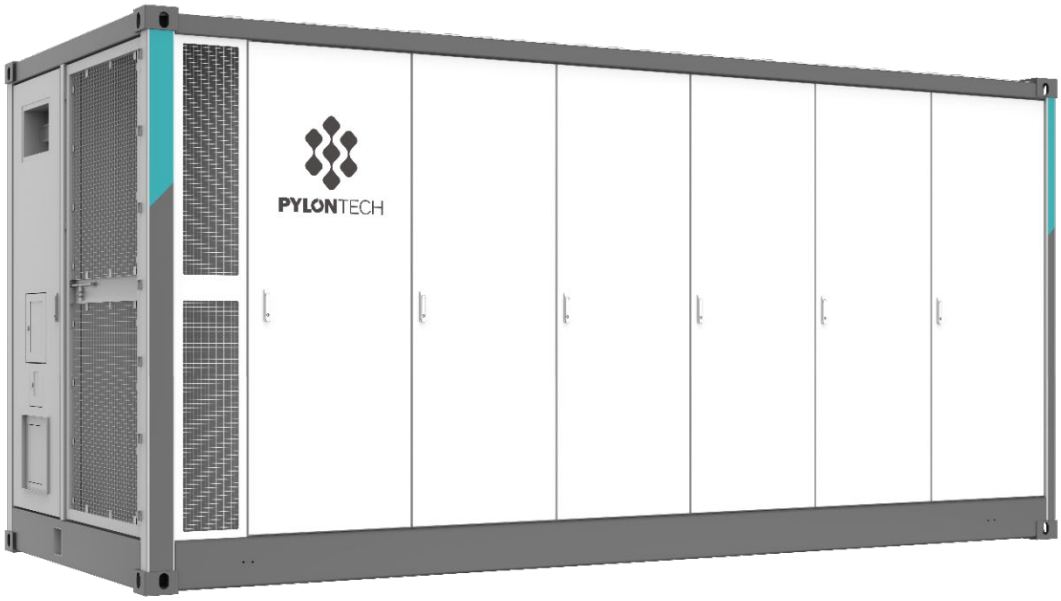


Container-L5000-BAT Lithium Iron Phosphate Battery Energy Storage System

Operation Manual

Information Version: 1.0

5PMPA08-00XXX

Legal Information

Disclaimer

The Manual contains instructions for the use of the product. All the pictures and charts in this manual are for description and explanation only. Pylon Technologies Co., Ltd. reserves the right to change the information in the manual which is subject to change without further notice.

Please read this manual carefully before using the product and keep this manual for further reference. Failure to use the product in accordance with the manual may result in serious injuries, property damages and may void the warranty, for which Pylon Technologies Co., Ltd. shall not be liable.

Pylon Technologies Co., Ltd. makes no representations or warranties express or implied, with respect to all the information in this manual.

In the event of any conflicts between this manual and the applicable law, the latter prevails.

The final interpretation of this manual belongs to Pylon Technologies Co., Ltd.

Contents

1 Information about this manual

1.1 Purpose

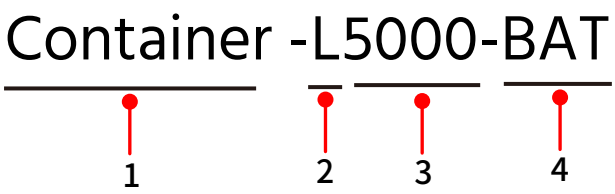
This manual describes the Lithium Iron Phosphate Battery Energy Storage System (hereinafter referred to as "the system" unless otherwise noted) from Pylontech in terms of its overview, installation, commissioning, maintenance, etc.

Please read this manual before installing the system and follow the instructions carefully during installation. In case of any confusion, please contact Pylontech immediately for advice and clarification (Contact information can be found on the back cover of the manual).

1.2 Validity

This manual is applicable to the container battery energy storage system: Container-L5000-BAT. It is mainly used in industrial and commercial application scenarios such as power grid peak cutting and valley filling, power capacity increase, etc. Container-L5000-BAT is a high-voltage energy storage system that can only be operated by authorized personnel and professionals.

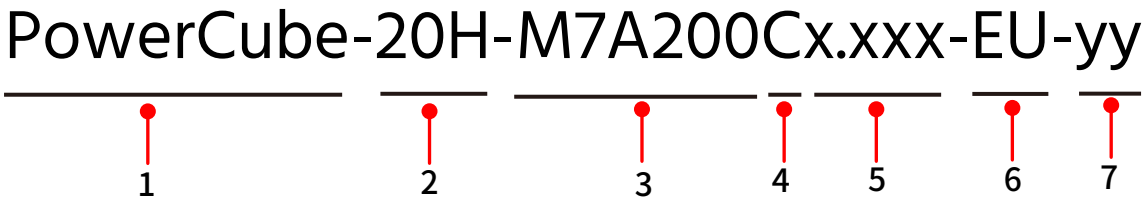
1.3 Product Name Description



No.	Designation	Description
1	System type	Container BESS System
2	Cooling type of the system	Liquid Cooling
3	The rated energy (in kWh) of the system*	The rated energy of this system is 5000 kWh.
4	Type of the container	“BAT” represents the container contains battery only (not including the PCS).

* The energy of the standard container is 5000 kWh. And the energy may differ based on your practical system.

1.4 Product Model Description



No.	Designation	Description
1	Product Series	PowerCube Series
2	Volume of the container	20ft container
3	Battery model used in the product	The product uses M7A200 battery module.
4	PCS type that can be used for this system	Centralized type PCS
5	The rated energy (in MWh) of the system (Where x.xxx=2.089~5.015, in step of 0.418)	The rated energy is x.xxx MWh.
6	Sales territory	The product is Intended for European market.
7	The firefighting configurations (Where yy=01, 02, 03, 04 or 05, in step of 01)	01: Explosion vent panel 02: Explosion vent panel + Sprinkler system 03: Explosion proof system 04: Explosion proof system + Sprinkler system 05: Explosion vent panel + Explosion proof system + Sprinkler system

1.5 Symbols Explanation

Symbol	Description
DANGER	**Danger**: Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	**Warning**: Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	**Caution:** Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTE	**Note:** Indicates additional information, emphasized contents, or important points helping you use the product better.

1.6 Abbreviations in this Manual

Abbreviation	Designation
Pylontech	Pylon Technologies Co., Ltd.
AC	Alternating Current
DC	Direct Current
QC	Quality Control
BMS	Battery Management System
BMU	Battery Management Unit
PCS	Power Conversion System
SOC	State of Charge
SOH	Battery State of Health, in percent
UPS	Uninterruptible Power Supply
BESS	Battery Energy Storage System
EMS	Energy Management System
PMU	Power Management Unit
CMU	Control Management Unit
SPD	Surge Protecting Device
EU	European Union
DOD	Depth of Discharge
MBMS	Master Battery Management System
MCU	Microcontroller Unit

2 Safety

Declaration

This system is only operated by authorized personnel. Read all safety instructions carefully prior to any work and follow these instructions at all times when working with the system.

Incorrect operation or work may cause:

- Injury or death to the operator or a third party.
- Damage to the system hardware and other properties belonging to the operator or a third party.

2.1 Symbols

	Read the manual before installing and operating the battery system.
	Must wear an ear protector.
	Must wear a safety helmet.
	General warning label indicating potential hazards.
	Warning: electric shock.
	Warning: flammable materials.
	Do not connect the positive and negative reversely.
	Keep away from flame or ignition sources.
	No access without permission.
	Grounding
	Recycle label.
	Label for Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU).
	The certificate label for CE.

2.2 Personal Requirements

Qualified personnel must have the following skills:

- Training in the installation and commissioning of the electrical system, as well as dealing with hazards.
- Knowledge of the manual and other related documents.
- Knowledge of the local regulations and directives.

2.3 Setting of Safety Warning Signs

During the installation, routine maintenance, overhaul and other operations of the system, to prevent irrelevant personnel from approaching and misoperation or accidents. Please observe the following:

- Obvious signs shall be set up at the front and rear switches of the maintenance equipment to prevent accidents caused by false closing
- Set up warning signs or safety warning tapes near the operation area.

2.4 Requirements for Escape Routes

To ensure that the staff can leave the site quickly in case of accident, please observe the following items:

In the process of equipment maintenance, overhaul and other operations, it is necessary to ensure that the escape routes are completely unblocked.

It is strictly prohibited to stack sundries in the escape way or occupy the escape way in any form.

2.5 Electrical Working

There is high voltage in the system, and accidental contact may lead to fatal electric shock danger, so when working with electricity, you should:

- Tag and lock the live area.
- Do a good job of protection, wear insulating gloves and shoes, and wear the corresponding level of anti-arc flashover clothing when necessary.
- There must be an escort to ensure personal safety.

2.6 Moisture Protection

The entry of moisture is very likely to damage electrical equipment! To ensure the normal use of various functions of the system, please observe the following items:

- Do not open the door of the system or equipment when the air humidity is above 95 %.
- Avoid maintenance or overhaul of the system in rainy or humid weather conditions.

In addition, the following protective or emergency measures should be taken according to the needs of the site:

- During the maintenance and overhaul of the system, relevant personnel shall take appropriate protective measures according to the needs of the site, such as wearing anti-noise earplugs, insulating shoes, insulating gloves and scalding gloves.

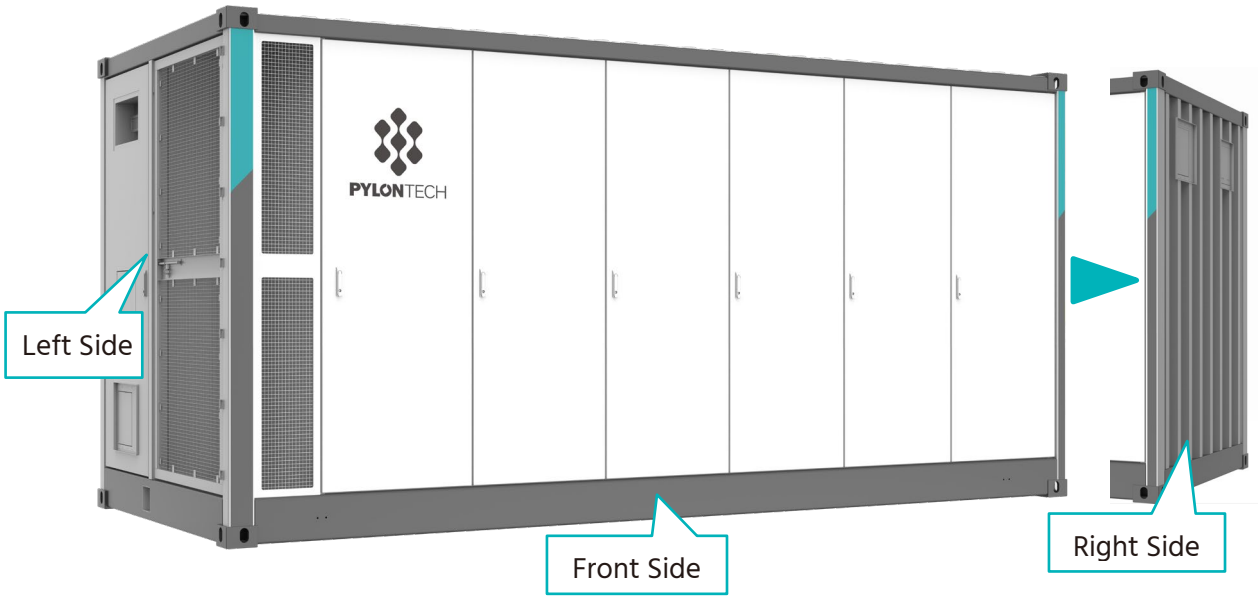
Take all necessary auxiliary measures to ensure the safety of personnel and equipment. Matters needing attention in the use of this manual:

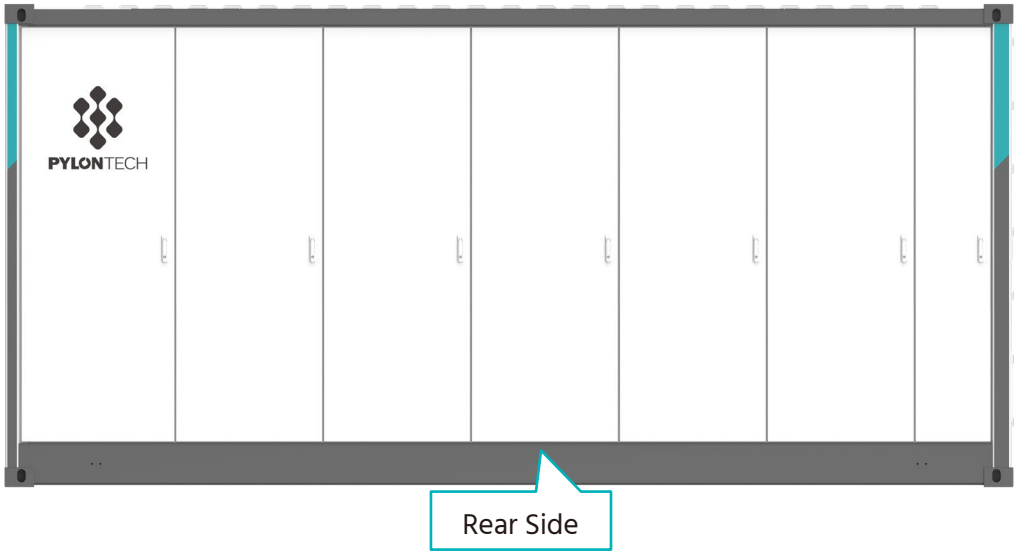
- This manual cannot cover all possibilities during operation, maintenance and overhaul. Please contact our company in time if you encounter any situation that cannot be explained in the manual.
- In order to facilitate users to read and use this manual better, a large number of pictures are configured in the manual. All pictures are for illustration purposes only. Users should refer to the actual products received.

3 System Introduction

3.1 System Description

This system is a high voltage battery storage system based on lithium iron phosphate battery. The system adopts module series design, which voltage level is 1500V.



