522kWh Outdoor Energy Storage Cabinet

Specification

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Catalogue

1. Product Presentation

1.1 Overview

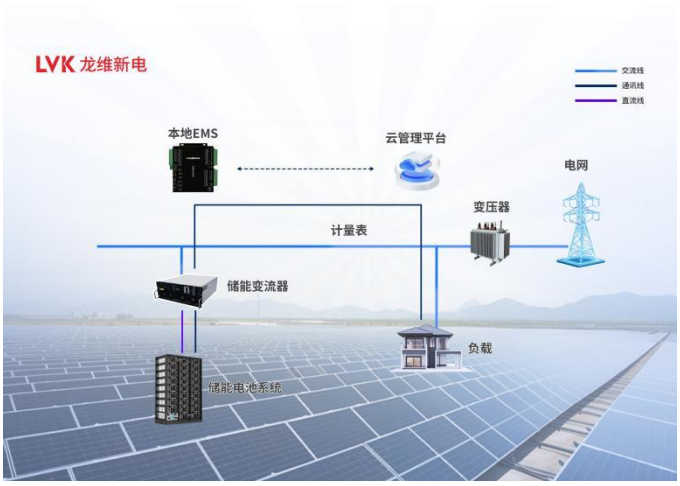
The 522kWh outdoor energy storage cabinet developed by our company, as a new generation of industrial and commercial energy storage solution, fully integrates advanced technologies such as "high efficiency, high safety, long life and easy expansion", forming a modular, standardized and intelligent outdoor energy storage system.

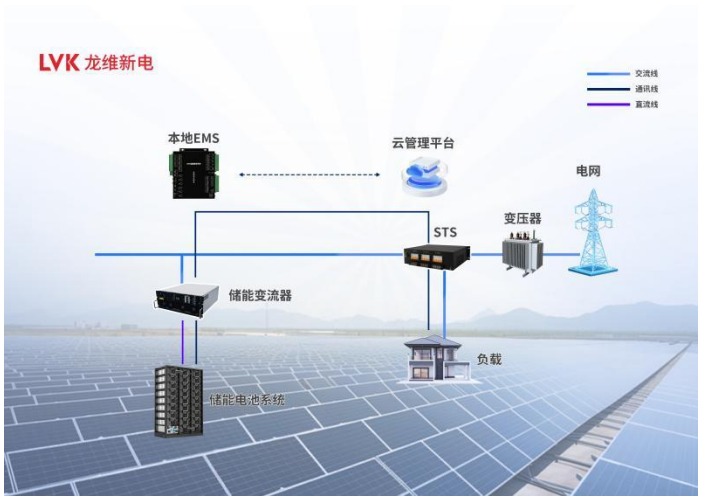
The energy storage adopts the design concept of "safe and reliable", and the components are self-developed or adopted by first-line suppliers, so as to provide customers with safe and reliable, affordable, high-quality, easy to install and expand, simple and easy to use energy storage products, so that the construction of energy storage projects is simpler, the use is more concise, and the operation and maintenance is easier.

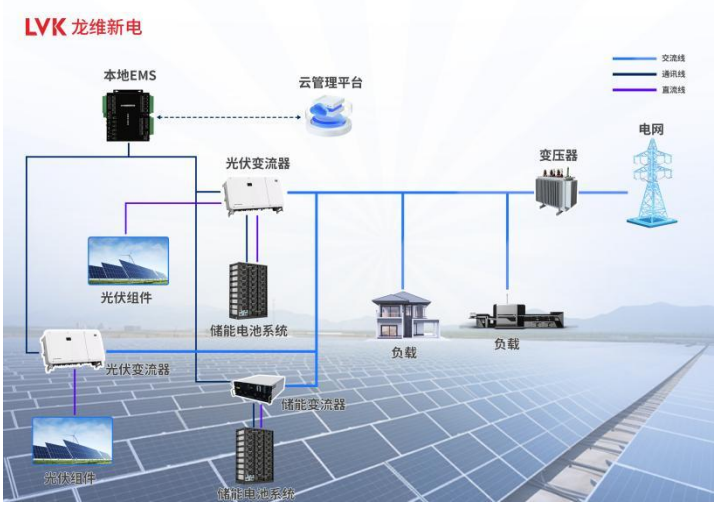
Figure 1-1 Schematic Diagram of 522kWh Outdoor Energy Storage Cabinet

