RENEPOLY

1000kW/2150kWh

储能集装箱用户手册

Energy Storage Container Product User Manual

客户接收栏	Customer Acceptance Column:
公司名称	Company Name:
批准	Approval:
日期	Date:

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Catalogue

Important Safety Instructions

Please read and follow these instructions carefully!

The precautions described in this chapter are intended to ensure personal safety, extend the service life of the product, and avoid property damage. Be sure to read all safety instructions in this article before running maintenance on your product.

The risk of human exposure to electricity should be minimized through effective equipment operation, design, specification and operation and maintenance. All power operations shall comply with the latest local power, building, fire prevention and related codes, standards, regulations or general requirements applicable to operation and maintenance. O&m personnel shall be trained according to relevant guidelines and practices, and qualified O&M personnel shall be authorized to perform power operations.

High Voltage Lithium Battery System (NESP) series When operating this battery system should pay attention to the following safety points.

The following warnings and safety instructions are not only for the safety of users, but also for the protection of products and related equipment. Below is a summary of NESP battery energy storage system use related warnings, safety instructions and general instructions applicable to battery systems.

1. **Safety precaution**

When approaching or operating a battery energy storage system, please strictly follo w the following safety regulations to ensure personal safety and normal operation of the equipment.

(1) General safety instructions: The safety instructions described in this chapter apply to all battery energy storage systems. Please read and follow them carefully.

(2) Customized safety solutions: Complete safety parameters and procedures should be customized according to the specific site environment, system configuration and local reg ulations. Customers should be responsible for developing and implementing detailed safe ty operating procedures.

(3) Safety warnings: All safety warnings in this manual must be carefully read and

understood before any operation or maintenance.

(4) Personnel access restrictions: Only authorized personnel with professional power training can enter the isolation area and contact the system. Operators should be familiar with the structure, functions and potential risks of the system. Before entering the isolati on area, appropriate personal protective equipment, such as insulating gloves, safety shoe s, etc., should be worn.

(5) Safety signs:
Clear and eye-catching safety signs, including hazard warnings, prohibition signs, emergency measures, etc., should be set up in conspicuous locations in the isolation area. Safety signs should use standardized symbols and text and comply with local regulations.

2. Safe electric operation

(1) All live electrical work requires a live work permit. Before starting power operations, all stored power should be released by a professional, the equipment should be verified to be down, and the proper locking/listing should be carried out.

(2) When the work area is close to live overhead power cables, equipment such as booms, masts and cranes, or the distance of their loads from the power cables, shall not exceed the permissible proximity limit.

(3) On-site power operation and maintenance operations must be planned in advance, even for temporary operations, using materials and industrial electrical components to ensure equipment function and personnel safety.

3. Safe battery operation

(1) Personnel access and training

Professional training: Personnel who come into contact with batteries must undergo professional training and understand the structure, working principle and safety precautions of the batteries.

Authorized operation: Unauthorized personnel are prohibited from operating or disassembling the batteries.

(2) Operation precautions

Disconnect the power supply: Before performing any operation, be sure to disconnect all power supplies, including high and low voltage.

Avoid short circuit: During operation, stay away from conductors and metal objects to prevent short circuits.

Protective equipment: Wear protective equipment such as insulating gloves and safety shoes.

(3) Environmental requirements:

The working environment should be dry and well ventilated, away from heat sources, fire sources and corrosive substances.

Avoid direct sunlight and high temperature environments.

(4) Prohibited behaviors:

It is prohibited to disassemble, squeeze, puncture or heat the battery.

It is prohibited to smoke, use open flames or organic solvents near the battery.

It is prohibited to connect the battery in series or in parallel with other types of batteries.

It is prohibited to discard the battery into ordinary garbage.

(5) Maintenance

Professional maintenance: The maintenance of the battery should be performed by professionals.

Regular inspection: Check the appearance of the battery, connecting wires, etc. regularly to detect and deal with abnormal conditions in time.

Record maintenance: Establish detailed maintenance records to track the use of the battery.

