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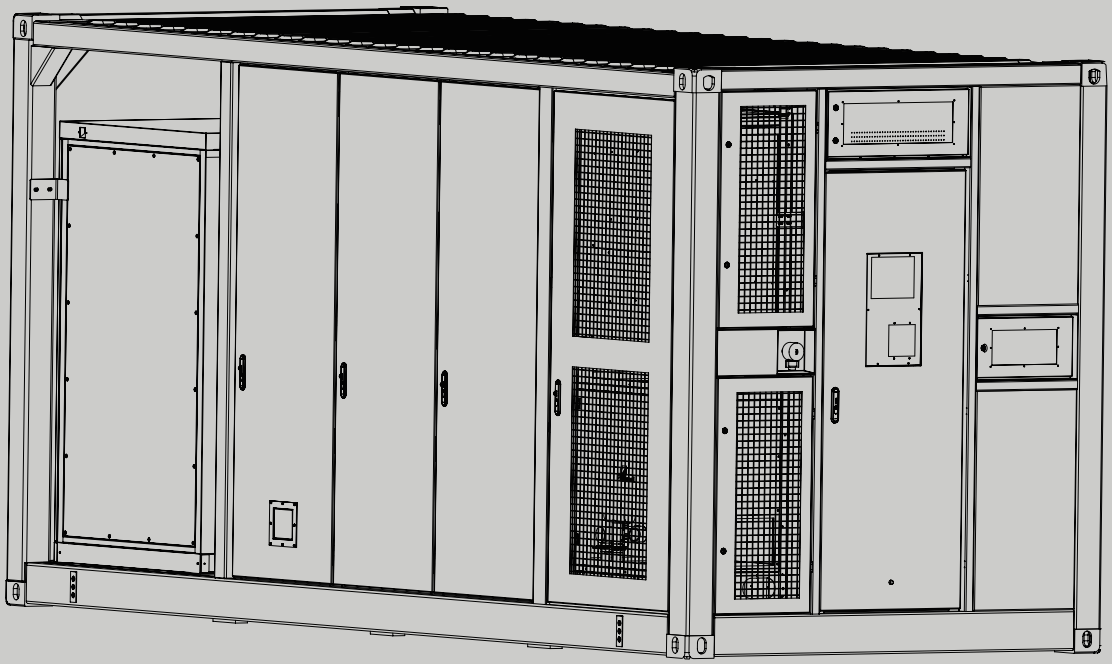

Containerized Battery Energy Storage System

Specification Manual

HP02CUBE Liquid-cooling Energy Storage Container

Revision History

Revision	Revision Date	Revised Pages	Description of Revision
V1.0	2025-05-20	-	Initial release.
V1.1	2026-02-11	Page01	Updated system parameters.

Abbreviations

Abbreviations	Meaning	Abbreviations	Meaning
BAU	Battery Array Unit	EMS	Energy Management System
BCU	Battery Control Unit	PCS	Power Conversion System
BMU	Battery Management Unit	PDU	Power Distribution Unit
BMS	Battery Management System	SOC	State of Charge
CDC	Control and Distribution Cabinet	UPS	Uninterruptible Power System

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- Product Model
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1 Overview

1.1 Validity

This document mainly describes the technical parameters, the structural features, and the electrical requirements of 2 MWh HP02CUBE liquid-cooling energy storage container (hereinafter referred to as "Container").

1.2 Product Introduction

HP02CUBE is a kind of non-walk-in liquid-cooling energy storage container, which is mainly applied to large and medium-sized energy storage power plants.

The container has a standard structure and is characterized by intelligent operation, convenient installation and maintenance, and efficient and controllable output. Based on liquid-cooling temperature control, modular design, systematic safety design, and intelligent management, the battery energy storage system (BESS) has equalized temperature, efficient operation, long lifetime, and convenient installation, operation, and maintenance.