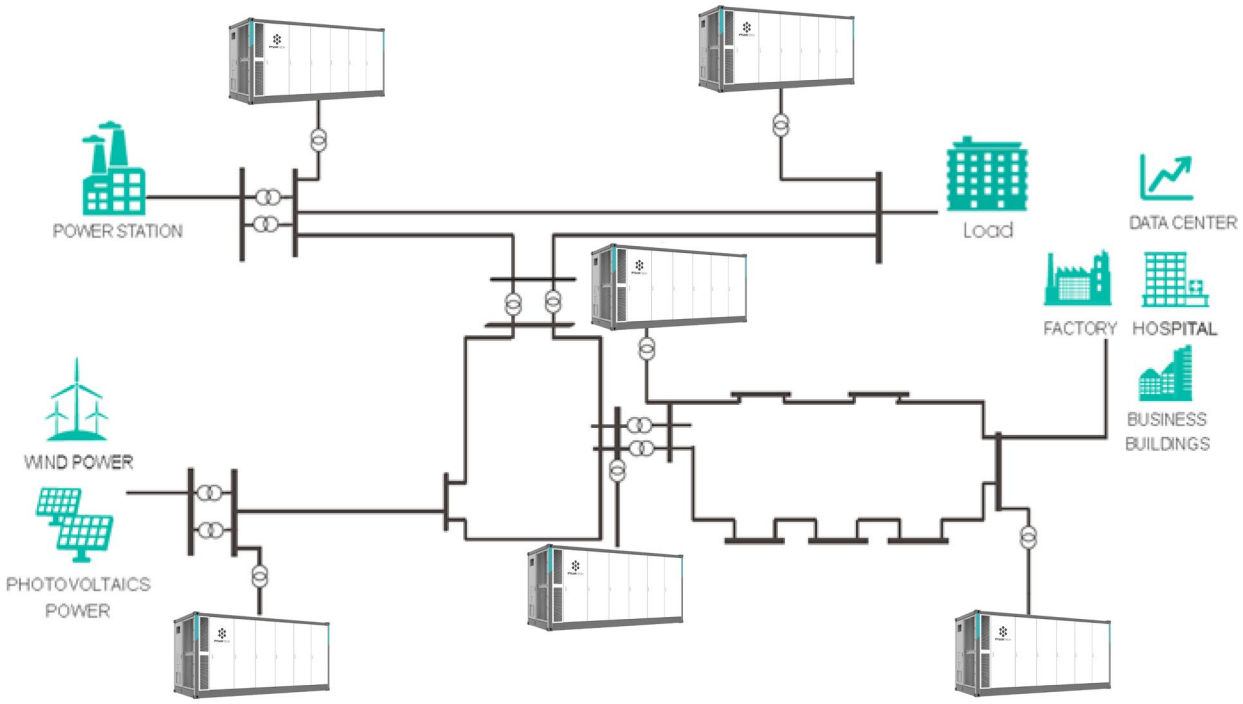


NOTE: The above pictures are for reference only, the appearance of the product is subject to the actual delivery.

3.1.1 System Overview

Through reliable BMS system and high-performance balancing technology, the whole system is characterized by flexible configuration and high reliability. It can be widely used in grid energy storage, photovoltaic energy storage, container energy storage, microgrid energy storage, data room and other application scenarios that need high-voltage batteries. The system application is shown in the following figure.

Product Application Scenario



3.1.2 System Specifications

Specifications	Parameters	PowerCube-20H-M7A200Cx.xxx-EU-yy (*)
System Parameters	Maximum Weight (ton)	Approx. 42
	Dimensions (mm)	6058(-6,0) (W) x 2896(-5,0) (H) x 2438(-5,0) (D)
	IP Rating	IP55
	Protective Class	Class I
	Pollution Degree	PD3 (Outside), PD2 (Inside)
	Cooling Type	Liquid cooling
	Liquid Coolant Type	50% water, 50% ethylene glycol
	Fire Fighting Mode	"yy" represents the firefighting configurations of the system (yy=01, 02,03,04 or 05) 01: Explosion vent panel 02: Explosion vent panel + Sprinkler system 03: Explosion proof system 04: Explosion proof system + Sprinkler system 05: Explosion vent panel + Explosion proof system + Sprinkler system
	Charge Temperature Range(°C)	-30~55
	Discharge Temperature Range(°C)	-30~55
	Relative Humidity	0-95%RH, non-condensing
	Altitude (m)	< 4000
Auxiliary Power Parameters	Power Input Voltage (VAC)	380
	Maximum Current (A)	100
	Rated Frequency (Hz)	50/60
	Wiring Method	3P4W
DC side Parameters	Rated Capacity (Ah)	314
	Rated Energy (kWh)	417.998 x n (n=5~12)
	Rated Power (kW)	208.99 x n (n=5~12)
	Nominal voltage (VDC)	1331.2
	Upper Limit Charging Voltage (V)	1497.6
	End-of -discharge Voltage (V)	1164.8

* "x.xxx" represents the rated energy (in MWh) of the system (Where x.xxx=2.089~5.015, in step of 0.418)

"yy" represents the firefighting configurations of the system (Where yy=01, 02, 03, 04 or 05, in step of 01, see details in the table above)

3.2 Reference standards

3.2.1 System Related Standards

No.	Description	Code
1	CE LVD Directive 2014/35/EU	EN 62477-1
2	UN38.3 Safe Transport Standard	UN38.3
3	CE EMC Standard	EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019

3.2.2 Battery Related Standards

No.	Description	Code
1	Safety Standard for Secondary Lithium Batteries	IEC62619-2022 IEC63056 IEC62477-1 IEC62040-1 ISO 13849-1
2	UN38.3 Safe Transport Standard	UN38.3
3	CE EMC Standard CE EMC Directive 2014/30/EU	EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019
4	Battery Cell Safety Standard	UL1642
5	Battery Cell Safety Standard	UL1973
6	Battery Cell Safety Standard	IEC60730-1 SIL B/II
7	Safety Standard for Electrical Devices CE LVD Directive 2014/35/EU	EN 62477-1
8	Safety Standard for Lithium Battery (Germany)	VDE2510-50

3.3 Layout of the Container

The external and internal layouts of the container are shown in the following figures.

- **External Layout**

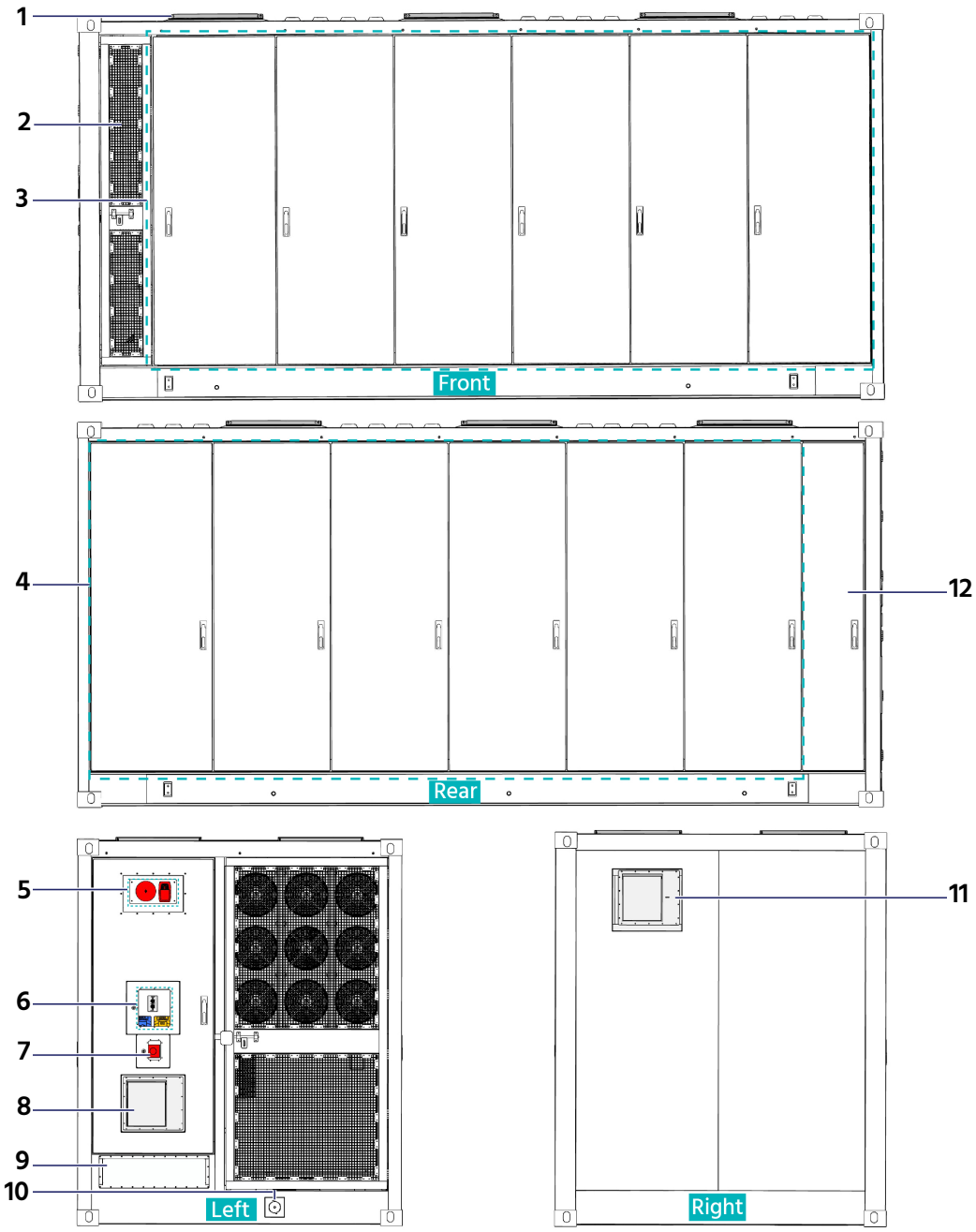
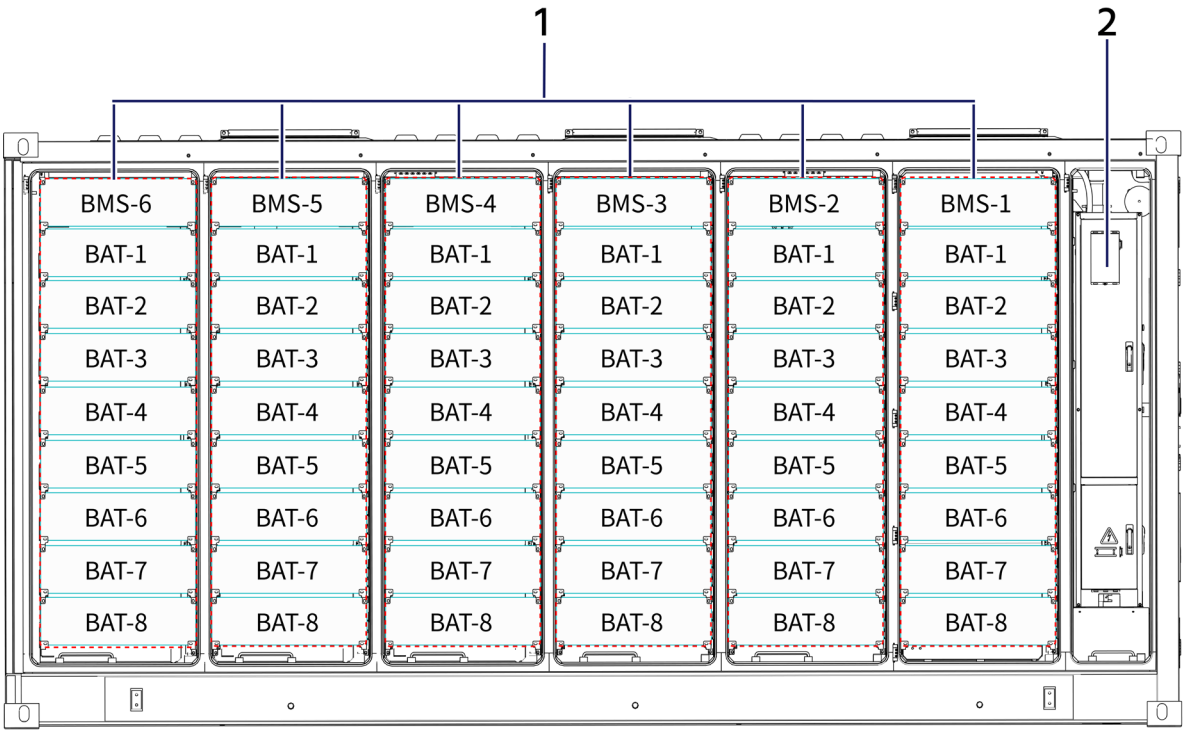


Figure	Description	Figure	Description
1	Explosion-proof panel (Optional)	7	EPO (Emergency Power OFF Switch)
2	Liquid cooler compartment door	8	Electric ventilation louver (explosion proof system)
3	Battery compartment doors	9	Cable glands (under the cover)
4	Battery compartment doors	10	Fire suppression water joint
5	Fire protection device*	11	Exhaust fan (explosion proof system)
6	Fire protection device*	12	Compartment door of communication cabinet

