if not, triggers the dry node signal to automatically disconnect the fuse.	• Fuse • Disconnector • Contactor

- Mechanical safety

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

- Environmental safety

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

3.7.3 Fire Suppression System

- Fire detection

The ESS is equipt with a smoke detector and a heat detector and they are connected to the "audible and visual alarm" by the signal input/output module.

When the sensitivity of smoke exceeds 2.5%/m, or the temperature is rising quicker than 10°C per minute, the system will trigger the local alarm system "audible and visual alarm". The detection and triggering of the fire protection system is reported to the BMS and local controller 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 commercial and industrial integrated cabinet.

There is a fire alarm in the cabinet, allowing people who are close to the cabinet to immediately notice the fire alarm.

- Fire extinguishing

The ESS is equipped with a fire extinguishing system that involves multiple sensors and clean agent that can be released in case a fire is detected inside. Please follow the recommended maintenance schedule in Section 8 for health checking of the fire extinguishing system.

The automatic fire extinguishing system (containing gas extinguishing agent) complying with NFPA 2001 can be triggered if the condition meets the detection thresholds and conditions. The BMS will initiate a system protection action by interrupting the power supplier in the cabinet and prevent fresh air from entering the container, all fans and liquid cooling units are also deactivated. Please refer to Annex 3 for the detailed logic of the fire suppression system.

4 Shipping and Delivery

4.1 Personnel Requirements

All personnel engaged in shipping, handling, and installation activities should be qualified per local regulation. Before installation, all personnel should fully read and understand this manual and follow the handling and installation guidelines specified in this manual.

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 personnel 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.

See Annex 1 and 2 for details of recommended tools and equipment. Confirm that all equipment is calibrated through the approved calibration procedure and that the calibration has not expired. The types and quantities of required items may be different according to the actual situation.

4.3 Transportation and Delivery

4.3.1 Transportation Requirements

The internal equipment of the energy storage system has been installed before leaving the factory and can be transported as a whole system. The cabinet can be hoisted and transported by a crane.

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.

NOTICE!


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

- Width × depth × height: 1006*1402*2424mm
 - Gross weight: 2685±50 kg (CPS ES-125kW/261kWh-US), 2632±50 kg (CPS ES-62.5kW/261kWh-US)
-

The transportation and movement of the energy storage system must meet the following conditions:

- Ensure that all doors of the energy storage system are securely locked before transport.
- Select appropriate transportation equipment based on site conditions, typically a crane. The equipment must have sufficient load-bearing capacity to safely handle the weight of the system.
- Prepare a clear, stable transportation path in advance.
- Remove any existing or potential obstacles along the route such as trees, overhead cables, or uneven surfaces.
- Avoid transporting or lifting the system during inclement weather conditions to ensure safety.
- Clearly mark the lifting operation area with warning signs, labels, barricades, and caution tape to prevent unauthorized or untrained personnel from entering the work zone.
- When positioning the energy storage system on the ground:
- Handle the unit carefully. Do not drag or push it across any surface.
- Place the unit on a solid, flat, and level foundation with adequate drainage that is free of obstacles or protrusions.
- Ensure the system is supported exclusively by its designated base structure.

4.3.2 Lifting

WARNING!


- During the process of hoisting the energy storage system, the local 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 extreme weather conditions such as heavy rain, fog and strong wind, the lifting operation should be stopped.

When lifting the energy storage system, 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 entire process.
- See the lifting schematic diagram below for the sling used, lifting angle and lifting speed.
- The crane shall have sufficient arm length and radius of turning around.
- Ensure that all sling joints are tight and secure, and all slings connected with lifting rings are of equal length.
- The length of the sling can be adjusted appropriately according to the requirements on site.
- During the whole lifting process, the energy storage system must be stable.
- Please use the four rings of the energy storage system to lift the energy storage system.
- Take all necessary auxiliary measures to ensure the safe and smooth lifting of the energy storage system.

The following figure shows the crane operation schematic diagram of the energy storage system during lifting. In the figure, the circle (circle A) in the inner layer indicates the working range of the crane. When the crane is working, it is forbidden to stand in the circle (circle B).

Radius of circle B $\geq 10\text{m}$.

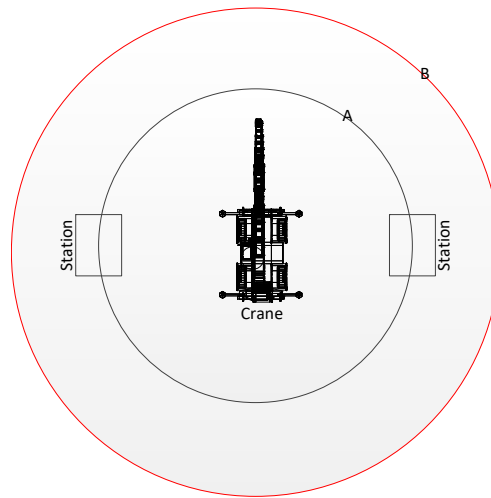


Figure 4-1 Schematic Diagram of Crane Operation

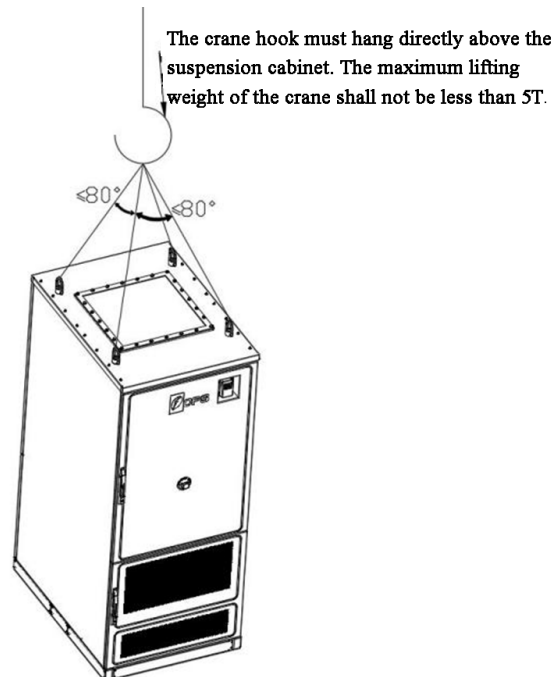


Figure 4-2 Energy Storage System Lifting

Technical requirements:

- Recommended lifting scheme: The lifting point is diagonal lifting, and the distance between the lifting appliance and the cabinet top is more than 1m.
- The force is exerted by the lifting rope on the lifting point of the cabinet, and the included angle between the ropes is less than or equal to 80° .
- Lifting speed ≤ 5 m/min.
- The cabinet needs to be protected during lifting, especially where the lifting rope contacts the cabinet.
- Maximum overall dimensions of cabinet: 1006mmx1402mmx2424mm (the height includes the dimension after the lifting rings are installed).
- Estimated total weight of cabinet: 2685 ± 50 kg (CPS ES-125kW/261kWh-US); 2632 ± 50 kg (CPS ES-62.5kW/261kWh-US).
- Sufficient safety factors shall be considered by professional lifting companies for lifting appliances and ropes.

4.3.3 Product Storage Requirements

- The State of Charge (SOC) of battery cells during storage period (within 12 months) shall be maintained at 30%~50%, and the temperature range shall be controlled at -10°C ~ 40°C (the cumulative duration at 30°C ~ 40°C shall not exceed 2 months). Meanwhile, a voltage test shall be conducted every 6 months. If the voltage is lower than 3.20V, the battery shall be isolated in time and charge-discharge maintenance shall

be carried out in order to adjust its SOC to 30%~50%. (Note: Static SOC is inaccurate and cannot be used as the sole criterion for judgment.)

- The battery may be recharged up to 3 times during its storage period before installation. If no recharge is performed, the storage period must not exceed 1 year. If the battery is not recharged in time as required, warranty will become invalid.
- The battery should be stored in a cool and dry place.
- The relative humidity should be between 5% and 80%, without condensation. The recommended storage environment temperature range is 20~30°C.

5 Installation

5.1 Unpacking Inspection of the System

5.1.1 Precautions

- Before unpacking, to prevent the equipment from tipping over, secure the boxed equipment to the forklift with ropes before moving. Move the equipment carefully, impacts or drops may cause damage.
- During unpacking, use tools with caution to avoid scratching the equipment.
- While removing the packaging, ensure the equipment remains stable and properly supported.
- If the installation environment is poor—such as the presence of dust, corrosive gases, splashing water, or large temperature variations—do not remove the packaging. If the packaging has already been removed, take appropriate dust-proof and anti-condensation measures (such as using a dust cover, plastic film, or fabric cover) to prevent internal condensation or corrosion damage to the batteries.
- After opening the package, check the equipment surface for any visible scratches, deformation, stains, or other abnormal damage, and notify the carrier or installer if any issues are found.

5.1.2 Safety Check

- **High-Voltage Hazard Warning:** This energy storage system operates with high-voltage electricity. Unauthorized personnel are strictly prohibited from operating the equipment. Personnel must maintain heightened safety awareness and wear appropriate personal protective equipment (PPE), including insulated gloves, at all times. Do not open or close any equipment without proper authorization. In the event of an incident, immediately disconnect the main circuit breaker and report the situation to the designated responsible personnel.
- **Environmental & Operational Safety:** Monitor weather conditions and exercise extreme caution during rain or adverse weather to ensure safe operation. Maintain a clean and obstruction-free operating environment for the energy storage system. Conduct regular inspections of fire protection equipment to ensure proper functionality. Keep all emergency escape routes clear and accessible at all times.
- **Insulation & Electrical Safety:** The energy storage system shall be free of insulation faults, and the insulation resistance of all busbars to ground shall not be less than 2.5 MΩ.
- Connection points of all wires shall be checked to ensure secure connection. It is required to refer to the local code for details and visually check the electrical safety clearance between power line electrodes. See the following table for details:

Table 5-1 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)

Note: Refer to the standard UL 1973-2022.

5.1.3 Equipment Status

- Check whether all devices within the battery system are free of damage and whether the power and communication cables of all BMS submodules are correctly connected.
- Inspect the cooling fans in the cabinet to ensure there are no foreign objects inside.
- Confirm that the DC power cables of each battery pack are securely connected.

5.1.4 Inspection Records

Although each ESS cabinet has been inspected and tested before delivery, the system shall be subject to a pre-commissioning check up prior to operation after final installation at the project site. Please refer to the Pre-commissioning inspection in this chapter for more information. In order to ensure the continuous and safe operation of the system throughout its life cycle, it is recommended that regular monitoring and maintenance according to this manual should be performed and results should be recorded.

5.2 Installation Space Requirements

The arrangement of the cabinet includes the following scenarios, and the spacing requirements for each scenario are as follows. Please note these are the minimum requirements from the product's perspective. Actual installation clearance may be different per project site and should strictly follow local safety code/regulations/guidelines.

