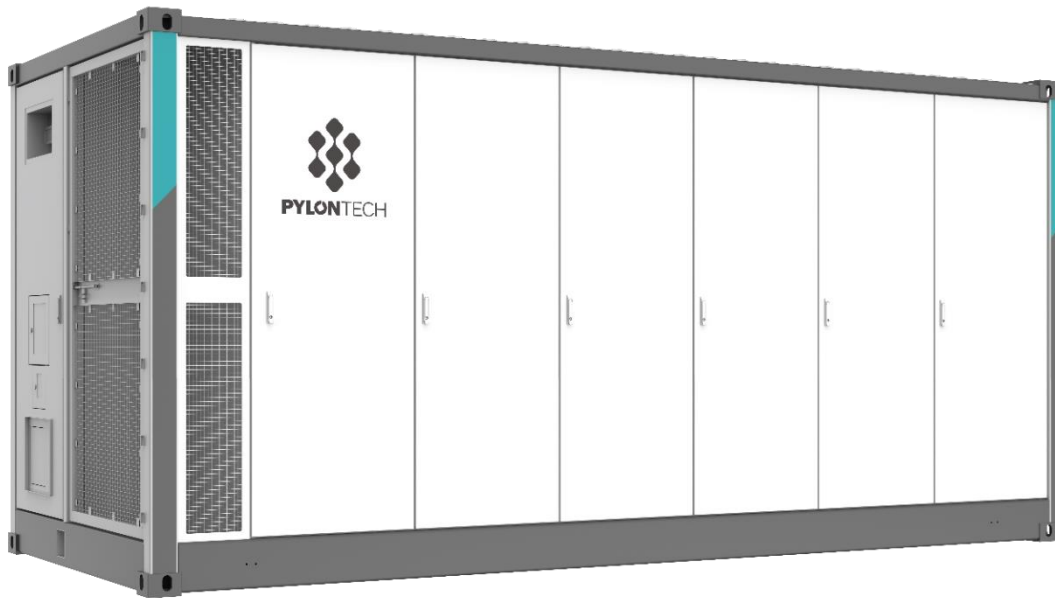




# **Container-L5000-BAT Lithium Iron Phosphate Battery Energy Storage System Operation Manual**

Information Version: 1.0

5PMPA08-00XXX

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# 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.

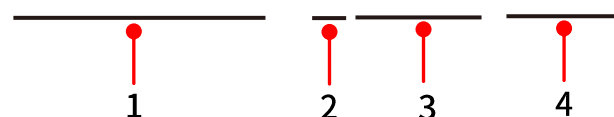
Please read this manual before installing the system and follow the instructions carefully during installation. In case of any confusion, please contact Pylontech immediately for advice and clarification (Contact information can be found on the back cover of the manual).

## 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

### Container -L5000-BAT



| 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

# PowerCube-20H-M7A200Cx.xxx-EU-yy



| 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<br>(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<br>(Where yy=01, 02, 03, 04 or 05, in step of 01)      | 01: Explosion vent panel<br>02: Explosion vent panel + Sprinkler system<br>03: Explosion proof system<br>04: Explosion proof system + Sprinkler system<br>05: Explosion vent panel + Explosion proof system + Sprinkler system |

## 1.5 Symbols Explanation

| Symbol                                                                                          | Description                                                                                                                    |
|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|              | <b>Danger:</b> Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.     |
|              | <b>Warning:</b> Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury. |
|              | <b>Caution:</b> Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.   |
|  <b>NOTE</b> | <b>Note:</b> 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                  |
| LEMS         | Local Energy 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 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.

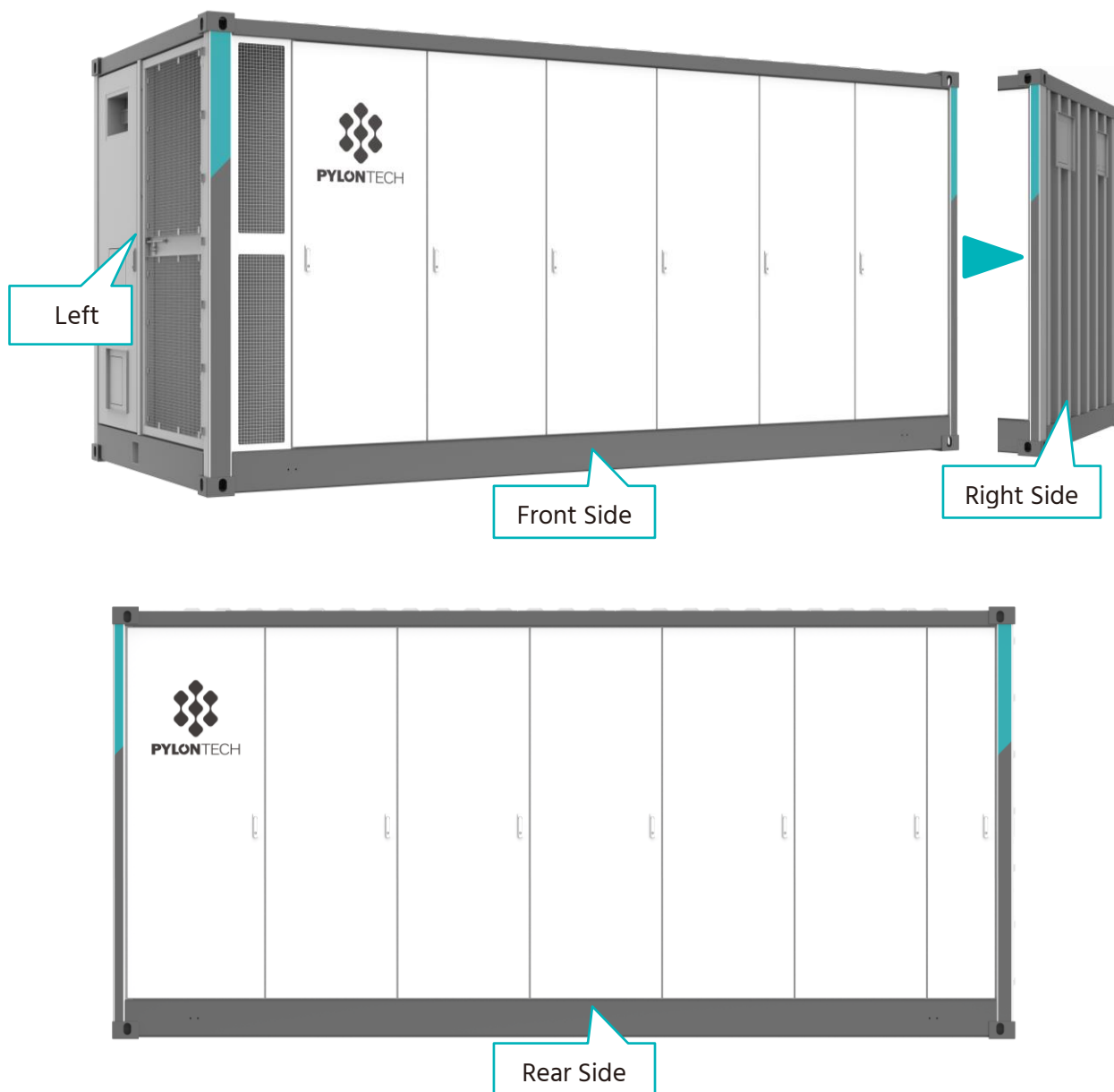
Take all necessary auxiliary measures to ensure the safety of personnel and equipment. Matters needing attention in the use of this manual:

- 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.

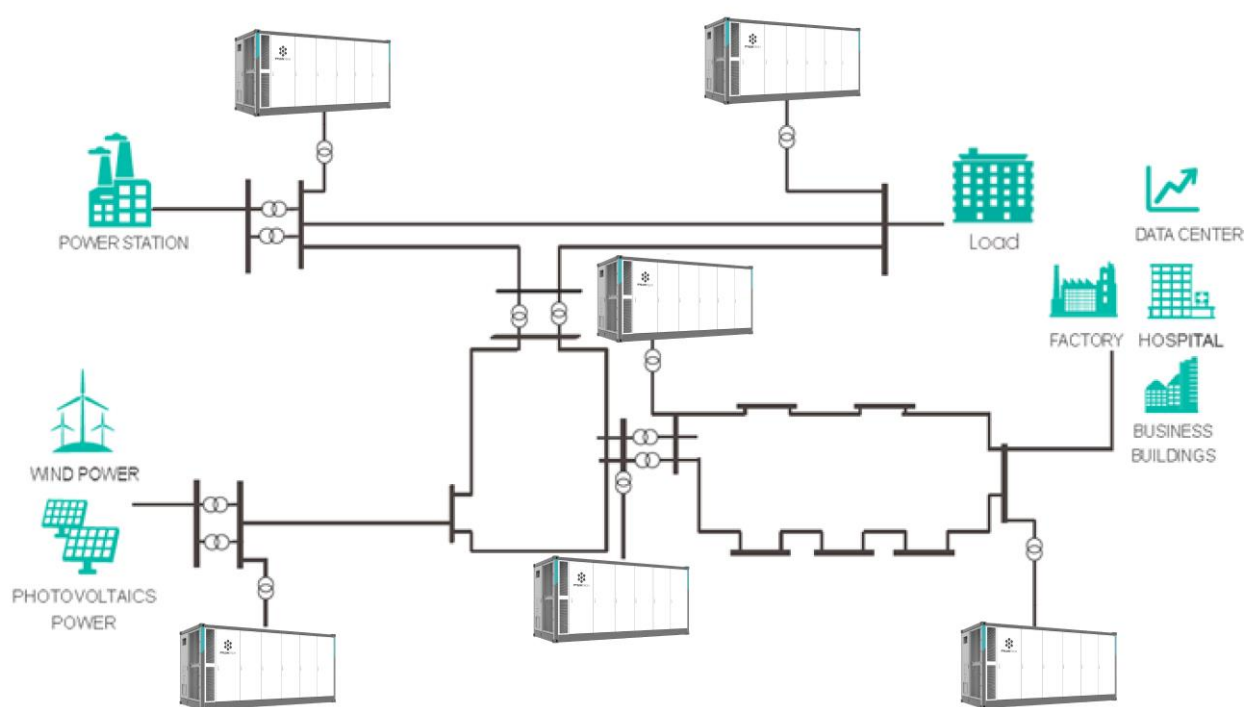


 **NOTE:** The above pictures are for reference only, the appearance of the product is subject to the actual delivery.

### 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 (*)                                                                                                                                                                                                                                                                                    |
|-----------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>System Parameters</b>          | 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)<br>01: Explosion vent panel<br>02: Explosion vent panel + Sprinkler system<br>03: Explosion proof system<br>04: Explosion proof system + Sprinkler system<br>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                                                                                                                                                                                                                                                                                                                  |
| <b>Auxiliary Power Parameters</b> | Power Input Voltage (VAC)        | 380                                                                                                                                                                                                                                                                                                                     |
|                                   | Maximum Current (A)              | 100                                                                                                                                                                                                                                                                                                                     |
|                                   | Rated Frequency (Hz)             | 50/60                                                                                                                                                                                                                                                                                                                   |
|                                   | Wiring Method                    | 3P4W                                                                                                                                                                                                                                                                                                                    |
| <b>DC side Parameters</b>         | 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<br>EN IEC 61000-6-4:2019 |