Figure 1-2: 522kWh Energy Storage Outdoor Cabinet Parallel Topology (battery-PCS-Grid-Connected Cabinet)

1.2 Product Application Scenario 1

场景一	Application scenario name	User-side energy storage
	Schematic diagram	
	Main function description	User-side energy storage systems primarily charge during off-peak or flat-rate electricity periods and discharge during peak demand times, generating revenue from price differentials through load leveling. These systems can also manage maximum power demands to eliminate short-term peak loads, thereby reducing users' basic electricity costs. Additionally, they provide backup power supply during high-demand periods and support dynamic capacity expansion capabilities.

Scenario 2	Application scenario name	Light storage and charging
	Schematic diagram	
	Main function description	Due to the significant short-term capacity expansion pressure on urban distribution networks, insufficient power supply has led to operational challenges for some charging stations and facilities, resulting in limited revenue generation. In photovoltaic-storage-charging systems, energy storage can absorb excess solar power during off-peak electricity periods and discharge during peak demand hours, effectively alleviating grid capacity constraints and boosting operational profitability for charging stations.
Scenario 3	Application scenario name	Backup power supply function (single machine 250kW/522kWh)
	Schematic diagram	
	Main function description	In industrial and commercial enterprises, STS modules can be selected to improve the power supply reliability in places with high requirements for power reliability. When the mains power is cut off, the power supply is switched to energy storage, and the switching time of STS is less than 20ms.
Scenario 4	Application scenario name	Microgrid

	Schematic diagram	
	Main function description	For remote areas with unstable or no mains power access, the energy storage system can be combined with other distributed power sources to form a small micro-grid to ensure power supply.

1.3 Product Features

1.3.1 Product Capacity

The capacity of the outdoor energy storage cabinet is 250kW/522kWh (0.5P). The outdoor cabinet can be expanded and matched freely according to user needs, and supports up to

Expand 10 units with capacity range of 250~ 2500kW/522kWh~ 5220kWh to meet the needs of energy storage projects of different sizes.

1.3.2 Product Formation

The outdoor energy storage cabinet integrates seven core systems, which can provide stable and reliable performance under different application scenarios and environmental conditions. The core systems are introduced as follows:

1) Energy storage battery system------for the storage and release of electricity;

2) Battery management system BMS------for battery data collection, status monitoring and control protection;

3) Energy management system EMS------configure power management strategy, monitoring, control and power flow;

4) Fire safety system------to provide effective means for fire safety protection;

5) Energy storage converter system PCS--two-way current conversion between battery DC and grid AC;

6) Fluidic cooling system----provides efficient temperature control for the cell;

7) The electrical system provides reliable power supply, lighting, grounding and other functions for the cabinet equipment.

1.3.3 Product Advantages

The main advantages of this series of products are as follows:

1) Using lithium iron phosphate polymer cell with high safety, high energy density and long cycle life, it can adapt to various application scenarios of 0.5P rate;

2) The high efficiency liquid cooling scheme is adopted to effectively optimize the temperature difference between batteries and improve the cycle life of batteries;

3) Adopt active safety fire protection scheme, and configure PACK grade D single package water injection fire extinguishing system, which can detect, alarm and put out fire in time and effectively, so as to firmly guard the lifeline of product safety;

4) The modular and standardized design scheme makes the single outdoor cabinet have small footprint, convenient transportation and installation, and high adaptability on the installation site. The outdoor cabinet is easy to expand, with 1~10 units (522kWh~5220kWh) expandable per group, and multiple groups of outdoor cabinets can be configured according to project requirements.

5) The parallel connection scheme on the AC side can fundamentally eliminate the circulating current between batteries and further improve the battery life.