(Note: The reserved distance includes tools required for equipment replacement in the cabinet and thermal management):

Unit: mm

Scenario 1:

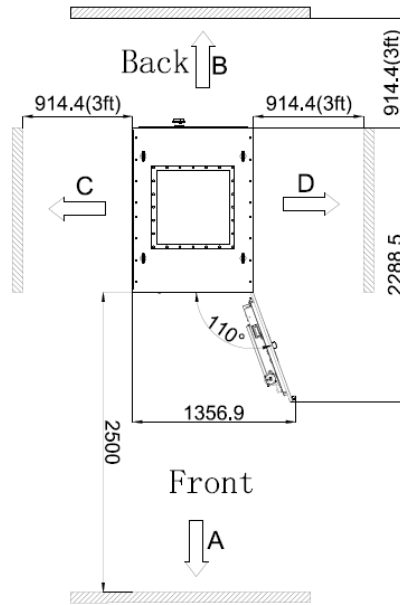


Figure 5-1 Layout Scenario I of C&I ESS Cabinet

Scenario 2:

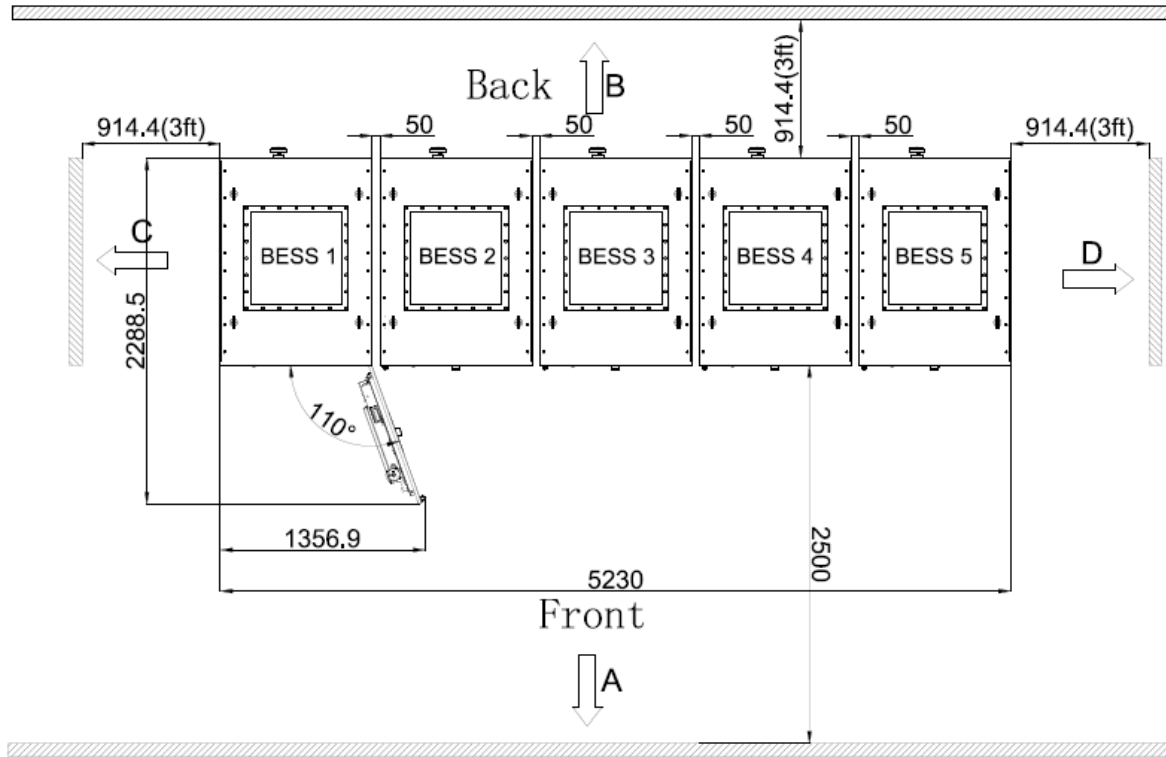


Figure 5-2 Layout Scenario II of C&I ESS Cabinet

Scenario 3:

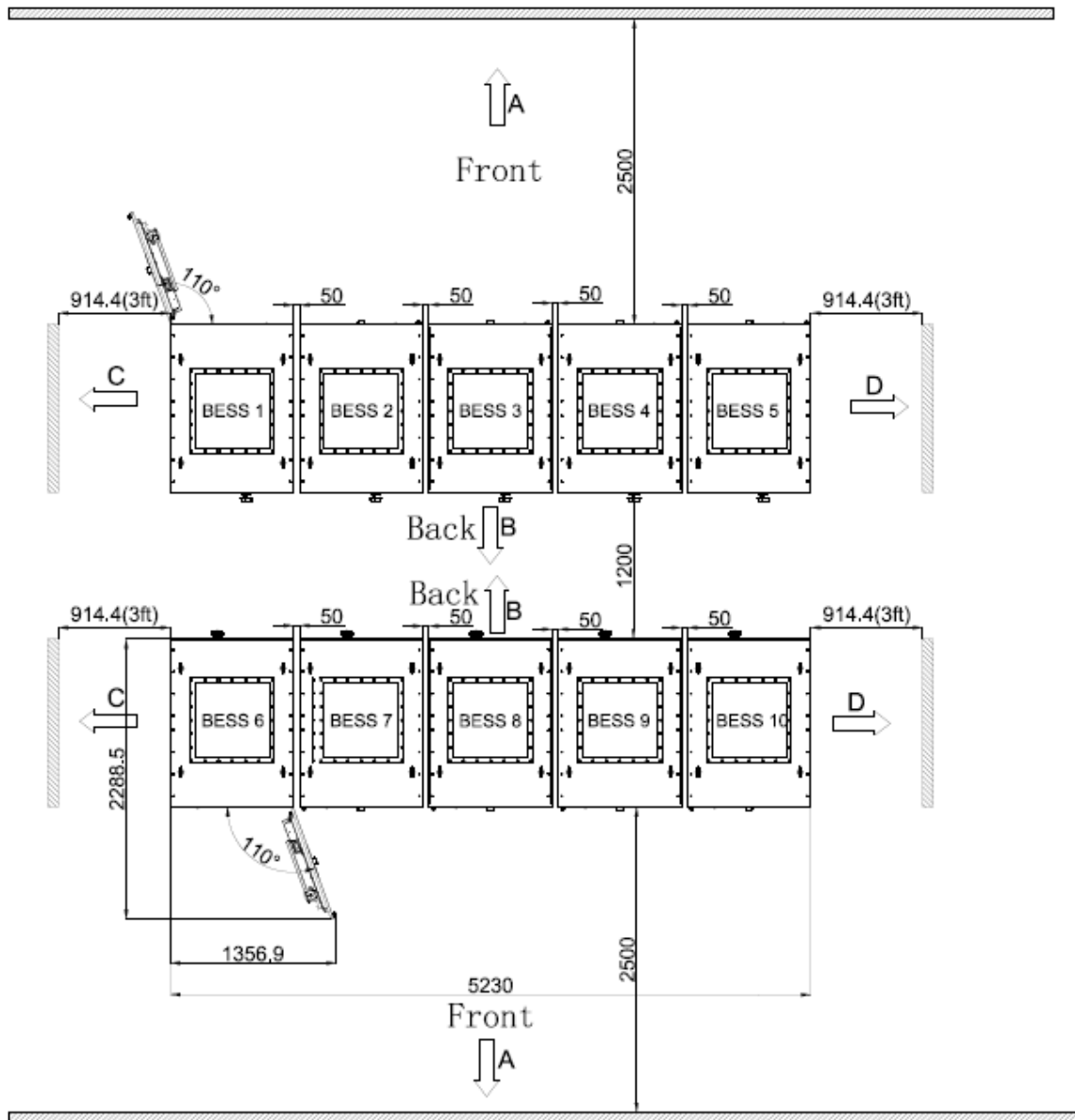


Figure 5-3 Layout Scenario III of C&I ESS Cabinet

Scenario 4:

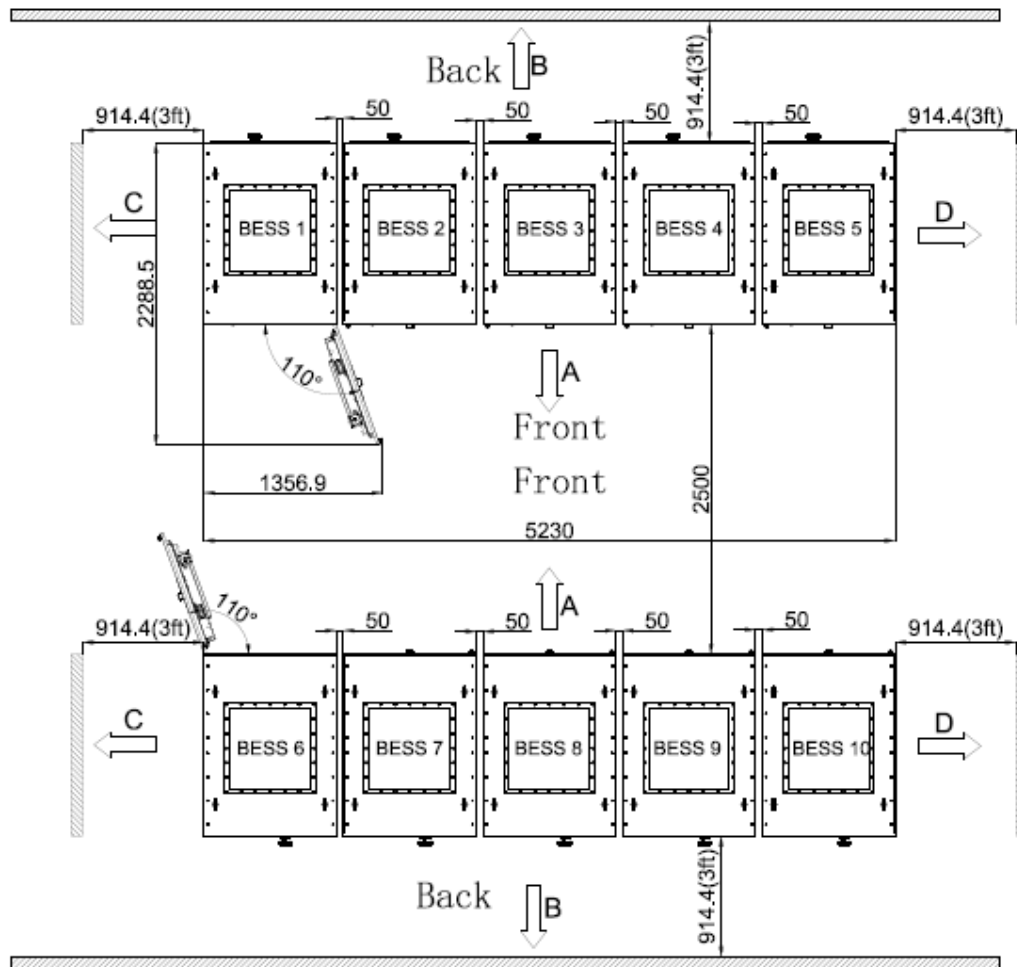


Figure 5-4 Layout Scenario IV of C&I ESS Cabinet

Cabinet Layout Instructions:

- The above figures illustrate four feasible cabinet arrangements, annotated with the required clearances in each direction.
- All cabinet tops must be kept free of obstructions. Maintain at least 1200mm of clearance above the top of cabinet.
- To facilitate battery pack maintenance using forklifts, a front clearance (Direction A) of 2500 mm is recommended. If smaller tools are utilized, this clearance must not be less than 1800 mm.
- A clearance of 900 mm shall be maintained between the cabinet rear (Direction B) and walls, and 1200 mm between back-to-back cabinets.
- On both cabinet sides (Directions C & D): C or D directions must provide a personnel passage space (at least 3ft) to allow service access to the rear side of unit. If passage for partial pack disassembly machinery is required, a minimum clearance of 2500 mm is recommended.