(6) Emergency treatment

Fire extinguishing: Use carbon dioxide or dry powder fire extinguisher to extinguish the fire.

Leakage treatment: If electrolyte leaks, it should be covered with sand or inert materials immediately and professional personnel should be notified to handle it.

Emergency contact: Keep the phone number of the emergency contact available at all times.

(7) Transportation and storage

Carry carefully: When carrying the battery, it should be handled with care to avoid severe vibration.

Fix firmly: During transportation, the battery should be fixed firmly to prevent movement.

Storage environment: The storage environment should be dry and well ventilated, avoiding high temperature, humidity and direct sunlight.

(8) Waste disposal

Professional recycling: Used batteries should be handled by professional recycling agencies and are strictly prohibited from being discarded at will.

Local regulations: The disposal of waste batteries should comply with local environmental regulations

4. Operation and maintenance precautions

Before operation and maintenance, all personal protective equipment (PPE) required for supervision and operation and maintenance should be equipped. During maintenance, use insulation tools, wear insulation gloves, and shoes. Insulated tools (hexagonal wrenches, bolt cutters, etc.) used in maintenance need to be wrapped with insulating tape to ensure that no metal is exposed outside except the parts where they are used.

Before performing O&M operations, O&M personnel should receive safety training and fill in the Safety Training Record Form.

All power cables shall be considered energized unless appropriate measures have been taken to complete the power off operation. Before performing O&M operations, ensure that the power is off and the battery is in off mode.

Before the electrical performance test, check whether the cables and bolts are loose. If it is found to be loose, tighten it with a specific tool. Use the correct torque to tighten the terminal, the tightening torque of different components refer to the following table:

Intercomponent fastening	Correct torque
The BAU is securely connected to the cabinet	2.8N.m
The HMI is securely connected to the cabinet	5N.m
The module is securely connected to the cabinet	9N.m
Module terminal lead	9N.m
High pressure box terminal lead	27N.m
High pressure box maintenance torque	M10：20-30N.m，M8：12-14N.m

Personal Protective Equipment (PPE) list

	Description	Picture	Requirement	Note
1	safety helmet		When entering the construction site, you should wear a safety helmet to protect your head. Helmets should comply with GB2811-2007 or local requirements for helmet use.	
2	Electrician's clothing		On-site operation and maintenance personnel should wear electrician's clothing.	
3	protective shoes		Wear protective shoes during battery transportation, installation, operation and maintenance. On-site operation and maintenance personnel are wearing protective shoes.	
4	protective gloves		Protective gloves are required for on-site O&M personnel.	
5	mask		On-site operation and maintenance personnel should wear masks	

Warning sign

			
Warning	Electric hazard	Arc flash hazard	Read Manual

 General Warning	 fire extinguisher	 Live warning	 No littering
 stab	 electrostatic Induction	 no smoking	 first-aid kit

Technical term definition

No	Term	Definition
1	Single battery	An electro chemical device consisting of electrodes and electrolytes, constituting the smallest unit of a battery pack, which can store the obtained electrical energy in the form of chemical energy and convert the chemical energy into electrical energy.
2	Battery modules	Two or more batteries electrically connected for use as energy sources.
3	Battery cluster	The battery system is composed of a number of battery modules in series and connected with the circuit system. The circuit system is generally composed of monitoring, protection circuit, electrical, communication interface and thermal management device.
4	Battery Array	The battery system is composed of several battery clusters connected to the same energy conversion system (PCS) in parallel, which can realize the power input and output of the whole battery system, and is controlled by the background monitoring system.
5	Battery Management System	The circuit system is used to manage the charging and discharging of a battery, improve the battery service life, and provide users with related information. It consists of BMU, BCMU, and BAMS management units. The two-layer or three-layer architecture can be selected based on the configuration of the energy storage system.