6) Adopting intelligent design ideas, it has cloud remote operation and maintenance function, full life cycle system maintenance, and can predict the impact of operating conditions on battery S0C and SOE, constantly select and replace control strategies, so that the system always runs in the best state, reducing the loss of battery performance and life.

7) Adopt the active system safety design idea, 24/7 cloud real-time monitoring, predict security risks in advance, issue security warnings in advance, and provide timely and effective protection when faults occur.

8) The outdoor cabinet has multiple protective functions such as "anti-corrosion, fireproof, waterproof, dustproof, shockproof and uv protection", and the structural strength and space can provide favorable protection for the stable operation of the energy storage battery system.

9) Users can choose to equip STS module according to their needs. After optional, outdoor cabinet has the function of backup power supply, which improves the power supply possibility in important places.

10) Users can choose photovoltaic MPPT module according to their needs. After the optional photovoltaic DC coupling function is selected, the outdoor cabinet will store the photovoltaic power into the energy storage cabinet.

11) Users can choose the photovoltaic energy storage dynamic adjustment system according to their needs to maximize the value of photovoltaic power generation.

1.3.4 Internal Layout

In order to improve system security, reduce the chance of equipment misoperation, reduce fire safety risks, save operating costs,

To ensure long-term stable operation of outdoor energy storage cabinets, the system consists of two compartments: the equipment compartment and battery compartment. These compartments are isolated using high-grade thermal insulation and flame-retardant materials. The equipment compartment houses liquid-cooled units and PCS (Power Control System) devices, while the battery compartment primarily contains the battery system. Both compartments are categorized into three functional zones: "Temperature Control", "Fire Safety", and "Functional Operations".

Table 1-1: Outdoor Cabinet Functional Division Description

Name of cabin	Main installation equipment	fire safety	Functioning	temperature control
equipment bay	Name: PCS, liquid cooling unit	External configuration water injection system	Local operation and troubleshooting	Liquid cooling, natural air cooling
Battery compartment	Name: battery pack, high voltage box, EMS	Active fire fighting, PACK grade aerosol + water injection fire fighting	System control, local operation, fault maintenance	liqukd cooling

1.4 Product Configuration List

The main equipment configuration of a single energy storage outdoor cabinet is as follows:

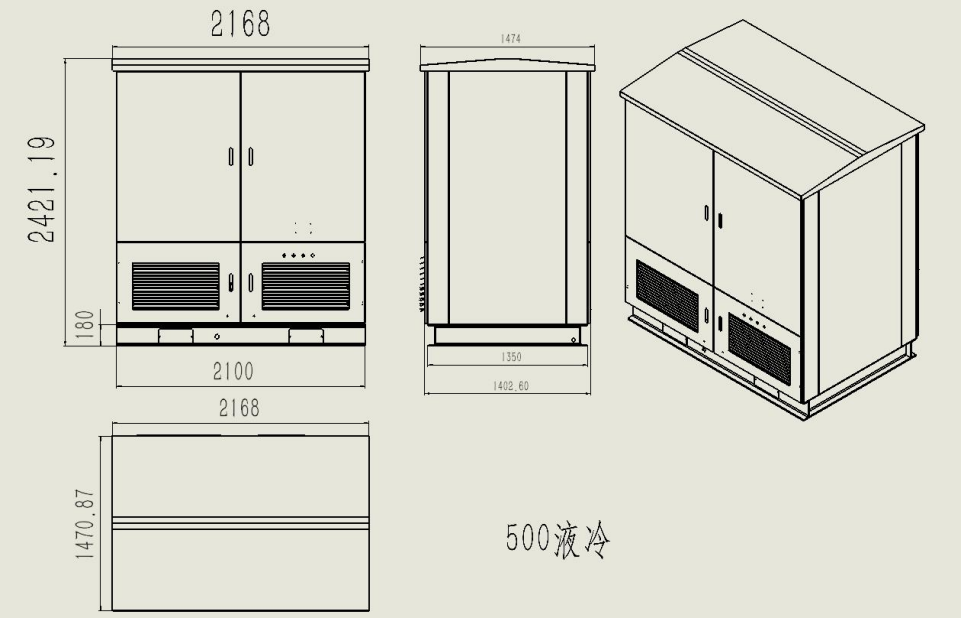
order number	systematic name	Name of main equipment	explain	unit	quantity
1	Battery system	52kWh battery pack	3.2V/314Ah lithium iron phosphate cell is adopted	individual	10
2	Battery management system	Control module	Each battery pack is configured with one slave control	individual	10
3		Master module	One main controller is configured for every 5 battery packs	individual	2
4	Electrical box	high-voltage compartment	Each outdoor cabinet is equipped with one high voltage box	individual	1
6	AC/DC converter system	PCS	125kW	cover	2
7	energy management system	EMS	Supports peak and valley filling, demand control and other functions, which are only configured in the main cabinet.	cover	1
8	fire extinguisher system	/	PACK a high-pressure water or aerosol fire suppression system	cover	1
9	Fluid cooling system	Refrigeration capacity 8kW	Cold plate, liquid cooling, etc	cover	1
10	Electrical support systems	/	Low-voltage electrical appliances, direct current, grounding, lines, etc	short for Taizhou	1
11	Cabinet	/	Cabinet sheet metal structure and its installation accessories.	cover	1