* For more details, please see *section 3.5.*

- **Internal Layout**



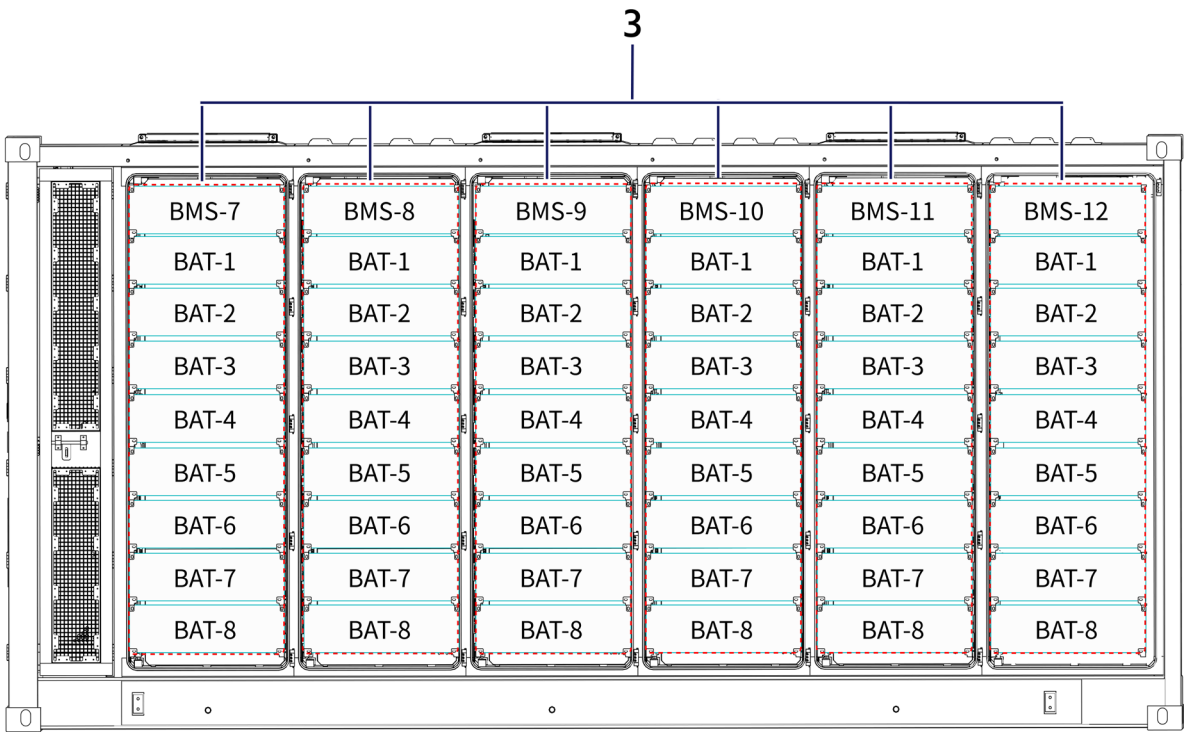
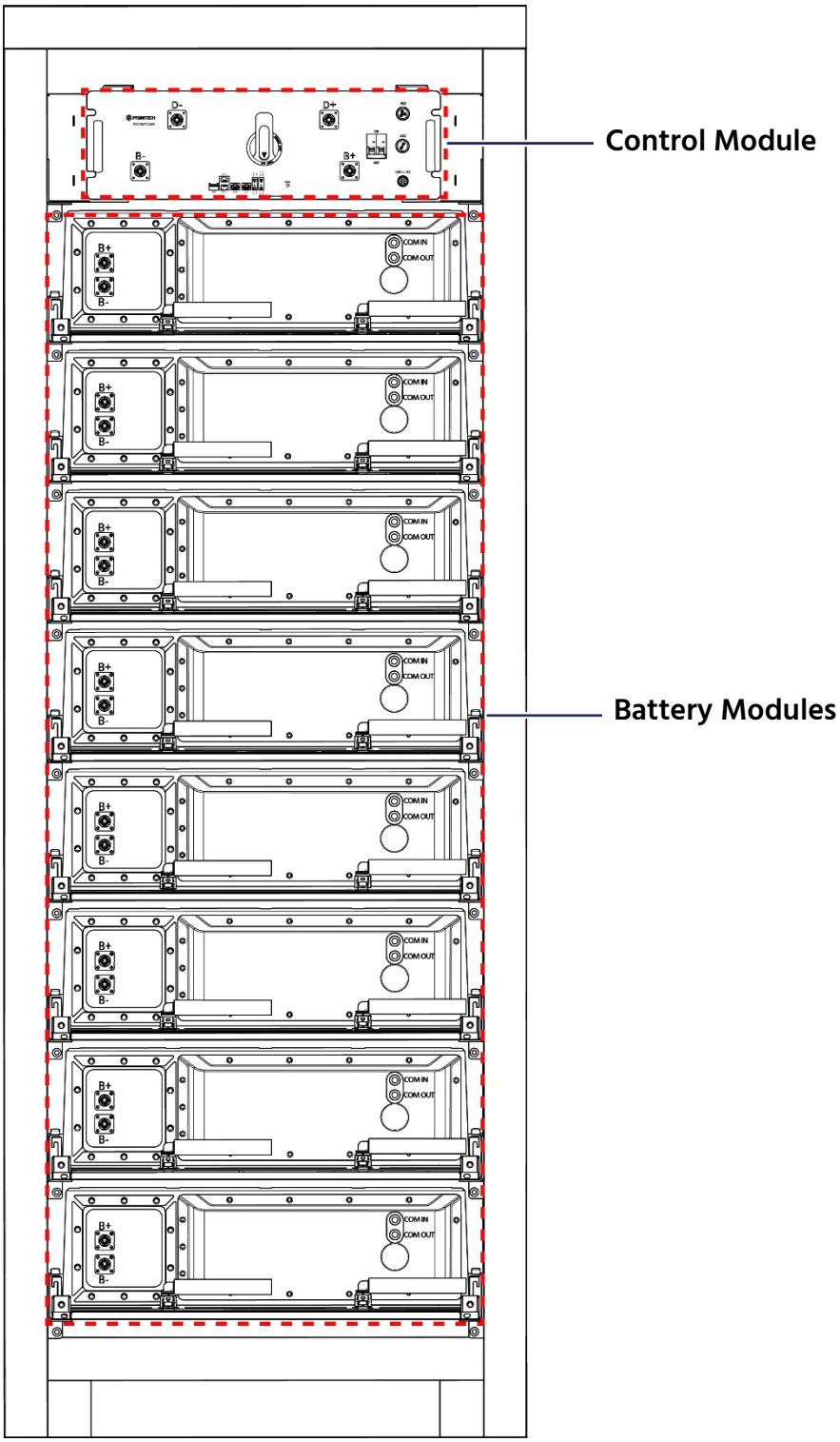


Figure	Description	Figure	Description
1	Battery Strings (Battery string 1 to 6)	3	Battery Strings (Battery string 7 to 12)
2	Communication Cabinet		

3.4 Battery String

The standard battery system consists of 12 sets of 418 kWh battery string. And each battery string contains eight battery modules and one control module. The appearance of the single battery string is shown as follows.

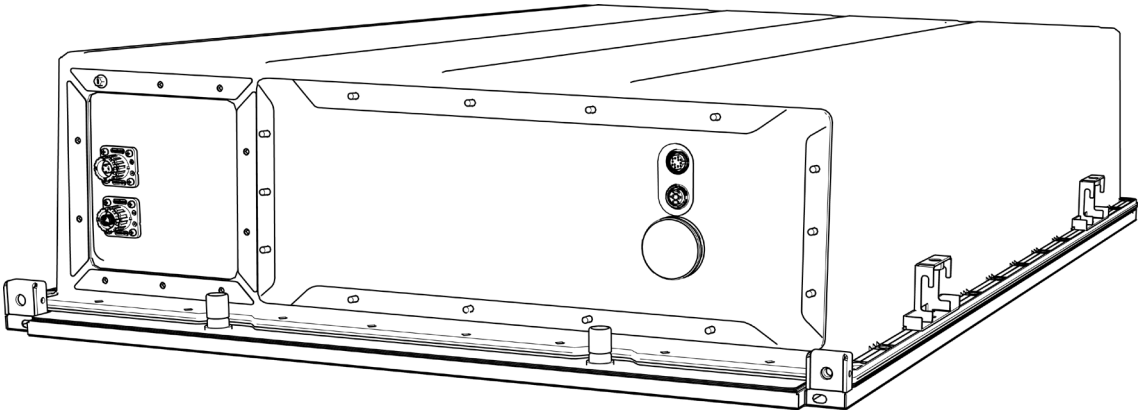


3.4.1 Single Battery System String Specifications

Specifications	PowerCube-M7A
System Voltage (VDC)	< 1500
Battery Module Type	HM7A200L
Control Module Type	S1500M7A200E
Rated Capacity (Ah)	314
Total Storage Energy (kWh)	418
Nominal Voltage (VDC)	1331.2
Charge Upper Limit Voltage	1497
Discharge Cutoff Voltage	1165
Nominal Current (Amps)	157
Maximum Continuous Current (Amps)	200
Peak Current (Amps)	250@15 seconds
Communication type	CANBUS & Modbus RTU &Modbus TCP/IP
Charge Temperature Range (°C) *	2~55
Discharge Temperature Range (°C) *	-28~58
Storage temperature range(°C)	-30 ~ 60
Humidity (%)	5 – 95 (without condensing)
Round-trip efficiency (%)	95
Depth of Discharge (%)	95
Operation Life (year)	10+
Cooling type	Liquid cooling
Altitude [m]	< 4,000

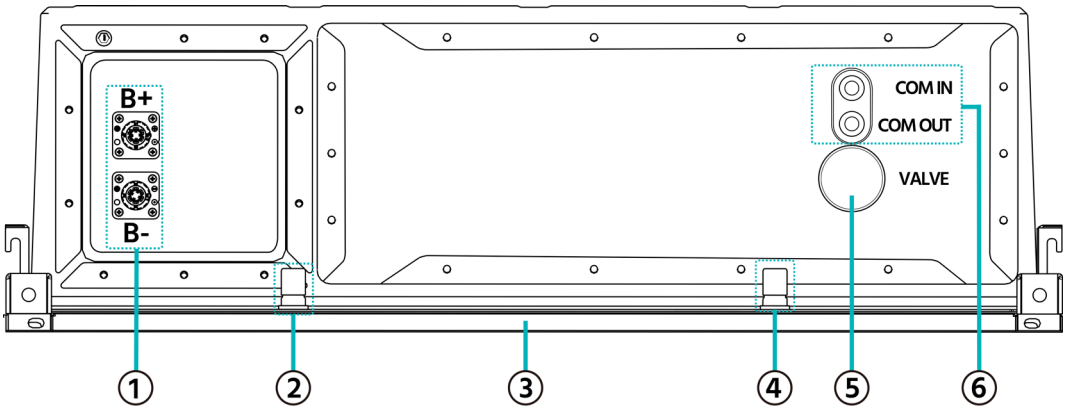
3.4.2 Battery Module

The appearance and the specifications of the battery module are shown as follows.



Specifications	HM7A200L
Cell Technology	Li-ion (LFP)
Battery Module Capacity (kWh)	52.25
Battery Module Voltage (VDC)	166.4
Battery Module Capacity (AH)	314
Dimension (W*D*H, mm)	1145×790×245
Protection Class	IP67
Weight (kg)	336±5
Charge Temperature Range (°C)	2~55
Discharge Temperature Range (°C)	-28~58
Storage Temperature (°C)	-30~60
Transportation Certificate	UN38.3

Front Interface of the battery module



Item	Description	Item	Description
①	Power Terminal B+/B-	④	Liquid Outlet Connector
②	Liquid Inlet Connector	⑤	Pressure Relief Valve
③	Liquid Cooling Plate	⑥	Communication Port (COM IN/ COM/ OUT)

① Power Terminal B+/B-

Positive (B+) and negative (B-) battery DC input terminals for connecting the batteries in serial.

② Liquid Inlet Connector

Connects the liquid cooling pipe for coolant in.

③ Liquid Cooling Plate

Regulates battery temperatures by the coolant flowing through the internal channels to ensure optimal battery performance, longevity and safety.

④ Liquid Outlet Connector

Connects the liquid cooling pipe for coolant out.

⑤ Pressure Relief Valve

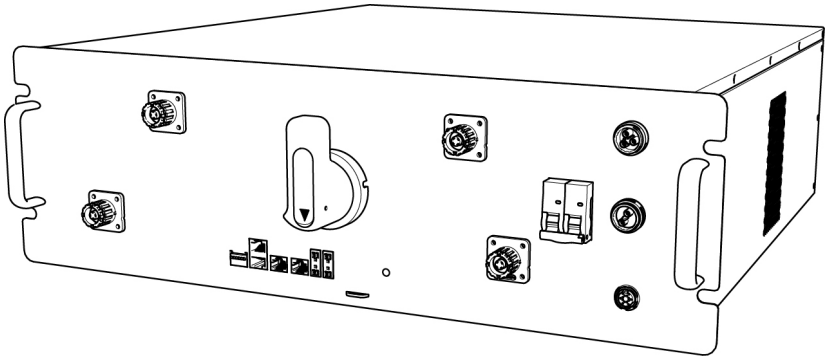
Prevents explosions caused by thermal runaway and automatically vents the internal pressure of the battery module in the event of a fire.

⑥ Communication Port (COM IN/ COM/ OUT)

Communication ports (CAN communication), between multiple serial battery modules and control module.

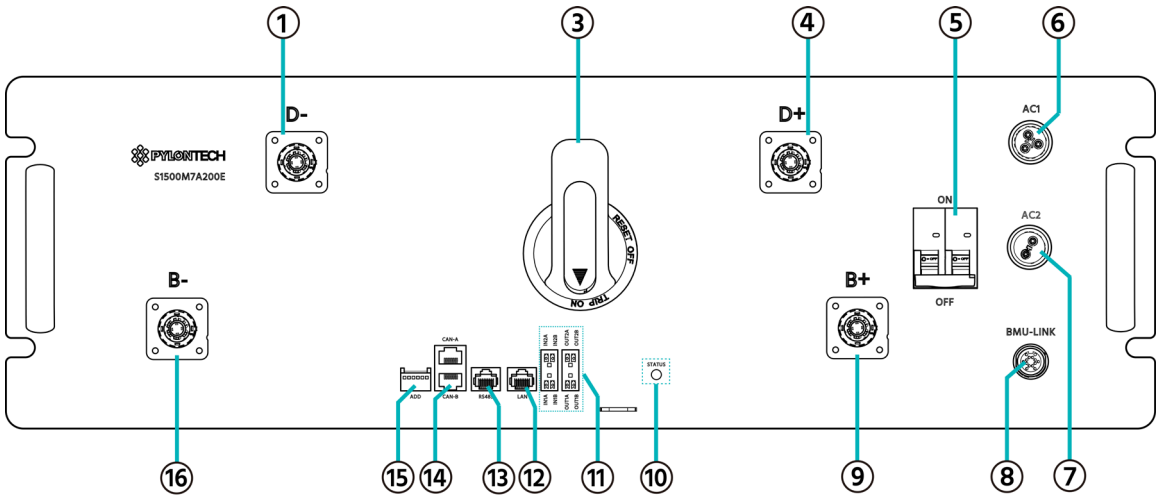
3.4.3 Battery Control module

Each battery string contains a battery control module. The appearance and the specification of the control module are shown as follows.



Specifications	S1500M7A200E
Related Product	PowerCube-M7A
AC Supply for BMS	230VAC/50Hz/1.3A
System Operation Voltage (VDC)	1000~1500
Dimension (mm)	330 (W) × 628 (D) × 150.5 (H)
Communication	RS485\CAN\LAN
Protection Class	IP20
Weight(kg)	13
Operation Life (Years)	15+

Front Interface of the battery control module



Item	Description	Item	Description
①	External Power Terminal D-	⑨	Power Terminal B+
②	SPD (Surge protection Device)	⑩	Status Indicator
③	Circuit Breaker	⑪	Dry Contact
④	External Power Terminal D+	⑫	LAN Port
⑤	Mirco Circuit Breaker	⑬	RS485 Port
⑥	AC Socket (AC1)	⑭	CAN-A, CAN-B Ports
⑦	AC Socket (AC2)	⑮	ADD Switch
⑧	BMU-LINK (Internal communication Port)	⑯	Power Terminal B-

① External Power Terminal D-

External DC connection for the battery system to the negative pole.

② Surge protection Device (SPD)

Protection against indirect and direct lightning effects or other transient overvoltage surges.

③ Circuit Breaker

On/Off switch for the control module, and carries out shunt tripping function when system is overcurrent or short circuit.

④ External Power Terminal D+

External DC connection for the battery system to the positive pole.

⑤ Mirco Circuit Breaker

Circuit breaker for AC power supply maintenance.

⑥ AC Socket (AC1)

Connects to external AC power supply.

⑦ AC Socket (AC2)

Connects to external AC power supply.

⑧ BMU-LINK

Communication port to connect the battery module.

⑨ Power Terminal B+

The battery's DC connection for the positive pole.

⑩ Status Indicator

Indicates the status of the battery string (Normal🟢, Abnormal🔴).

⑪ Dry Contact

(Dry Contact Terminals): provide 2 input and 2 output dry contact signals.

Dry Contact Definitions

In/Out	Function	Open and close state
In1	Reserved	Normal close.
In2	Emergency stop	Normal close, power relay opened when signal received.
Out1	Stop charging	Normal close, when suggested charge current is "0", it shall open.
Out2	Stop discharging	Normal close, when suggested discharge current is "0", it shall open.

⑫ LAN Port

RJ45 port, follows Modbus TCP/IP protocol, used for communication between battery string and MBMS, switch or upper controller.

⑬ RS485 Port

Console Communication Terminal: (RJ45 port), for manufacturer or professional engineer to debug or service.

⑭ CAN A, CAN B Ports

RJ45 Port, follows CAN protocol, for communication between the battery system and the PCS.

CAN A connects to another BMS.

CAN B connects to PCS.

⑮ ADD Switch

6-bit dial switches to manually distribute the communication addresses of the battery system. Lower position is OFF, means "0". Upper position is ON, means "1". 1st bit to 5th bit are for address, and the 6th bit dial switch supports a 120Ω resistance.