6	Battery Management Unit	It has the function of monitoring the voltage and temperature of the single battery in the battery module, and can safely manage the charging and discharging process of the battery module, and provide a communication interface for the battery. The BMU is the smallest management unit of a battery management system (BMS). It provides internal information about battery modules to the battery cluster management system (BCMU) through communication ports.
7	Battery cluster Management System	The real-time monitoring and management system composed of circuit equipment can effectively manage the battery cluster charging and discharging process safely, alarm and emergency protection of possible faults, and ensure the safe, reliable and stable operation of the battery. The BMS is the intermediate level of the system that collects information from the battery management unit (BMU) down and provides information to the upper system (BAMS).
8	Battery Array Management System	It is a real-time monitoring and management system composed of electronic circuit equipment, which centrally manages the batteries of the entire energy storage battery stack to ensure the safe, reliable and stable operation of the battery. BAMS is the highest level of the battery management system, connected down to the battery Cluster Management System (BCMU).
9	State of Charge	The ratio of the actual available battery power to the rated battery power.
10	State of Health	Ratio of the total charge and discharge capacity of a battery to the rated capacity.

1. **Battery Chamber**

The energy storage system uses the lithium iron phosphate battery technology route. A single container has a capacity of 2.15MWh and a DC power of 1MW. It is composed of 10 sets of lithium iron phosphate battery clusters and 10 sets of modular PCS, 1 control and bus cabinet, 1 set of BMS system, etc. Each set of battery clusters is composed of 5 battery packs, and each battery pack is composed of 48 batteries connected in series. Each battery pack is configured with one BMU. Five BMUs connect to the BCMU of a high voltage control box through communication, and 10 BCMUs connect to the BAMS of the bus cabinet.

In the three-layer architecture of the energy storage BMS system (the bottom battery management unit BMU, the middle battery cluster management unit BCMU and the top layer BAMS), the BAMS is at the top layer and is mainly responsible for real-time data acquisition of the BCMU. Real-time calculation, performance analysis, alarm processing, protection processing and record storage make each battery equal output, ensure the system to achieve the best operating state and the longest running time, but also responsible for communication with PCS, EMS, to achieve linkage.

Description		technical parameters	Notes
Battery prefabrication cabin parameters	Size and model specifications	6058×2438×2896mm	
	Cell Capacity	280Ah	
	Rated Capacity	2.15MWh	
	String grouping mode	10*1P240S	
	Charge and discharge ratio	≤0.5C/0.5P	
	Thermal management mode	Liquid cooling	
	Fire fighting	Aerosol	

2. Battery cabin composition

No	Device name	Specification of equipment	Amount
1	20 feet battery container system	（6058×2438×2896mm）Including lighting, power distribution, box interior installation, etc	1set
2	Battery cluster 215.04kWh	1P240S(280Ah cell, 1P48S1 modules, 5 modules in series into 1 battery cluster)	10sets
3	High Voltage box	The 1000V250A contains the main switch, BMU, fuse, contactor, switching power supply, housing, and busbar	10sets
4	Busbar chamber	1000V2000A	1set
5	PCS	100kW	10sets

6	Liquid cooling unit	40kWCooling Capacity	1set
7	automatic fire extinguishing system	Aerosol	1set
8	wall mounted air conditioner	2kW cooling capacity with dehumidification function	1set

2-1 Outline diagram of energy storage system

3. BMS

3.1 BMS overview

The BMS system uses a standard three-tier architecture, including Battery Management Unit (BMU), Multi-Battery Management System (MBMS), and the Battery Array Management System(BAMS).

The BMU is responsible for modular-level data acquisition and balancing control.

BCMU is responsible for data acquisition and protection control of battery clusters.

BAMS is responsible for the battery stack information summary and external communication.

The BMS system has the self-test function. After the system is powered on, it detects its own hardware and software (voltage, temperature, communication, etc.) to ensure the safety and stability of the system.

3.2 BMS Basic Function

BMU Basic Function

- Collects the battery voltage.
- Collect battery temperature;
- equilibrium (active and passive equilibrium);
- Upload battery data.