Note: The equipment name/specification and corresponding quantity are subject to the actual supply.

1.5 Product Parameter Table

system parameter	
Capacity of a single outdoor cabinet	250kW/522kWh
Maximum number of units in each group	10 short for Taizhou
Maximum capacity per group	2500kW/5220kWh
Discharge operating temperature	-15℃~45℃
Stable charging work	0℃~45℃
Storage temperature (℃)	Within a month: -20℃ to 45℃
	Within six months: 0℃~35℃
noise	<75db
cooling-down method	liqukd cooling
cycle index	8,000 times @25℃,0.5P,70%EOL
	4200 times @25℃,0.5P,80%EOL
fire extinguisher system	Active fire warning, Pack level aerosol fire extinguishing + water injection
Detector type	Sensation temperature, combustible gas
Reference size (width * depth * height mm)	2200*1500*2400mm
weight (T)	5
Corrosion resistance level	C3/C4/C5 (optional)
levels of protection	Battery compartment: IP54
	Equipment chamber: IP54
Allow relative humidity	0~95%
Allow altitude	≤4000m (decrease above 2000m)
system effectiveness	85%
communicating protocol	Modbus TCP/RTU
system operation mode	Peak and valley cutting
	Demand control
	Dynamic expansion
	Photovoltaic storage
	Anti-reflux function
	Charging pile energy storage

attestation	Battery: GB/T 36276
	BMS:GB/T 34131
	PCS:GB/T 34120
Communication side parameters	
Rated AC power (KVA)	250
AC overloads (KVA)	275
mode of connect-ion	Three phase four wire
Allowable grid voltage range (V. ac)	400 (-5%~5%)
Allowable grid frequency range (Hz)	50/60 (-2.5~2.5)
power factor	-0.99~0.99
Maximum conversion efficiency	≥98%
cooling-down method	liqukd co-oling
Unbalanced load capacity	100%
DC side parameters	
Battery type	lithium iron phosphate
compound mode	2P260S
Rated capacity (Ah)	314
Rated energy (kWh)	522
rated voltage (V)	832
Rated charge/discharge ratio	0.5P
Operating voltage range (V)	676~936



Outdoor Cabinet Size Drawing

2. Introduction to Core System

2.1. Energy Storage Battery System

The grouping of the energy storage battery system in the prefabricated cabin is as follows:

Table 2-1 Battery System Grouping Form

order number	top class	522kwh energy storage outdoor cabinet
1	Connected in parallel groups	2P260S
2	Number of cells (pieces)	520
3	Number of battery packs (pcs)	26
4	Number of battery clusters (pcs)	2
5	Number of high-voltage boxes (pcs)	1

Note: In the group form, "S" represents series and "P" represents parallel.