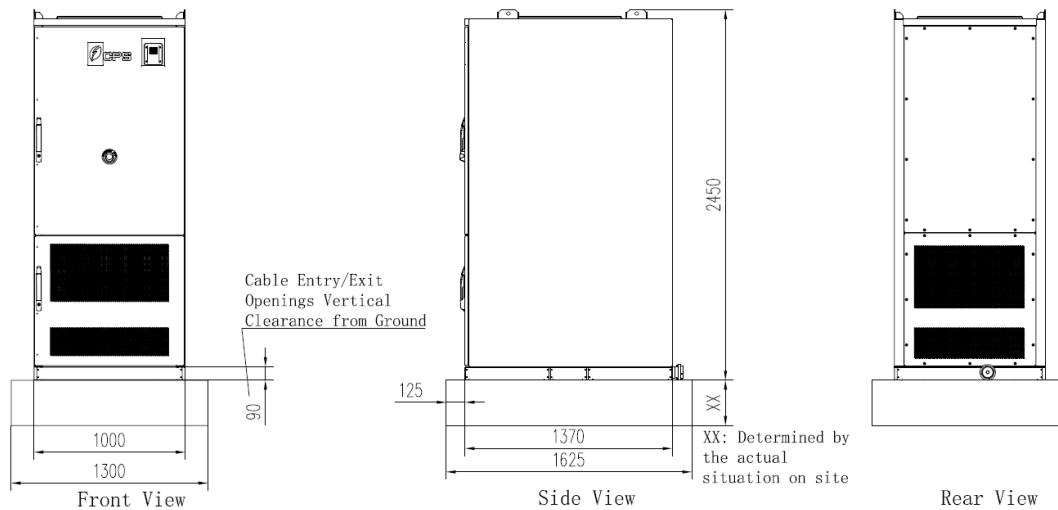
5.3 Installation Site Surface Requirements

The cabinet shall be installed on a structure supported by concrete foundation or channel steel. It must be ensured that the foundation is smooth, solid, safe and reliable, and has sufficient bearing capacity. The foundation surface shall not be sunk or inclined.

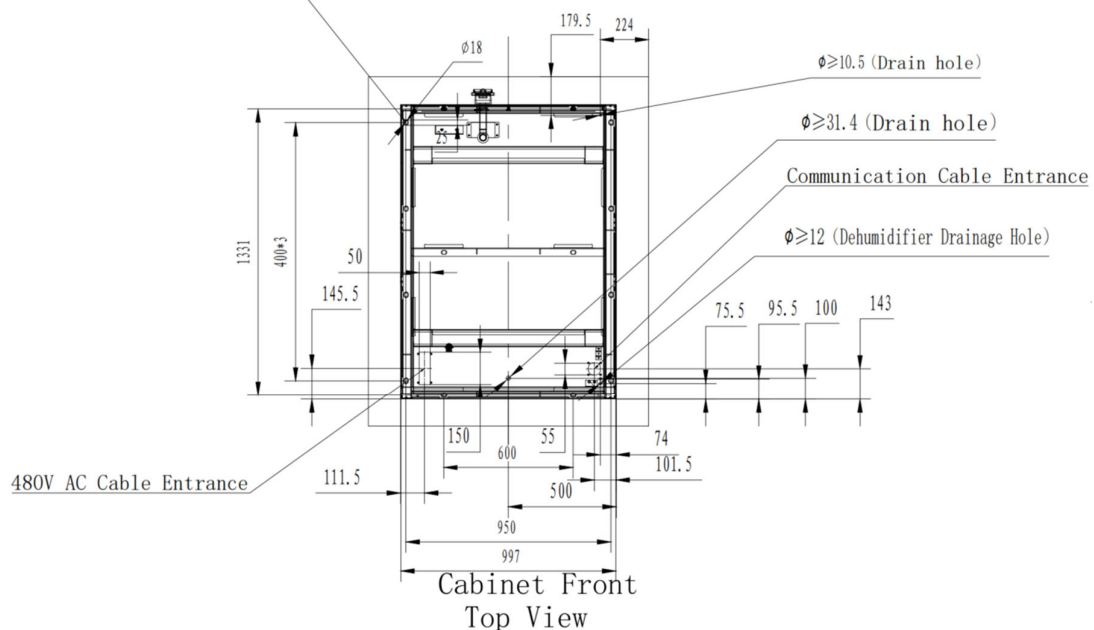
The cabinet can be welded with the foundation steel plate, or in other ways with the same connection firmness.

The number of supporting points on the foundation and the bearing capacity of the support unit of the C&I ESS Cabinet are shown in the figure below. For the latest foundation drawing, refer to the CPS website.

Unit: mm



Slotted Holes for Cabinet
Base Mounting: 12-18*25



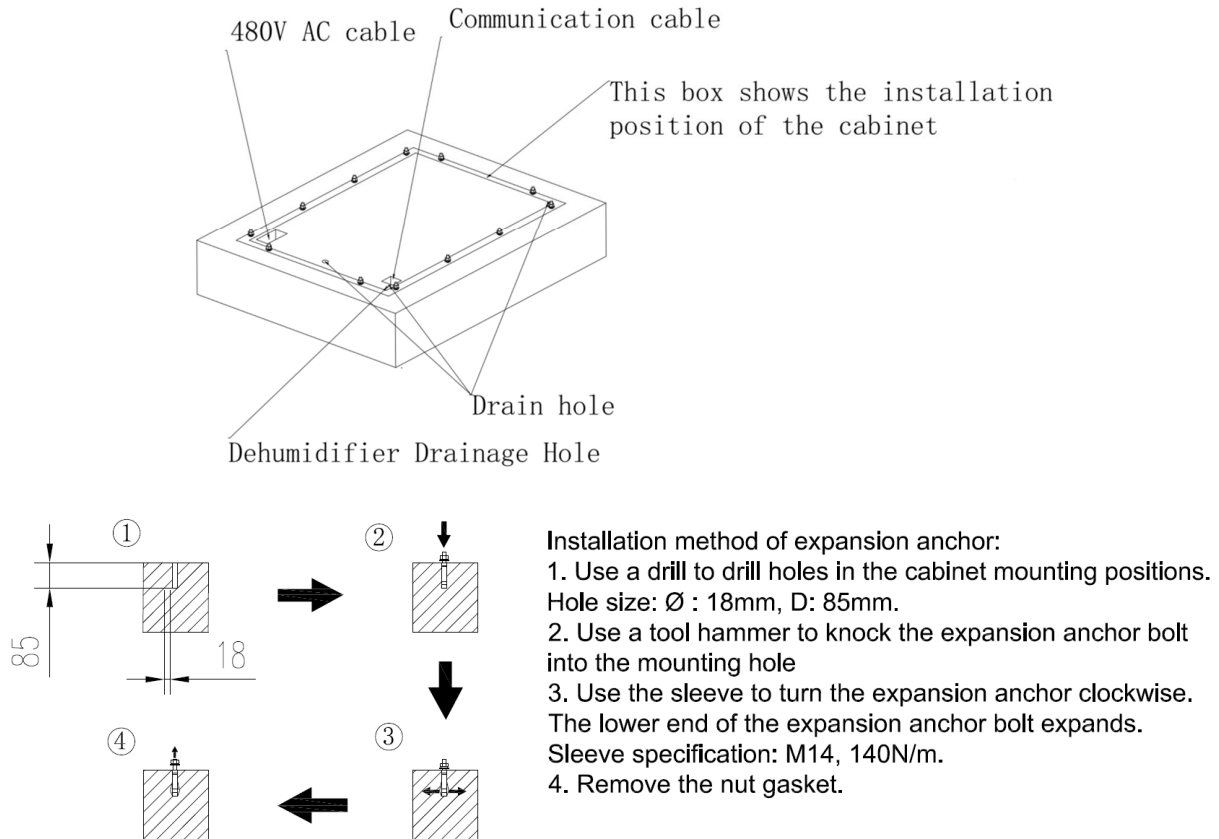


Figure 5-5 Foundation Requirement

Technical description:

- This drawing is for reference only and serves as a guideline for the customer's foundation design. It shall not be used as an official construction drawing for foundation work.
- The foundation base surface for the integrated cabinet must be elevated above ground level and higher than the maximum precipitation height at the project site.
- The total weight of the integrated cabinet is $2685 \pm 50\text{kg}$ (CPS ES-125kW/261kWh-US) or $2632 \pm 50\text{kg}$ (CPS ES-62.5kW/261kWh-US).
- It is recommended that the foundation's minimum load-bearing capacity exceeds twice the total weight of the machine.
- The foundation should be raised sufficiently to prevent flooding from reaching the battery cabinet. The exact elevation shall be determined by the installer based on site conditions and applicable local regulations.
- The foundation surface must be properly leveled and even, with only minimal variation (no more than 2 mm up or down across the entire base). If the foundation flatness exceeds this tolerance, it may result in cabinet doors failing to open/close properly or irreversible permanent structural deformation. Strict compliance with this requirement is essential to ensure safe and reliable system operation.
- For the scenario of multiple cabinets, a spacing of 50mm between cabinets is recommended to facilitate on-site installation.

5.4 Cable Connections of the Energy Storage System

To facilitate the on-site wiring, all internal cables between equipment inside the cabinet product are connected before delivery.

The cables connecting to the cabinet product and external equipment are routed through the bottom of the cabinet. 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 bottom cable inlet and outlet holes of the cabinet product are shown in the following figure.

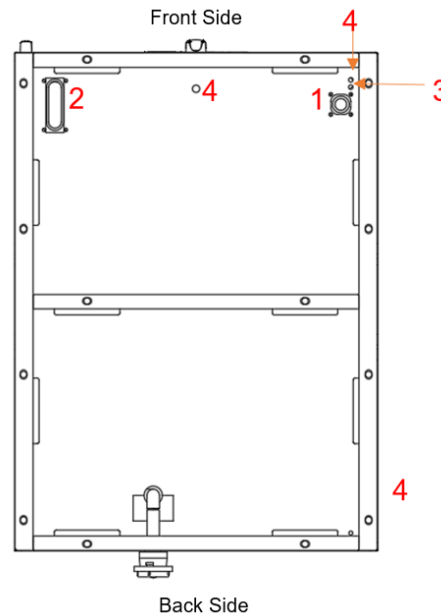


Figure 5-6 Bottom Incoming and Outgoing Line Holes

The function of each hole is as follows:

Table 5-2 Bottom Inlet Holes of the Cabinet

No.	Name	Description
1	Communication cable and grounding cable entry hole	Communication cables and cabinet grounding cables pass through this hole to connect to external devices. The customer shall drill holes according to actual requirements.
2	AC power cable entry hole	AC power cables pass through this hole to connect to external devices. The customer shall drill holes according to actual requirements.
3	Dehumidifier water drain hole	The dehumidifier water drainpipe passes through this hole, directing the dehumidified water outside the cabinet.
4	Liquid drain hole	Liquid in the compartment, such as residue condensation water, is discharged through this hole.