2 System Parameters and Compositions

2.1 System Parameters

Item	Parameter
Configuration	6× (1P48S × 8)
Rated energy (MWh)	2.064
Rated voltage (V)	1228.8
Rated charging/discharging current (A)	840
Voltage range (V)	1075.2 to 1382.4
Auxiliary power supply	380 Vac ± 5% 50 Hz
Recommended usable SOC window	10%-90%
Working altitude (m)	≤3000 (>3000, derating)
Working temperature (°C)	-30 to +55 (>45°C, derating)
Storage temperature (°C)	Short period (within one month): -20 to +45 Long period (within one year): 0 to +35
Storage humidity	≤95%RH, without condensing
Dimensions (L × H × W [mm])	6058 × 2896 × 2438
Color	RAL 7035 (standard color)
Weight (T)	28 ± 0.5
Protection degree	IP54
Charging/discharging efficiency	≥93%, (25°C ± 2°C, 0.5C)
Cooling	Liquid cooling
Fire suppression system	Gas fire suppression system, water fire suppression system, venting system
Detector	Temperature sensor, smoke detector, combustible gas detector, carbon monoxide detector

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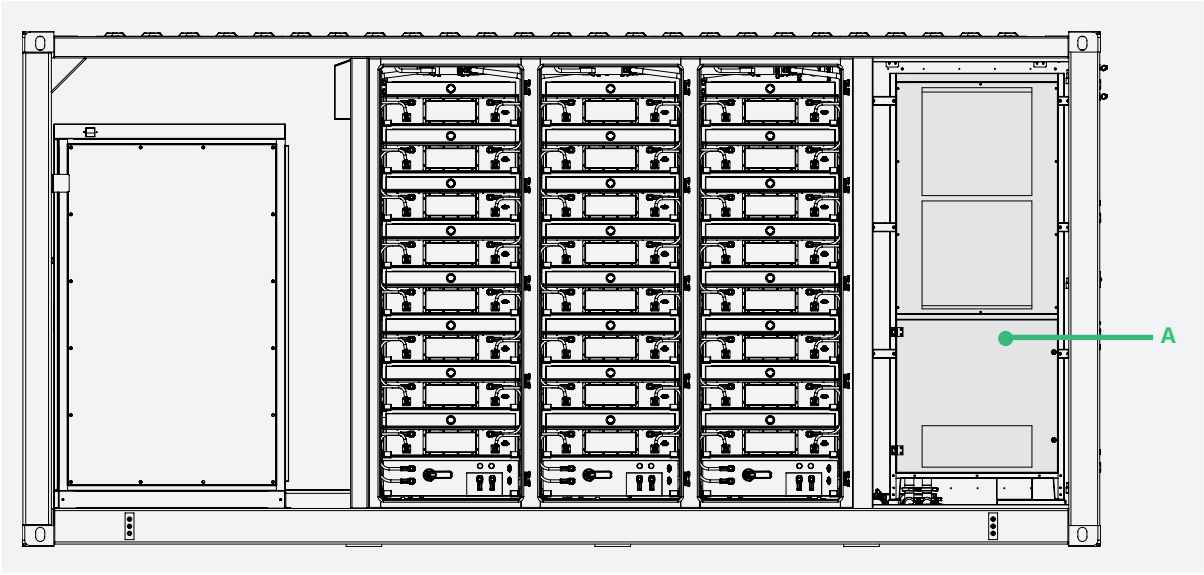
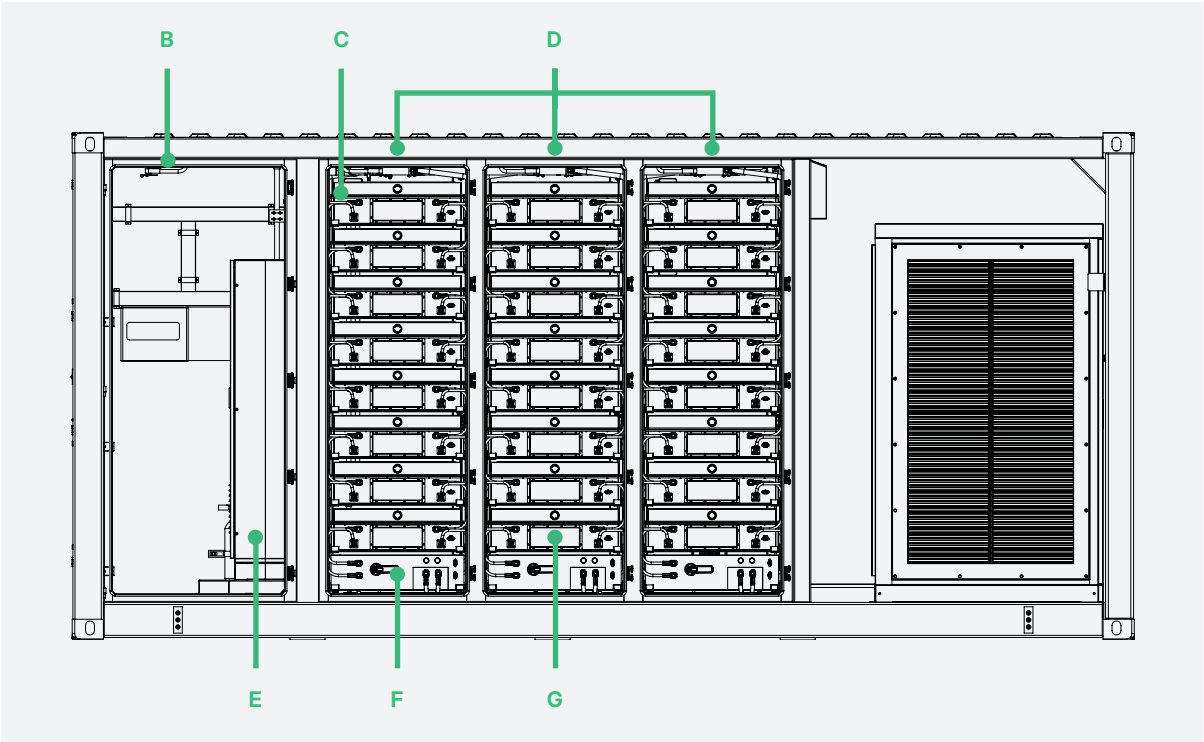
2.2 System Compositions