2.1.1 Energy storage cells

This product utilizes a long-life 3.2V/314Ah lithium iron phosphate polymer cell, featuring high safety, high energy density, long cycle life, and cost-effectiveness. The cell has passed third-party certification testing conducted by authoritative institutions in accordance with the GB/T 36276-2018 standard. Basic parameters of the battery and core components are as follows:

Table 2-2 3144h Basic Parameters of the Cell

order number	项目	specifications	remarks
1	Cell model	LFP	LFP
2	Cell weight (kg)	5.6±0.15	After the Blue Band
3	rated capacity （Ah)	314	25℃ standard charge and discharge
4	Nominal energy (Wh)	1004.8Wh	
5	rated voltage （V)	3.2	
6	Charging limit voltage (V)	3.6	
7	Release limit voltage (V)	2.6	
8	Rated charging power	0.5P	

order number	项目	specifications	remarks
9	Maximum charging power	0.5P	
10	Rated discharge power	0.5P	
11	Maximum discharge power	0.5P	
12	cycle index	≥8000 times	@25℃,0.5P/0.5P, EOL70%
13	Internal resistance of communication (mΩ)	≤0.18	

2.1.2 battery pack

The liquid-cooled battery pack used in this product is independently developed, designed and manufactured by our company. Its internal components are mainly composed of cells, copper connection bars, box liquid cooling plates, collection and communication wire bundles, BMS and other components.

Each battery pack is arranged with 52 voltage collection points and 28 temperature collection points inside, which are connected to the BMU through the wire harness. The outdoor cabinet can accurately evaluate the state of the cell, and reduce the probability of safety accidents by the temperature difference in the battery pack.

1) Battery pack parameter table

Table 2-4 Battery Pack Parameter Table

order number	项目	parameter	remarks
1	burst mode	1P52S	
2	Rated energy (kWh)	52	
3	rated voltage (V)	166	
4	Working voltage range (V)	135~1187	Single cell voltage 2.6 ~ 3.6
5	power rating (kW)	52	
6	Charging temperature range (℃)	0~45	
7	Discharge temperature range (℃)	-15~45	
8	Recommended temperature range (℃)	28±3	
9	levels of protection	IP67	
10	Thermal management mode	liqukd cooling	
11	communication mode	CAN	
12	Size (W*D*H,mm)	2200*1500*2400	

2.1.3 Battery clusters

The battery cluster is mainly composed of the battery pack and high voltage box. Each battery pack is installed in the outdoor cabinet, and the modules are connected through DC power cable and BMU communication wire harness

The high-voltage box serves as the input and output window of the battery cluster's energy flow and information flow. It contains BMU main control, contactors, electrical appliances, fuses, pre-charging resistors, switching power supplies and other components, which can be configured and modified according to project requirements.

Each energy storage outdoor cabinet is arranged with 10 battery boxes and 1 high-voltage box in the battery compartment to form two battery clusters. The basic parameters of the battery cluster are as follows:

Table 2-5 Battery Cluster Parameters of the Battery Compartment

order number	项目	parameter
1	Cell selection	3.2V/314AH
2	burst mode	1P52S*5
3	rated voltage （V）	832
4	Working voltage range (V)	676~936
5	Rated energy (kWh)	522
6	Rated charge/discharge ratio	0.5P/0.5P @25℃
7	Thermal management mode	liqukd cooling
8	Best cycle temperature (℃)	25
9	Temperature control range (℃)	±3
10	guard mode	Fuses, contactors, circuit breakers
11	BMS configure	BCU： 2 BMU： 10
12	High pressure box configuration	1 short for Taizhou

2.2 Battery Management System

Battery management system is an important basis for energy storage batteries to achieve stable operation. It has a variety of functions such as data collection, status monitoring, control and protection, which can realize comprehensive perception of battery state, early warning and accurate control.

2.2.1 BMS Equipment Composition

The BMS of this product adopts a two-level architecture scheme, which has the characteristics of wide functional coverage, small size, strong anti-interference performance, safety and reliability. Each battery pack has one BMU (slave unit) built in, and each battery is equipped with one main control unit (BCU).