Note: Detailed dimensions of each opening are specified in the cabinet base reference drawings provided separately.

5.4.1 Cable Specifications

The recommended wire gauge and type for each phase and ground can be found in the table below.

Table 5-3 Cable Specifications

Phase	Cables	Bolt	Torque
L1/L2/L3	1/0-3/0AWG CU; 2/0-3/0 AWG AL	M10	221.3 in-lb/25 N.m
External Grounding Wire	3 AWG – 2 AWG CU	M8	221.3 in-lb/25 N.m

- The wire temperature rating must be 221°F (105°C).
- Lugs must be crimped using a hydraulic cable lug crimper.

5.4.2 Fabrication of cable terminals

Notes:

The cable lugs shall be provided by the customer.

- When using copper core cable, please use copper terminal lugs.
- When using copper-clad aluminum cable, please use copper terminal lugs.
- When using aluminum cable, please use copper-aluminum bimetallic lugs.

Notes:

The cavity formed by the conductor crimping piece of the lug after crimping should completely enclose the wire core, ensuring that the wire core is tightly and securely bonded with the lug, with no looseness.

Tools for making cable terminal with a lug:

1: Cable; 2: Heat-shrinkable sleeve; 3: Cable lug; 4: Hydraulic pliers; 5: Hot air gun

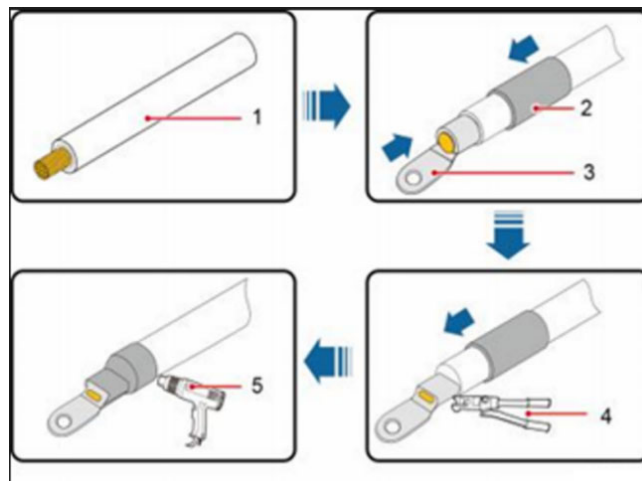


Figure 5-7 Cable terminal crimping process

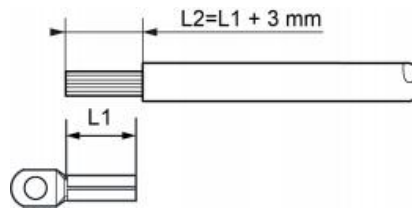


Figure 5-8 Recommended Stripping Length of Grounding Wire

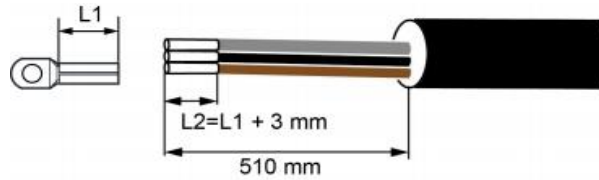


Figure 5-9 Recommended Stripping Length of Output AC Power Cable

5.4.3 AC Cable Connection

Operation steps

1. Open the front doors and rear panels

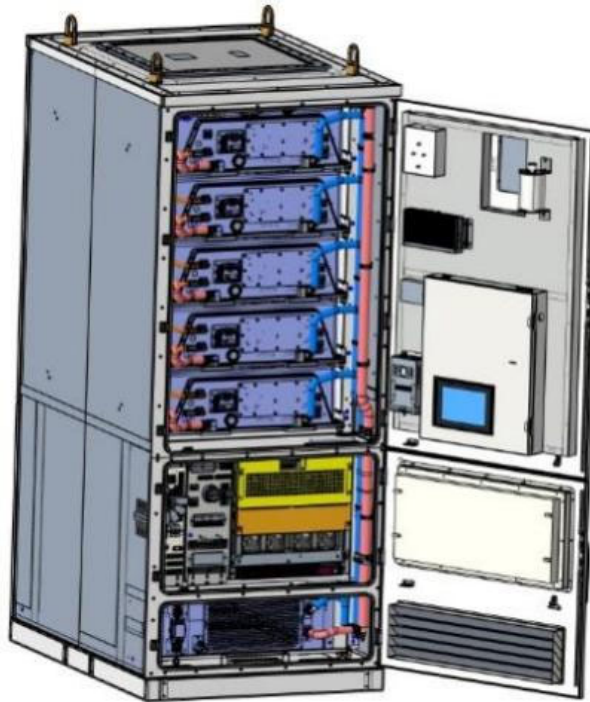


Figure 5-10 Opening Cabinet Doors

Opening the front door:

- a) Unlock the front door with the key attached to the cabinet.
- b) Open the front door and secure it using the door limit bracket underneath the door panel.

2. Connect the output power cables

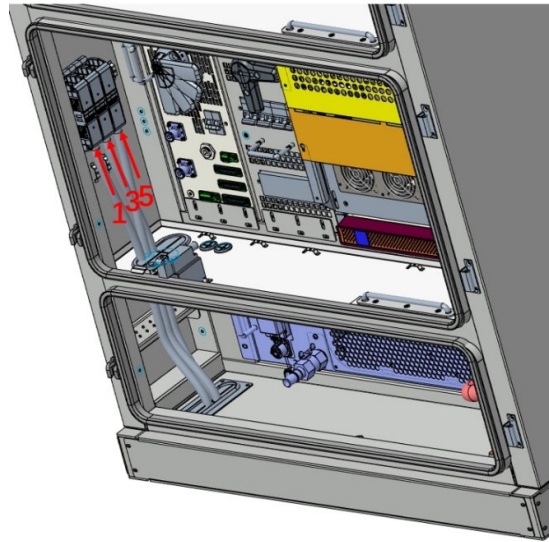


Figure 5-11 AC Output Terminal Location

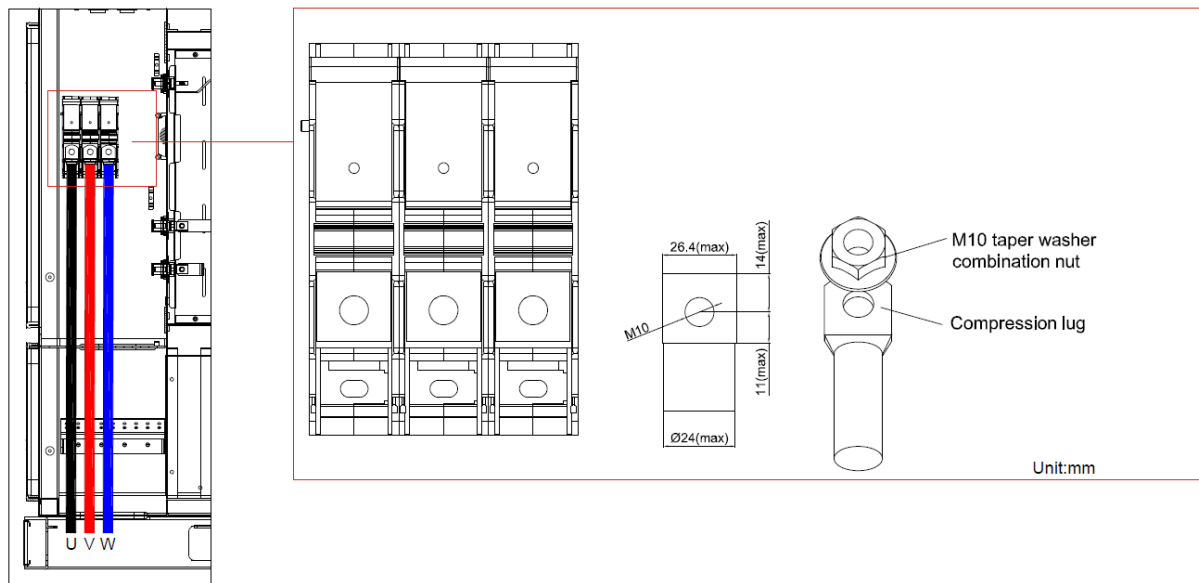


Figure 5-12 Output Power Cable Connection

CAUTION!



- Each phase terminal can be connected with two cables;
- The specific wiring phase sequence follows the colors of the heat-shrinkable sleeve on the copper bar.

3. Close the front door panel

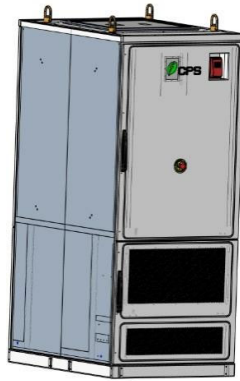


Figure 5-13 Closing Front Door Panel

Close the front door:

- a) Remove the limit bracket that secures the front door and place it in its initial position.
- b) Close the front door and ensure that the door lock is in the fully locked position.

Treatment after wiring:

- a) Check the correctness and firmness of the wiring. Once confirmed, seal the incoming and outgoing cable areas with fire-and-water proof putty.

5.4.4 Communication Connection

The energy storage system supports ModbusTCP protocol for the third-party dispatching & cloud platform or EMS to access. This can be connected through LAN1 network port of the LEMS host. The communication between external EMS and LEMS should be CAT5e or CAT6.

For the scenario of multiple cabinets:

- Network Connection:

An Ethernet cable must be used to connect the switch in one cabinet to the switch in another cabinet.

- Emergency Power Off Wiring:

In case there are multiple cabinets operating in parallel, the Emergency Power Off button must also be wired from the 2XT terminal block in one cabinet to the 2XT terminal block in another cabinet. Please refer to the picture below for the location of 2XT terminal.