### 3.2.2 Battery Related Standards

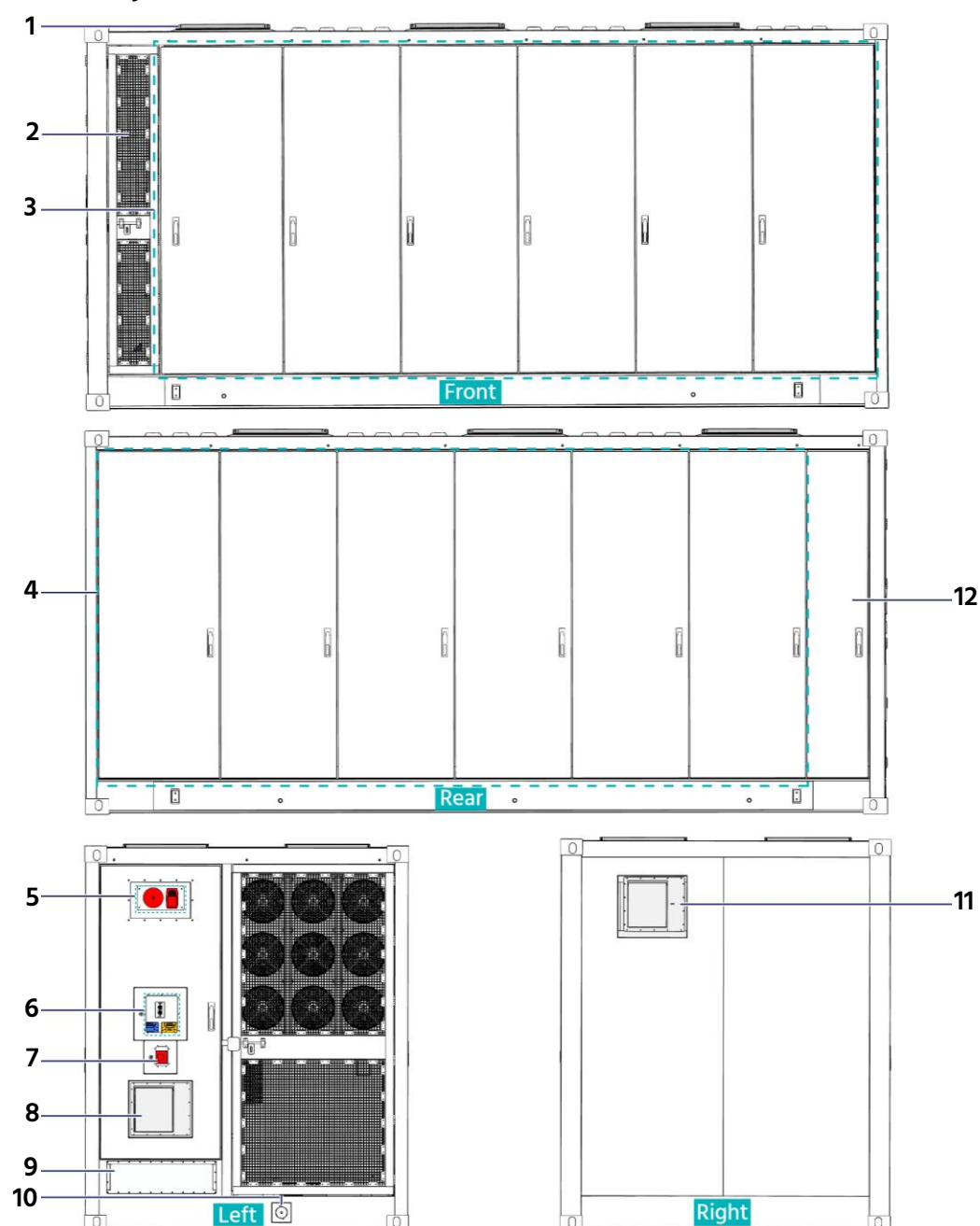
| No. | Description                                                           | Code                                                                 |
|-----|-----------------------------------------------------------------------|----------------------------------------------------------------------|
| 1   | Safety Standard for Secondary Lithium Batteries                       | IEC62619-2022<br>IEC63056<br>IEC62477-1<br>IEC62040-1<br>ISO 13849-1 |
| 2   | UN38.3 Safe Transport Standard                                        | UN38.3                                                               |
| 3   | CE EMC Standard<br>CE EMC Directive 2014/30/EU                        | EN IEC 61000-6-2:2019<br>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<br>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.

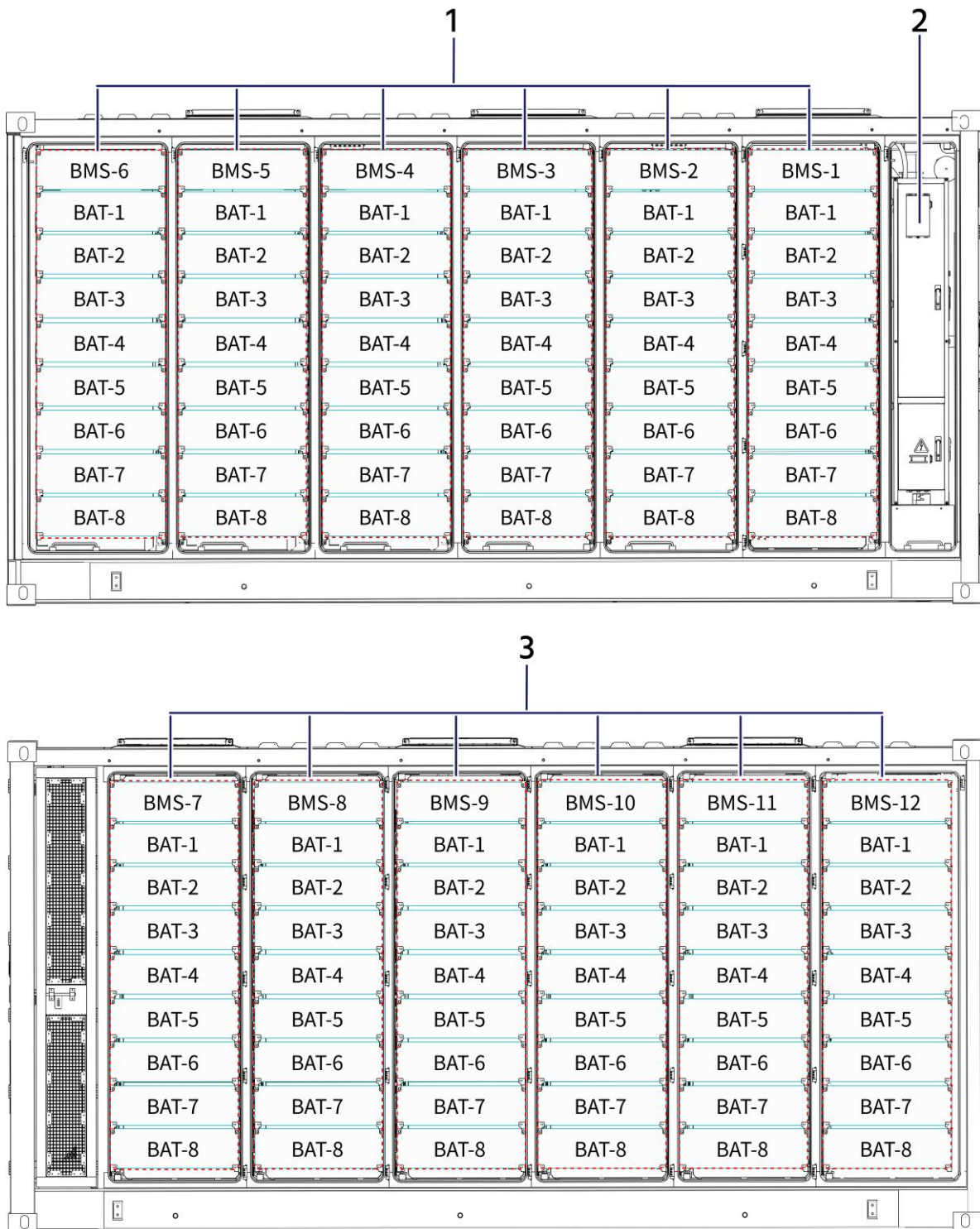
- **External Layout**



| Figure | Description                     | Figure | Description                                          |
|--------|---------------------------------|--------|------------------------------------------------------|
| 1      | Explosion vent 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*.

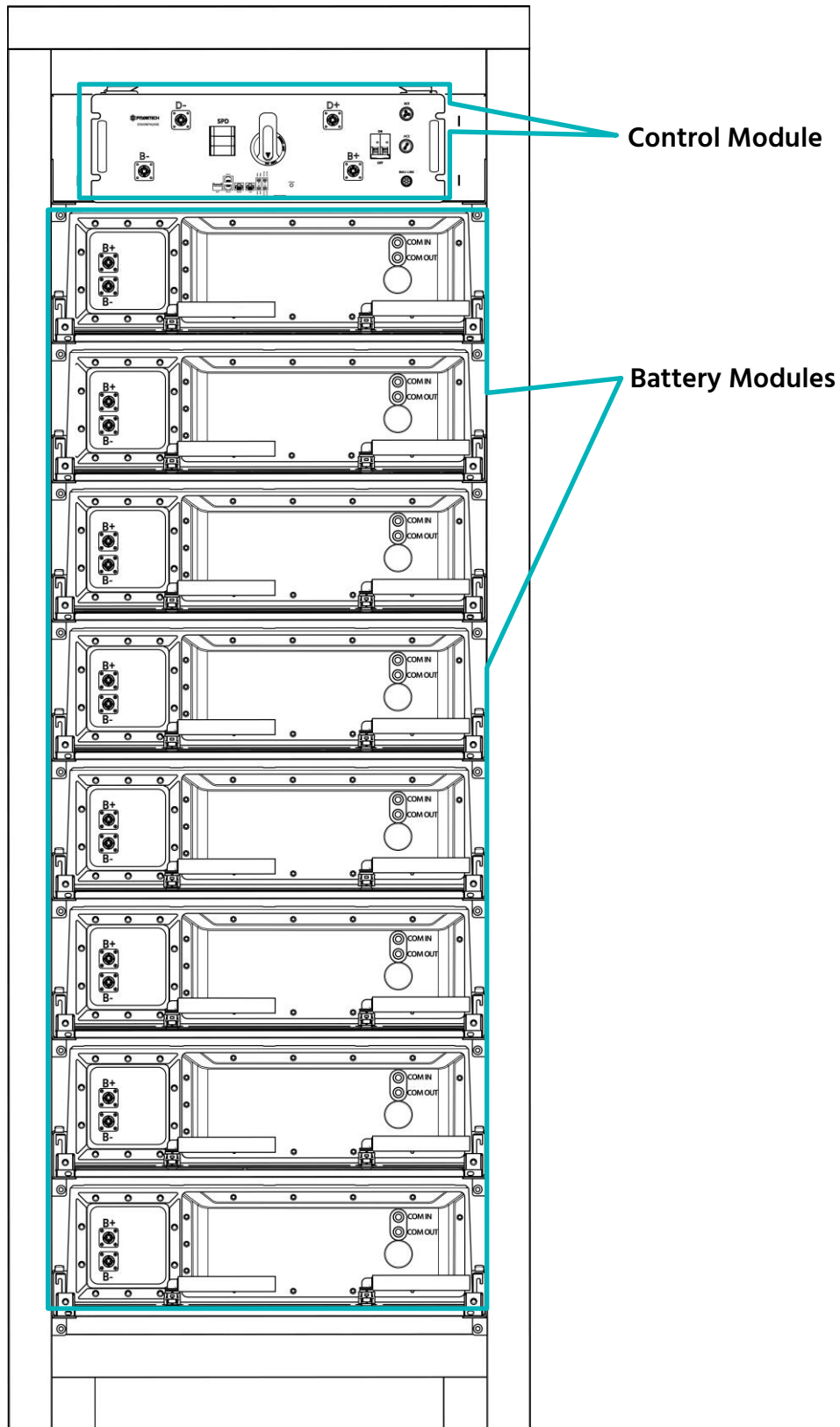
- Internal Layout



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

### 3.3.1 Battery String

The standard battery system consists of 12 sets of 417.9 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.

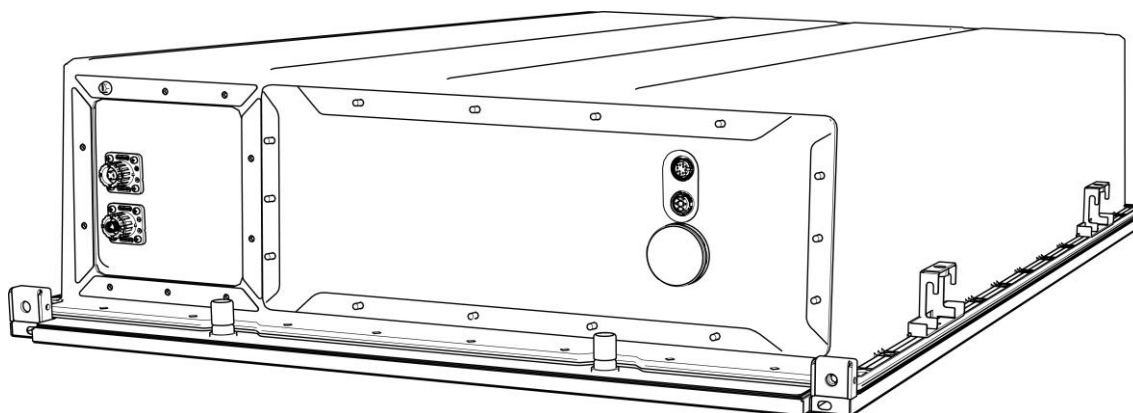


### 3.3.1.1 Single Battery System String Specifications

| Specifications                     | PowerCube-M7A                       |
|------------------------------------|-------------------------------------|
| System Voltage (VDC)               | < 1500                              |
| Battery Module Type                | HM7A200L                            |
| Control Module Type                | S1500M7A200E                        |
| Rated Capacity (Ah)                | 314                                 |
| Total Storage Energy (kWh)         | 417.9                               |
| Nominal Voltage (VDC)              | 1331.2                              |
| Charge Upper Limit Voltage         | 1497                                |
| Discharge Cutoff Voltage           | 1165                                |
| Nominal Current (Amps)             | 157                                 |
| Maximum Continuous Current (Amps)  | 188                                 |
| 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                              |
| 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                             |