Table 2-6 Battery Management System Configuration Table

order number	device name	Configuration instructions	function declaration	installation site
1	BMU	From the control unit, each battery pack has one built in	Mainly responsible for the state parameter collection and monitoring of battery pack	Inside the battery pack
2	BCU	Master control unit, one for each battery cluster	It is mainly responsible for data monitoring, state calculation, charge and discharge management of single cluster battery system, communication with other devices, and implementation of system strategy	Inside the high pressure box

2.2.2 Introduction to the Main Functions of BMS

order number	Function name	order number	Function name
1	Battery voltage and temperature measurement function	7	Operation parameter setting function
2	Online SOC diagnosis	8	Active equilibrium function
3	Battery system protection function	9	memory function
4	Communication function	10	Battery state estimation
5	Thermal management function	11	Time-sensitive functionality
6	Self-diagnosis and fault tolerance	12	Fault waveform recording function
... For more functional requirements, please contact us			

2.2.3 BMS Communication Architecture

The communication architecture between BMS devices in this product is as follows:

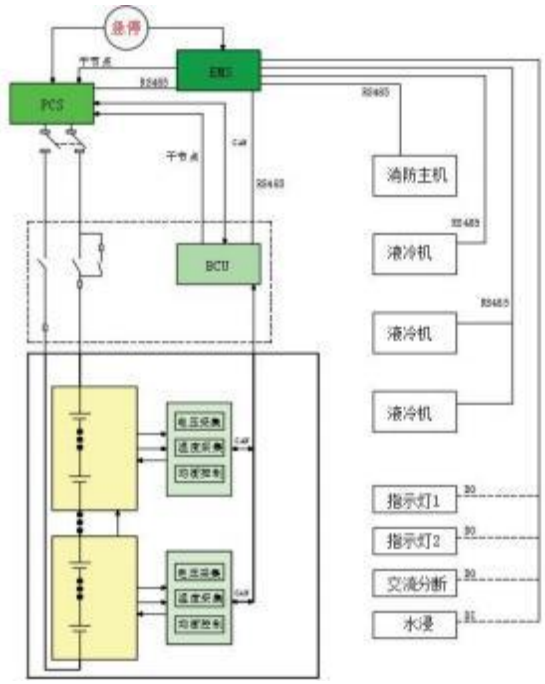


Figure 2-3 Schematic Diagram of BMS Communication Architecture

2.2.4 BMS Parameter

Table 2-6 BMS Parameter Table

order number	device name	项目	parameter
1	BMU Control unit	Working voltage range	9~32 V
2		Number of battery management units	64 bunch (Max)
3		Balanced approach	Active equilibrium
4		Voltage acquisition range	0~5 V
5		Number of temperature measurements	-40~250℃
6	BCU main control unit	Working voltage range	9~32 V
7		SOC accuracy	±5%
8		SOH accuracy	±8%
9		Voltage acquisition range	0~1000 V
10		Current acquisition range	-522~522 A
11		Temperature collection range	-40~250℃
12		Communication interface type	CAN\RS485

2.3 Energy Management System

The Energy Management System (EMS) is designed to monitor, control, and optimize energy flow and consumption within power systems. By leveraging data acquisition, analysis, and decision support technologies, it enables real-time monitoring of equipment performance, energy usage patterns, and environmental conditions, thereby achieving efficient energy management and operational optimization.

2.3.1 Energy scheduling and control strategy

The energy storage outdoor cabinet energy management system has peak shaving and valley filling, demand control,dynamic expansion, light storage and charging application, storage and charging application, anti-flow control and other control strategies.

2.3.2 Major Function

(1) Data monitoring and collection: The energy management system can monitor the generation, storage and consumption of energy in outdoor cabinets in real time; in addition, it can collect data from BMS, PCS, power environment system and other equipment, including battery charge and discharge status, temperature, voltage, current, etc.