- System upgrade

BCMU Basic Function

- Data collection: total voltage, current;
- Insulation testing;
- Relay control and condition detection;
- System fault management: alarm, protection;
- SOC and SOH estimation of a single cluster;
- Master/passive equalization control;
- Communicates with the BMU to collect the voltage and temperature of all cells.
- Communicate with the chief controller BAMS to upload battery information;
- System upgrade

BAMS Basic Function

- Battery pack charge and discharge management;
- Battery thermal management;
- Safety protection for system anomalies;
- Fault diagnosis;
- SOC and SOH estimation;
- Communicate with PCS, EMS and other devices;
- Data storage, transmission and processing;
- System upgrade

3.3 Bus communication

The BMS , PCS and other peripherals and external communication maintain RS485 and Ethernet communication modes.

3.4 BMS topology diagram

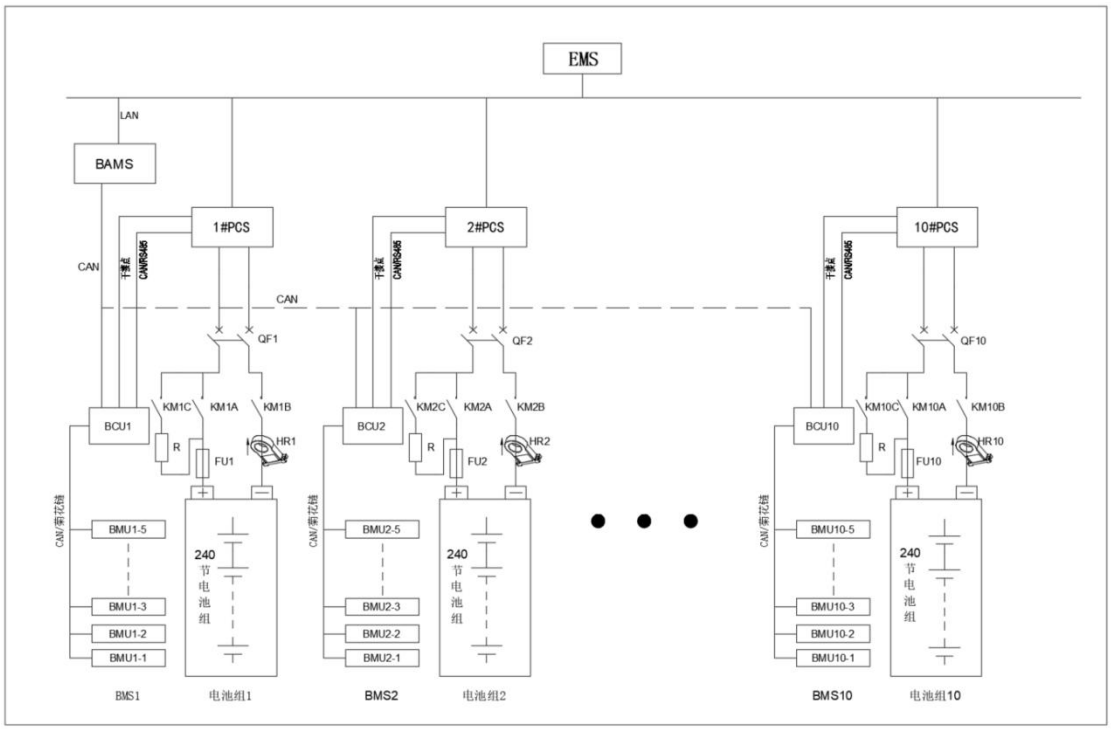


Figure3-1 BMS topology diagram

4. Introduction of BESS

4.1 BESS overview

The energy storage power station uses rechargeable lithium iron phosphate batteries, which have high thermal stability, high safety and long life. It mainly relies on lithium ions to move between the positive and negative electrodes to achieve the battery charging and discharging process, with high energy density and fast charging and discharging rate.

The battery module consists of multiple cells in series and parallel to form a modular battery module, which is equipped with a temperature and voltage detection device and a BMU sampling device.

The battery system can be combined by multiple battery modules according to the actual needs of the project, combined with the control box and external communication module configuration, and then adapt to the needs of the energy storage system.