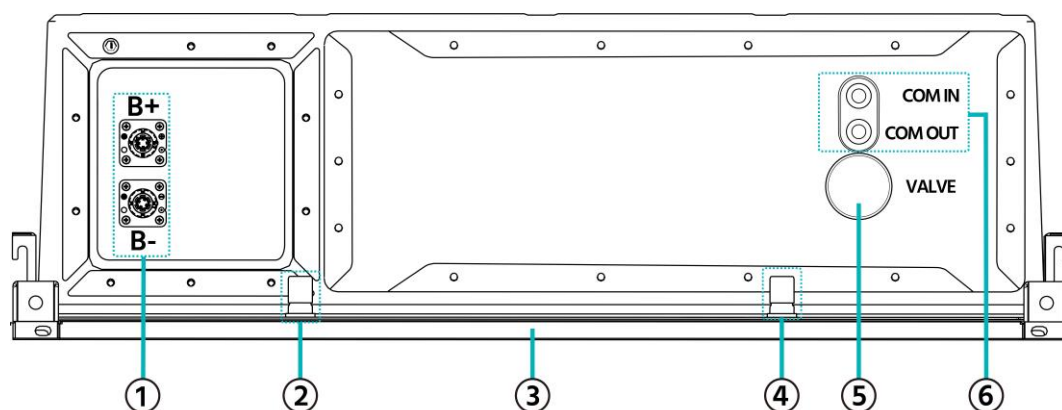
### 3.3.1.2 Battery Module

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)            | 790 ±5 (W) x 1145±5 (D) × 245±5 (H) |
| 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

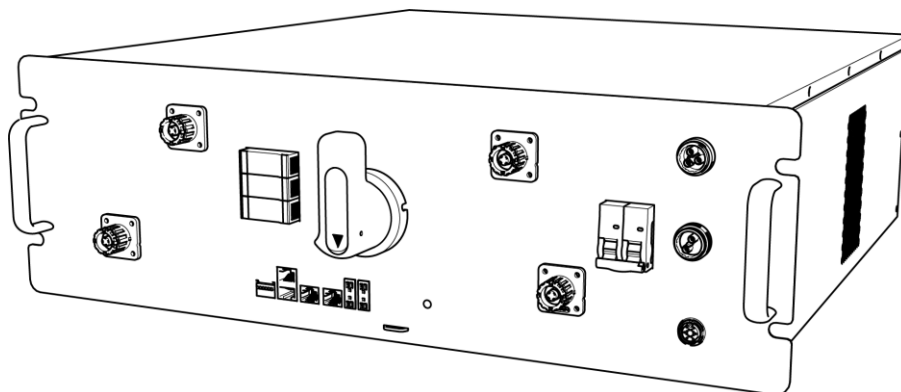
Prevents explosions caused by thermal runaway and automatically vents the internal pressure of the battery module in the event of a fire.

### ⑥ Communication Port (COM IN/ COM/ OUT)

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

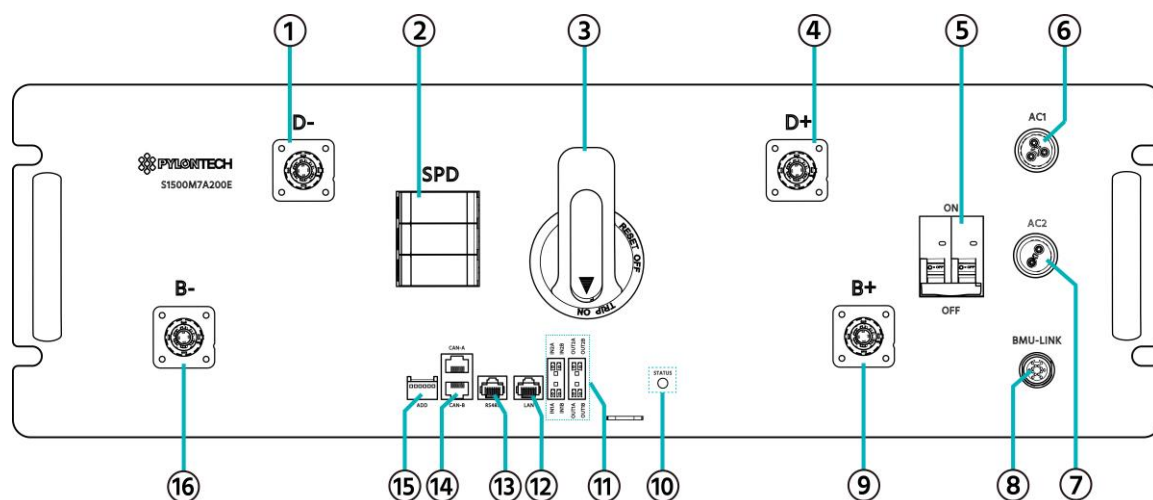
### 3.3.1.3 Battery Control module

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)                 | 600 ±5 (W) × 620±5 (D) × 200±5 (H) |
| Communication                  | RS485\CAN\LAN                      |
| Protection Class               | IP20                               |
| Weight(kg)                     | 29                                 |
| 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 & ④ External Power Terminal (D-/D+)

External DC connection for the battery system to the DC copper bars in the communication and confluence cabinet.

### 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.

### ⑤ Mirco Circuit Breaker

Circuit breaker for AC power supply of AC1 and AC2.

### ⑥ AC Socket (AC1)

Connects to external AC power supply for BMS (battery control module).



#### ⑦ AC Socket (AC2)

Connects to external AC power supply for shunt trip.

#### ⑧ BMU-LINK

Communication port to connect the battery module.

#### ⑨& ⑩ Power Terminal B+/B-

Power terminal to connect the battery module.

#### 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 LEMS, 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 (provided by the customer).

CAN A connects to another BMS.

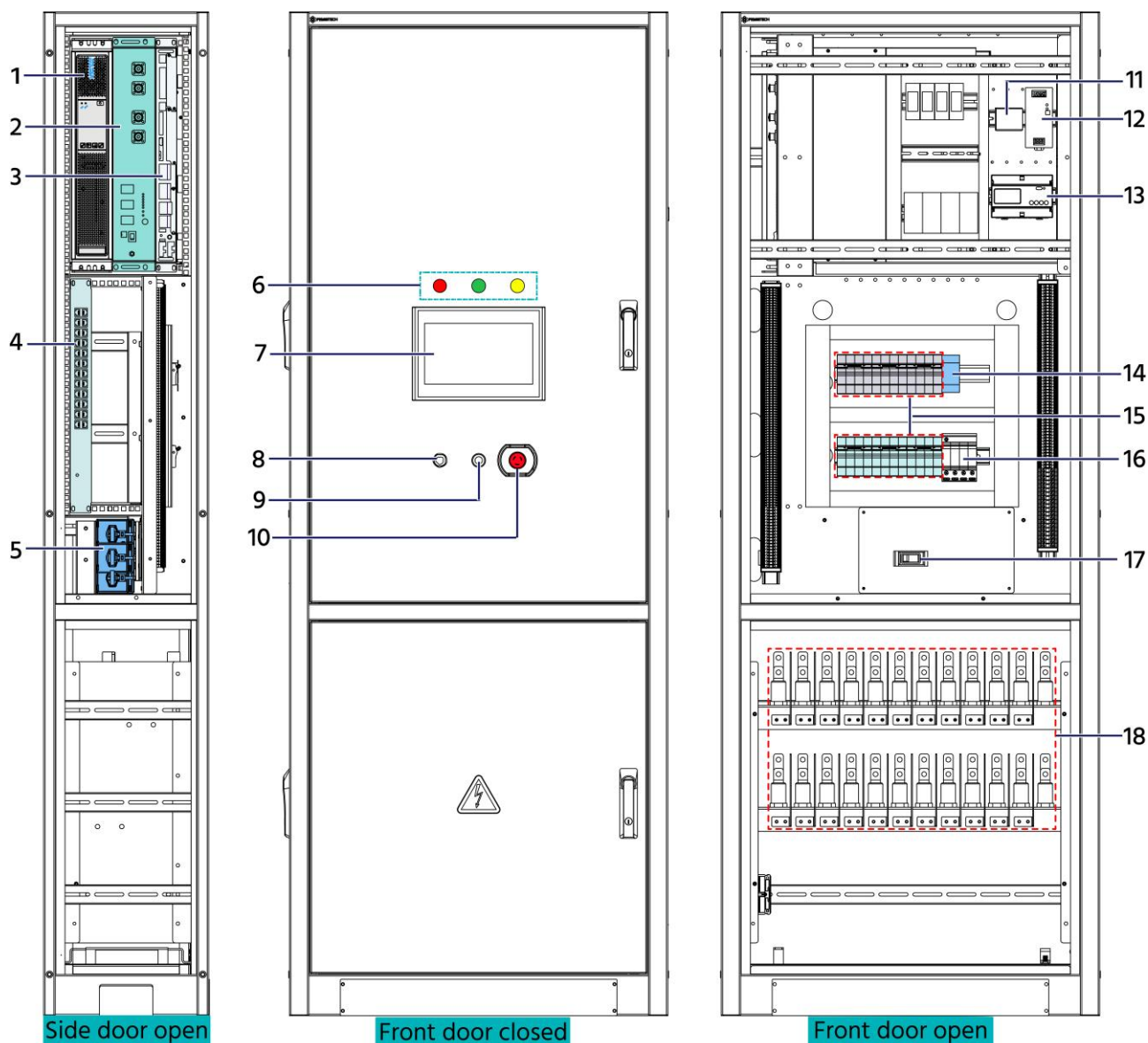
CAN B connects to PCS.

#### ⑮ ADD Switch

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

### 3.3.2 Integrated Communication Cabinet

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



| Figure | Description                  | Figure | Description                   |
|--------|------------------------------|--------|-------------------------------|
| 1      | UPS                          | 10     | Emergency Stop Button         |
| 2      | UPS Battery                  | 11     | Fuse                          |
| 3      | LEMS                         | 12     | Switch Mode Power Supply      |
| 4      | Ethernet Switch              | 13     | Energy Meter                  |
| 5      | Current Transformer (TA)     | 14     | Overhaul socket               |
| 6      | Status LED                   | 15     | Circuit Breakers              |
| 7      | HMI Screen                   | 16     | SPD (Surge Protection Device) |
| 8      | Remote/Local Transfer Switch | 17     | Circuit Breaker (QF1)         |
| 9      | Black Start Button           | 18     | Busbars                       |

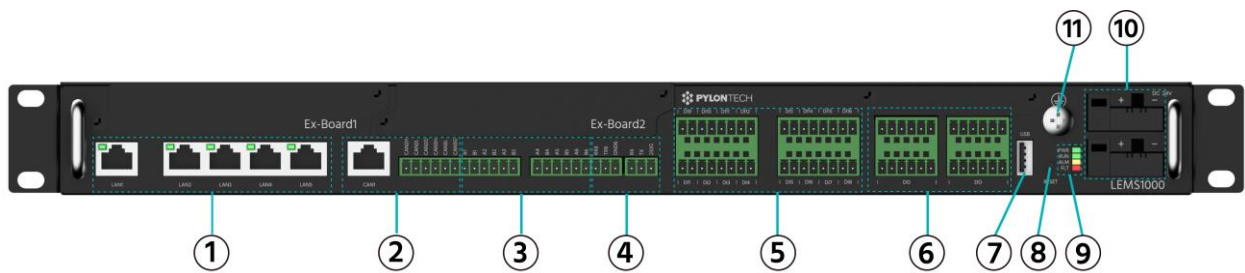
### 3.3.2.1 LEMS

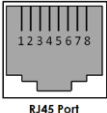
The energy storage battery container adopts a local energy management system device LEMS 1000 for communication. It can communicate upwards with devices such as EMS, upper controller, touch screen, etc. It can also communicate downwards with devices such as battery control module, PCS, fire suppression 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 (W) x 246.5 (D) x 44 (H)               |
| Protection degree             | IP20                                         |
| Pollution degree              | PD2                                          |
| Protection Class              | Class III                                    |
| Weight (kg)                   | 4.0                                          |
| Working temperature (°C)      | -40~85                                       |
| Storage temperature (°C)      | -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                                           |

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. <div><br/>RJ45 Port</div> <div><br/>RJ45 Plug</div> | All these three CAN ports can be connected through CAN ports to devices e.g. PCSs.                                                       |
|     |      | CAN2H/<br>CAN2L/ CAN2G<br>(CAN2) | CAN Port                                                                                                                                                                                                                                                                              |                                                                                                                                          |
|     |      | CAN3H/<br>CAN3L/ CAN3G<br>(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<br>RX/TX/232G                                                          | Two debug ports.                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 5   | DI                  | DI1~16                                                                              | Dry Contact, 16 Digital Inputs. Passive signal or active signal not higher than 5V.<br>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 <i>section 2.2</i> 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.<br>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 <i>section 2.3</i> 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<br>/FLT                                                                 | See <i>Section 3.5.1.2</i> for detailed instructions.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 10  | 9~36VDC input       | DC 24V + -                                                                          | Power supply for the device, external power supply of 9~36VDC.<br>There are two power ports for backup.                                                                                                                                                                                                                                                                                                                                                                        |
| 11  | Grounding Bolt      |  | Grounding Protection                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## LED Indicators Instructions