The container is an integrated system with high energy density, including battery clusters, control and distribution cabinet (CDC), battery management system (BMS), thermal management system, and fire suppression system.





* The picture shown here is for reference only. The actual product may differ.

NO.	Component	Quantity	Remarks
A	Thermal Management System	1	It includes 40 kW liquid-cooling unit and liquid-cooling pipeline. Its function is to cool or heat the container, ensuring the stability of the container environment.
B	Fire Suppression System	1	It includes fire alarm system, gas fire suppression system, water fire suppression system, and venting system. Its function is to monitor the fire suppression status of the containerized battery energy storage system in real time, thus preventing the fire accidents.

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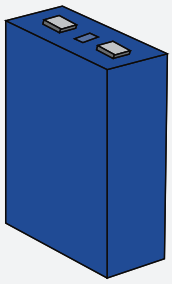
C	Battery Pack (also known as Battery Module)	48	1P48S
D	Battery Cluster (also known as Battery Rack)	6	Its function is to stably transmit the power to the CDC. 6 battery clusters are connected in parallel. Each battery cluster includes 8 battery packs and 1 PDU.
E	CDC	1	DC 1500 V/1400 A. Its function is to adjust and integrate the output of the battery clusters, and finally transmit the power to the power conversion system (PCS).
F	Power Distribution Unit (PDU)	6	DC 1500 V/140 A
G	Battery Management System (BMS)	1	It has a three-tier structure, including 48 BMU, 6 BCU, and 1 BAU distributed in the battery cluster and the CDC. Its function is to collect data from the BESS and communicate with other devices in real time.

2.3 Cells

An aluminum shell lithium iron phosphate battery with a nominal voltage/capacity of 3.2 V/280 Ah.



Basic Parameters	
Chemical material	LFP
Capacity (Ah)	280
Energy (Wh)	896
Rated voltage (Vdc)	3.2
Voltage range (Vdc)	0.5C, 2.5-3.65
Temperature range (°C)	Charging temperature: 0 to +60 Discharging temperature: -30 to +60
General Parameters	
Dimensions (W × D × H [mm])	173.7 × 72 × 207.2
Weight (kg)	5.42 ± 0.3
Storage temperature range (°C)	0 to +35
Standard and Compliance	
UN 38.3; ANSI/CAN/UL 9540A; ANSI/CAN/UL 1973; IEC 62619; GB/T 36276-2018; UL 1642; IEC 62133; IEC 62660; Bankability	

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2.4 Battery Pack

A battery pack contains 48 cells, 28 NTC temperature sampling circuits, and 1 BMU. The BMU collects the voltage and temperature of the cells, so as to realize equalization control. The appearance of a battery pack is shown as follows.