(2) Data Analysis and Optimization: Energy management systems utilize advanced data analytics to process and analyze collected system data, enabling comprehensive understanding of operational status and performance metrics. Through systematic analysis, these systems can identify potential issues within energy infrastructure and deliver optimization recommendations, including adjustments to charging/discharging strategies and improvements in energy utilization efficiency.

(3) Energy Scheduling and Control: The Energy Management System intelligently coordinates energy distribution based on real-time demand and system status. By analyzing demand forecasts, electricity pricing trends, grid load patterns, solar PV output levels, and charging station availability, it optimally manages the charging/discharging cycles of energy storage facilities.

(4) Fault Detection and Safety Protection: The energy management system promptly identifies and alerts for faults in energy storage facilities, such as battery overloads, excessive charging, or abnormal temperatures, ensuring safe operation. Additionally, it integrates with the power distribution network to enable remote monitoring and protection of these systems.

(5) Cloud remote operation and maintenance: The energy management system will collect the operation and fault data of the equipment and upload it to the cloud, which can accurately predict and locate faults remotely, greatly reducing the operation and maintenance work of engineers.

(6) Operation benefit display:
The energy management system can display the energy storage benefits and electricity information.

2.3.3 EMS Communication Architecture Diagram

Figure 2-4 EMS Communication Architecture Diagram

2.4 Energy Storage Converter System

The outdoor energy storage cabinet is equipped with two 125kW Power Conversion Systems (PCS). These PCS units, designed to connect battery systems with the grid (and/or loads), enable bidirectional power conversion by controlling battery charging/discharging cycles and performing AC/DC conversion. Featuring a three-phase four-bridge topology, they provide single-phase, three-phase active/reactive power control capabilities while precisely addressing three-phase imbalance issues.

2.4.1 Control Function

PCS can be combined with EMS to achieve peak and valley filling, demand control and other control functions.

2.4.2 Defencive Function

PCS can carry out real-time fault protection according to the voltage and frequency of the grid side and its own operating state. The protection functions include: power grid over/under voltage, power grid frequency over/under frequency, DC over/under voltage, AC over current, DC over current, phase loss, anti-islanding and other protection functions.

2.5 Fire Safety System

This series of products employs an active fire safety strategy to disconnect high-voltage circuits before thermal runaway occurs, with real-time monitoring of cell temperature, voltage signals, and electrical circuits. Each outdoor energy storage cabinet operates as a protected zone featuring dual-layer protection: pack-level and cabinet-level safeguards. The pack-level protection system uses integrated two-in-one detectors installed within each battery pack to monitor combustible gas concentrations and temperatures. Each battery pack is equipped with an electromagnetic valve and a pack-level nozzle. These integrated detectors are electrically connected to the cabinet's non-pressure-based fire suppression system, which relays control commands to the corresponding electromagnetic valves. The fire suppression system's outlet connects to the electromagnetic valve via high-pressure hoses and quick-connect fittings. When thermal runaway occurs in a battery pack, the integrated detector transmits alarm signals to the system, activating its water injection or aerosol suppression mechanisms. Water or mist extinguishing agents are directly delivered to the affected battery pack through quick-connect pipelines and pack-level nozzles.

The cabinet-level protection system employs passive fire suppression technology, integrating a non-pressurized water injection system with temperature-sensing magnetically activated components. When the internal cabinet temperature exceeds the activation threshold of the magnetically sensitive device, it generates pulse currents to activate either the water injection system or aerosol extinguishing equipment. This mechanism provides full immersion protection for energy storage cabinets while simultaneously transmitting activation signals to the cabinet-mounted non-pressurized fire suppression system.

2.5.1 Major Equipment

(1) Composite fire detector

Function: It integrates carbon monoxide and temperature into one set, and monitors and analyzes the thermal runaway characteristics of batteries in energy storage cabinets.