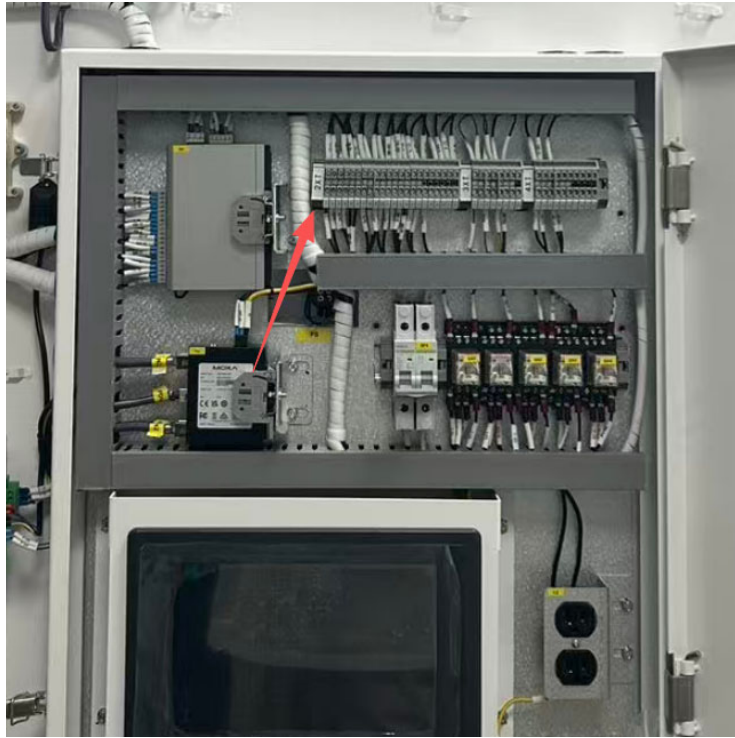


Figure 5-14 Location of the 2XT terminal block (in the Distribution box 2 on the cabinet front door)

Note: Specific terminal numbers shall be subject to the electrical wiring diagram of the project.

5.4.5 Grounding Wire Connection

In order to reduce and eliminate 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 the latest NEC codes.

Before delivery, all internal electrical/grounding connection between the internal components and the cabinet have been completed. On the site, grounding connection is required between equipotential bonding inside the cabinet and external grounding points.

In order to facilitate on-site cable connection, the cabinet is designed with a grounding bar on the bottom plate inside the cabinet, as shown in the following figure.

Use M8 bolts to connect the grounding cable to the grounding bar. Refer to the following figure for the dimension of grounding bar. Note: according to the thickness of grounding wires, choose grounding lug with its installation hole compatible with M8 metric nut.

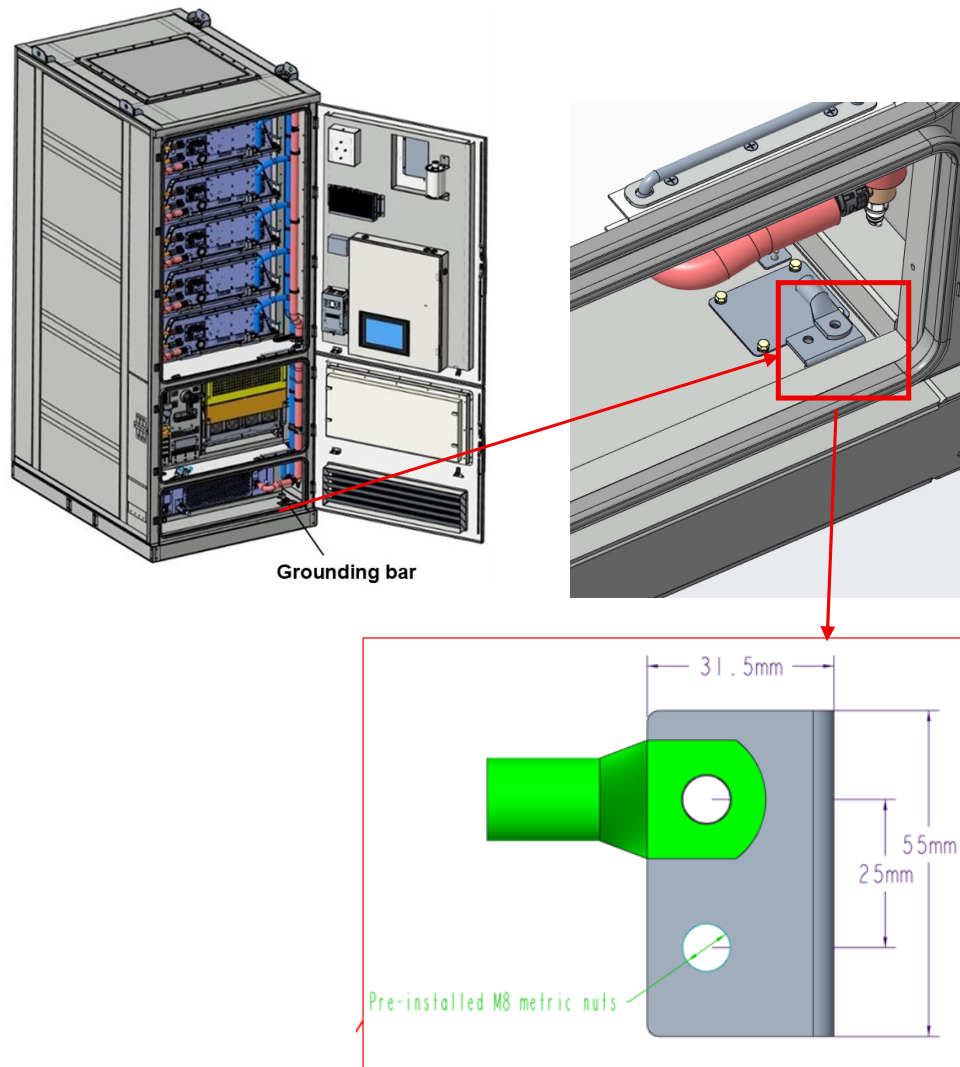


Figure 5-15 Location of Grounding Bar (grounding lug is not included)

5.5 System Pre-commissioning Inspection Checklist

The system and installation should be inspected by qualified personnel according to the following items after installation and before powering on the unit.

1) Label Inspection

- The contents of the nameplates, labels and warning signs shall be complete and clearly shown.
- Grounding signs and symbols are clear, and the contact surface of grounding devices shall be free from paint and rust.

2) Cabinet Door Inspection

- The cabinet door shall open and close smoothly and flexibly, with a maximum opening angle greater than 90°.
- When opening or closing the door, the surface coating must stay intact to keep the cabinet sealed.
- The protective strips around the door should lie flat, without any peeling or shrinkage.
- Once the door is closed and locked, it should align neatly with the cabinet frame, with an edge displacement of less than 2 mm. The door panel must also remain straight and perpendicular.

3) Appearance Inspection inside the Cabinet

- The inner and outer surfaces of the cabinet must have smooth, even coating without defects such as pinholes, bubbles, sagging, or exposed areas. There should be no scratches, stains, or trimming marks. The cabinet should be clean and free of loose materials such as thread ends, ties, or metal scraps.
- Inside the cabinet, the copper bars and component coatings must also be uniform, smooth, well-adhered, and free from corrosion.
- The cabinet interior must be inspected and confirmed to be free of standing water.

4) Inspection of Dust Filter on the cabinet door

- The dust filter shall be installed flat without looseness and shall be pulled out and put in smoothly without jamming (pay attention to the position of the air inlet surface of the dust filter).

5) Torque checks

- The cabinet mounting bolts must be securely tightened, with each nut torqued to the required standard and properly marked.
- All connecting cables and grounding wires must be installed correctly and firmly secured, with each nut torqued to the standard required in this manual and properly marked.

6) Connection between Battery Pack (without MSD installed)

- Inspect the junction between each battery pack and its connector to ensure it is firmly seated and the clip has snapped back into place.
- Verify that the polarity of the battery pack connecting harness is correct.

7) Connection of High-voltage Box and Battery Pack (without MSD installed)

- Verify the high-voltage box and the battery packs are securely connected, with the connector fully seated and the clip snapped back into place.

- Verify that the polarity markings on the high-voltage box, the battery packs, and cable connectors match correctly on the connections.

8) Connection of External Cables

- Verify the wiring on AC output terminals shall be consistent with the cable connections described in this manual.
- External communication cables are securely connected to the port on the LEMS. Communication cables must be twisted-pair shielded cables or Ethernet cables to ensure reliable data transmission and minimize interference.

Please contact CPS America to schedule on-site commissioning service after the installation is completed and the aforementioned inspections are completed.

6 Alarms and Troubleshooting

NOTICE!



- This energy storage system product is a high-voltage system, which can only be operated by qualified and authorized personnel!
- Under fault conditions, dangerous voltage levels may be present. Contact with live parts can result in serious injury or death.
- Before troubleshooting, it is necessary to check whether all cable connections are correct and secure.
- Always follow all provided safety instructions and warning labels during operation.
- When performing maintenance, ensure that appropriate personal protective equipment (PPE) is worn in accordance with local electrical safety standards.

Common system product faults involve the following equipment: BMS, battery and cable, liquid cooling unit and pipeline, auxiliary power transformer, PCS, and dehumidifier. For detailed fault causes and troubleshooting of each equipment, please see below. Do not modify any internal cable or remove components inside the ESS cabinet. The information provided in this section is for the user's reference. Please contact CPS for technical support when troubleshooting is needed.

6.1 System Alarms

6.1.1 LEMS Alarm Information

Table 6-1 LEMS Alarm Information

Description	Alarm level	Cause of fault	Handling suggestions
Cabinet level aerosol spraying alarm	Level III	Aerosol spraying	1. Check the source of ignition
Battery compartment temperature sensing alarm	Level II	Temperature detector action	Refer to <i>Troubleshooting of Fire Protection Products</i>
Battery compartment smoke sensing alarm	Level II	Smoke detector action	Refer to <i>Troubleshooting of Fire Protection Products</i>
Level I fire alarm	Level II	1) Concentration of combustible gas $\geq 20\%LEL$ 2) Smoke detector action 3) Temperature sensing detector action Any of the above conditions are met	1. Check whether it is a false alarm 2. Check whether there is a combustible gas leakage 3. Check the cell temperature 4. Check whether the compartment is scorched.
Level II fire alarm	Level III	1) Temperature detector action+combustible gas	1. Check the source of ignition

		concentration $\geq 50\%$ LEL 2) Simultaneous action of smoke detector and temperature detector	
PCS communication is abnormal	Level III	1) The connected network cable is loose 2) PCS IP address setting error 3) LEMS IP address setting error	1. Check whether the network cable wiring is correct and loose 2. Check whether the LEMS IP setting is correct 3. Check whether the PCS IP setting is correct
BMS communication is abnormal	Level III	1) The connected network cable is loose 2) BMS IP address setting error 3) LEMS IP address setting error	1. Check whether the network cable wiring is correct or loose 2. Check whether the LEMS IP setting is correct 3. Check whether the BMS IP setting is correct
LEMS black screen	Level III	1) Abnormal power supply 2) LEMS screen crash	1. Check whether the power supply is normal 2. Restart LEMS 3. Restart LEMS to enter BIOS. If it cannot enter the desktop, replace the hard disk 4. Restart LEMS. If the BIOS cannot be entered, replace LEMS

6.1.2 BMS Alarm Information

Table 6-2 BMS Alarm Information

Description	Alarm level	Cause of fault	Handling suggestions
High monomer SOC (mild)	Level I	Prompt for high system capacity	No treatment required
High monomer SOC (moderate)	Level I	Full system reminder	No treatment required
Cell/battery pack/total voltage overvoltage (mild)	Level I	Prompt for high system capacity	No treatment required
Cell/battery pack /total voltage overvoltage (moderate)	Level I	Prompt for full system capacity	No treatment required
Cell/battery pack /total voltage overvoltage (severe)	Level II	1. Abnormal communication of system 2. PCS is abnormal (no response to charging prohibited) 3. BMS is abnormal	1. Check the PCS status 2. Check the communication status between BMS and PCS