Basic Parameters	
Nominal capacity (kWh)	43.008
Number of cells	48
Cell self-discharge/Month	≤3% (25°C, 30%SOC, 3)
Voltage range	134.4 Vdc-172.8 Vdc (Cell: 2.8 V-3.6 V)
Rated voltage (Vdc)	153.6
Rated charge rate	0.5P
Rated discharge rate	0.5P
Max. continuous current (A)	170 @1 min
IP rating	IP67
General Parameters	
Dimensions (L × W × H [mm])	1036 × 761 × 246
Weight (kg)	315 ± 5
Cooling	Liquid cooling
Communication	Daisy chain
Standard and Compliance	
UN 38.3; UL 9540A; ANSI/CAN/UL 1973; IEC 62619; GB/T 36276-2018	

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2.5 Power Distribution Unit

The power distribution unit (PDU) is a high voltage circuit management and protection module connecting battery clusters and the CDC. It contains Battery Control Unit (BCU), detection devices, and protection devices, and is designed to collect and monitor battery cluster data (voltage, current, temperature, etc.), control and protect the contactors. Based on the electrical characteristics, heat dissipation, safety, operation, and maintenance of each component, the PDU is characterized by a reasonable structure, flexible configuration, and high safety and reliability.



Basic Parameters	
Max. allowable voltage (Vdc)	1500
Max. allowable working current (A)	200
Working power supply (Vdc)	24
Communication	CAN, daisy chain
Protection	Overcurrent protection, overvoltage protection, short circuit protection
Dimensions (W × D × H [mm])	758 × 478 × 200

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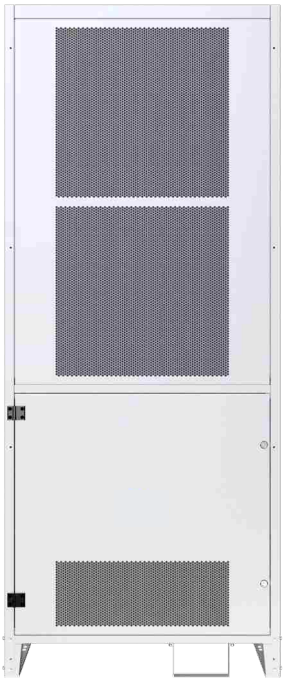
2.6 Liquid Cooling Module

The liquid cooling module is a kind of temperature control device, which can cool and heat the battery to maintain system temperature and difference, thus improving the consistency and lifetime of the system. The liquid cooling module has the functions of host computer communication and alarm, is highly reliable and easy to operate.



Item	Parameters
Rated working voltage	380~415V, 3~, 50/60Hz
Supported voltage range	400 ± 15% V, 3~, 50/60 ± 3 Hz
Max. working current (A)	58.5
Dimensions (W × D × H [mm])	980 × 630 × 2400
Noise (dB [A])	75
Protection degree	IPX5
Refrigerant	R410A
Coolant	Ethylene glycol aqueous solution (50%)
Refrigerating capacity @L45/W18 (kW)	40
Heating capacity (kW)	12.5
Water outlet temperature (°C)	18
Rated circulating water flow	400 L/min@150 kPa
Refrigerating input power @L45/W18 (kW)	21
Heating input power @Tu=10°C (kW)	14
Self-circulation model power (water pump only) (kW)	0.94
Max. consumption power (kW)	23.9

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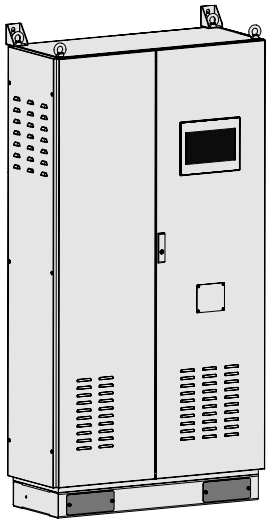
2.7 CDC