⑯ Power Terminal B-

The battery's DC connection for the positive pole.

3.5 Communication and Confluence Cabinet

The internal layout of the communication cabinet is shown in the following figure.

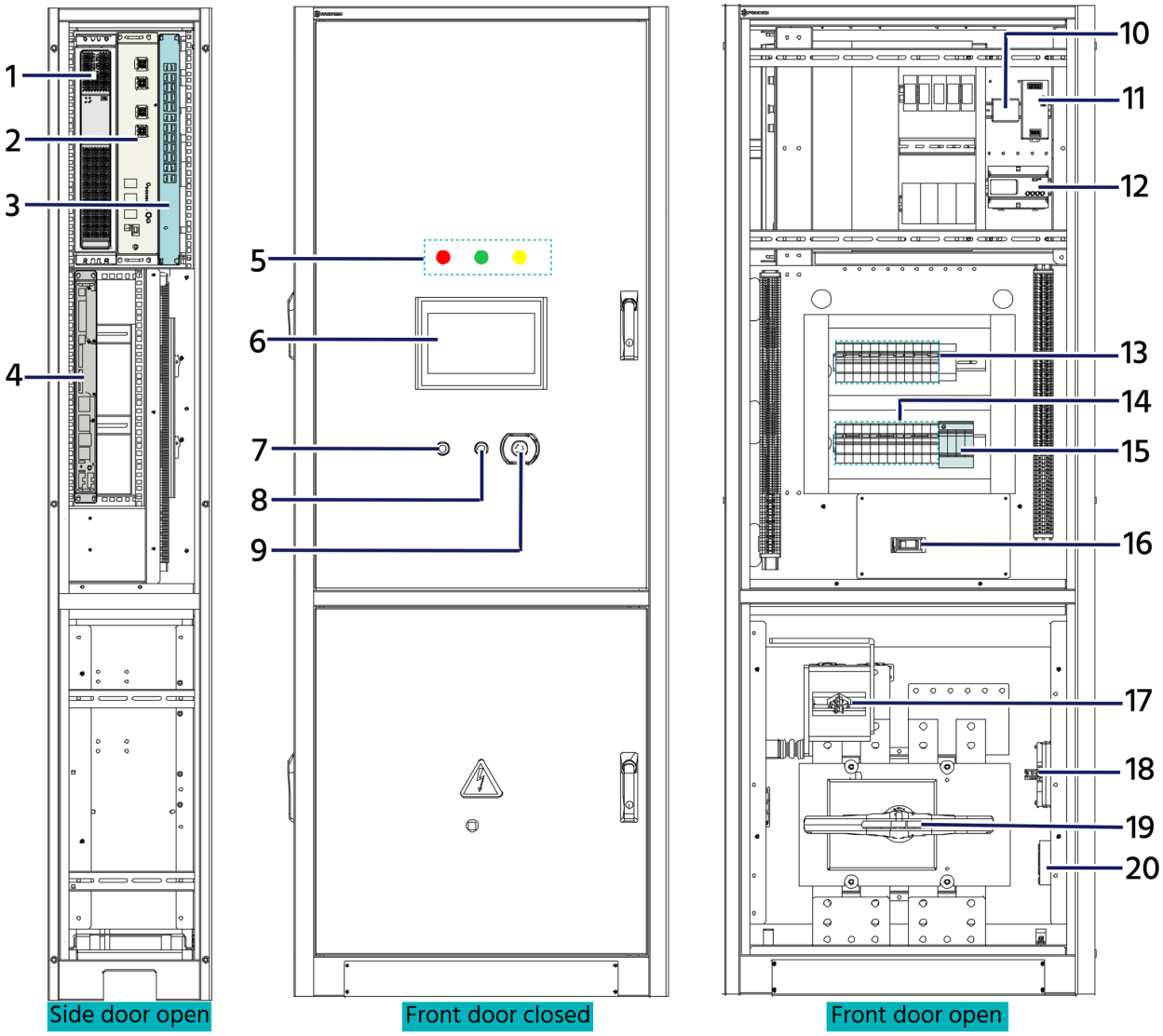


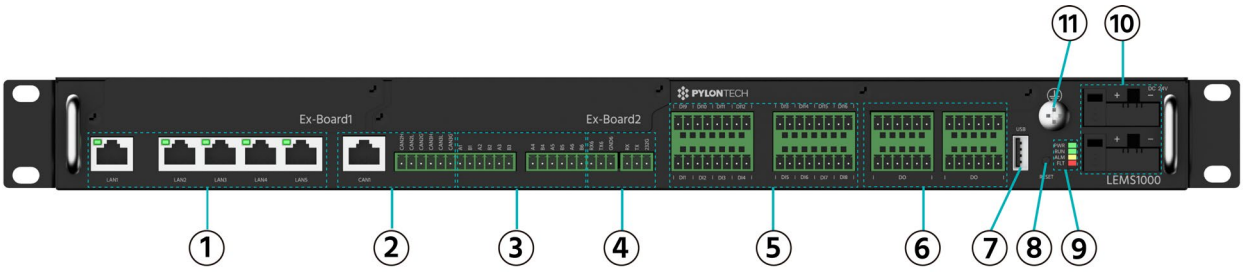
Figure	Description	Figure	Description
1	UPS	11	Power Switch
2	UPS Battery	12	Energy Meter
3	MBMS-B	13	Circuit Breakers
4	Switch	14	Circuit Breakers
5	Status LED	15	SPD (Surge Protection Device)
6	HMI Screen	16	Circuit Breaker (QF1)
7	Remote/Local Transfer Switch	17	Fuse
8	Black Start Button	18	Fuse
9	Emergency Stop Button	19	Isolating Switch (QS1)
10	Fuse	20	SPD

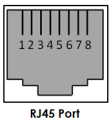
3.5.1 LEMS

The energy storage battery container adopts a local energy management system device LEMS 1000 for communication. It can communicate upwards with the devices as EMS, upper controller, touch screen, etc. It can also communicate downwards with the devices as battery control module, PCS, fire suppression control panel, power meter, UPS, thermal management device, sensors, etc.

Item	Specification
Operating voltage range (VDC)	9~36
Communication interface	LAN/CAN/RS485/RS232/USB
System Consumption (W)	12
Dimensions (mm)	482.6 (L) x 246.5 (D) x 44 (H)
Protection degree	IP20
Pollution degree	PD2
Protection Class	Class III
Weight (kg)	4.0
Working temperature (℃)	-40~85
Storage temperature (℃)	-40~85
LAN (maximum 10 Sockets)	Speed:100/1000Mbps
CAN (maximum 3 groups)	Baud rate: 500K; terminal resistance: 0/120Ω
RS485 (maximum 6 groups)	Baud rate:9600/115200
RS232(maximum 2 groups)	Baud rate:115200
DI (maximum 16 connects)	Dry Digital Input
DO (maximum 8 connects)	Passive Digital Output
USB	USB 2.0
Operation Life (year)	15

3.5.1.1 Interface Panel of the LEMS



No.	Port	Silk-screen	Description and Function	
1	LAN	LAN1	An Ethernet Port (100Mbps) with default IP:192.168.10.100	Used for SCADA, EMS, Cloud Platform etc. They are backup for each other, and support IEC61850, IEC60870-5-104, and Modbus/TCP protocols.
		LAN2	An Ethernet Port (1Gbps) with default IP:192.168.11.100	
		LAN3	LAN3 and all batteries' main control boards (CMUs) are connected to the ethernet switch so they can communicate with each other by Pylon IBC Protocol.	LAN3/4/5 are switched from the chip's original 1Gbps LAN port with default IP:162.172.1.100, 192.168.3.100, and 192.168.0.100.
		LAN4	Used to connect to PCS through Modbus/TCP protocol, and the slave LEMS1000s.	
		LAN5	Used to connect to the touch screen or PCs with BatteryView Pro installed.	
2	CAN	CAN1	a RJ45 Port, pin2 is CAN1G, pin4 is CAN1H, pin5 is CAN1L.  RJ45 Port  RJ45 Plug	All these three CAN ports can be connected through CAN ports to devices e.g. PCSs.
		CAN2H/ CAN2L/ CAN2G (CAN2)	CAN Port	
		CAN3H/ CAN3L/ CAN3G (CAN3)	CAN Port	

No.	Port	Silk-screen	Description and Function
3	RS485	A1B2~A6B6	All these six RS485 ports can be connected through RS485 ports to devices, e.g. air-conditions, energy meters, humidity-temperature sensors, air-cooled chiller, H2/CO concentration sensors, PCSs, dehumidifiers, etc.
4	RS232	RX6/TX6/GND6 RX/TX/232G	Two debug ports.
5	DI	DI1~16	Dry Contact, 16 Digital Inputs. Passive signal or active signal not higher than 5V. They can be used to monitor the signals such as fire-alarm, door open, UPS fault, PCS fault and etc. And every signal can be configured to any DI arbitrarily from DI1 to DI16. The default state can be configured also. Use the signals according to the specific system, referring to *section 2.2* for details of the DI signals.
6	DO	DO1~8	Dry Contact, 8 Isolated passive Digital Outputs, specification is DC 30V/2A, AC 240V/0.25A. They can be used to control the signals such as main shunt trip, LEDs, load relay, on-off grid relay and etc. And every signal can be configured to any DO arbitrarily from DO1 to DO8. Each DO port has three pins for NC, COM, NO, and can be used flexibly. Use the signals according to the specific system, referring to *section 2.3* for details of the DO signals.
7	USB	USB	USB2.0 port for device upgrade or data download using a U-disk.
8	Reset Switch Button	RESET	Press this button restart the system.
9	LED Indicators	PWR/RUN/ALM /FLT	See *Section 3.5.1.2* for detailed instructions.
10	9~36VDC input	DC 24V + -	Power supply for the device, external power supply of 9~36VDC. There are two power ports for backup.
11	Grounding Bolt		Grounding Protection

3.5.1.2 LED Indicators Instructions

LED Indicator	Silk-screen	Indication	Details
	PWR	Power LED	Green. LED indicator on indicates the device itself is Powered on. ● When the device is powered on, it will flash once per two seconds (0.5Hz). ● When the device is being upgraded or data-downloading, it will flash twice per second (2Hz).
	RUN	Run LED	Green. LED indicator on indicates the system is Running. ● When the device is running normally, it will be constant on. ***NOTE:*** DO NOT perform maintenance work when the system is running.
	ALM	Alarm LED	Yellow. LED indicator on indicates the system is in Alarm status. ● When the LED flashes once per two seconds (0.5Hz), it indicates a minor alarm. ● When the LED is constant on, it indicates a major alarm.
	FLT	Fault LED	Red. LED indicator on indicates the device is in Fault status. ● When the system has a critical issue, it will be constant on. And most power supply will be shutdown. ***NOTE:*** If this happens, the device needs check or repair prior to further work.

3.5.2 UPS

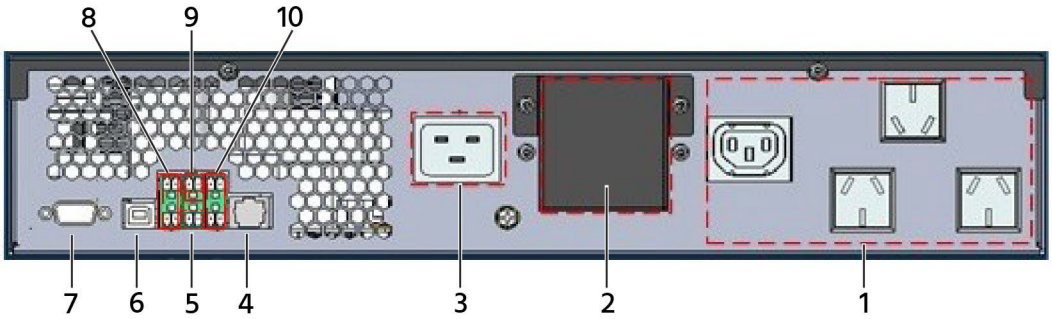
The electrical cabinet is equipped with an UPS to supply power for BMS, MBMS, ethernet switch, and other loads, so as to ensure that the system can still operate for a period of time in case of mains power failure.

3.5.2.1 Front Panel of the UPS

As shown in the following figure, the UPS front panel provides ventilation holes, operation and display panel, LED indicators and functional keys.

NO.	Description
1	Ventilation holes
2	Functional keys
3	Operation and display panel
4	LED indicators

3.5.2.2 Rear Panel of the UPS



NO.	Description	NO.	Description
1	Output outlet	6	USB port
2	Battery module port	7	Intellislot port (DB9)
3	Input outlet	8	Output dry contact port
4	Ethernet port	9	REPO (Remote Emergency Power Off) Port
5	Battery module number detection port	10	Input dry contact port

3.5.3 UPS Battery (US2000C)

Before normal operation, power cables of the UPS battery (US2000C) need to be connected in the following picture, connecting the orange cable to the orange terminal, and black cable to the black terminal.

Turn on the Power switch of US2000C. Press the “SW” button of US2000C for about 3 seconds, and observe the indicator light of the UPS host. If there is mains power, the indicator light is green, indicating normal startup.

When you need to shut down the UPS, turn off the Power switch of US2000C and observe the UPS LED light. If it is off, the UPS is shut down.

NOTE: For more detailed information of the UPS, please refer to the separate UPS manual.

3.6 Liquid Chiller

The system is equipped with a liquid chiller to control the temperature of the battery compartment.