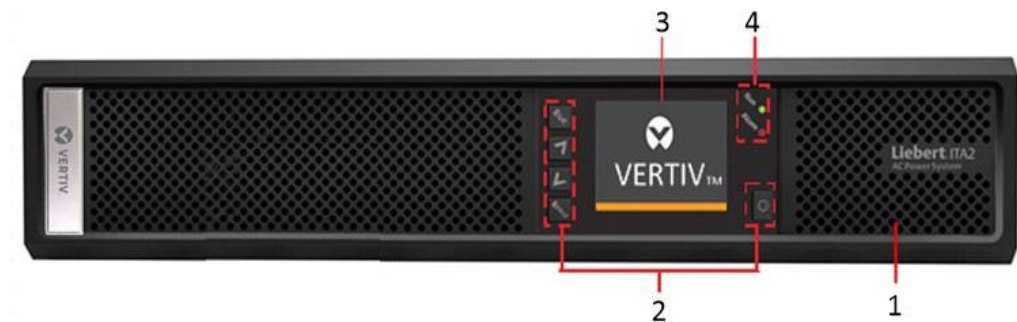
| LED Indicator                                                                       | Silk-screen | Indication | Details                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------|-------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | PWR         | Power LED  | <p>The green LED indicator on indicates the device itself is Powered on.</p> <ul style="list-style-type: none"> <li>● When the device is powered on, it will flash once per two seconds (0.5Hz).</li> <li>● When the device is being upgraded or data-downloading, it will flash twice per second (2Hz).</li> </ul>             |
|    | RUN         | Run LED    | <p>The green LED indicator on indicates the system is Running.</p> <ul style="list-style-type: none"> <li>● When the device is running normally, it will be constant on.</li> </ul> <p><b>NOTE:</b> DO NOT perform maintenance work when the system is running.</p>                                                             |
|  | ALM         | Alarm LED  | <p>The yellow LED indicator on indicates the system is in Alarm status.</p> <ul style="list-style-type: none"> <li>● When the LED flashes once per two seconds (0.5Hz), it indicates a minor alarm.</li> <li>● When the LED is constant on, it indicates a major alarm.</li> </ul>                                              |
|  | FLT         | Fault LED  | <p>The red LED indicator on indicates the device is in Fault status.</p> <ul style="list-style-type: none"> <li>● When the system has a critical issue, it will be constant on. And most power supply will be shutdown.</li> </ul> <p><b>NOTE:</b> If this happens, the device needs check or repair prior to further work.</p> |

3.3.2.2 UPS

The electrical cabinet is equipped with an UPS to supply power for BMS, LEMS, 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.

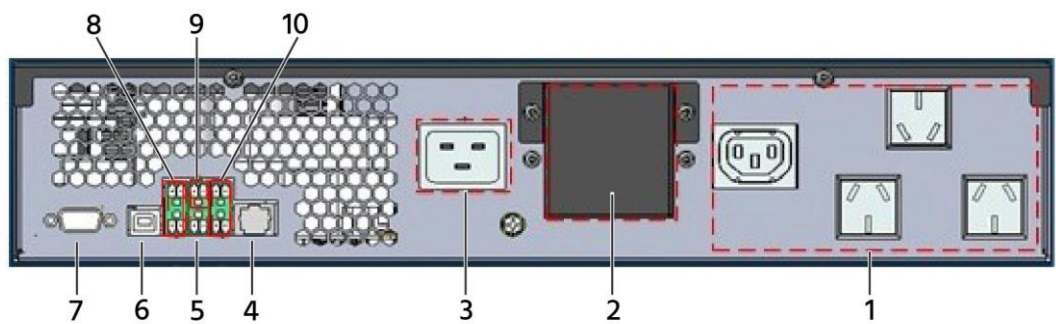
Front Panel of the UPS

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              |

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                 |

### 3.3.2.3 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.



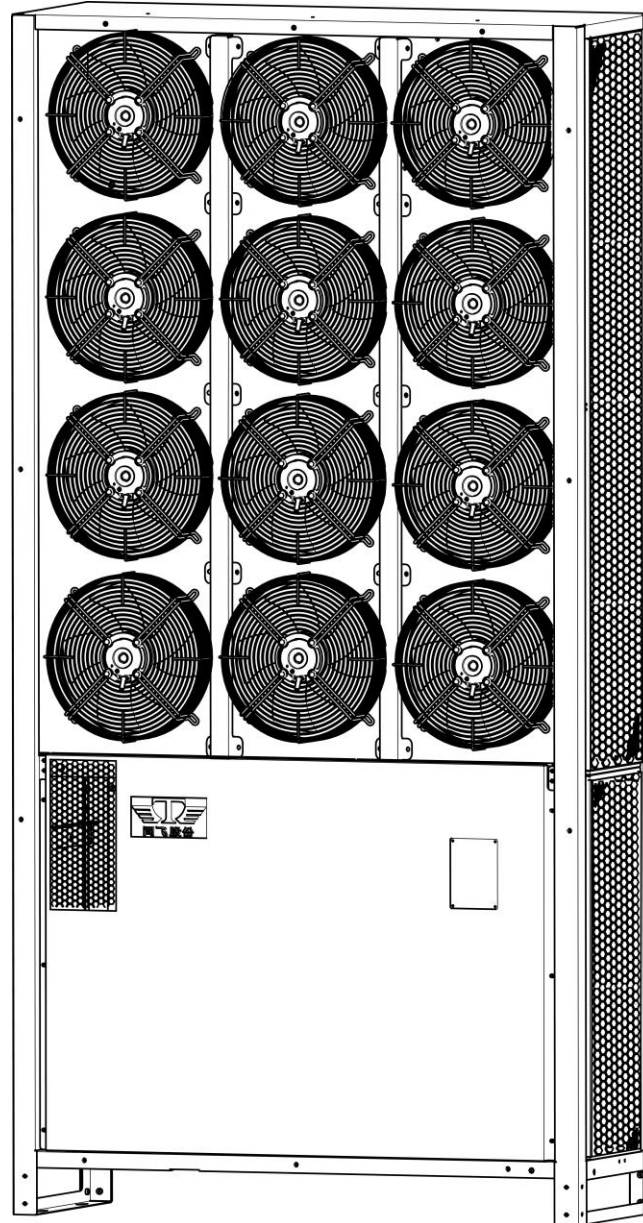
**NOTE:** For more detailed information of the UPS, please refer to the separate UPS manual.



### 3.3.3 Liquid Chiller

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

The appearance of the liquid chiller is shown as below:



## Specifications of the Liquid Chiller

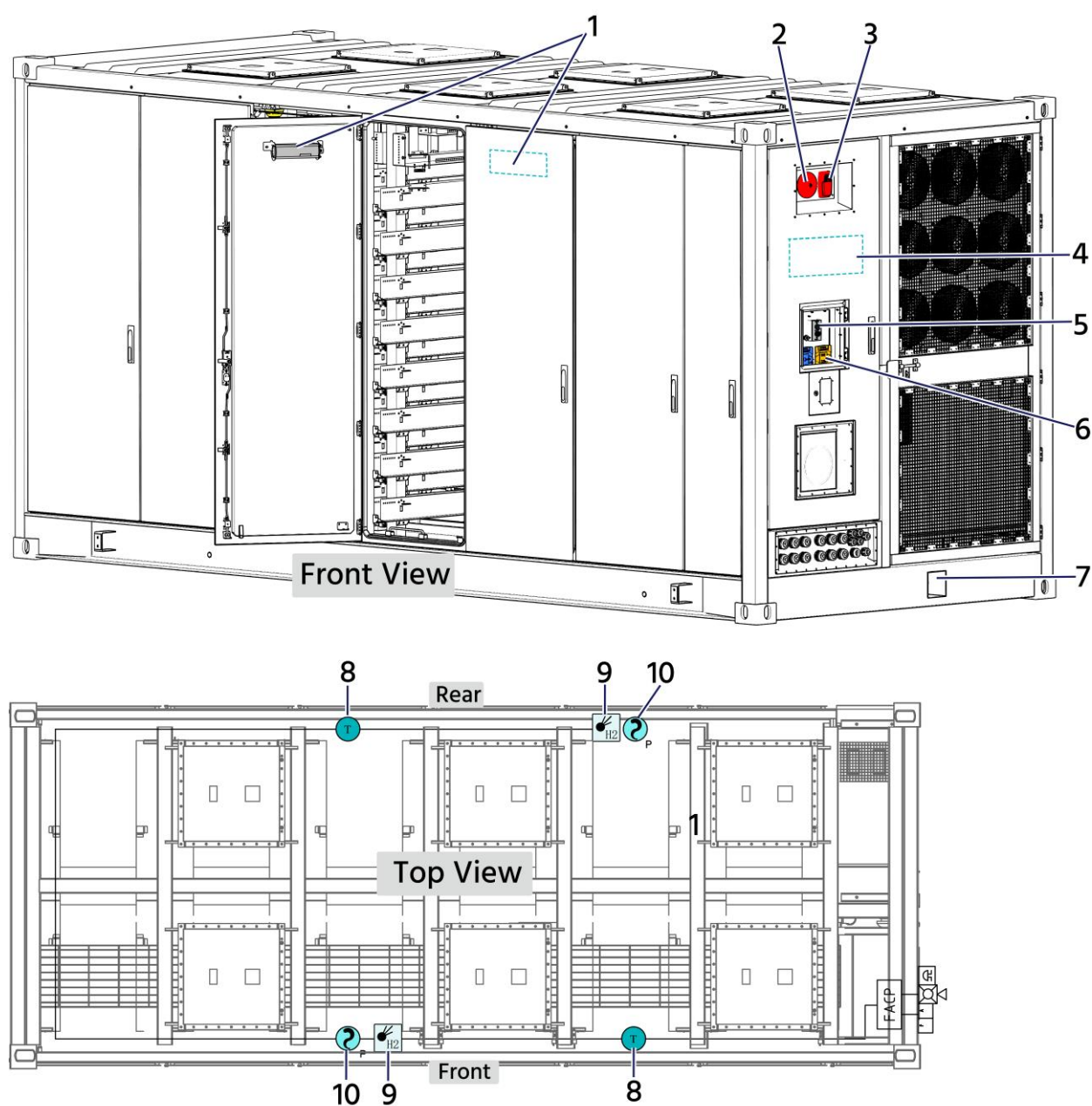
| Item                                          | Specification                                                                           |
|-----------------------------------------------|-----------------------------------------------------------------------------------------|
| Power supply                                  | 3/N/PE AC 400V $\pm$ 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°C/W20°C); 52 (L45°C/W18°C)                                                      |
| Cooling power/current (kW/A)                  | 32.2/50.4 (L45°C/W20°C); 32.5/50.8 (L45°C/W18°C)                                        |
| 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 (°C)                     | 15~35                                                                                   |
| Refrigerant                                   | R410A                                                                                   |
| Condensing air volume (m <sup>3</sup> /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                             | Φ 63.5 chuck                                                                            |
| Drainage/refilling size                       | DN15 internal thread                                                                    |
| Tank capacity (L)                             | 12                                                                                      |
| Ambient temperature range (°C)                | -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                                                     |

### 3.3.4 Safety Features

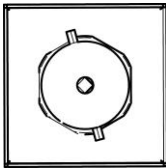
This system is equipped with safety features that include a fire protection system as well as explosion proof and vent systems.

#### 3.3.4.1 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.

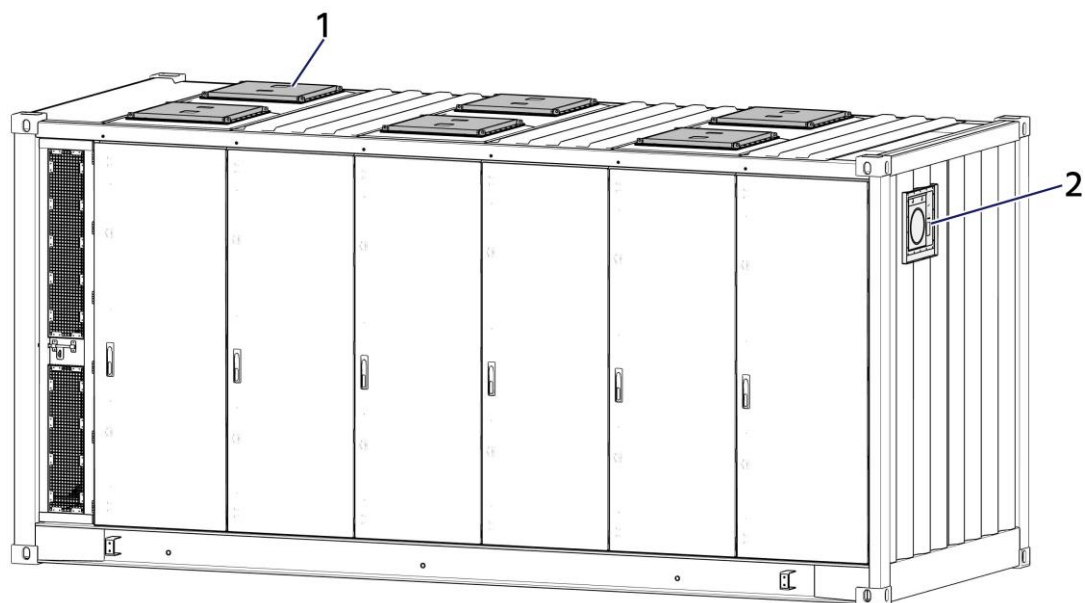


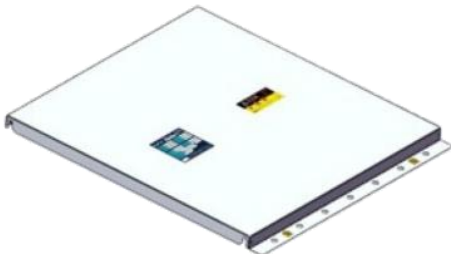
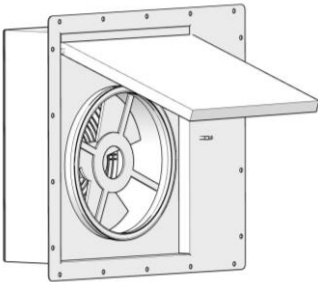
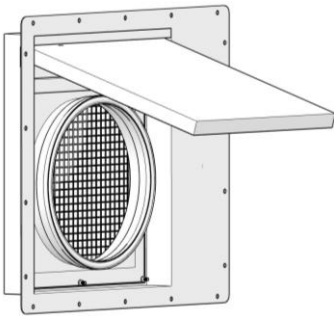
**NOTE:** See the next page of the descriptions of the figures.