The CDC includes the power distribution part and the control part,

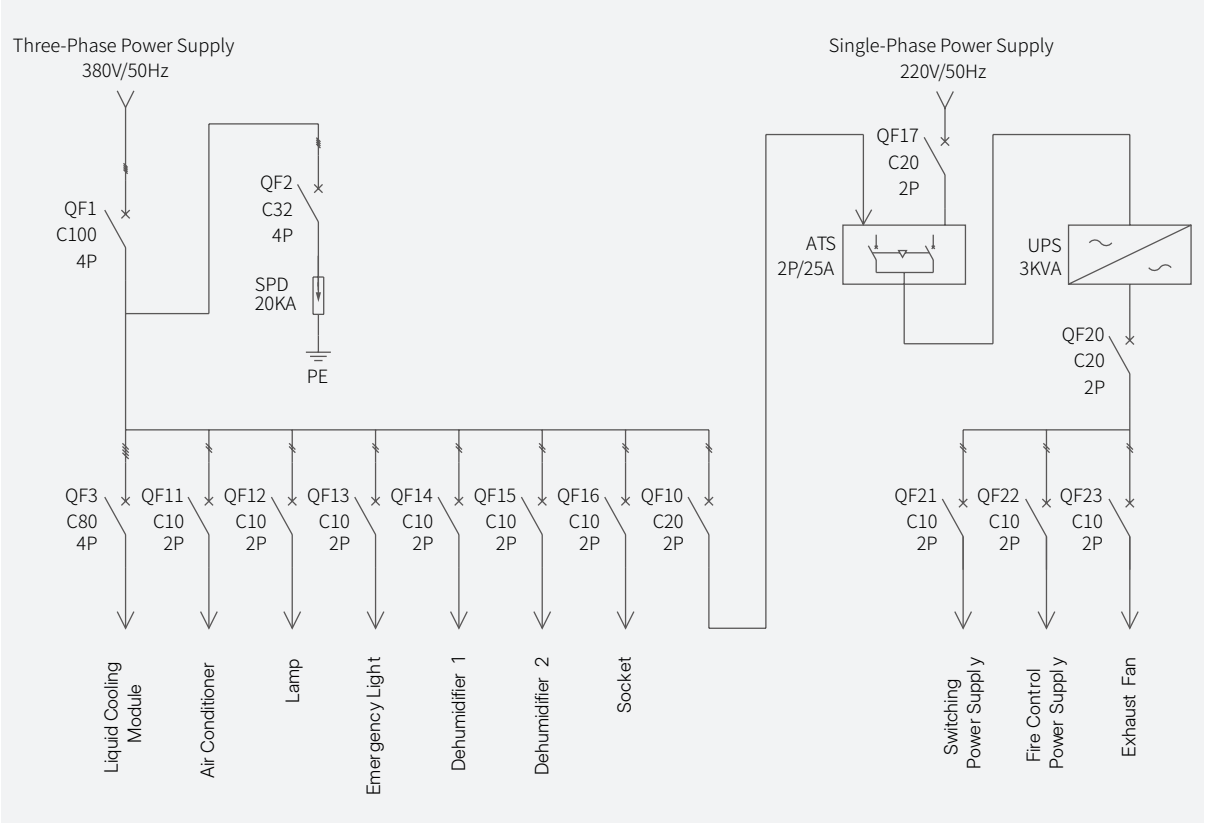
The power distribution part supplies power to some components of the container; the control part including Battery Array Unit (BAU) controls the internal working status of the container.



Control and Distribution Cabinet Technical Parameters

Item	Parameters
Communication	RS485, CAN, Ethernet
Protection	Short circuit protection, surge protection
Dimensions (L × W × H [mm])	957.4 × 400.2 × 1827

Power Distribution Primary Diagram



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2.8 Battery Management System

The battery management system (BMS) has a three-tier structure, including Battery Management Unit (BMU), Battery Control Unit (BCU), and Battery Array Unit (BAU).

- BMU, the first level control system, belongs to the slave control unit, managing and collecting the detailed information of cells.
- BCU monitors multiple BMU, processes and analyzes the basic information of cells received from BMU, thus accurately calculating the battery State of Charge (SOC). Based on the system control strategy, BCU will upload the data to the higher level Energy Management System (EMS), or issue a control command to the BMU, ensuring the normal operation and efficient management of the battery system.
- BAU monitors multiple BCU.

BMU Technical Parameters

Item	Performance Parameters	Value	Remarks
Working voltage	Range (V)	9-32	-
Single unit voltage sampling	Range (V)	1-5	-
	Accuracy (mV)	±5	Temperature range: 0°C to +60°C
		±10	Temperature range: -40°C to 0°C/+60°C to +85°C
	Number of channels	48	Supported up to 48 channels, optional as required
Cell temperature sampling	Range (°C)	-40 to +125	-
	Accuracy (°C)	±2	Temperature range: -25°C to +85°C
		±3	Other temperature range
Equalization	Equalization current	100 mA@Vcell > 3.2 V	Passive equalization