		(charging prohibited not executed)	
Cell/battery pack/total voltage undervoltage (mild)	Level I	Prompt for low system capacity	No treatment required
Cell/battery pack /total voltage undervoltage (moderate)	Level I	Prompt for system capacity emptying	No treatment required. Pay attention to the system strategy and recharge in time
Cell/battery pack /total voltage undervoltage (severe)	Level II	1. Abnormal communication of system 2. PCS is abnormal (no response to discharging prohibited) 3. BMS is abnormal (discharging prohibited not executed)	1. Check the PCS status 2. Check the communication status between BMS and PCS
High charging/discharging temperature (mild)	Level I	System cell temperature too high	1. Check the working state of liquid cooling unit
Low charging/discharging temperature (mild)	Level I	System cell temperature too low	1. Check the working state of liquid cooling unit
High charging/discharging temperature (moderate/severe)	Level II	Abnormal temperature control system or abnormal battery cell	1. Check the working state of liquid cooling unit 2. Check the battery state 3. Contact the manufacturer for maintenance
Low charging/discharging temperature (moderate/severe)	Level II	Abnormal temperature control system or abnormal battery cell	1. Check the working state of liquid cooling unit 2. Check the battery state 3. Contact the manufacturer for maintenance
Charging prohibited	Level I	System full and charging prohibited alarm	No treatment required
Discharging prohibited	Level I	System emptying and discharging prohibited alarm	No treatment required
ESBMM communication fault	Level II	Abnormal communication of battery pack	1. Check whether the communication harness between battery pack is abnormal 2. Check whether the communication between high-voltage box and battery pack is abnormal 3. Restart the high-voltage box 4. Contact the manufacturer for maintenance

Insulation resistance mild/moderate/severe	Level II	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	1. Power off the system entirely and check the DC cable 2. Check the ambient humidity 3. Check the working state of dehumidifier 4. Contact CPS Customer Service
Low/high combustible gas concentration	Level II	There is combustible gas in the battery box	1. Power off the system entirely and contact the manufacturer for maintenance
Level I fire alarm	Level II	Abnormality in the battery box	1. Contact CPS Customer Service
Level II fire alarm	Level II	There may be a fire risk in the battery box	1. Contact the manufacturer for help 2. Cut off the AC source 3. Prepare fire extinguishing media (fire hydrants, etc.) 4. Contact the fire department for help
Faulty intake/exhaust valve	Level II	1. There are foreign matters in the intake/exhaust valve 2. Faulty intake/exhaust valve	1. Check the intake/exhaust valve for foreign matters 2. Check whether the intake/exhaust valve is abnormal 3. Contact CPS Customer Service
Communication of dehumidifier is lost	Level II	Abnormal communication between dehumidifier and BMS	1. Check the status of dehumidifier 2. Check the communication harness between dehumidifier and BMS 3. Restart the system 4. Contact CPS Customer Service
I/O device communication is lost	Level II	Abnormal communication between I/O equipment and BMS	1. Check the status of I/O equipment 2. Check the communication harness between I/O equipment and BMS 3. Reboot system 4. Contact CPS Customer Service

Communication loss of liquid cooling unit	Level II	Abnormal communication between liquid cooling unit and BMS	1. Check the status of liquid cooling unit 2. Check the communication harness between the liquid cooling unit and BMS 3. Reboot system 4. Contact CPS Customer Service
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6.1.3 Troubleshooting of BMS

Table 6-3 BMS Faults and Solutions

S/N	Faults	Solutions
1	The display and control cannot work normally after startup	Record the fault and restart the power supply.
2	No data can be retrieved on the display and control screen	Check whether the BMS cable has proper connection and the battery cluster has correct IP address.
3	Total voltage of a single battery cluster is too low, and ESBMM is disconnected	Check whether the 24V line of ESBMM is connected correctly; replace the ESBMM module and check whether it returns to normal.
4	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 it returns to normal.
5	ESBMM does not perform equalization function	Remove the battery pack, and check whether the sampling fuse is blown; Replace the ESBMM module and check whether it returns to normal.
6	The display control 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 there is any abnormality in the power circuit, such as whether the power connector terminals are tightly inserted, etc.; 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.

6.2 Troubleshooting of Liquid Cooling Unit

Table 6-4 Fault Analysis of Liquid cooling unit

Fault	Possible cause	Inspection item or treatment method
The external circulation fan does not run	The liquid cooling unit is not powered on	Check whether the power input end of the liquid cooling unit is energized.
	Circuit breaker is tripped due to lightning strike	Check whether the circuit breaker inside the liquid cooling unit is closed.
	Abnormal power input is detected in the liquid cooling unit (such as overvoltage or undervoltage)	Confirm whether the liquid cooling unit has corresponding alarms, and if so, handle them according to the instructions of the liquid cooling unit.
	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 is not started	Refer to the handling method for the 'compressor is not started' in the instructions of liquid cooling unit
	Control panel fault	Replace the control panel according to the instructions of the liquid cooling unit.
	Fan fault	Replace the fan and replace the external circulation fan according to the instructions of liquid cooling unit.
External circulation fan generates abnormal sound	The fan bearing is worn	Replace the fan and replace the external circulation fan according to the instructions of the liquid cooling unit.
	The fan blade scratches other objects	Check for interference between cables and fan blades.
Compressor is not started	It is not powered on (in standby state)	Check the main power switch and the operation display interface to see whether the compressor is started.
	Circuit connection is loose	Tighten the circuit connector.
	Open or short circuit	Check the circuit for open or short circuits and repair the main power supply.
	Converter fault	Replace the converter.
	Control panel damage	Replace the control panel according to the instructions of the liquid cooling unit.
	Compressor motor fault	Replace the compressor.

The compressor does not work	There is no need for cooling	Check the output status of the outlet liquid temperature compressor on the display screen interface. Check whether the operation interface is in cooling state.
	Shutdown delay	The compressor has the shortest shutdown time under normal conditions. If the temperature rises to the starting point again during this period, the compressor will still be started with a delay.
High exhaust pressure	The condenser is blocked by dirt	Clean the condenser with compressed air or a vacuum cleaner equipped with a brush head.
	External circulation fan not working	Refer to the above table.
Internal circulating water pump does not start	It is not powered on (in standby state)	Check the main power switch and the operation display interface to see whether the compressor is started.
	Circuit connection is loose	Tighten the circuit connector.
	Pump converter fault	Replace the pump converter.
	Pump is in a self-protection state due to no coolant	Check whether there is coolant in the circulation system, and if not, replenish it.
	Pump body fault	Replace the water pump. Replace the pump according to the instructions of the liquid cooling unit.
The electric heating tube does not work	No heating demand is required	Check whether the outlet temperature and heating setpoint are reasonably set.
	Circuit connection is loose	Tighten the circuit connector.
	Overheating protection is activated	Wait for a period of time and restart the electric heater to observe whether it works normally.
	Electric heater fault	Replace the electric heater. Replace the heater and circulating water pump according to the instructions of the liquid cooling unit.
The automatic topping up pump does not work	Topping up pump fault	Replace the automatic topping up pump.
	The topping up pump is stuck.	Check whether there are foreign matters in the topping up pump, and if so, remove them. Replace the topping up pump if it is damaged.
	The terminal is loose	Check whether the butt terminal of topping up pump is loose.
	Axial of topping up pump is worn	Replace the automatic topping up pump.

Automatic topping up pump makes abnormal sounds during operation	Fixing screw of the topping up pump is loose	Tighten screws.
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6.3 PCS Troubleshooting

Table 6-5 PCS Troubleshooting

Fault type	Fault code	Solutions
Alarm	1. Temperature sensor abnormality	Definition: Prompt of abnormal temperature detection
		Possible causes: 1. The temperature sensor connector is experiencing poor contact; 2. The temperature sensor is damaged
		Recommended treatment measures: 1. Observe the temperature display value; 2. Disconnect the DC switch to re-energize the system; 3. Contact CPS Customer Service
	2. Communication fault	Definition: Inverter internal communication failure
		Possible causes: 1. The internal communication cable connector of the inverter is experiencing poor contact
		Recommended treatment measures: 1. Observe for 5 minutes to see if the inverter can automatically clear this alarm; 2. Disconnect the DC switch to re-energize the system; 3. Contact CPS Customer Service
	3. External fan fault	Definition: Visible abnormal operation of external fan
		Possible causes: 1. The fan is stalled; 2. The service life of the fan has expired; 3. Poor contact of the fan connector
		Recommended treatment measures: 1. Observe for 5 minutes to see if the inverter can automatically clear this alarm; 2. Check whether there are foreign matters on the fan blades; 3. Disconnect the DC switch to re-energize the system; 4. Contact CPS Customer Service
	4. EEPROM fault	Definition: Internal alarm
		Possible causes: Something is wrong with the internal memory
		Recommended treatment measures: 1. Observe for 5 minutes to see if the inverter can automatically clear this alarm; 2. Contact CPS Customer Service
Protection	1. Overtemperature protection	Definition: Ambient temperature, or inverter internal temperature too high. In the off-grid state, the DC voltage is lower than the discharge finish voltage;

		Possible causes: 1. The ambient temperature outside the inverter is too high; 2. The fan is stalled; 3. The installation of the inverter fails to meet the requirements, thus affecting cooling
		Recommended treatment measures: 1. Please confirm that the external ambient temperature is within the specified working range; 2. Check whether the cooling air inlet is blocked; 3. Check whether the cooling fan is stalled; 4. Check whether the installation position meets the requirements; 5. Observe for 30 minutes to see if the inverter can automatically clear this alarm; 6. Contact CPS Customer Service
	2. Abnormal power grid voltage	Definition: The grid voltage exceeds the specified range
		Possible causes: 1. Grid voltage is abnormal; 2. The connecting wire between the inverter and the power grid is in poor contact
		Recommended treatment measures: 1. Observe for 10 minutes to see if the inverter can automatically clear this alarm; 2. Check whether the voltage of the power grid is within the specified range; 3. Check whether the power grid connection has been disconnected or whether there is any abnormality; 4. Contact CPS Customer Service
	3. Abnormal power grid frequency	Definition: Power grid voltage or frequency is abnormal
		Possible causes: 1. Grid frequency is abnormal; 2. The connecting wire between the inverter and the power grid is in poor contact
		Recommended treatment measures: 1. Observe for 10 minutes to see if the inverter can automatically clear this alarm; 2. Check whether the grid frequency is within the specified range; 3. Check whether the power grid connection has been disconnected or whether there was any abnormality; 4. Contact CPS Customer Service
	4. High battery voltage	Definition: The battery voltage exceeds the specified value
		Possible causes: Too high battery voltage