| 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) | <p>Extinguishant release manual automatic switch</p>  | 1 pc                                                                                                   |
| 5   | Emergency Startup/<br>Emergency Stop Switch                   |                                                      | 1 pc                                                                                                   |
| 6   | Emergency stop/manual release button                          |                                                      | 1 pc Emergency stop button<br>1 pc Manual release button                                               |
| 7   | Water suppression joint                                       |                                                      | 1 (together with the spray headers and lines inside the container to compose the water 31spray system) |
| 8   | Heat detector                                                 |                                                      | 2 pcs                                                                                                  |
| 9   | H2 detector                                                   |                                                      | 2 pcs                                                                                                  |
| 10  | Smoke detector                                                |                                                      | 2 pcs                                                                                                  |

### 3.3.4.2 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

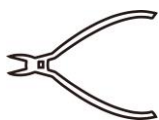
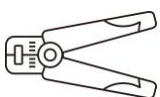
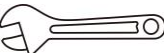
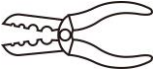
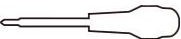
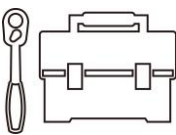
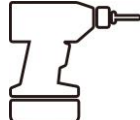
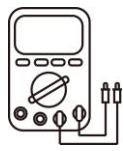
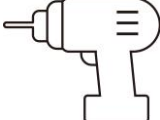
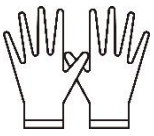
#### Checking the Outer Packing

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.

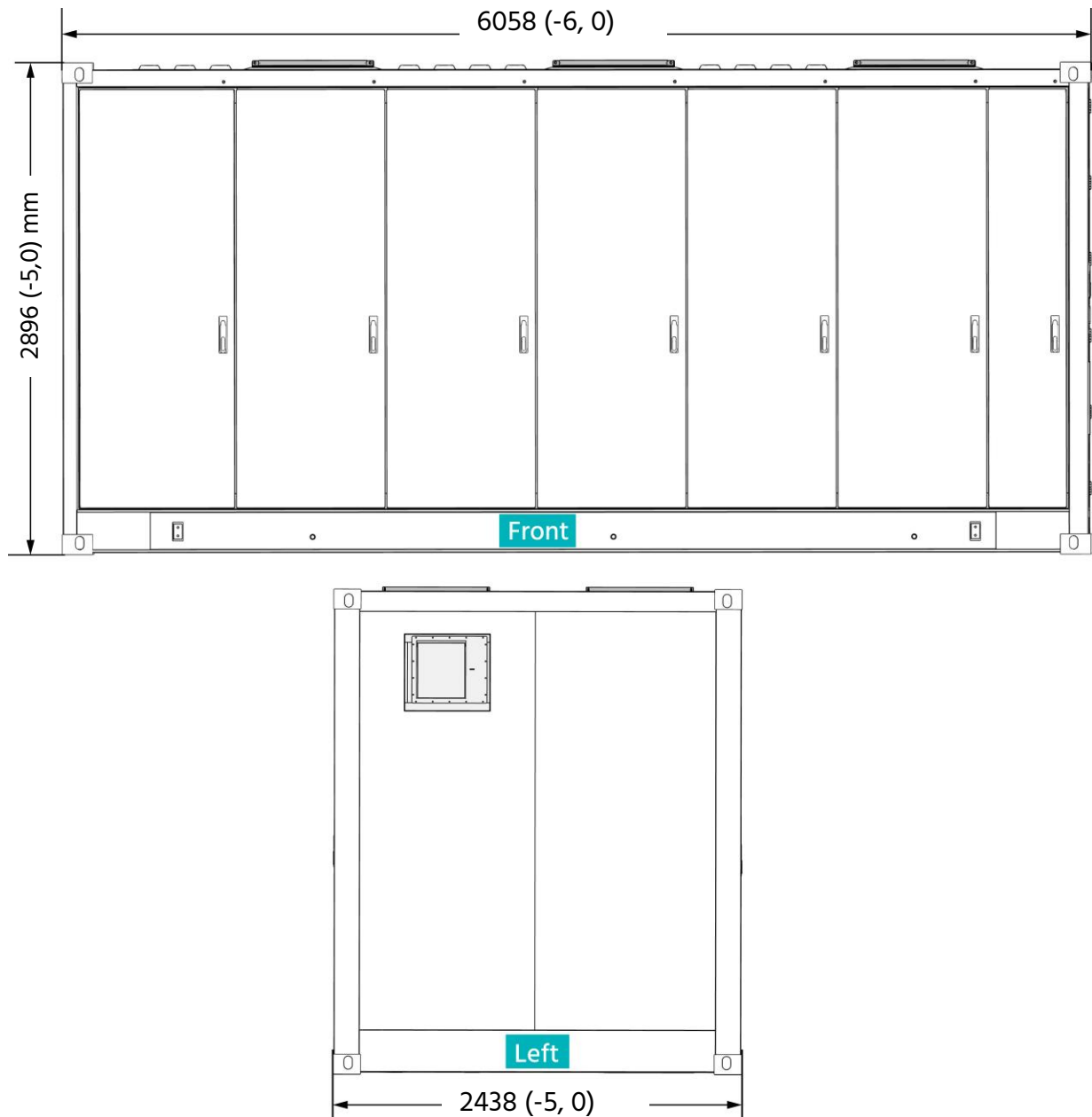
### 4.2 Preparing tools and instruments

| Tools                                                                               |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|    |    |    |      |     |    |
| Wire Cutter                                                                         | Crimping Modular Plier                                                              | Adjustable Wrench                                                                   | Wire Stripper                                                                         | Torque Wrench                                                                         | Screwdriver                                                                           |
|  |  |  |  |  |                                                                                       |
| Cable Tie                                                                           | Socket Wrench set                                                                   | Electric Drill                                                                      | 1000VDC Multimeter                                                                    | Electric Screwdriver                                                                  |                                                                                       |
| PPE (Personal protective equipment)                                                 |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |
|  |  |  |    |  |  |
| Insulating Gloves                                                                   | Anti-arc Flash Suit                                                                 | Safety Shoes                                                                        | Ear Protector                                                                         | Safety Goggles                                                                        | Anti-static Bracelets                                                                 |

 **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 Overall Dimensions

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.



## 4.4 Installation Environment Requirements

### 4.4.1 Installation Site Selection

- Ensure that the BESS is installed away from residential areas to avoid noise.
- Ensure that the installation site is away from high salt and high corrosion environment.
- Keep away from heat, flammable, explosive and corrosive materials. Keep away from harmful gas concentration areas.
- Ensure that the environment around the installation site is dry and well-ventilated.
- Ensure that there are no trees around the installation location to prevent high winds from knocking down branches or leaves and blocking the doors or air intakes of the BESS.

### 4.4.2 Foundation Requirements



BESS is heavy, and all conditions of the installation site (mainly geological conditions and environmental climate conditions) should be examined before building the foundation.

The installation foundation needs to meet the following requirements:

- It is recommended that the relative density of the soil in the installation site be at least 98%. If the soil is loose, take measures to ensure that the foundation is stable.
- The installation foundation should be able to bear the total weight of the whole container system (approx. 42 tons). And the foundation should be flat, firm, safe and reliable.
- The foundation shall be made according to the drawings provided by Pylontech. The surface tolerance of the foundation shall be  $\pm 5\text{mm}$ .
- Cable routing should be considered when building the foundation.
- Drainage measures should be built according to local geological conditions.

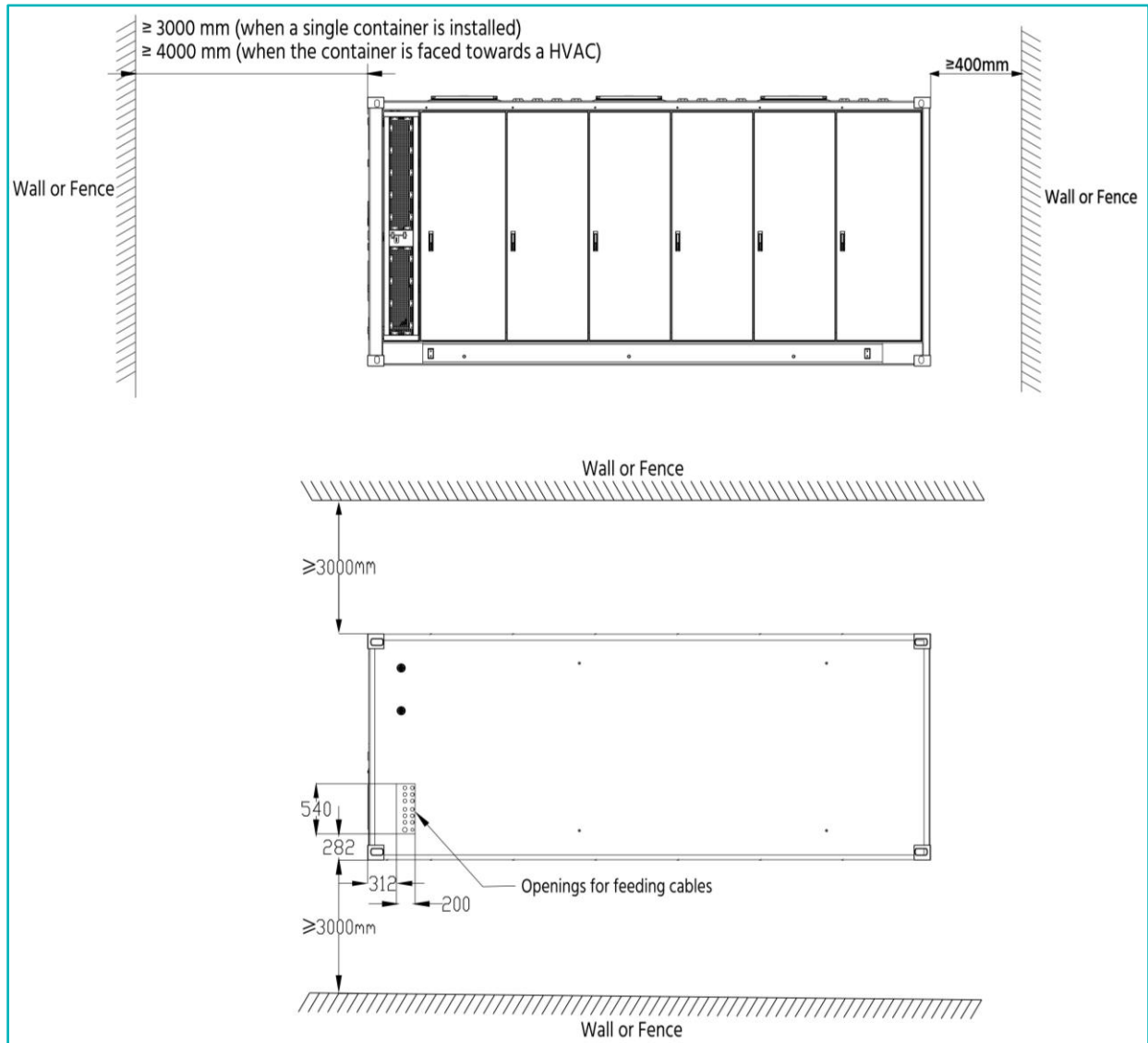


**NOTE:** For more detailed requirements of foundation, please refer to the drawings provided by Pylontech or contact Pylontech.