BCU Technical Parameters

Performance Parameters	Value	Remarks
Working humidity range	0%RH-95%RH	-
Working altitude (m)	≤4000	-
Voltage range (power supply) (V)	9-32	-
Working consumption (W)	≤1.7	Voltage range: 9 V-32 V
Sleep consumption (mW)	≤100	Voltage range: 9 V-32 V

BAU Technical Parameters

Performance Parameters	Value	Remarks
Working humidity range	0%RH-95%RH	-
Working altitude (m)	≤4000	-
Voltage range (power supply) (V)	21.6-26.4	-
Working consumption (W)	≤5	Voltage range: 24 Vdc

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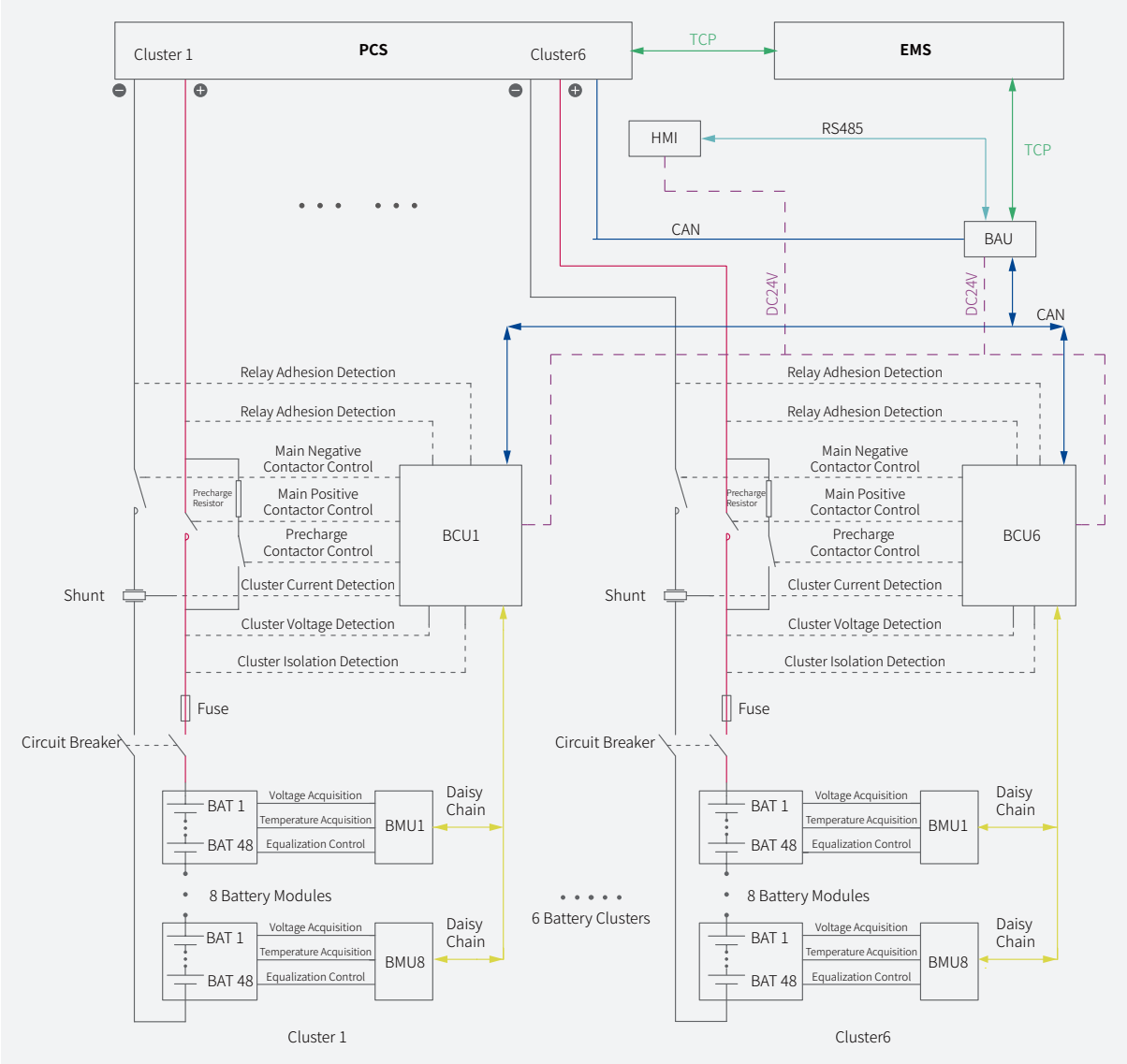
Battery Management System (BMS) Topology



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2.9 Fire Suppression System

The fire suppression system includes three parts.