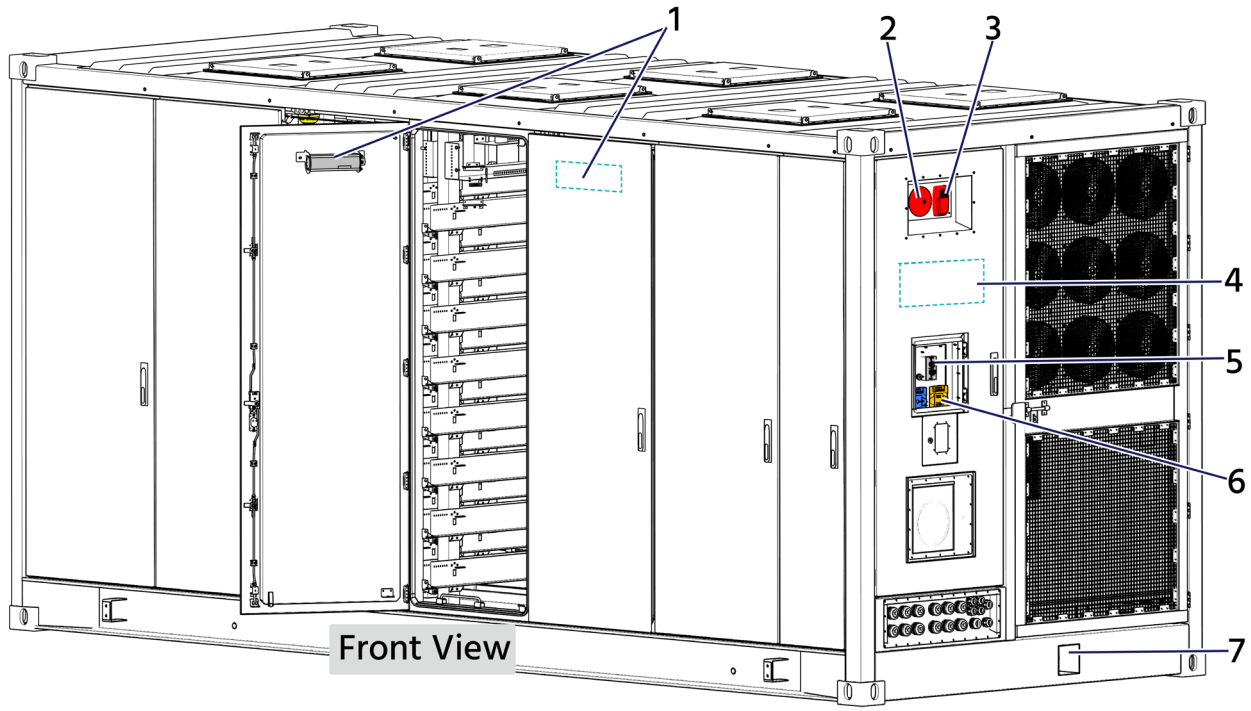
Item	Specification
Power supply	3/N/PE AC 400V±10% 50/60Hz
Maximum current (kW/A)	56.4
Standby power (W)	100
Self-circulation power (kW)	4.2
Communication protocol	RS485
Cooling capacity (kW)	57 (L45℃/W20℃); 52 (L45℃/W18℃)
Cooling power/current (kW/A)	32.2/50.4 (L45℃/W20℃); 32.5/50.8 (L45℃/W18℃)
Heating capacity (kW)	24
Heating power/current (kW/A)	28.2/41.4
Working mode	Automatic control mode, cooling mode, heating mode, standby mode, self-circulation mode
Liquid setting range (℃)	15～35
Refrigerant	R410A
Condensing air volume (m^3/h)	19800
Noise (dB(A))	＜ 85
Rated flow (L/min)	500
Rated differential pressure (kPa)	130
Max. Inlet/outlet differential pressure (kPa)	350
Liquid circuit system design pressure (Bar)	6
Inlet/outlet size	Φ63.5 chuck
Drainage/refilling size	DN15 internal thread
Tank capacity (L)	12
Ambient temperature range (℃)	-30～55
Anticorrosion grade	C3
Applicable altitude (m)	≤3000
Protection degree	IP55
Painting	RAL7035 Textured finish
Dimensions (mm)	1200 (W)×440(D)×2400 (H)
Weight (kg)	≤450
Coolant	Concentration ≤60% glycol solution

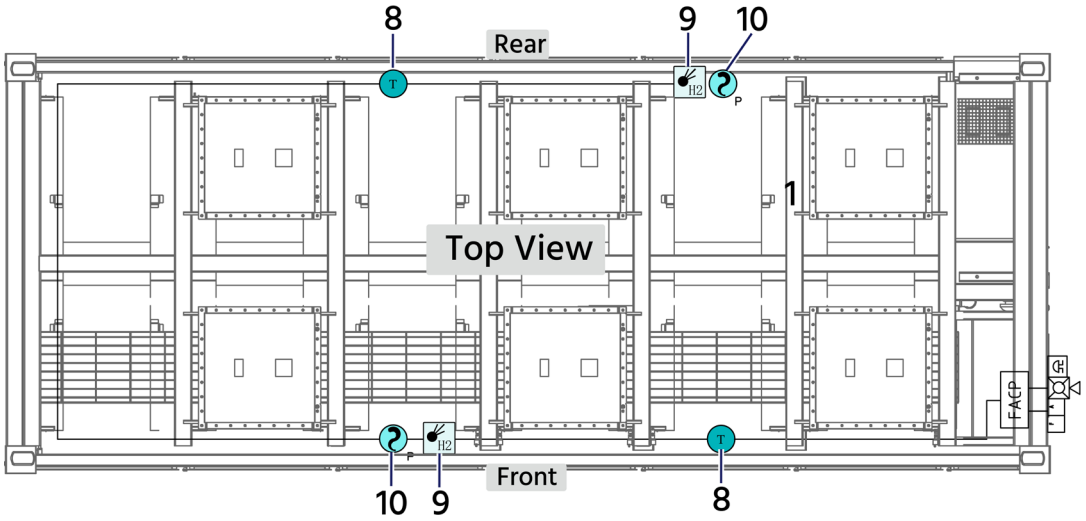
3.7 Safety Features

This system is equipped with safety features that include a fire protection system as well as explosion proof and vent systems.

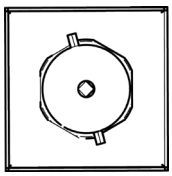
3.7.1 Fire Protection System

The fire protection system is mainly composed of fire alarm system and fire suppression system. The former consists of detectors, strobe sounder, fire bell, automatic extinguishing panel, etc. The latter consists of aerosol, water spray system, etc. Please see the following for details.



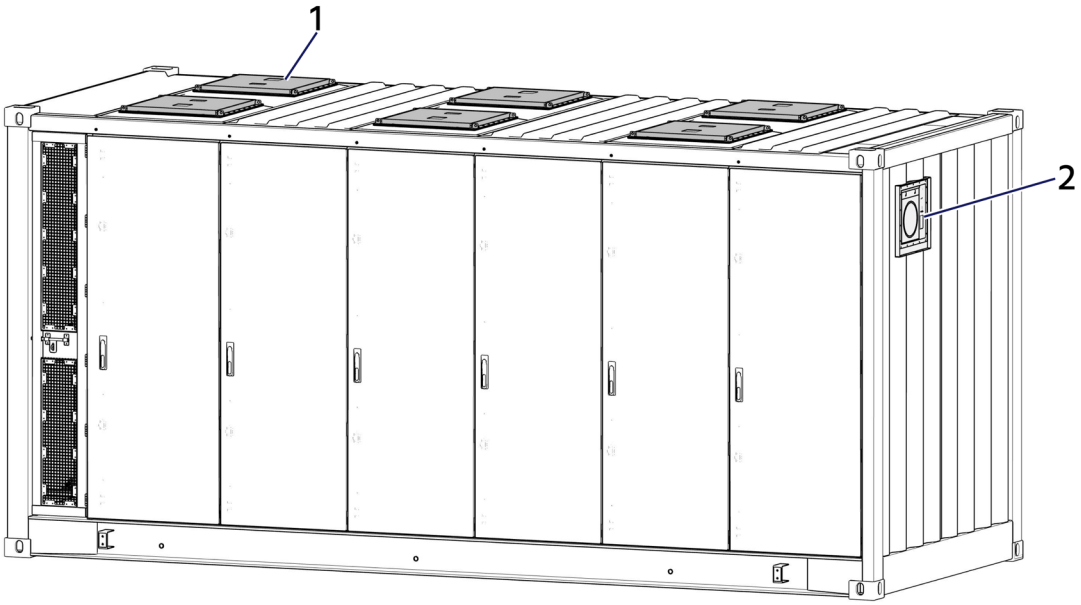


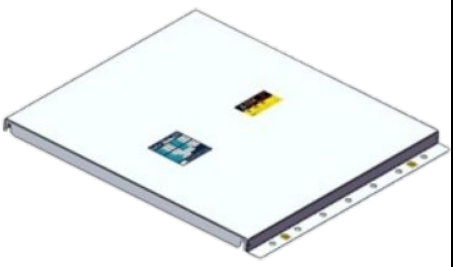
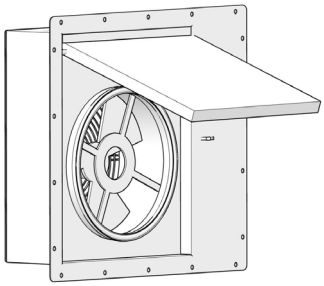
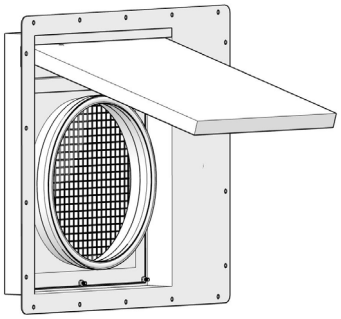
NOTE: See the next page of the descriptions of the figures.

No.	Description	Icon	Qty.
1	Aerosol		Totally 4 pcs (two on the front doors, the other two on the opposite doors of the rear)
2	Fire Bell		1 pc
3	Sounder Strobe		1 pc
4	Automatic extinguishing panel (on the inner side of the door)	Extinguishant release manual automatic switch 	1 pc
5	Emergency Startup/ Emergency Stop Switch		1 pc
6	Emergency stop/manual release button		1 pc Emergency stop button 1 pc Manual release button
7	Water suppression joint		1 (together with the spray headers and lines inside the container to compose the water 30spray system)
8	Heat detector		2 pcs
9	H2 detector		2 pcs
10	Smoke detector		2 pcs

3.7.2 Explosion proof and vent systems

The system is equipped with explosion proof and vent systems to ensure safety. Please see the following for details.



No.	Description	Icon	Qty.
1	Explosion vent panel (optional)		6 pcs
2	Exhaust fan (together with the venilation louver to compose the explosion proof system)		1 pc exhaust fan
			1 pc electric ventilation louver (on the opposite side)

4 Installation

4.1 Checking Before the Installation

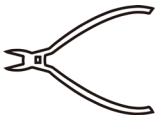
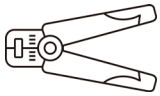
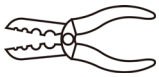
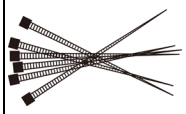
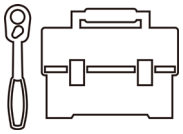
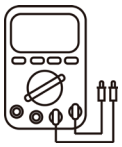
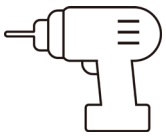
Checking the Outer Packing

After receiving the product, check the outer packing for damage, such as holes, cracks, deformation and so on. If any damage is found, contact us as soon as possible.

Checking Deliverables

After unpacking the product, check that the deliverables are complete. If any item is missing or damaged, contact us as soon as possible.

4.2 Preparing tools and instruments

<table>
<tr><th colspan="6">Tools</th></tr>
<tr><td> 
Wire Cutter</td><td> 
Crimping Modular Plier</td><td> 
Adjustable Wrench</td><td> 
Wire Stripper</td><td> 
Torque Wrench</td><td> 
Screwdriver</td></tr>
<tr><td> 
Cable Tie</td><td colspan="2"> 
Socket Wrench set</td><td> 
Electric Drill</td><td> 
1000VDC Multimeter</td><td> 
Electric Screwdriver</td></tr>
<tr><th colspan="6">PPE (Personal protective equipment)</th></tr>
<tr><td> 
Insulating Gloves</td><td> 
Anti-arc Flash Suit</td><td> 
Safety Shoes</td><td> 
Ear Protector</td><td> 
Safety Goggles</td><td> 
Anti-static Bracelets</td></tr>
</table>

NOTE: Use properly insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, cover the entire exposed metal surfaces with available insulated alternatives, except their tips, with electrical tape.

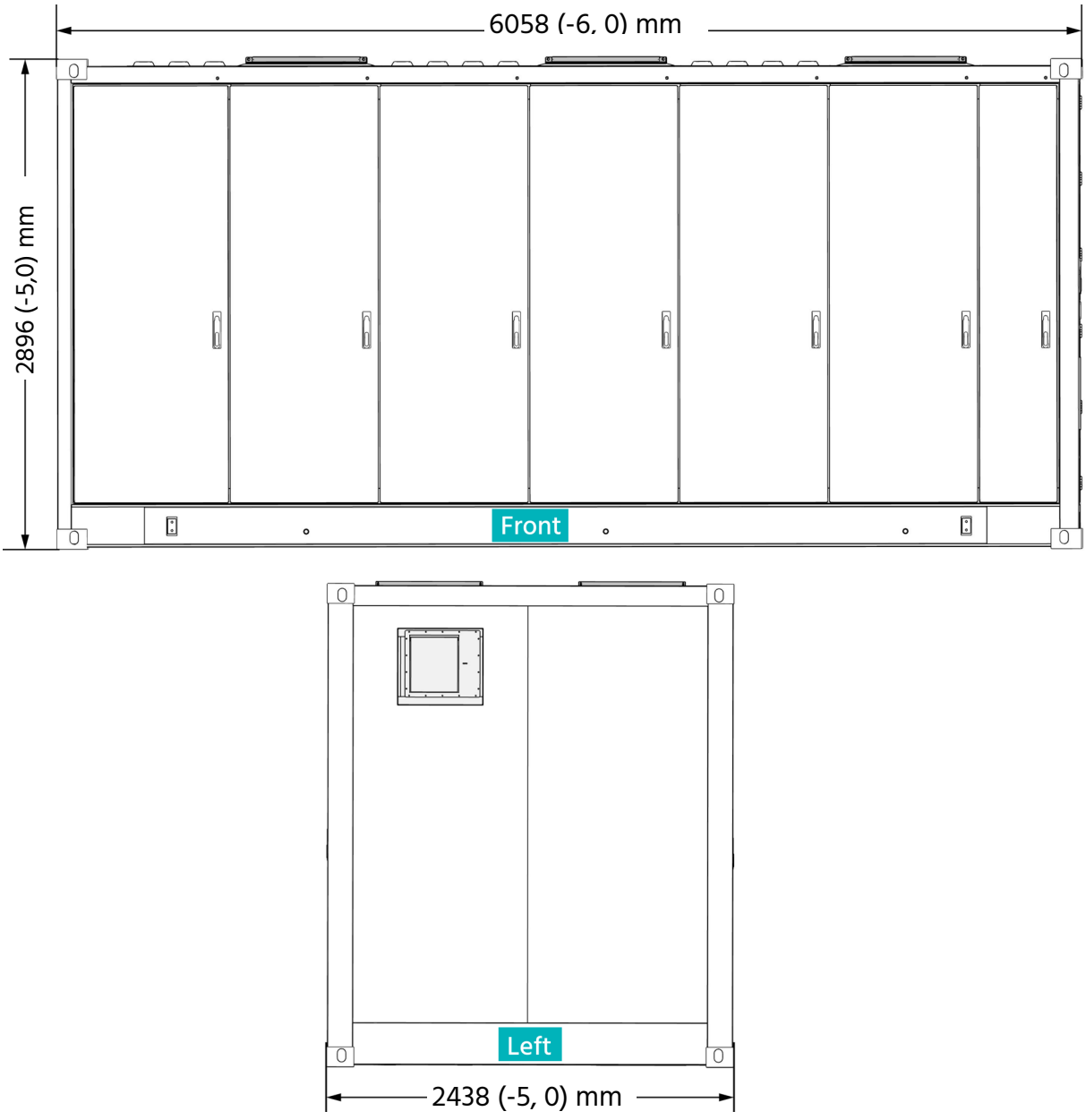
4.3 Installation Site Requirements

The installation site needs to meet the following requirements:

- The installation site should be able to bear the total weight of the whole container cabinet system (approx. 42 tons).
- The installation site should be concrete, flat, firm, safe and reliable.