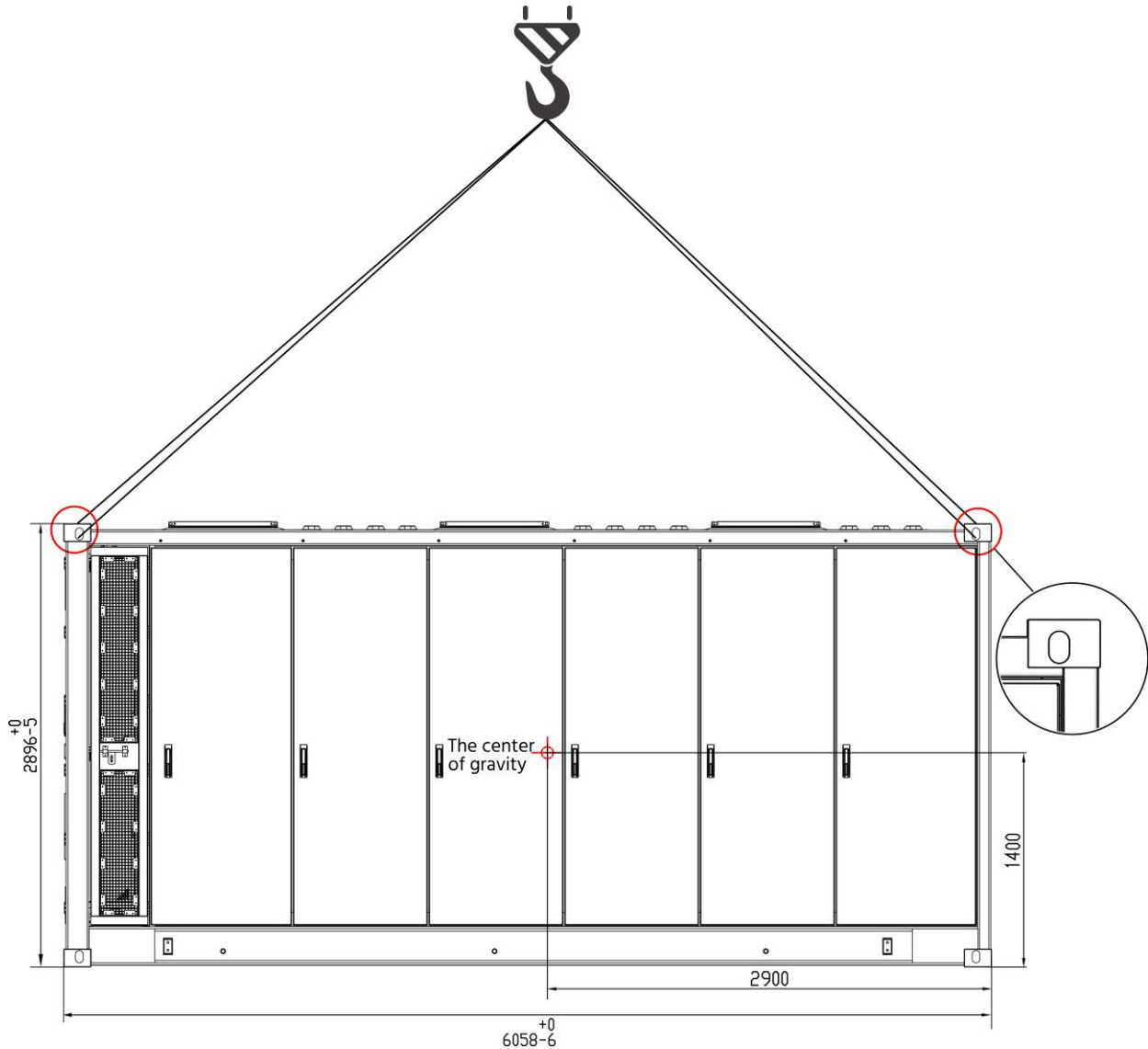
#### 4.4.3 Installation Clearances

It is recommended to reserve sufficient space around the container to meet heat dissipation and maintenance requirement. The smallest clearances for one single BESS is shown below.



## 4.5 Hoisting

There are four lifting points on the top four corners of the container. Please use cranes bearing weight more than 42 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.

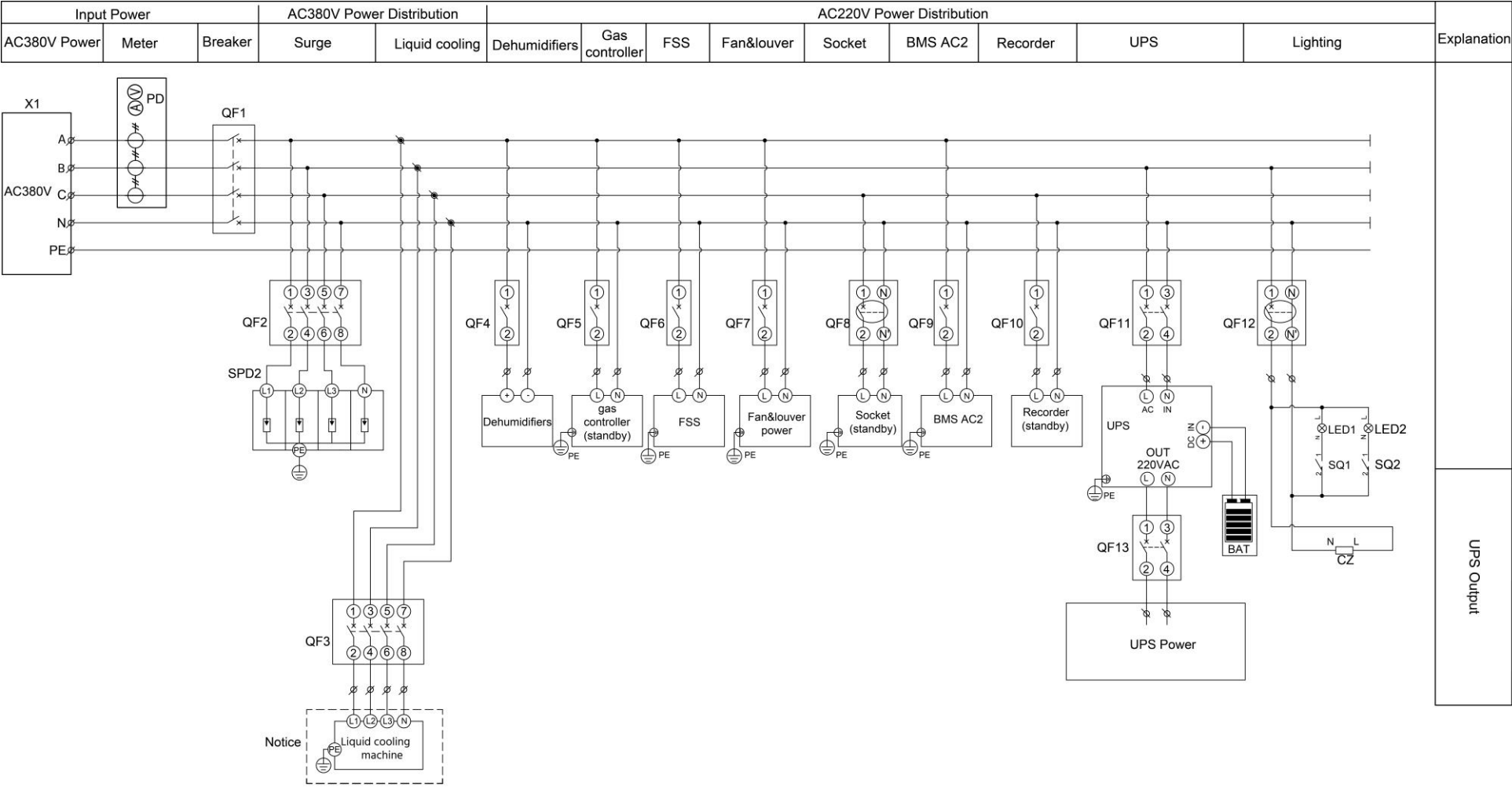
### **DANGER**

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



Notice: All PE cables are elicited from the PE bar in the cabinet.

## 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 |
|---------------------------------------|---------------------------------------------------|----------------|
| Auxiliary Power cables                | 4x 25 mm <sup>2</sup>                             | SC16-8         |
| Ground PE-Cable                       | 16 mm <sup>2</sup>                                | SC16-8         |
| Ground PE - galvanized flat iron      | 4x 50 mm                                          | /              |
| External Ethernet communication cable | Ultra Category 6 shielded cable                   | RJ45           |
| External RS485 cable                  | Twisted shielded cable $\geq 1,5$ mm <sup>2</sup> | 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  $4\Omega$  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  $\geq 2$  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.



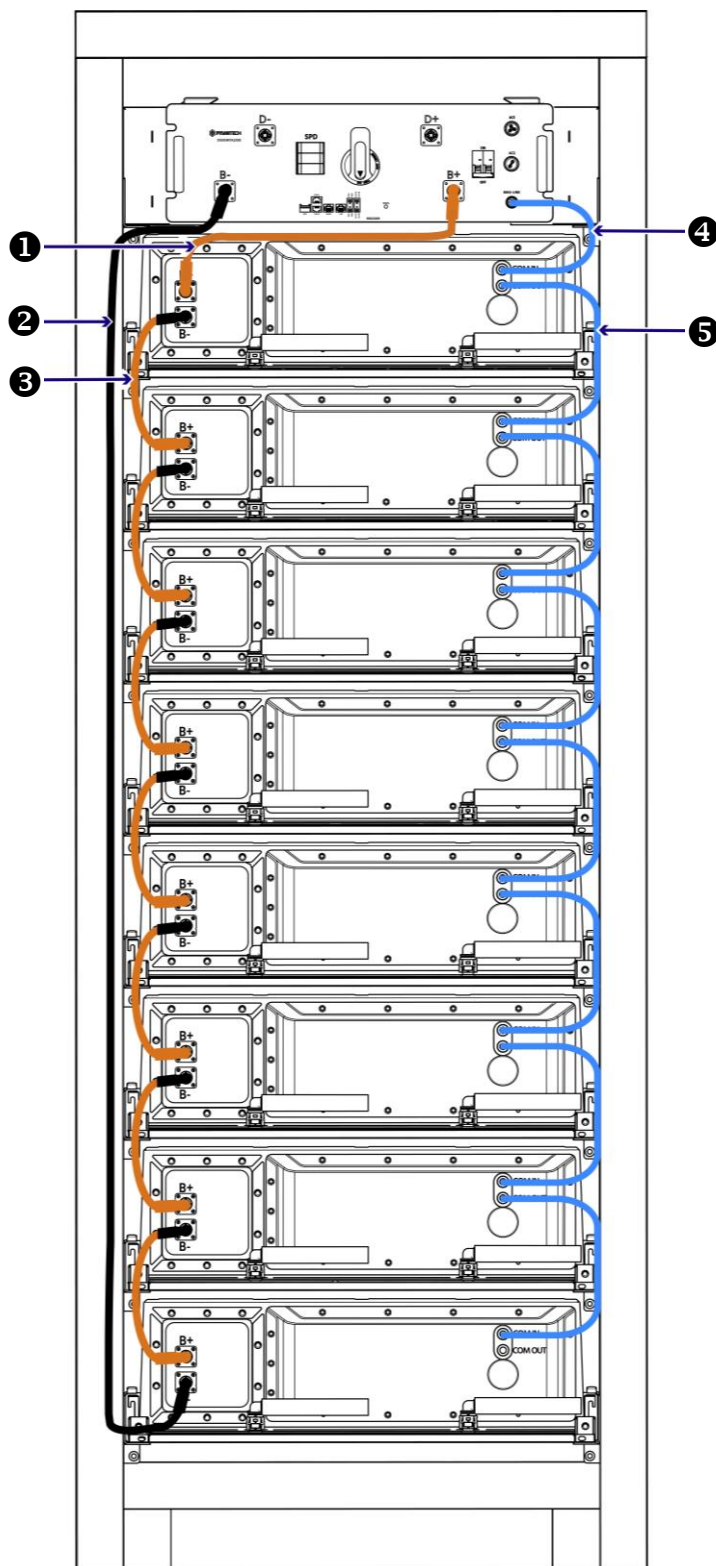
Do not connect the positive and negative reversely.