The battery module uses 48 sets 3.2V/280Ah lithium iron phosphate batteries to form a standardized 1P48S battery module for energy storage. Battery module bus adopts laser welding, reliable connection, high matching accuracy and strong environmental adaptability. According to the specific working conditions of energy storage applications, a reasonable liquid cooling plate is designed to ensure the consistency of cell temperature.

The following table describes battery module parameters：

Specification	Unit	Parameters
Series-parallel system	-	1P48S
Rated capacity	Ah	280
Rated voltage	V	153.6
Operating voltage range	V	134.4~175.2
Charge and discharge ration	C	0.5
Cooling mode	-	Liquid cooling
Rated capacity	kWh	43.008

The external accessible surface of the battery module is covered by an insulating material.

The electrical clearance design of each part of the battery module meets the relevant standards.

Battery cluster/rack—215.04kWh			
No	item	Description	unit
Battery pack			
1	Cell type	LFP	
2	Group mode	1P 48S	
3	Rated capacity	280	Ah
4	Rated voltage	153.6	V
5	Rated energy	43.008	kWh
6	DC voltage range	134.4~175.2	V
Battery rack			
1	Group mode	5S(Modules)	
2	Rated capacity	280	Ah
3	Rated voltage	768	V
4	Rated energy	215.04	kWh
5	DC voltage range	672~864VDC	V
Charge and discharge parameter			
1	Maximum charge and discharge current	140	A
2	Standard charging condition	CC-CV,charging current: 140A	
3	Standard discharging condition	CC, discharging current: 140A	
4	Communication type	CAN	
Environment			
1	Operating temperature	0~ 45℃	
2	Recommended operating temperature	25±5℃	
3	Storage temperature	-20~45°C	
4	Humidity	0 ~ 95 % RH	
Weight			

1	Weight	＜30	t

Each battery cluster is configured with one high voltage box. Each 20-foot battery container contains 10 battery clusters, and each battery cluster is connected to one PCS.

The installation form of the battery cluster is as follows:

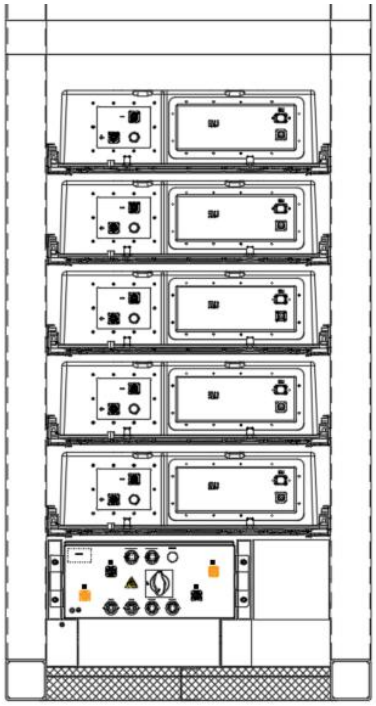


Figure 4-1 Battery cluster configuration structure

The three views of the battery module are as follows:

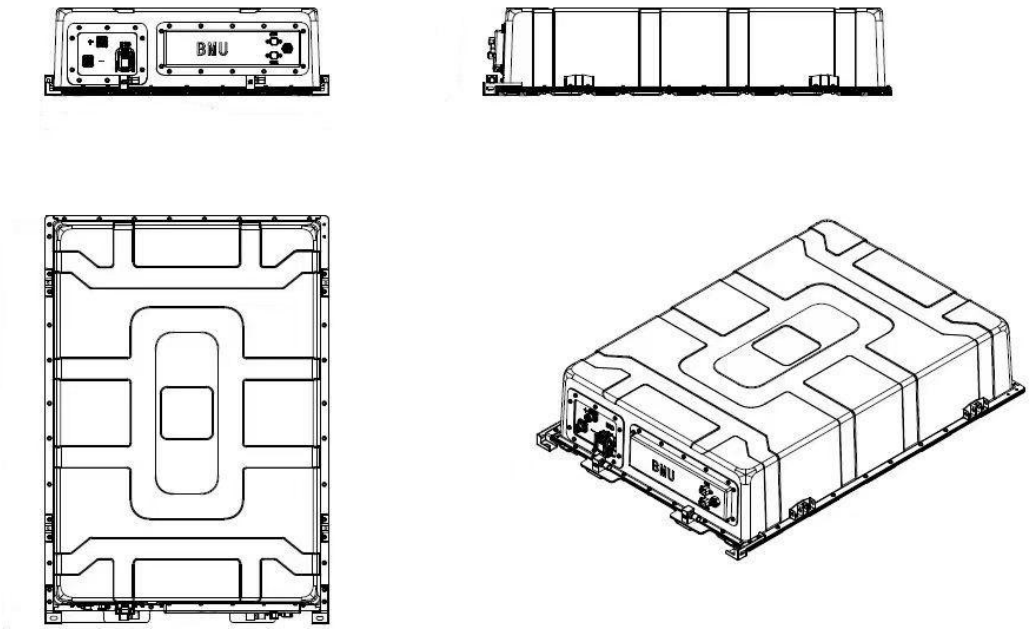


Figure 4-2 Three views of the battery module

4.2 Battery Pack operation and maintenance

In order to safely use and maintain the product, relevant personnel must be professionally trained and qualified to work, unrelated personnel are prohibited to open or disassemble the battery. Personnel must follow the following safety instructions:

1. do not throw the battery into the garbage;

2. It is strictly prohibited to disassemble, squeeze, Pierce or burn;

3. in the loading and unloading and transportation process to avoid violent vibration;

4. it is strictly prohibited to expose the battery to a temperature above 60 ° C;

5. do not use in series or parallel with other types of batteries;

6. in the operation and maintenance, please do not wear gold and silver jewelry or watches and other metal jewelry;

7. It is strictly prohibited to charge without charging protection line or use non-battery manufacturer approved equipment;

8. Disconnect all high-voltage and low-voltage switches when connecting and disconnecting battery or system cables;

9. always remember that there is high pressure inside the battery system, even if the system is not running, when the system is disconnected from service;

10.After switching, use a multimeter to confirm that there is no voltage at the high voltage end before performing the next step

11. The working environment of the battery and battery pack should be free from corrosive, explosive and insulating gases and conductive dust, and away from heat sources;

12. During maintenance, please use insulation tools, wear insulation gloves, insulation shoes, insulated tools used during maintenance (such as hex wrenches, bolt cutters, etc.) should be wrapped with insulating tape to minimize exposed areas.;

13. after the maintenance work, please clean the tools and materials in time, do not put metal objects on the inside or top of the equipment;

14. Fire extinguishing method: use carbon dioxide or dry powder fire extinguisher to extinguish fire, or bury sand and soil;

15. When replacing the battery box, be sure to disconnect the high voltage and low voltage electricity, and remove the service switch;

16. If you find that the battery power supply time is greatly shortened or frequent failures occur, you should promptly ask professionals to diagnose and maintain the system.

17. Equipment for operators: guidance documents, multimeter, fire extinguisher, safety helmet, protective eyepieces, cotton work clothes, cotton protective gloves, high pressure glove tools, high pressure insulation shoes, etc.

Note: If the operation and maintenance personnel have any questions about the maintenance of the battery and system, please contact the corresponding departments and engineers of the company; No unauthorized contact by non-professionals.

4.3 Instructions for battery pack

1. it is recommended that the normal working environment temperature is about 25℃.

2. The recommended working voltage of a single battery is 2.8V~3.6V.

3. if there is no special requirement, the SOC of the system single battery is 40%, and the SOC value will be gradually reduced because of self-discharge, which will affect the product life. If the product is not used for a long time, it should be charged to 50% and then stored; After that, recharge every 1-2 months and keep the SOC value up to 50-80%; If it is not used for a long time and there is no effective recharge, it will cause damage to the battery, at this time, you should take the initiative to contact the company's after-sales department or service station to discuss the disposal plan.

4. In any case, charging devices that meet the requirements of national standards should be used for charging.

5. the battery should be charged in time after full discharge.