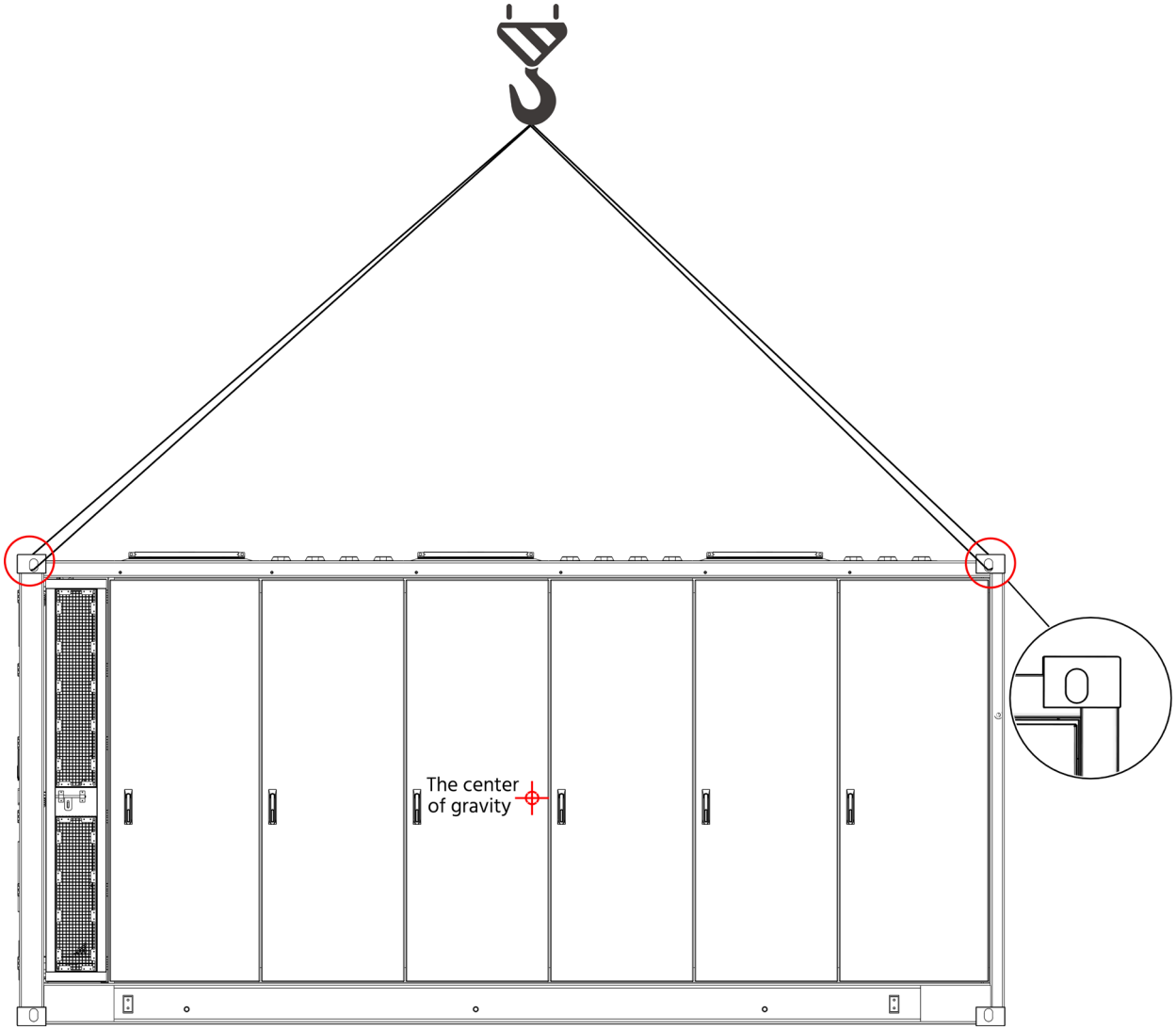
4.4 Installation Space Requirements

The external dimensions (W x H x D) of the storage system are 6058 (-6, 0) mm x 2896 (-5,0) mm x 2438 (-5, 0) mm.



4.5 Hoisting

The are four lifting points on the top four corners of the container, shown below. Please use cranes bearing weight more than 45 tons for lifting the container.



DANGER

There is danger during hoisting, please follow the requirements below.

- During the whole process of lifting the equipment, all safety operation standards and specifications of the country where the project is located shall be strictly observed.
- DO NOT stand within 10 meters of the operation area, especially under the lifting arm during lifting or moving, to avoid casualties.
- In case of bad weather conditions, such as heavy rain, fog, strong wind, etc., the lifting work should be stopped.
- Please refer to the lifting points and the center of gravity for hoisting.

NOTE:

- The lifting acceleration should be less than 1.4G and the duration should be less than 1.2G.
- During the hoisting operation, there should be professionals on site to command the whole process.
- The strength of the sling used should at least meet the lifting requirements of the equipment weight.
- Ensure that all sling connections are safe and reliable.
- The length of the sling can be adjusted according to the actual requirements on site.
- Make sure that the equipment is stable and free from deflection during the whole lifting process.
- Please use the supporting spreader to lift the equipment.
- Take all necessary auxiliary measures to ensure the safe and smooth lifting of the equipment.
- The lifting weight of crane and wire rope under load shall meet the weight of this product.
- When lifting, protect the surface of the box to avoid paint scratches.

5 Electrical and Communication Wiring

DANGER

This system is a high voltage DC system, operated by qualified and authorized person only.

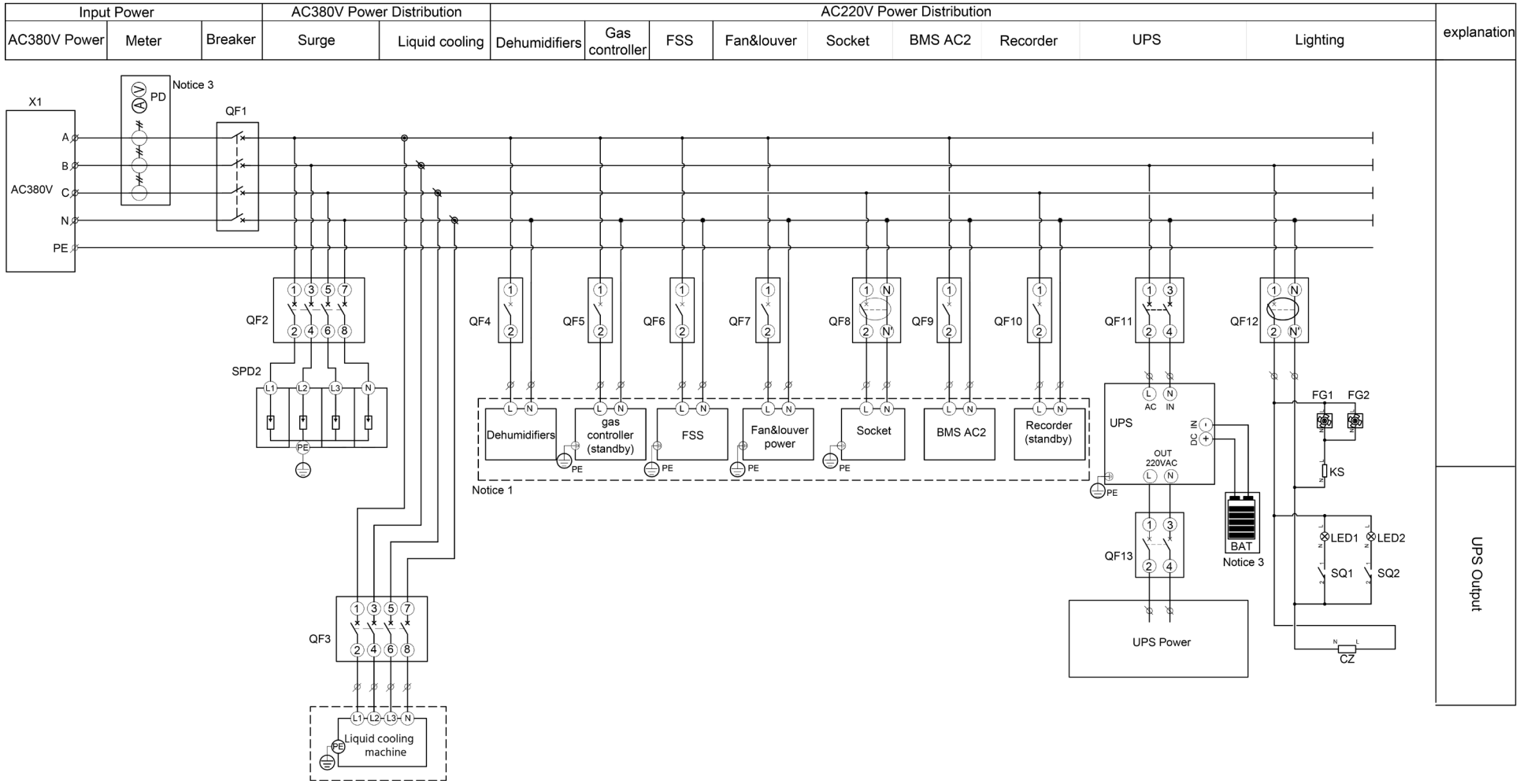
DANGER

When wiring the cables, ensure that the energy storage system DC side and AC side are all disconnected.

DANGER

Whenever operating the system, wear suitable personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles.

5.1 System Diagram



5.2 Cable Requirements and Bolt Torque

- **Cable Requirements**

The wire diameter of the cables used in the outdoor cabinet must be selected in accordance with the maximum current of the AC side and DC side, and there must be a residual reservation.
Please follow the cable specifications below.

Cable	Wire Diameter Requirements	Terminal Model
AC Side Phase A	As the wires' diameters are related to the lengths of the wires, please refer to the separate PCS manual for details.	
AC side phase B		
AC side phase C		
AC side N phase		
Auxiliary Power cables	4x16 mm^2	SC16-8
Ground PE-Cable	16 mm^2	SC16-8
Ground PE - galvanized flat iron	4x 30 mm	/
External Ethernet communication cable	Ultra Category 5 shielded cable	RJ45
External RS485 cable	Twisted shielded cable ≥ 1,5 mm2	E1510

- **Bolt Torque**

When fixing electrical cables, make sure that the cable terminals are completely tightened with the copper bars or terminal blocks to avoid heating or even fire of the cables caused by poor contact, and the following torque requirements should be met when the cables are connected:

Screw Size	M3	M4	M5	M6	M8	M10	M12	M16
Torque (N•m)	0.9	2	4	7	17	35	55	119.5

5.3 Grounding

DANGER

Life-threatening electric shock may occur if the grounding is insufficient or absent. Before battery installation, make sure that the grounding points of the container are stable and reliable.

The system has four grounding points, as shown in the figure below.

- Before hoisting, the grounding grid should be laid. Connect the furthest two points for grounding connection.
- The grounding resistance is determined to be less than 4Ω and the grounding cable should be crimped.
- The grounding bar shall be solid polished copper or metal bar, with tinned or nickel plating, the grounding depth shall be >=2 meters inside the earth.

5.4 DC Side Wiring

During transportation, each battery module in each string is disconnected. The cables need to be connected when they arrive at the site. Please refer to *section 5.4.1* for wiring diagram of the battery strings.

The cables from the battery control modules to the DC confluence copper bars in the communication and confluence cabinet have been installed at the factory. Please check the installation status of the cables when they arrive at the site, and use a multimeter to check the cable connection.

DANGER

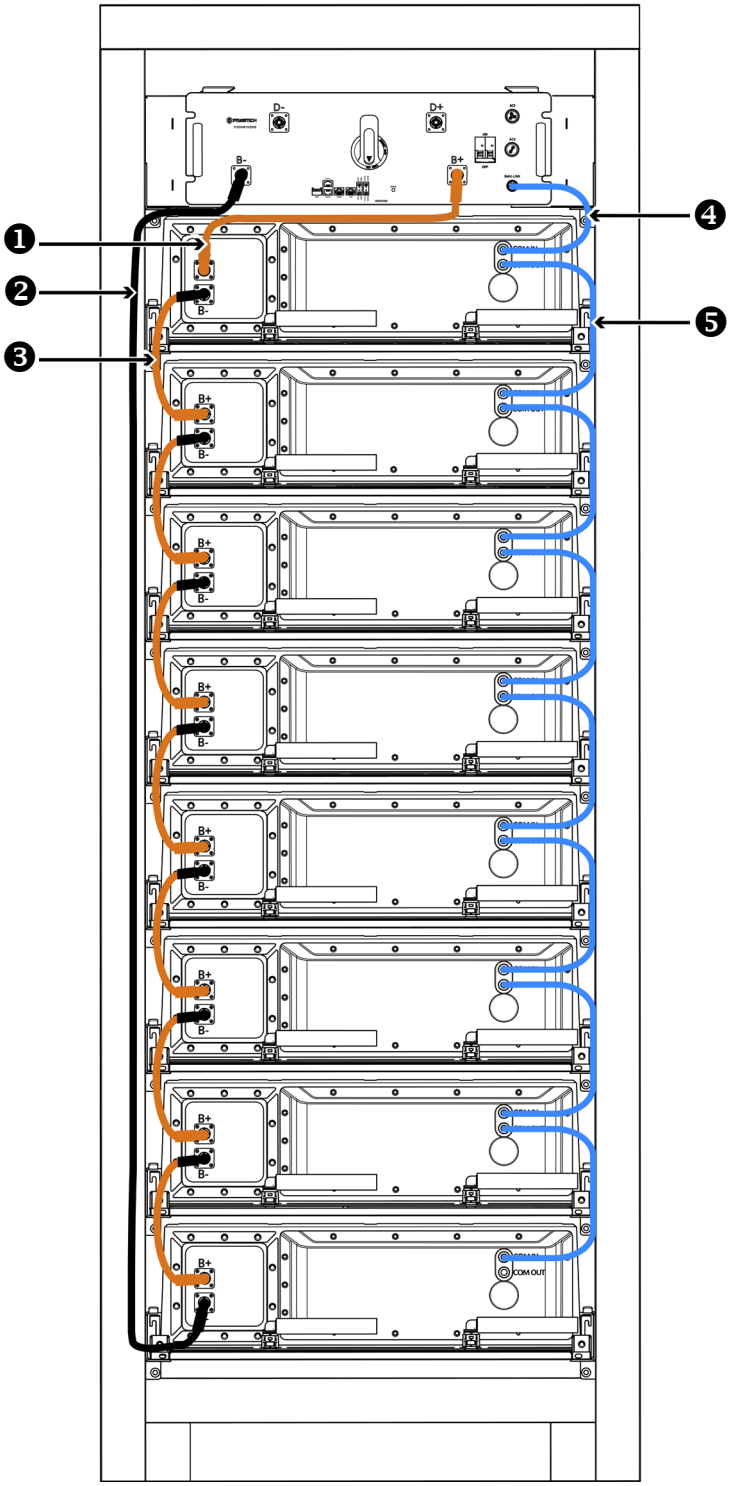
Do not connect the positive and negative reversely.

(1) Connect the positive and negative electrodes of the battery modules in series.