- (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

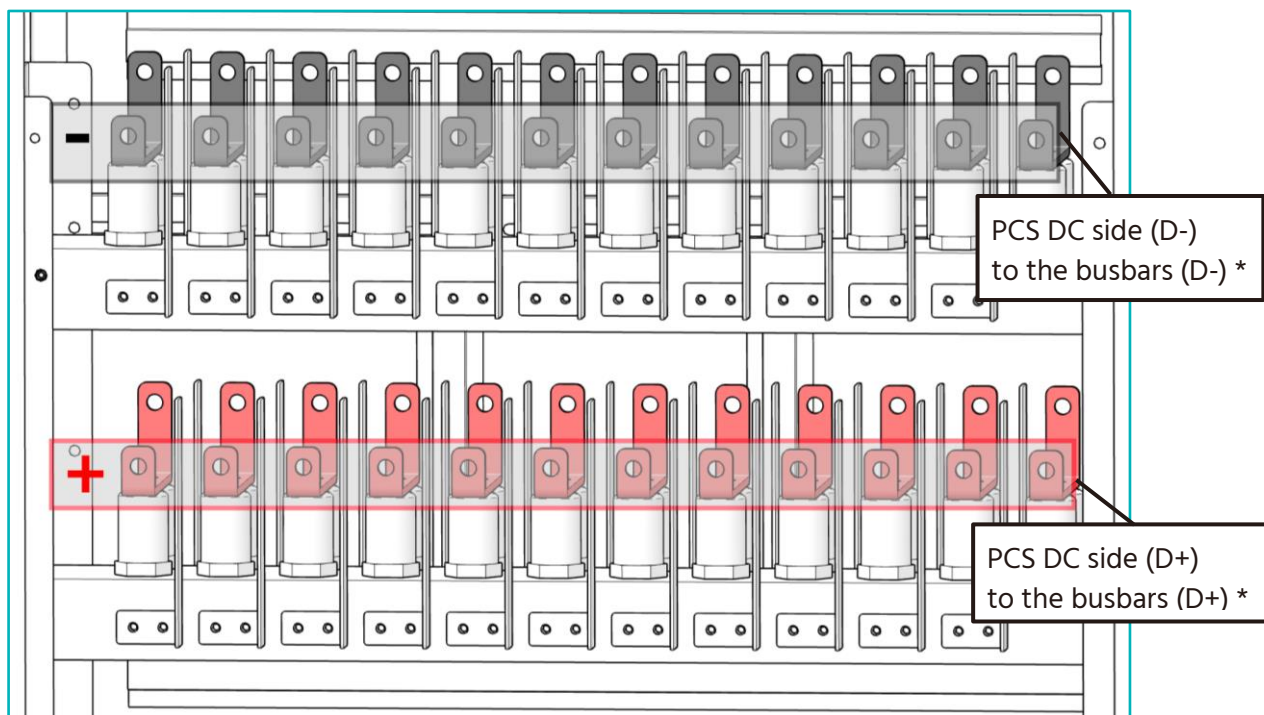
There are 12 battery strings in the container. For single battery strings' system, the cable connection should be done according to the drawing below.



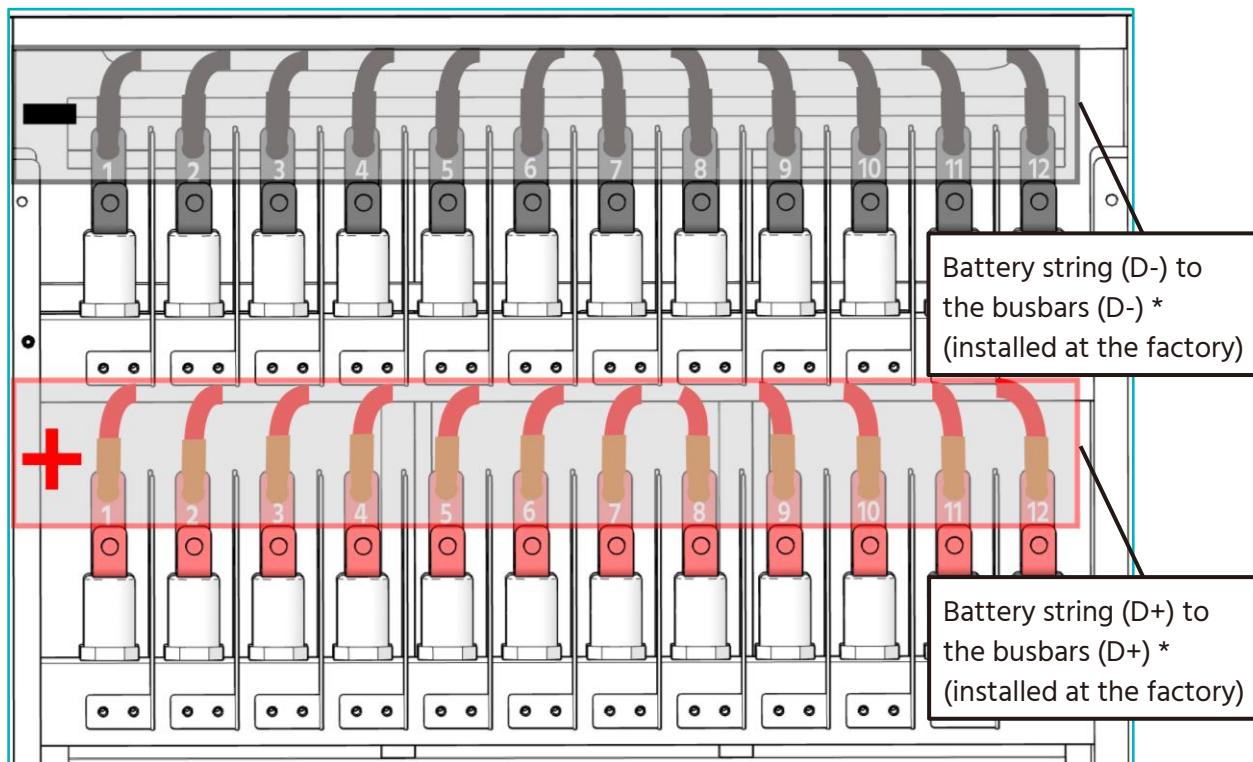
|   |                                                                       |
|---|-----------------------------------------------------------------------|
| ❶ | Power Cable, Orange (BMS 'B+' to Battery Module 'B-')                 |
| ❷ | Power Cable, Black (BMS 'B-' to Battery Module 'B-')                  |
| 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 DC Cables from the PCS (provided by the customer) to the busbars

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



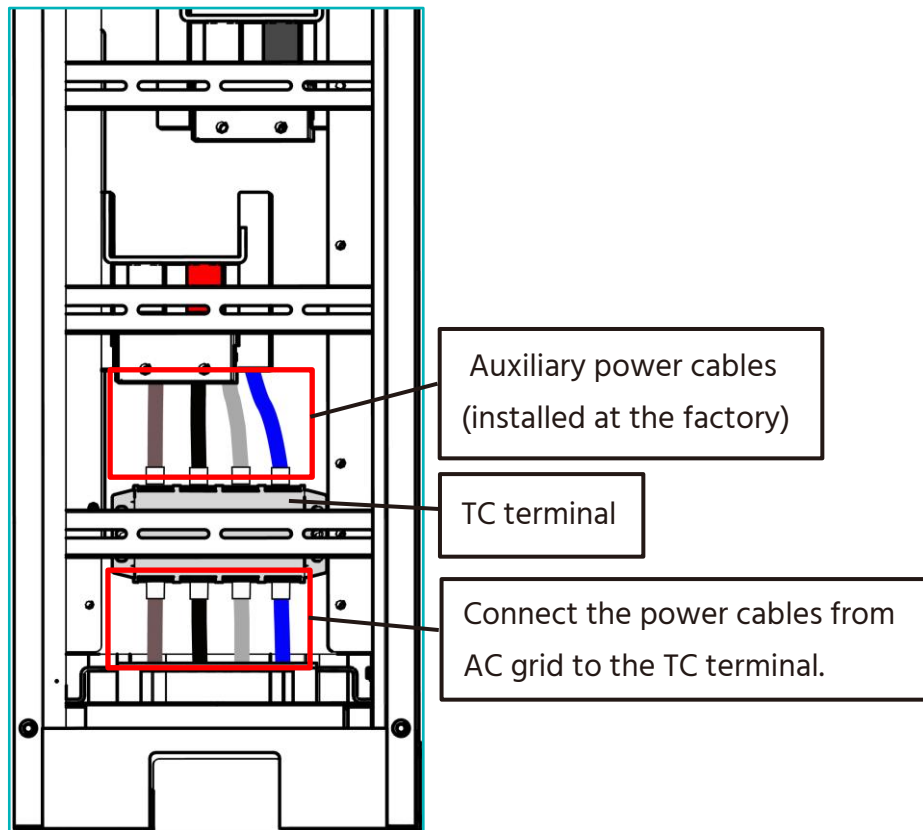
\* The PCS number corresponds to the battery string number as below.



\* The figure represents the order for battery string 1~battery string 12.

## 5.5 AC Side Wiring

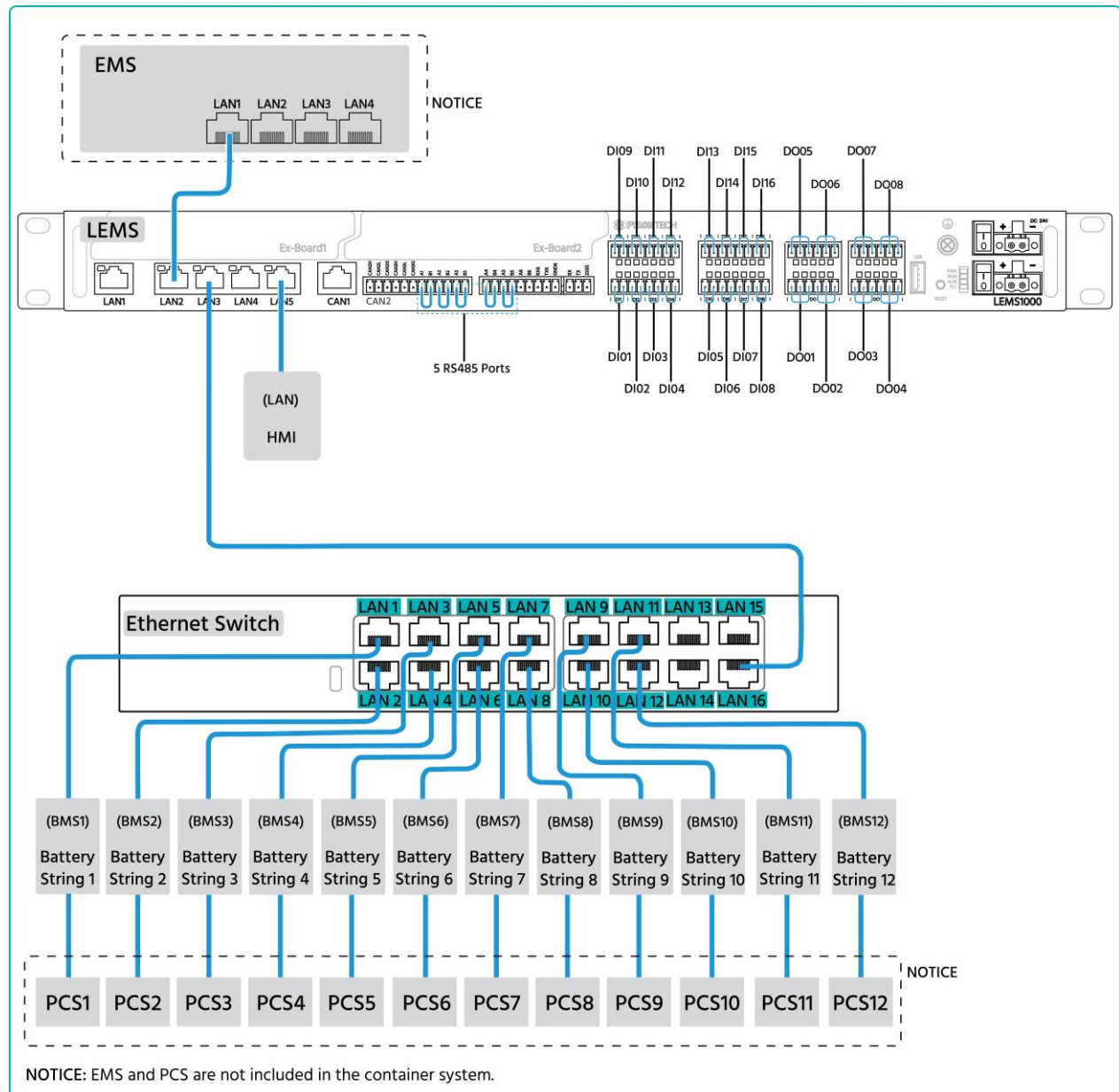
Connect the cables from the AC grid to the TC terminal in the integrated communication cabinet. According to the labeling, connect the cables of each phase sequence in turn and three opposite sequences are not allowed.



**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.



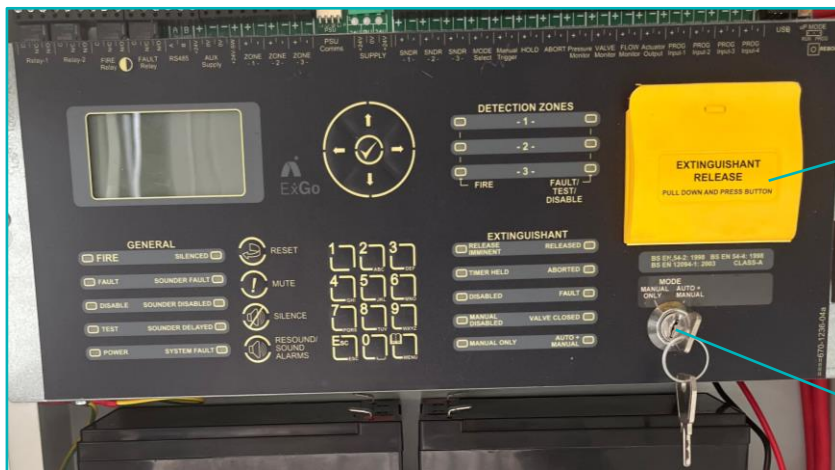
## 6 Commissioning

### 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.

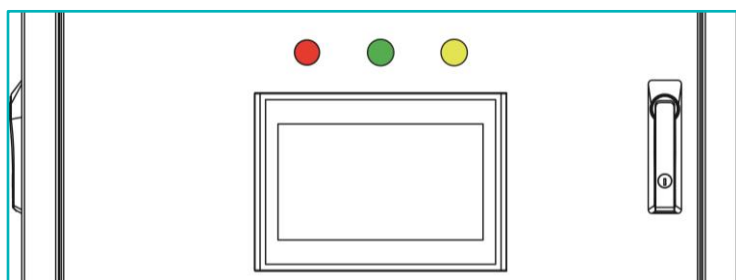


Press the extinguishant release button for manually suppressing fire.