Installation position: one composite fire detector is arranged in each battery pack, which is connected to the cabinet-type non-storage pressure fire extinguishing device of energy storage by CAN bus communication

(2) Cabinet energy storage non-pressure fire extinguishing device

Function: Control and fire extinguishing integrated design, is the data processing center and fire suppression main body of the entire fire extinguishing system. On the one hand, it communicates with fire detectors through CAN communication; on the other hand, it has built-in fire extinguishing agent bottles. At the same time, the controller in the device also has functions such as fire detector fault detection and alarm signal output.

Installation position: in the outdoor energy storage cabinet.

3) Packaging grade water injection system or aerosol nozzle

A pack-level water injection system nozzle is arranged on each battery pack (installation holes need to be reserved in advance on the battery pack), and connected to the solenoid valve through TFEE hose and quick connector, and then connected to the agent outlet of the cabinet-type energy storage non-storage pressure fire extinguishing device.

(4) electromagnetic valve

Function: Receive the command of the control host, open the detector, and realize the single package injection of fire extinguishing agent for the thermal runaway battery pack

Installation position: one solenoid valve is arranged on the outer side panel of each battery pack.

2.5.2 Program Logic Control

(1) Level 1 alarm:

The concentration of carbon monoxide is 190ppm

Execution action:
The detector increases the sampling frequency and focuses on monitoring the battery pack with high gas concentration.

(2) Level 2 alert

When the carbon monoxide concentration is greater than or equal to 890ppm or the temperature rise is greater than or equal to 1℃/s for 10 seconds, the controller uploads the second-level alarm information through RS485.

(3) Level 3 alert

When the carbon monoxide exceeds 1522ppm and (temperature is ≥65℃ or temperature rise is greater than 1℃/sustained for 10 seconds), the controller opens the fire extinguishing agent bottle, and the fire extinguishing agent is applied to the battery pack through the pipeline and nozzle.

The controller performs the action: RS485 uploads the three-level alarm information.

2.6 Fluid Cooling System

2.6.1 Fluid Cooling System

The liquid cooling system is composed of the liquid cooling unit and the supporting pipeline. When the temperature of the cell is too high or too low, the heat exchange between the coolant circulation and the battery system is used to achieve the best working temperature condition of the battery pack.

2.7 Electrical System

The outdoor energy storage cabinet provides a unified primary and secondary interface , which can realize the standardization of power grid connection, communication and debugging work, improve the efficiency of electrical construction of products and reduce the risk of construction.

The outdoor energy storage cabinet is powered by mains power and DC power. The mains power mainly supplies power to non-important loads in the cabin, such as chiller, cooling fan, etc.; the DC power mainly supplies power to important equipment in the cabin, such as BMS, fire protection, EMS, etc.

2.8 Circulation System

The outdoor energy storage cabinet is equipped with temperature and humidity sensors as well as water intrusion sensors. When high humidity is detected inside the cabinet, it will activate to maintain low humidity levels in the battery compartment. When abnormal temperature or water intrusion is detected, alarm signals will be generated to promptly notify maintenance personnel for handling.

3. Matters Need Attention

(1) Do not immerse the product in water.

(2) , The product is not used and stored correctly, there are risks of fire, explosion and burn, do not disassemble, crush, incinerate and heat the product.

(3) Do not put the product in fire or expose it to high temperature conditions exceeding those specified in this specification for a long time, otherwise it may cause fire.

(4) Keep the product out of reach of children, do not remove the original packaging before use, and dispose of used products in accordance with local recycling or waste regulations.

(5) Do not disassemble, remove or repair the product in any way without authorization.

(6) Do not use products of different brands.

(7) If the product is emitting odor, heat, deformation, discoloration or any other abnormal phenomenon, do not use it and move it to a safe place.

(8) , It is strictly prohibited to use plastic for electrical connection. Incorrect electrical connection may cause overheating of the product during use.

(9) The product must be protected during use from mechanical vibrations, impacts, and pressure shocks to prevent internal short circuits that could cause high temperatures and fires. As the product carries potential hazards, proper safety measures must be implemented during operation and maintenance. Failure to comply may result in serious personal injury or property damage. Non-compliance with these warnings could lead to multiple catastrophic consequences.