- Gas Fire Suppression System: It uses a pipe network filled with perfluorohexanone or heptafluoropropane as a fire extinguishing agent. It is integrated with automatic control systems, including smoke detectors, temperature sensors, and a fire control panel.
- Water Fire Suppression System: It utilizes a water mist spray pipe layout. It can cooperate with the external water swivel (on the surface) for manual water connection or integration with fixed fire hydrants.
- Venting System: The venting system circulates and exhausts gases inside the product to prevent hazards like spontaneous combustion or explosions. This system automatically activates when gas concentrations exceed safe levels, as detected by a gas monitoring system.

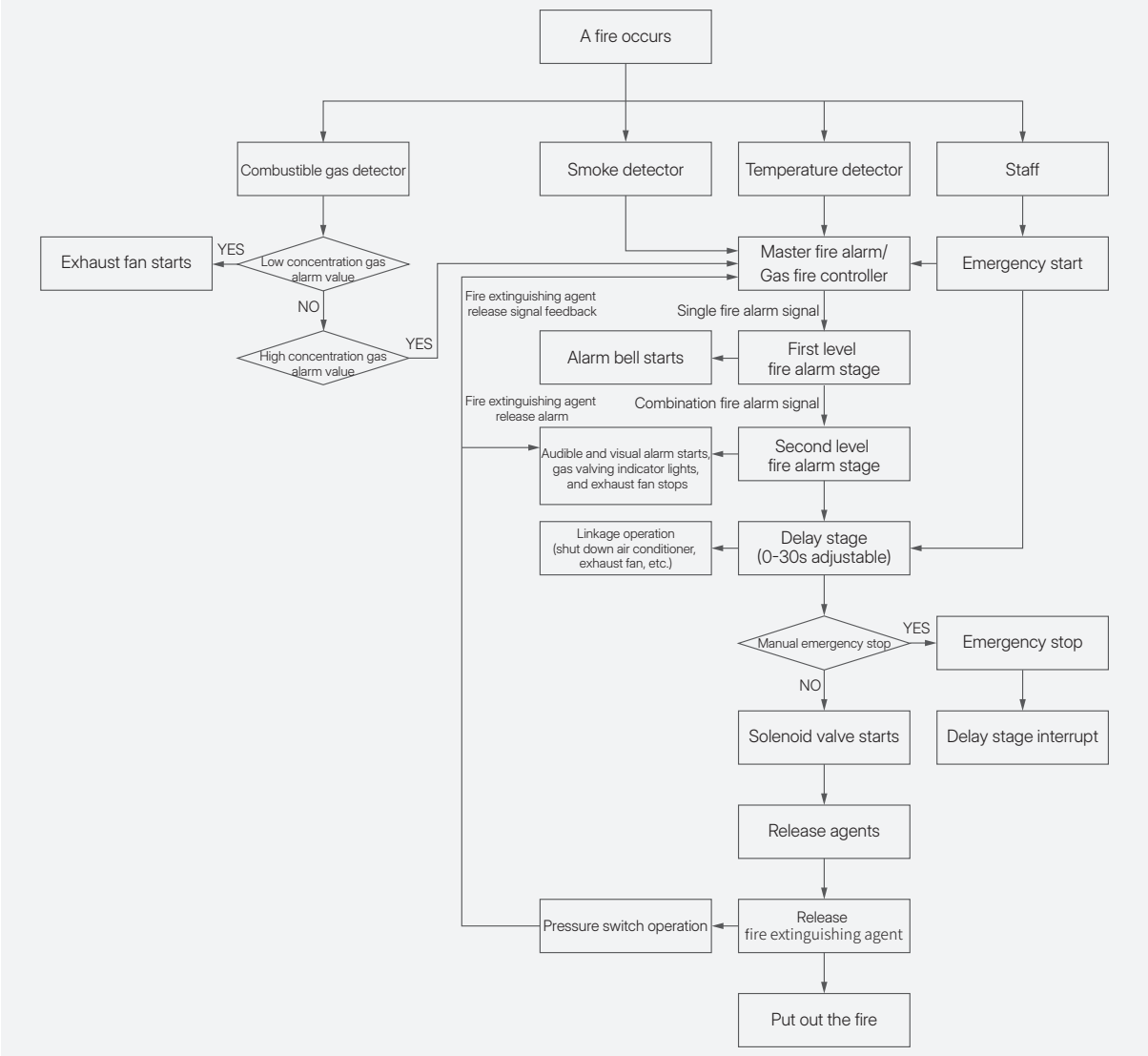
The fire suppression system has auto control mode and manual control mode.