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/<br>Fault | STATUS<br>(green)           | STATUS (red)                | Descriptions                                                                                     |
|----------------|------------------|-----------------------------|-----------------------------|--------------------------------------------------------------------------------------------------|
|                |                  | ●                           | ●                           |                                                                                                  |
| Shut Down      | /                | Off                         | Blink 1*<br>(slow flashing) | Indicates the battery modules in the battery system are shutdown. And the BMS is still power on. |
| Initialization | Normal           | Blink 2*<br>(slow flashing) | Off                         | Indicates the battery system is initializing.                                                    |
| Sleep          | Normal           | Blink 2*<br>(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*<br>(slow flashing) | Off                         | Indicates the battery system is discharging.                                                     |
| Fault          | Fault            | Off                         | Blink 3*<br>(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

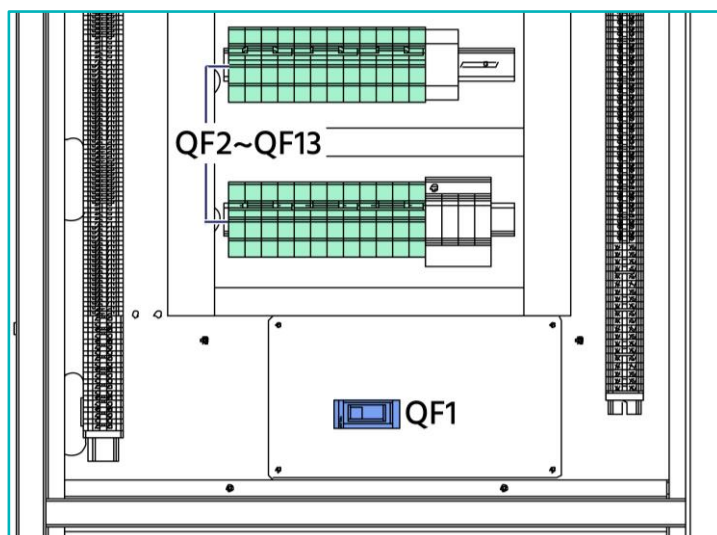
Ensure that the voltage of the inverter/PCS matches the voltage of the battery system. Check that all the power switches are OFF.

### WARNING

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

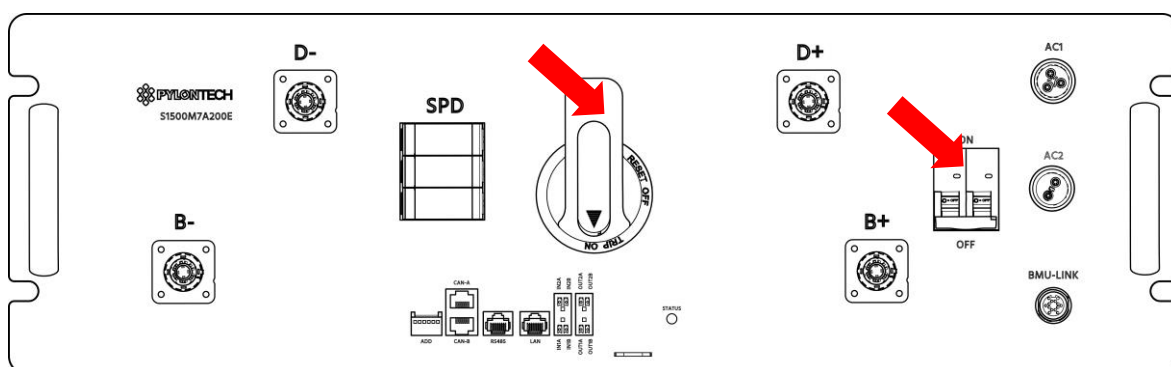
### Procedure

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.
9. Turn on circuit breaker "QF9" of the battery strings' shunt trip.
10. Turn on circuit breaker "QF10" of the recorder overhaul socket.



11. Turn on circuit breaker "QF11" of the UPS power input. 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.

12. Turn on circuit breaker “QF13” of the UPS power output. And the battery strings’ BMSs are power on.
13. Turn on circuit breaker “QF12” of the lightening facility in the container.
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 steps above 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 in an 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 is 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.

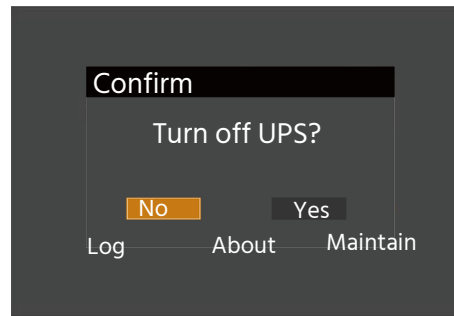
 **NOTE:** Before maintenance or long-term storage, ensure to turn the system off.

### 7.1 System Turning Off

#### Procedure

1. Disconnect the AC switch and DC switch of the PCS to ensure no current flows through the battery string. Check that PCS power decreases to 0.
2. Turn off circuit breakers QF12 and QF11 in the cabinet.
3. 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.



4. Turn off the circuit breaker QF13 of the UPS power output.
5. Turn off the circuit breaker and micro circuit breaker one after another from BMS1 to BMS12.
6. Turn off the circuit breakers QF10, QF9, QF8, QF7, QF6, QF5, QF4, QF3 QF2 and QF1 one after another in the cabinet.
7. 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



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.

### 7.3.1 Battery Control Module Maintenance

The replaceable internal overcurrent protective of the control modules are as follows:

| Part                  | Manufacturer                            | Model          | Specification                                                                        |
|-----------------------|-----------------------------------------|----------------|--------------------------------------------------------------------------------------|
| Fuse                  | Guangdong Eugard Co., Ltd               | ESH5582        | Rated Voltage: 1500VDC<br>Rated Current (In): 4000A<br>Rated Breaking Capacity:250kA |
| Fuse<br>(Alternative) | ADLER<br>Elektrotechnik<br>Leipzig GmbH | ASE3400DB3     | Rated Voltage: 1500VDC<br>Rated Current (In): 400A<br>Rated Breaking Capacity: 250kA |
| SPD                   | CITEL                                   | DS50PV-1500/51 | DC 1500V/15KA/40KA/T2/4P                                                             |
| SPD Fuse              | Guangdong Chnbel Co., Ltd               | HV-200A (S)    | DC 1500V/200A/30KA                                                                   |

### 7.3.2 Battery Module Maintenance

The replaceable internal overcurrent protective of the battery module are as follows:

| Part                  | Manufacturer                            | Model          | Specification                                                                 |
|-----------------------|-----------------------------------------|----------------|-------------------------------------------------------------------------------|
| Fuse                  | Advanced<br>Surgetech<br>Materials Ltd. | A372102-400 DY | Rated Voltage: 250VDC<br>Rated Current: 400A<br>Rated Breaking Capacity: 50kA |
| Fuse<br>(Alternative) | EUGARD CO., LTD                         | HEV2-400C      | Rated Voltage: 250VDC<br>Rated Current: 400A<br>Rated Breaking Capacity: 50kA |

## 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.<br>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

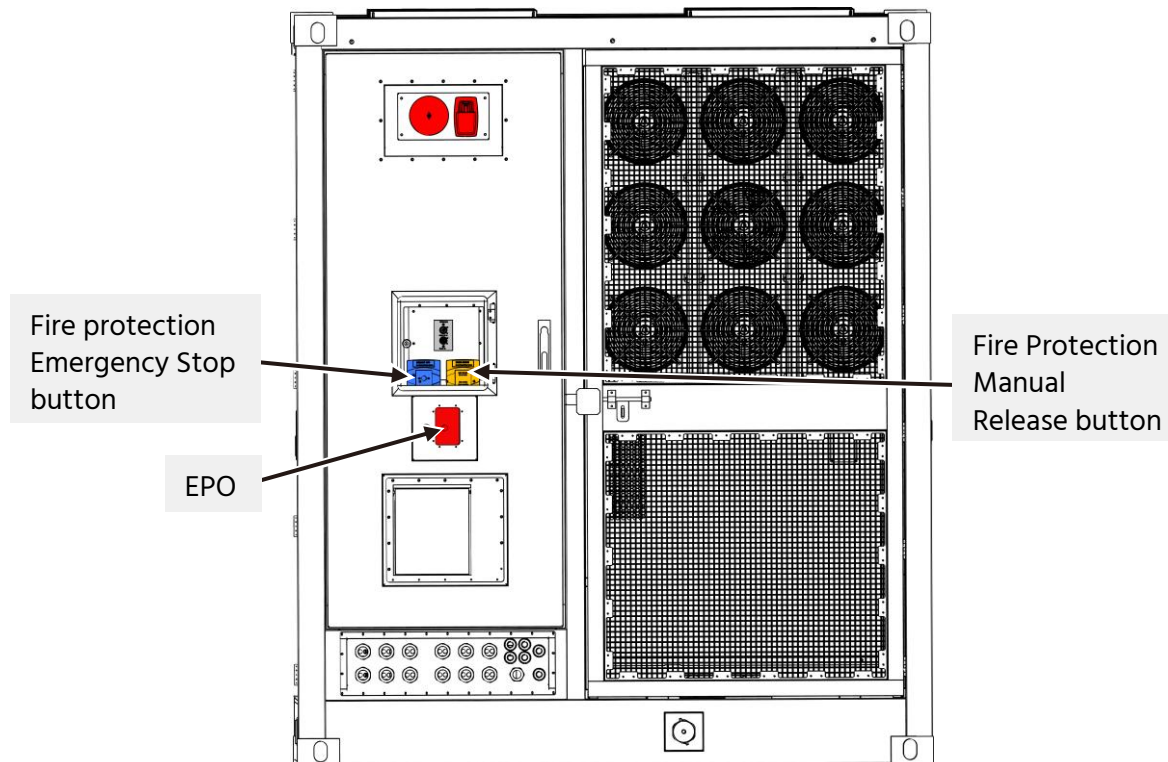
Please refer to the *Liquid Cooler Product Manual* for the liquid cooler troubleshooting.



## 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.

## 9 Transportation and Storage

### 9.1 Transportation

Attention should be paid to the following matters during transportation:

- (1) The BESS system is transported with batteries installed. During transportation, it should not be subjected to severe impact.
- (2) During transportation, it should be securely fixed and not displaced inside the carriage.
- (3) During transportation, it should be placed and transported strictly in the vertical direction, with a tilt angle less than 5 °, and should not be transported horizontally or sideways to avoid damaging the components due to vibration.
- (4) During transportation, it is not allowed to ship together with flammable, explosive, or corrosive goods.
- (5) The equipment is not allowed to withstand washing and mechanical damage from rain, snow, or liquid substances.

#### **NOTE:**

- 1) The SOC of a single battery is around 20-30% before shipment. The remaining capacity of batteries after shipment and before charging varies depending on storage time and storage conditions.
- 2) The battery module complies with the UN38.3 certification standard.

## 9.2 Storage

### CAUTION

Be sure to follow the instructions below for long-term storage. Otherwise, the battery's cycle life will decrease.

- (1) Relative humidity is less than 65%, the environment is clean, ventilated and free of corrosive gases. The temperature requirements are as follows:

| Storage Temperature (T)                                            | SOC      | Storage Duration                                                                      |
|--------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|
| $T < -40\text{ }^{\circ}\text{C}$                                  | /        | Not allowed                                                                           |
| $-40\text{ }^{\circ}\text{C} \leq T < -30\text{ }^{\circ}\text{C}$ | 20%~ 40% | $\leq 7$ days                                                                         |
| $-30\text{ }^{\circ}\text{C} \leq T < -20\text{ }^{\circ}\text{C}$ | 20%~ 40% | $\leq 30$ days                                                                        |
| $-20\text{ }^{\circ}\text{C} \leq T < 35\text{ }^{\circ}\text{C}$  | 20%~ 40% | $\leq 180$ days (After 180 days of storage, a full charge and discharge is required.) |
| $35\text{ }^{\circ}\text{C} \leq T < 50\text{ }^{\circ}\text{C}$   | 20%~ 40% | $\leq 30$ days                                                                        |
| $50\text{ }^{\circ}\text{C} \leq T < 60\text{ }^{\circ}\text{C}$   | 20%~ 40% | $\leq 7$ days                                                                         |
| $T \geq 60\text{ }^{\circ}\text{C}$                                | /        | Not allowed                                                                           |

- (2) Keep away from all kinds of harmful gases, flammable, explosive items and corrosive chemicals. And there should be no strong mechanical vibration, impact or strong magnetic field of the storage site.

## Annex: Cause and Effect Matrix for ESS Container Products

Information Version: V1.0

| <div>System Output</div> <div>System Input</div> | 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 Detect or 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.                                                                   |



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