(2) Connect the internal and external communication cables of the battery string

5.4.1 Wiring of Single Battery String System

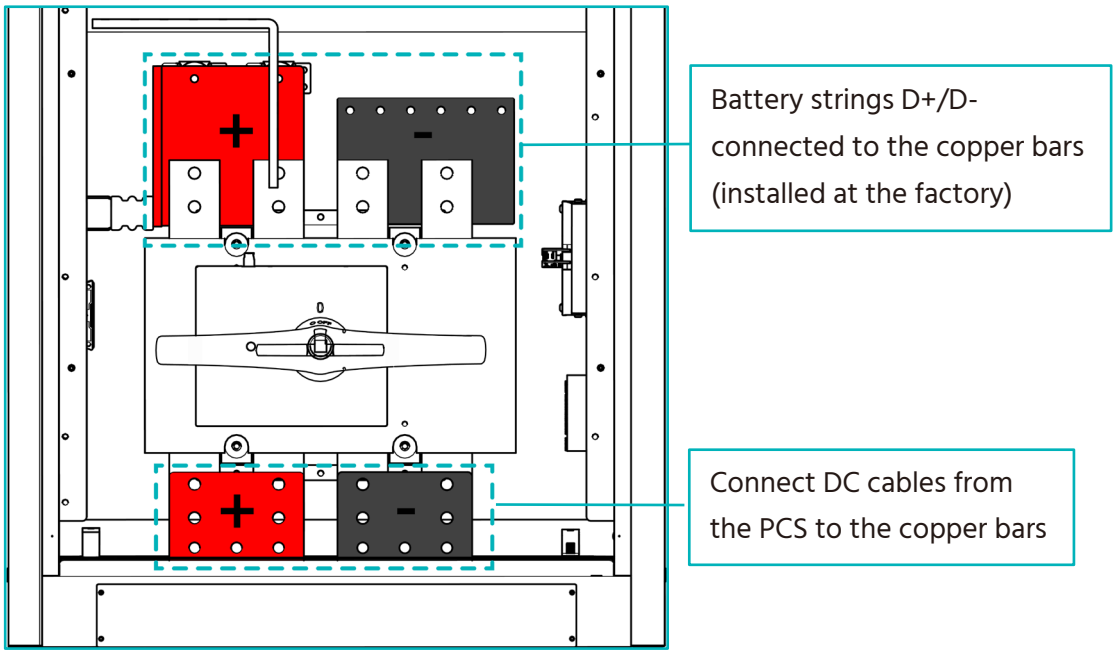
There are 12 battery strings in the container. For single battery strings' system, the cable connection should be done according to the drawing below.



❶	Power Cable, Orange (BMS 'B+' to Battery Module 'B-')
❷	Power Cable, Black (BMS 'B-' to Battery Module 'B-'_
❸	Power Cable, Orange (BMS 'B+' to Battery Module 'B-')
❹	Communication Cable (Battery module cascade communication connection)
❺	Communication Cable (battery module and BMS connection)

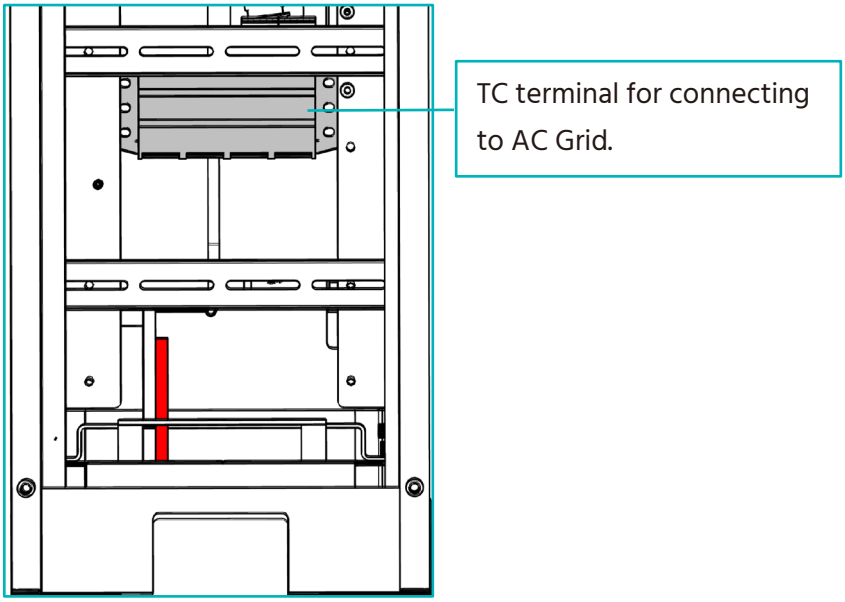
5.4.2 Cables from the DC confluence copper bars

The DC confluence copper bars are in the communication and confluence cabinet, shown below. Connect the DC side cables from the PCS (provided by the customer) to the copper bars (positive to positive, negative to negative).



5.5 AC Side Wiring

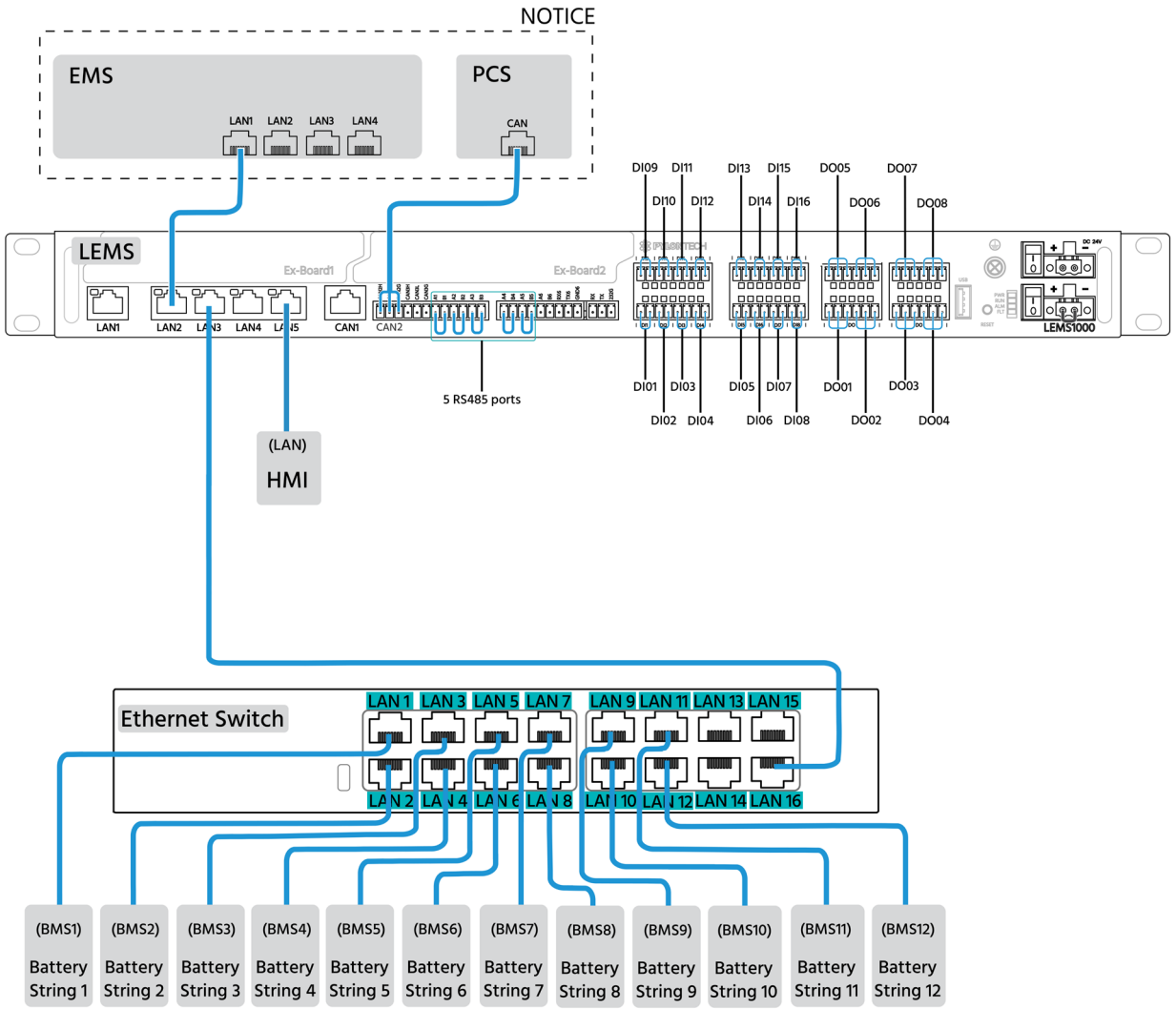
Connect the cables from the AC grid to the TC terminal in the communication and confluence cabinet. According to the labeling, connect the cables of each phase sequence in turn and three opposite sequences are not allowed.



NOTE: Ensure that all connections are correct, and there is no overlap and no stress between the wires and sheet metal.

5.6 Communication Wiring

- Check the wiring according to the diagram below, and connect with CAN, 485 and dry contact of PCS during system installation.
- Check the wiring with reference to the diagram below, and connect with LAN0 and 485 with EMS during system installation.



NOTICE: EMS and PCS are not included in the container system.

6 Commissioning

6.1 Fire Protection System Prerequisites

> **⚠ WARNING**
>
> Before system commissioning, ensure to set the Automatic extinguishing panel (on the inner side of the door) to Manual mode for safety.

The operation position is shown in the following figure.

Press the extinguishant release button under the yellow cover for manually suppressing fire.

Turn this key for setting to Manual mode.

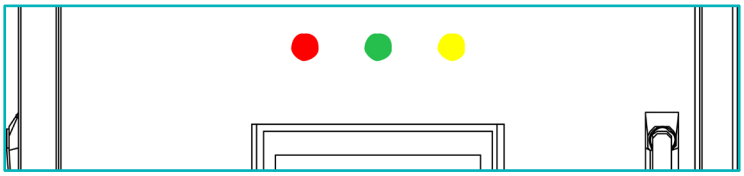
> **⚠ WARNING**
>
> If a fire occurs during the installation or commissioning of the system, please manually open the yellow device shown above to press the Extinguishant Release button or press the manual release button. If there is no fire, DO NOT touch the Extinguishant Release button to prevent equipment damage.

Press the extinguishant release button for manually suppressing fire.

1. Open all the doors and check all the detectors without plastic packaging.
2. Check whether all detectors are in good condition.

6.2 System Status

The container system status (Run 🟢 , Alarm 🟡, Fault 🔴) can be viewed through the Status LED on the door of the communication and confluence cabinet.



6.2.1 Battery String Status

The battery string status can be viewed through the "STATUS "LED on the BMS of the battery string. Following are the details:

"STATUS" LED: shows the status of battery module (Normal 🟢, Fault 🔴).

Table of LED Indicators Instructions

Battery Status	Normal/ Fault	STATUS (green)	STATUS (red)	Descriptions
		🟢	🔴	
Shut Down	/	Off	Blink 1* (slow flashing)	Indicates the battery modules in the battery system are shutdown. And the BMS is still power on.
Initialization	Normal	Blink 2* (slow flashing)	Off	Indicates the battery system is initializing.
Sleep	Normal	Blink 2* (slow flashing)	Off	Indicates Sleep Mode, to save battery power.
Idle	Normal	Light	Off	Indicates Idle Mode, to save battery power.
Standby	Normal	Light	Off	Indicates Standby Mode.
Charge	Normal	Light	Off	Indicates the battery system is charging.
Discharge	Normal	Blink 2* (slow flashing)	Off	Indicates the battery system is discharging.
Fault	Fault	Off	Blink 3* (fast flashing)	Indicates the battery system has a fault.

***** The LED Blink instructions:

Blink 1 - 0.3 seconds light / 3.7 seconds off.

Blink 2 - 0.5 seconds light / 0.5 seconds off.

Blink 3- 0.1 seconds light / 0.1 seconds off.

6.3 System Turning On

⚠ WARNING

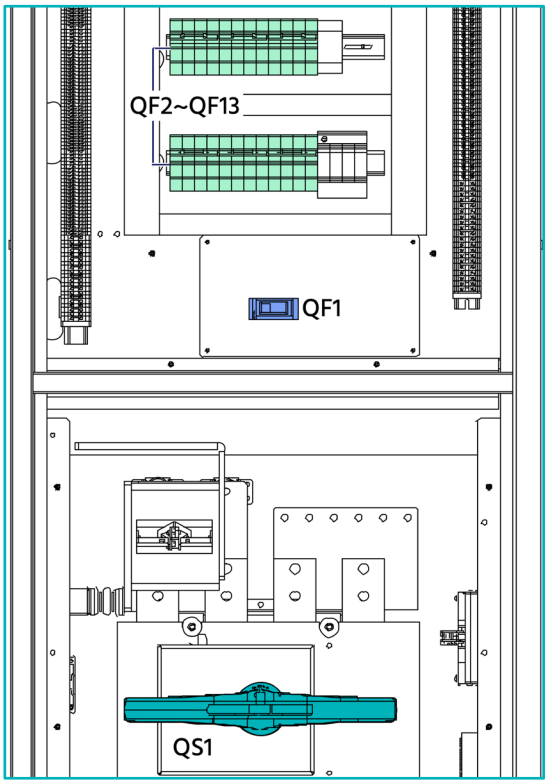
Ensure that the voltage of the inverter/PCS matches the voltage of the battery system. Check that all the power switches are OFF.

⚠ WARNING

The external switch or breaker between PCS and battery string must be off before the battery system power on.

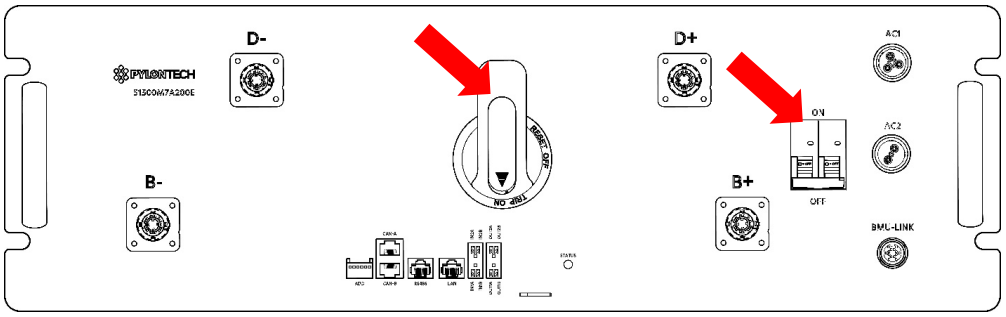
Procedure

1. Turn on the main circuit breaker “QF1” in the cabinet.
2. Turn on circuit breaker “QF2” of SPD.
3. Turn on circuit breaker “QF3” of the liquid chiller and the liquid chiller starts up.
4. Turn on circuit breaker “QF4” of the dehumidifier and the dehumidifier starts up.
5. Turn on circuit breaker “QF5” of the gas controller.
6. Turn on circuit breaker “QF6” of the fire protection device.
7. Turn on circuit breaker “QF7” of the explosion proof system.
8. Turn on circuit breaker “QF8” of the overhaul socket and QF9 of the battery strings’ shunt trip.
9. Turn on circuit breaker “QF10” of the recorder overhaul socket and QF9 of the battery strings’ shunt trip.