All protection areas in the container have two separate detection circuits. When the detector sends a fire signal:

- If the system is in auto control mode, the gas fire controller will send an alarm signal and actuating signal, and the fire suppression system will be automatically activated.
- If the system is in manual control mode, the gas fire controller will only send an alarm signal. After the staff verify the fire alarm, press the emergency start button on the alarm control panel or the emergency release/ stop button at the door opening of the protection area to start the system and release fire extinguishing agents.

* Do not trigger the fire suppression switch unless there is an emergency.

Working Process of Fire Suppression System



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3 Transportation and Storage

When transporting or storing the container, comply with all instructions and safety precautions in this document, otherwise, any improper or incorrect operations will void the warranty.

3.1 Transportation Ways

You can choose land transportation or shipping. The container uses an integrated design and a simple hoisting design, convenient for transportation.

* Currently, the container has not obtained the permission for air transportation and has no detailed instructions for railway transportation.

3.2 Transportation Requirements

All devices in the container have been pre-installed and secured in the container before the delivery, therefore, it can be hoisted and transported as a complete unit.

Tool Requirements

- Maintain all machines and tools needed during the transportation before use.
- Use professional lifting tools to lift and install the container.
- Select appropriate crane or other lifting tools according to the site conditions. The lifting tools used shall have a sufficient bearing capacity, boom length, and turning radius.
- Use additional traction devices if moving the container on inclined surfaces.

Personnel Requirements

- All personnel who work with the product should have professional training.
- During the handling and transportation, keep the mechanical parameters (shape, dimensions, and weight) of the container in mind.

Environmental Requirements

- Transport or move the container during favorable weather to avoid risks.
- Remove potential barriers like trees, cables, or other obstructions along the transport path.
- Install temporary warning signs or fences to isolate the lifting and transport area.

Other Requirements

- Comply with local safety regulations for container operation during handling and transportation.
- Lock the doors of the container and all internal devices before the transportation.
- Mostly, the total weight of the truck will exceed the general road permissible range when transporting the container by truck. Therefore, overweight permission in the local area is needed.
- Use ropes to fasten the top lifting ring of the container to the transport vehicle, which can prevent excessive tilting during land transportation.

3.3 Storage Requirements

Comply with the following storage requirements.

Environmental Requirements

- Store the container on a solid, flat, dry ground with sufficient bearing capacity. Avoid locations with vegetation, standing water, or uneven surfaces. The surface levelness error should not exceed 5 mm.
- Storage temperature: -20°C to +45°C; recommended temperature: 0°C to +35°C.
- Storage humidity: 0-95%RH, without condensing.
- Store the battery packs in a clean and dry place away from direct sunlight, rain, hazardous gas, flammable and explosive materials, and corrosive chemicals.

Protection Requirements

- Based on site geological and meteorological conditions, raise the base of the container to a specific height to prevent condensation or water damage, especially in areas with heavy rainfall.

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- Store the container in a place where it can be protected from mechanical impact, heavy pressure, and strong magnetic fields.
- Take effective measures to protect the air inlet and outlet of the container and prevent rain, sand, or dust from accumulating in the container.
- Periodically check whether the package is intact (at least once half a month). Replace the package damaged by insects or rodents in a timely manner.
- Check whether the container and all internal devices are intact.
- If the container has been stored for more than six months, a visual and complete check is needed. Before the installation, first check the container and all internal devices are intact; secondly, power on to check other aspects. If necessary, the container must be tested by qualified personnel before the installation.

Other Requirements

- Store the container in a sealed package and avoid tilting or inverting the package.
- Lock the doors of the container and all internal devices before the storage.
- Take measures to protect the battery packs from sudden temperature changes or accidental collisions.
- After the container is stored for more than six months from the date of delivery, charge and discharge the container once to bring the system SOC to 30%-40%. After recharging, the SOC of each battery cluster should be the same.

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