		Recommended treatment measures: 1. Observe for 30 minutes to see if the inverter can automatically clear this alarm; 2. Check whether the battery voltage exceeds the specified range; 3. Disconnect the battery input switch, wait for 5 minutes and then close it again; 4. Contact CPS Customer Service
	5. GFCI fault	Definition: Excessive system leakage current
		Possible causes: 1. Excessive parasitic capacitance of the battery due to environmental factors; 2. Abnormal connection to ground; 3. A fault occurs inside the inverter
		Recommended treatment measures: 1. Observe for 10 minutes to see if the inverter can automatically clear this alarm; 2. Check whether the electrical connection is abnormal; 3. Contact CPS Customer Service
	6. Protection 0010~0620	Definition: Protection occurs inside the inverter
		Possible causes: Inverter internal protection action
		Recommended treatment measures: 1. Continue to observe for 10 minutes to see if the inverter can automatically clear this alarm; 2. Contact CPS Customer Service
Fault	7. Fault 0010~0150	Definition: A fault occurs inside the inverter
		Possible causes: A fault occurs inside the inverter
		Recommended treatment measures: 1. If necessary for operation and after confirming that there are no other issues, disconnect the DC switch and then close it before restarting once; 2. Contact CPS Customer Service

6.3.1 Troubleshooting of LED Light

Table 6-6 Troubleshooting of LED Light

LED light fault status	Troubleshooting method
The "Power" light and LCD screen are not on	1. Disconnect the external AC circuit breaker 2. Turn the DC switch to "OFF" position 3. Check the battery input voltage and polarity

The "GRID" light flashes	1. Disconnect the external AC circuit breaker 2. Turn the DC switch to "OFF" position 3. Check whether the wiring of power grid and circuit breaker is correct and firm
"RUN" light is off or "FAULT" light is on	Refer to Table 6-4 for troubleshooting

6.4 Troubleshooting of Fire Protection Products

Table 6-7 Troubleshooting of Fire Protection Products

Fault	Possible cause	Inspection item or treatment method
False alarms from smoke detectors or failure to trigger a fire alarm	Detector is contaminated or damaged	Check whether the detector is too dirty, and return to the factory for repair or replacement
False alarms from temperature detectors or failure to trigger a fire alarm	Detector is damaged	Contact CPS Customer Service

6.5 Troubleshooting of Flammable Gas Detector

6.5.1 Onboard Diagnostics

The GD-6 continuously monitors all of its critical functions through software diagnostics that test and validate the operation of the equipment. If a problem is detected, the device will switch to a fail-safe/error mode or fault state. In this error mode, the alarm relay will be activated, the 4-20 mA current loop will change to 24 mA, the unit will display an error code, the green status indicator LED will flash, and the buzzer will sound intermittently. If the fault fan setting option is set to "on," the fan relay will also be activated. This is a safety precaution. To clear this mode, simply turn off the power to the device for a few seconds or press the TEST switch (located inside the device). This will cause the device to restart a 1-minute self-test cycle.

6.5.2 "t" error Codes

Table 6-5 "t" Error Codes

tXX	Description of tXX code
t01	Sensor fatal error
t02	Sensor offset adjustment error
t04	Sensor algorithm error
t08	Sensor output error
t10	Sensor self-diagnosis error
t20	Sensor outrange error
t40	Sensor memory error
tYYY	Description of tYYY code
t001	Missing sensor (only at power-up)
t002	Each time it is powered on, it will check whether the ABC is disabled. If it is not disabled, it will try to set it as disabled. If it fails, the fault t002 will be triggered.
t004	EEPROM check error
t008	Modbus communication error (during normal operation)
t010	EEPROM is damaged

t020	Factory calibration error
t040	Never calibrated at the factory
t080	Pressure error during factory calibration
t100	Within the range, the reading is lower than -100ppm for more than 15 seconds
t200	Sensor is expired
t400	Faulty pressure sensor
t800	Circuit board is not tested

Note: For fault codes greater than 080, for t100, the display will alternate between t1 and t00, and for t200, it will alternate between t2 and t00.

If the error mode repeats frequently, please check for a continuous power supply and proper voltage. If it is not a power issue and the device continues to experience repeated errors, please contact CPS.

If the error mode indicates "sensor expired," please refer to the sensor lifetime reset section of these user instructions.

6.5.3 Sensor Deterioration

The gas sensor in the detector is extremely sensitive to the surrounding environment. Therefore, if it is exposed to silicone-based substances, its sensing performance may deteriorate. Such substances include common oils and lubricants that use silicone compounds as additives in machinery, halogen compounds used in fire extinguishers, refrigerants such as Freon, organometallic compounds, sulfur compounds, chlorinated compounds, acetylene, olefins, or environments with high concentrations of combustible gases.

6.5.4 End-of-life Signal

The GD-6 features a long-lasting, non-replaceable catalytic combustion sensor. After five (5) years of installation of the GD-6, the sensor end-of-life signal will be activated, indicating that the GD-6 has reached its typical service life. The end-of-life signal will result in the error code t200 "sensor is expired". Refer to the Error Codes section. The end-of-life signal can be silenced for 48 hours by pressing the "ENTER/TEST" button or temporarily disconnecting the power supply to the device. The end-of-life signal provides users with the opportunity to test and/or calibrate the sensor to ensure that, despite being close to its expected end of life, it is still operating within acceptable parameters. The silencing feature will remain available for 29 days following the initial end-of-life signal from the GD-6. After these 29 days, the GD-6 can no longer be silenced, and the sensor must be calibrated and the sensor life reset, or the GD-6 detector must be replaced.

6.6 Troubleshooting of Dehumidifier

After powering on, the dehumidifier enters a self-check state. Once the self-check is completed, the dehumidifier will enter operational mode after 3 seconds, and the digital display will show the humidity value of the enclosure.

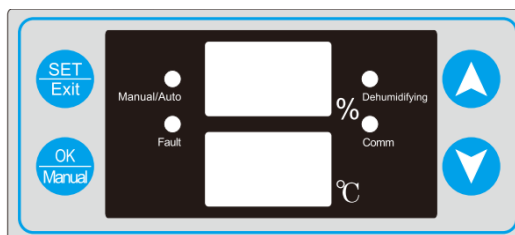


Figure 6-1 Dehumidifier Indicator Light

Indicator light description:

- **Manual/automatic:** The indicator light is on, indicating that the dehumidifier is in manual operation mode. When the indicator light is off, it indicates that the dehumidifier is in automatic operation mode.
- **Dehumidification:** The dehumidification indicator light is on, indicating that the device is currently in dehumidification mode. If the light is off, it signifies that the dehumidification process is complete. ("Manual/automatic" light off indicates automatic dehumidification; manual light on indicates manual dehumidification)
- **Communication:** The indicator light is on, indicating that data is being received from the host.
- **Fault:** The indicator light is on, indicating that the device fails.

Fault display explanation: If the humidity value on the digital display shows "---", it indicates a fault with the humidity sensor or that there are water droplets on the humidity sensor. If the temperature value on the digital display shows "---", it indicates a fault with the temperature sensor.

The fault codes are as follows:

E2: External temperature sensor fault; E3: Cold side temperature sensor fault; E4: Hot side temperature sensor fault;

E5: External ambient temperature too high; E6: Temperature environment too high.

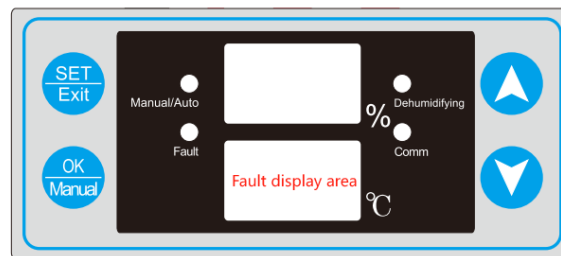


Figure 6-2 Dehumidifier Indicator Light Fault

6.7 Troubleshooting of Auxiliary Power Transformer

6.7.1 Temperature rises abnormally

- Check whether the temperature controller fails;
- Check whether the ventilation of air duct is normal;
- Check the load of auxiliary power transformer. If faults in the temperature controller and blowers have been ruled out, and the temperature continues to rise under normal load conditions, it should be confirmed that there is a fault within the auxiliary power transformer. The operation should be halted, and maintenance should be performed. Possible causes include partial short circuit in the windings, partial short circuit in the core, prolonged overload operation, or deteriorating cooling conditions.

6.7.2 Abnormal sound

- If the sound is coming from within the auxiliary power transformer, it may be due to the core not being firmly secured or the core not being grounded.

- If the sound is coming from outside, it may be due to overload operation, high voltage, missing phase operation, magnetic resonance in the power grid system, short circuit or grounding on the low-voltage side, or loose external connections.

6.7.3 Low insulation resistance of the core to ground

This issue is primarily caused by high ambient humidity, which leads to moisture absorption in the dry-type auxiliary power transformer. As a result, the insulation resistance decreases, potentially affecting safe operation. Contact CPS Customer Service for support if low insulation resistance of the core to ground is found.

6.7.4 The insulation resistance of the core to ground is zero

This may be due to burrs, metal wires, or other debris being brought to the core by the paint; bridging between the core and the clamping piece; insulation damage of the base may cause the core to be connected to the base; or a metal object falling into the low-voltage coil, resulting in a connection between the clamping plate and the core. Contact CPS Customer Service for support if the insulation resistance of the core to ground is zero.

6.8 UPS Troubleshooting

- The UPS is specialized equipment and should only be operated by CPS authorized personnel.
- The power supply and communication must be cut off before the replacement of main components.
- All components can only be repaired and replaced by CPS authorized personnel, and can only be replaced with approved materials, components and parts.

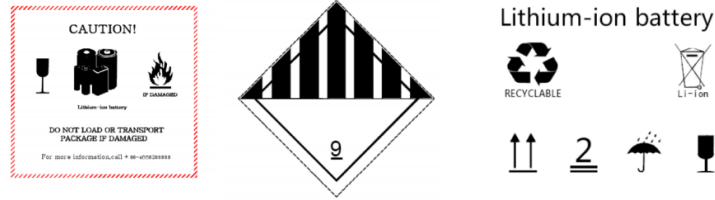
6.9 Decommissioning

The energy storage system shall be decommissioned and disposed of at the end of their service life in the manner determined by its Owner according to local regulations on or requirements for waste disposal or recycling.

The lithium-ion battery shall be decommissioned and disposed of according to the following provisions:

Observe the following instructions if the battery is physically damaged, smoked, burnt out or expires:

- 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 handling the battery pack;
- Provide external insulation to the battery pack during transportation;
- Make sure that the disconnect of high-voltage box is turned off;
- Make sure that there is an original plastic cover at the battery output terminal for protection/heat insulation;
- Pack the battery pack into a plastic bag;
- Secure the battery pack to avoid further vibration and impact;
- Prevent the battery pack from getting wet by rain or water.



6.10 First Aid Recommendation

Response Measures in Case of Electrolyte or Substance Leakage

In the event of a leak or overflow of electrolyte or other hazardous substances, evacuate the area immediately. Ensure the space is well-ventilated to disperse harmful gases or vapors. Use an absorbent cloth to clean the affected area, then seal the cloth in a plastic bag and place it inside a metal container. Allow time for the battery to cool and for any remaining vapors to fully dissipate. Avoid any direct contact with the liquid, including skin and eyes, and prevent inhalation of vapors. Use appropriate absorbent materials to collect spilled substances and dispose of them via incineration, following local hazardous waste regulations. Please seek emergency medical care immediately if any of the following conditions occur.