10. Turn on circuit breaker “QF11” of the UPS power input. recorder overhaul socket and QF9 of the battery strings’ shunt trip. Use  or  move the cursor, press the “Enter”  key to select "Yes", then the running indicator (green) flashes, and then the running indicator is solid on.
11. Turn on circuit breaker “QF13” of the UPS power output. And the battery strings’ BMs are power on.
12. Turn on circuit breaker “QF12” of the lightening facility in the container.
13. Turn on the isolating switch QS1 (main DC switch of battery strings).
14. Switch on all the BMSs (Battery Control Modules) from BMS1 to BMS12 one by one as following steps.

    (1) Turn on the circuit breaker and the micro circuit breaker of the BMS.



    (2) Repeat the above steps to turn on the BMS2 to BMS12.

NOTE: The second BMS must be operated after the first battery string’s self-check succeeds, which should be done within 30 seconds.

⚠ WARNING

If there is any failure during the self-check, be sure to debug the failure prior to next step.

NOTE: External device (PCS, EMS, etc.) should communicate with BESS through LAN, CAN or RS485. Otherwise the battery system will work abnormally.

⚠ CAUTION

When the EMS (outside the container) monitors the bus voltage of the DC side of the PCS and the DC side of the battery, the PCS can be powered down. The power increases step by step, and the main circuit side starts charging and discharging.

⚠ CAUTION

The whole Battery Energy Storage System (BESS) should be charged to full at first before commercial operation, or after it is left unused for a long time.

15. Now the whole turning on process of the container is completed, the HMI display on the communication and confluence cabinet is lit up.

7 Maintenance

⚠ DANGER

This system is a high voltage DC system, operated by qualified and authorized person only.

⚠ WARNING

Do not turn off the circuit breakers of the BMSs (battery control modules) during normal running status (unless emergency situation). Otherwise it will cause current surge to the rest of the battery strings. Be sure to turn off the PCS first prior to turning off the BMSs in normal running condition.

⚠ CAUTION

The UPS can be powered on if there exists any equipment that needs working without power outage. Otherwise the UPS should be turned off to save its power.

⚠ CAUTION

Before changing the battery module for service, be sure to charge/discharge the new battery at the same open circuit voltage as the other ones in the battery module system. Otherwise the system needs a long time to do balance for this new battery module.

NOTE: Before maintenance or long-term storage, ensure to turn the system off.

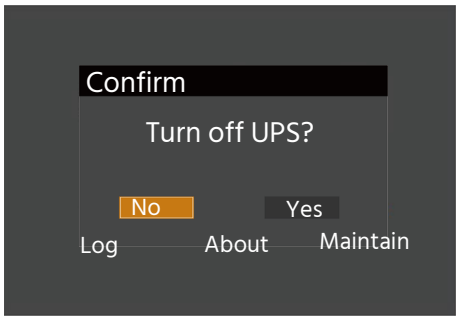
7.1 System Turning Off

Procedure

1. Disconnect the AC switch and DC of the PCS to ensure no current flows through the battery string.
2. Check that PCS power decreases to 0. And disconnect the isolating switch QS1 in the communication and confluence cabinet.
3. Turn off circuit breakers QF12 and QF11 in the cabinet.
4. Turn off the UPS as following:

   (1) Long press the power button ⏻ on the front panel of the UPS.

(2) Click “Yes” to confirm “Turn off UPS” on the display panel. After a while, the UPS shuts down.



5. Turn off the circuit breaker QF13 of the UPS power output.
6. Turn off the circuit breaker and micro circuit breaker one by one from BMS1 to BMS12.
7. Turn off the circuit breakers QF10, QF9, QF8, QF7, QF6, QF5, QF4, QF3 QF2 and QF1 one by one in the cabinet.
8. Now the whole system is turned off.

7.2 Routine Maintenance

Due to the influence of ambient temperature, humidity, dust, vibration, etc., the internal components of the system or equipment will be aged or worn, which will lead to the potential failure of the system or equipment. Therefore, it is necessary to carry out routine and regular maintenance on the system to ensure its normal operation and service life.

⚠ WARNING

Only qualified and authorized personnel can maintain the system. During maintenance, do not leave screws, washers, tools and other metal parts inside the equipment, otherwise the equipment may be damaged.

⚠ WARNING

After the system is out of operation, you must wait at least 10 minutes before carrying out maintenance or overhaul operations on the system. After the system is shut down, pay attention to:

- Ensure that the system is not accidentally re powered on.
- Use a multi-meter or a stylus to check to ensure that the system is completely dead.
- The possible live parts adjacent to the operating part shall be covered with insulating cloth.
- During the whole process of maintenance and overhaul, it is necessary to ensure that the escape routes are completely unblocked.

NOTE: Before maintenance, be sure to Set the fire protection to **Manual Only**. See *section 6.1* for details.

Routine maintenance table

The regular maintenance plan is formulated according to different equipment. Please refer to the following table and the recommended cycle for maintenance:

Project	Standard	Frequency
Battery string hardware	Whether the LED light on the main control box displays normally.	half a year
	Whether the relay inside the main control box can be disconnected normally.	half a year
	Whether the LED on the battery pack displays normally.	half a year
	Check that if there is abnormal sound or abnormal operation of the battery string fan.	half a year
Container	Check that if there are signs of aging and burning at the wiring bolts of the battery and the electric cabinet, and shake them by hand to make sure that they are in a tight state.	one year
	Check the power cable and control cable for signs of broken skin. If there are any signs, it is necessary to add corresponding insulation measures or replace cables.	one year
	Check the connector for looseness, serious rust or oxidation on the terminal surface, and good contact.	one year
	Check that if the grounding point is loose.	one year

Firefighting maintenance items and frequency

Project	Standard	Method	Frequency
Firefighting system	Fire protection system linkage testing.	Conduct fire system linkage testing.	one year
	Bleed indicator light.	Pull up pressure switch reset button.	one year
	Smoke and temperature detectors, alarm bells.	Use a fire test smoke temperature gun. If the smoke does not exceed the preset alarm value, the indicator light flashes once every 6 seconds; If the smoke exceeds the preset alarm value, stable indicator light on, fire extinguishing controller generates an alarm and triggers an alarm bell.	one year
	Audible and visual alarm.	Press the manual release button on the control panel.	one year
	UPS on the control board.	Disconnect the power input from the control panel and allow the rear battery to power the control panel.	one year

7.3 Battery Maintenance

DANGER

The power must be turned off prior to any maintenance of the battery.

Voltage Inspection

Check the voltage of battery system through the monitor system. Check if the system is abnormal voltage. For example: Single cell's voltage is abnormally high or low.

SOC Inspection

Check the SOC of battery system through the monitor system. Check if the battery string is abnormal SOC.

Cable Inspection

Visual inspect all the cables of battery system. Check if the cables are broken, aging, or getting loose.

Balancing

The battery strings will become unbalanced if not fully charged for a long time. The balancing maintenance (full charged) should be done every 3 months and is usually done automatically by communication between the system and external device.

Output Relay Inspection

Under low load condition (low current), switch the output relay to OFF and ON to hear the clicking sound, which means this relay can be turned off and on normally.

History Inspection

Analyze the historical records to check if there is an accident (alarm and protection) and analyze the reasons.

Environment Inspection

Check the installation environment such as dust, water, insect etc.

7.4 Liquid Chiller Maintenance

Please refer to the separate Liquid Chiller product manual for maintenance information.

8 Trouble Shooting

The common faults and solutions during the commissioning of the energy storage system are shown in the following sections. If the problems cannot be solved according to this manual, please contact us. We need the following to help you better.

- Machine serial number, production date and software version
- Manufacturer, model and configuration information of the equipment
- Simple fault description
- Failure site photos

8.1 System Troubleshooting

Local monitoring checks the fault trigger location, which is divided into battery string fault, fire fault and air conditioning fault.

8.2 Battery String Failure

- Use a 232 to USB device to connect to the on-site PC, and at the same time, contact the after-sales engineer of Pylontech to obtain the CRT software and install the software.
- Connect RJ45 port to the 232 debugging port of the corresponding fault master, and connect USB port to the PC end of the computer. Open the control panel to read the port number, and select the port number of the software as the corresponding serial port.
- Connect the computer to WIFI or network and install sunflower remote software, opening the Battery view debug APP.
- Contact the dispatched after-sales engineer for troubleshooting.

8.3 Fire Fighting Failure

No.	Fault	Checking method
1	Power Failure	There is no 230V AC power supply, and the system operates using backup batteries. If there is no power outage, or check the electrical fuse inside the panel.
2	Battery failure	Check if the two batteries are connected and connected together, Test the battery. Disconnect the battery and ensure that 28 volts can be measured on the battery charger lead.

No.	Fault	Checking method
3	Auxiliary 24V fault	The LED light indicates that the fuse protecting the R0V output has been activated and exceeds the rated value of the output.
4	Communication fault	Communication interruption between relay panels or accessory boards. Check all communication faults between repeaters and auxiliary boards to determine the root cause of the problem.
5	Manual release fault	Manual release switch input short circuit or open circuit. Remove the wiring and reinstall the end of the line. Check the wiring of the manual release circuit.
6	Release fault	Release switch input short circuit or open circuit. Remove the line and reinstall the end of the line. Check the wiring of the release pressure switch circuit.

If other faults occur, please contact the supplier.

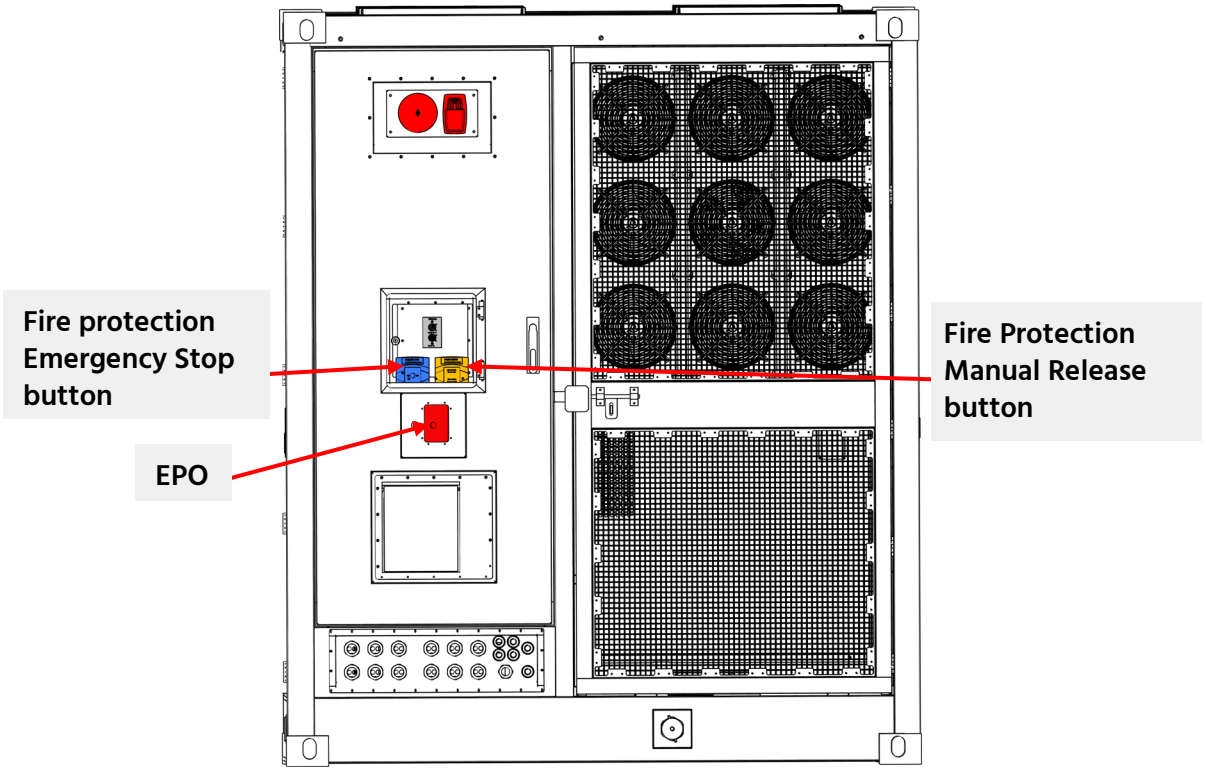
8.4 Liquid Cooler Failure

Please refer to the *Liquid Cooler Product Manual* for the liquid cooler troubleshooting.

8.5 Emergency Disposal

8.5.1 EPO

In case of fire or any situation beyond the control of anyone, please immediately tap the EPO (emergency stop button) to stop the system. DO NOT touch the EPO during normal operation. To restore the system, firstly rotate the EPO button in the operating direction on the panel to make the button pop up, and then power on the system according to the power on steps.



8.5.2 Fire protection emergency stop and manual release

> **⚠ WARNING**
>
> DO NOT operate the fire-fighting equipment when the system is free of fire, which may cause the system to fail to operate normally later.

In the event of fire, the fire protection system will spray automatically. If the fire protection system does not act, please operate the fire protection manual release button for active fire protection.

If any misoperation triggers the fire protection system to start, press the fire protection Emergency Stop button, seeing the figure above.

Annex: Cause and Effect Matrix for ESS Container Products

Information Version: V1.0

System Output / System Input	Notification			Action					Output signal			
	Bell Alarm	Horn Strobe Alarm	Gas Release Indicator LED Action	Agent Release Count-down Starts	Agent Release Count-down Pauses	Agent Release Count-Down ends	Ventilation Operation	Ventilation Shutdown	Fire Alarm	Agent Release Signal	General Fault	Gas Detector Signal
Description	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**k**	**L**
Smoke detector alarm x 1	√								√			
Heat detector alarm x 1	√								√			
Smoke detector alarm x 2	√								√			
Heat detector alarm x 2	√								√			
Smoke and heat detector alarm	√	√	√	√		√		√	√	√		
Manual pull station action	√	√	√	√		√		√	√	√		
Pressing and holding abort station button					√							
Any fault of fire control panel											√	
H2 detector action							√					√

NOTE: See the table as follows for detailed instructions.

Instructions of the System Output Items (A~L)

Item	Instructions
A	Bell releasing alarm indicates a potential fire hazard.
B	Horn strobe releasing alarm indicates that fire extinguishing agents are to be released.
C	Gas release indicator LED lighting indicates not entering the space where fire extinguishing agents are to be released.
D	The countdown of agent releasing starts, and countdown period can be adjusted from 0 to 30 seconds.
E	The countdown of agent releasing is paused at 30 seconds by pressing and holding the abort station button.
F	The countdown of releasing agent has ended, and the agent has been released into the container.
G	The explosion-proof ventilation device operates to reduce the amount of combustible gas in the container to a safe range.
H	Before agent releasing, turn off the ventilation device to prevent the agent from leaking.
I ~L	Output dry contact signals of external device and host.

Pylon Technologies Co., Ltd.

No.300, Miaoqiao Road, Kangqiao Town

Pudong New Area, Shanghai 201315, China

T +86-21-51317699 | **F** +86-21-51317698

E service@pylontech.com.cn

W www.pylontech.com.cn