First Aid Measures

- **Eye Contact:** Immediately flush eyes with plenty of water for at least 15 minutes, lifting both upper and lower eyelids occasionally. Seek emergency medical assistance promptly.
- **Skin Contact:** Remove any contaminated clothing. Rinse the affected skin thoroughly with water or take a full shower for at least 15 minutes. Seek emergency medical assistance promptly.
- **Inhalation:** Move the individual to fresh air immediately. Administer oxygen if available and needed. Seek emergency medical attention.
- **Ingestion:** If the substance is accidentally ingested, seek emergency medical care immediately.

7 Maintenance Schedule

NOTICE!



- The operation and maintenance of equipment such as the battery, liquid cooling unit, fire fighting components and auxiliary power transformer must be carried out by qualified and authorized personnel.
- The system must be shut down for semi-annual and annual maintenance items.
- Please reach out to CPS service for next steps if any component is damaged or replacement during the inspection.
- The ESS cabinet contains high-voltage components that pose serious risk of electric shock or death if not handled properly. The following safety precautions must be strictly followed before performing any operation or maintenance work on the system.
 - Do not touch any live parts at any time.
 - Always wear appropriate personal protective equipment (PPE) during inspection, maintenance, or service.
 - Observe and follow all warning labels and safety messages on the equipment and within product documentation.
 - Carefully follow all safety instructions provided in this manual.
 - Make sure to disconnect all external power sources, wait for at least 15 minutes to allow the capacitor energy to be fully discharged before opening any cabinet panels/doors.
 - Ensure all disconnected circuits cannot be automatically re-energized, such as by remote commands, timers, or auto-reclose functions.

Regular maintenance according to the following schedule must be conducted to ensure the ESS operates properly and efficiently. The maintenance intervals shown in the tables below are for reference purposes, and the shorter maintenance intervals may be needed according to the actual environmental conditions of the installation.

Table 7-1 Battery Maintenance Procedure

Frequency	Category	Maintenance Contents
Quarterly (Remote monitoring/ inspection through EMS)	Voltage inspection	Check and confirm both DC and AC voltage of the battery system are within the normal specification range.
	Output relay inspection	Check output relay's warning history through EMS and confirm there is no operating error.
	Inspection of Warning, Errors or Alarms	Analyze the operational records, check for all warnings, alarms and error codes, and analyze the cause.
Semi-annually (Physical inspection)	Cabinet doors	Check and confirm the cabinet doors can open and close freely and the hinges are not deformed. When closed, the doors should align with the cabinet firmly and no gap is visible.
	Dust/water ingress inspection	Open the cabinet door and inspect any excess dust, debris, or water ingress mark in the cabinet.

	External appearance	Check the external appearance of the battery cabinet for rusting, fading, cracking, peeling, or deformation. Check warning signs, manual starter, Emergency Power Off switch to confirm that all of them are in their original positions and not damaged.
	Air inlet filter screen	Inspect the air inlet filter (on the front lower door) and clean dust or debris.
	Cabinet fan	Inspect the cabinet fan located on the rear panel and clean dust or debris.
	Fire suppression system	1. Check and confirm the smoke detector, temperature detector, fire extinguishing device and gas detector are firmly attached to the cabinet and not loose or damaged, confirm the wire connected to these devices are not loose or damaged. Remove obstructions on the aforementioned detectors, if any. 2. Check and confirm there is no leakage or trace of leakage on the fire extinguisher.
	Liquid cooling unit	1. Check the appearance and remove the dust and dirt coverage on the surface, the fan and make sure there is no obstruction at the air outlet. 2. The condenser is not blocked by dust and foreign matters, and the fin is free of serious bending deformation. 3. Electrical cables are free of aging, damage, arcing marks and other abnormalities. 4. Coolant pipes are firmly connected to the unit and no visible cracking or leakage. 5. Sample coolant and check if the concentration, PH, electrolyte concentrations meet the requirements according to the operation instructions of freezing point tester or test strip. Make sure that no dirt, sediment or algae is detected. Test period: once a year for the first 3 years, then once every six months to a year for the next 3 years, then shorten it to once a quarter. The specific adjustment of the frequency also depends on the condition of the liquid; if the liquid is in good condition, frequent testing is not necessary.
Annually (Physical inspection)	DC relay inspection	When receiving command from EMS, check and confirm the DC relay can be disconnected and connected normally and a click sound is heard.
	Cable inspection	Visually inspect the AC output cables of the battery system. Check for broken, aged or loose cables/terminals and arcing mark, if any.
	DC connector inspection	Check and confirm that all DC cable connectors are firmly connected to the battery packs, the high voltage box, and the PCS.

	PCS Module	1. Check and confirm the PCS module is firmly secured and not loose. 2. Check and confirm all electrical connections, including DC terminals, AC terminals, grounding cables, communication cables, and any connections between the PCS modules (for 125kW) are firmly connected. No arcing marks, decoloration, deformation can be observed on the connector surface. 3. Clean any dust and sundries in the radiator, terminal, and mesh. 4. If the system is experiencing high temperature warning or abnormal fan noise during battery operation, it is necessary to replace the PCS external cooling fan.
	UPS	Check the UPS LCD screen for any error message. If a UPS battery replacement is needed, please contact CPS for next steps. If the ESS is stored and not operating for more than 6 months, fully recharge the UPS battery manually every 6 months before operating the UPS. The typical rated service life of the UPS battery is 3-5 years depending on the usage intensity and ambient temperature.
	Dehumidifier	The fan blades are free of damage and rotate freely. Check and confirm the dehumidifier is firmly secured on the door and all cables are firmly connected.
	Circuit breakers	Check whether there are cracks, decoloration, deformation or other damage on the circuit breakers. Test and confirm the circuit breaker handle can operate smoothly at all positions.
	Aux power transformer	1. Open the rear panel of the cabinet, check the transformer and ensure that there is no damage, decoloration, or other abnormality on the surface. 2. Clean the external surface of auxiliary power transformer and surrounding environment if excess dust and dirt are found on the surface. 3. Check the wiring and grounding conductors to ensure there is no loose connection.

Annex 1 List of Personal Protective Equipment (PPE)

S/N	Category	Example	Requirement	Note
1	Safety helmet		Wear a helmet correctly before entering the construction site to protect your head; The helmet shall meet the requirements of ANSI Z89.1 Industrial Safety Helmets.	
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 shall wear masks	

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

Annex 2 List of Recommended Tools

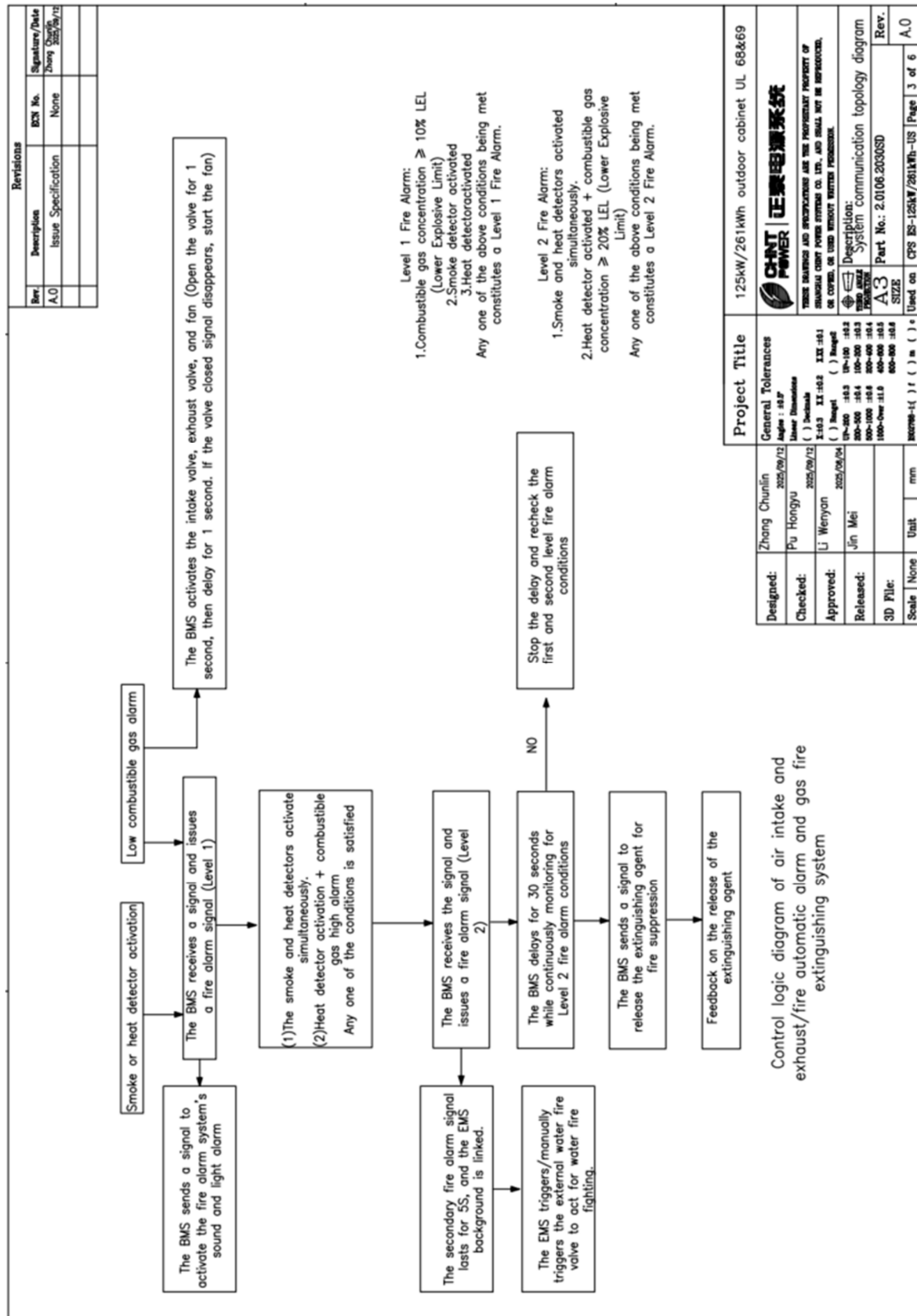
The following tools are recommended and may change per site requirements.

S/N	Name	Material	Specification	Sample	Qty.	Note
1	Laptop	N/A	N/A		2	
2	Tape measure	Steel	5m		1	
3	Wrench (insulated)	Stainless steel	1 complete set		1	
4	Socket wrench (insulated)	Stainless steel	1 complete set		1	
5	Torque wrench (insulated)	Stainless steel	1 complete set		2	
6	Screwdriver	Stainless steel	1 complete set		1	
7	Gradiometer (level)	Aluminium alloy	1000mm		1	
8	Electric wrench	N/A	N/A		1	
9	Electric drill	N/A	N/A		1	
10	Multimeter	N/A	N/A		1	
11	Battery tester	N/A	N/A		1	Example: HIOKI 3564

Annex 2 List of Recommended Tools

S/N	Name	Material	Specification	Sample	Qty.	Note
12	Forklift	N/A	N/A		1	

Annex 3 Internal Fire Suppression System Logic





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