4.4 Usage precautions

To prevent battery leakage, abnormal heating, fire, performance degradation, explosion and other accidents, please use the battery properly according to the following specifications. The Company shall not be responsible for accidents caused by failure to operate in accordance with the provisions of this manual.

1. handle gently to avoid severe vibration.

2. do not immerse the battery and its accessories in water or other liquids, and pay attention to moisture; Do not use organic solvents to clean the battery case. Avoid short circuit at the positive and negative output ends of the battery or battery string.

3. Do not remove the battery. Removing the battery may make the internal short circuit, cause the internal material to decompose, fire, explosion, etc. In addition, removing the battery may cause the battery electrolyte to leak; If there is any electrolyte on the skin, eyes or other parts of the body, rinse immediately with water and see a doctor immediately.

4. It is forbidden to put waste batteries into the fire, otherwise it will cause dangerous accidents such as explosions.

5. if the battery is damaged, deformed, electrolyte leakage or smell odor and other abnormal phenomena, do not use the battery; Please send it to the manufacturer's authorization office or relevant agencies for proper handling. In addition, the battery that leaks the electrolyte should be away from the fire source to avoid causing an explosion. Battery replacement. The battery shall be replaced and installed by the battery supplier, and the user shall not replace the battery without authorization.

6. Private disassembly is prohibited. The user shall not disassemble the battery, battery pack and charger without authorization, otherwise, our company will not be responsible for the loss caused by this main reason.

7. When an accidental fire occurs in the battery, use carbon dioxide or dry powder fire extinguisher to extinguish the fire, or bury it with sand and soil.

4.5 Operation warnings and prohibited actions

Operation warning :

1. before using the battery equipment, please carefully consult the manual.
2. the battery must be charged and discharged within the operating temperature range.
3. the battery must be charged and discharged below the maximum power/current within the operating temperature range.
4. PACK must check the direction of the positive and negative terminals before connecting.
5. when connecting the wire to the battery PACK, it is necessary to check the insulation to prevent the battery from short circuit.
6. before the first use, if corrosion or odor is found, please return the product to the sales staff immediately.
7. Batteries should be kept away from children and pets.

8. when the long service life of the battery becomes short, please replace the new battery in time.

9. Isolate the metal plate from the battery and other components to prevent short circuit of the battery or battery pack.

Prohibited actions :

1. the continuous current should not be greater than the maximum charge/discharge current.

2. do not try to disassemble and replace the battery.

3. do not throw the battery or let the battery be subjected to serious mechanical impact.

4. do not use sharp objects (such as: nails, knives, pencils, drills) to Pierce or destroy the battery housing.

5. do not mix with other types of batteries, battery packs or the same type of other manufacturers of batteries, battery packs.

6. PACK installation process, do not use excessive force to squeeze the battery.

7. Do not mix old and new batteries or battery packs.

8. do not expose the battery to high temperature environment (such as open flame).

9. do not place the battery in a microwave or high pressure environment.

10. should pay attention to the battery or battery pack positive and negative terminals, do not reverse connection.

11. do not use conductive materials (such as metal, wire, etc.) directly connected to the positive and negative terminals of the battery or battery pack.

12. Do not immerse the battery in water or seawater

13. Do not apply excessive heat and pressure to the battery during connection and grouping.

4.6 Maintenance

According to the operation instructions, the battery should be fully charged before the first discharge of the battery, and then use. After the battery is fully charged and discharged 3 to 5 times, the maximum capacity can be reached. When the battery is low on power, you should charge it in time. Leaving the battery in a power-deficient state for a long time will affect its service life.

Check the battery regularly to confirm:

1. positive and negative electrode connection is normal;

2. the system insulation is normal;

3. Whether the battery voltage is normal;

4. whether the ambient temperature meets the storage or use requirements;

4.7 Battery resting and storage

Standing battery: The battery is installed on the system rack. Battery in storage: Spare module.

1. Whether the charging and discharging voltage and current meet the requirements of use

2. The battery cell in the battery pack can be stored under the condition that 50%(3.291V)≤SOC≤80%(3.331V), and the storage period is ≤3 months.

3. stored in a clean, dry, ventilated, cool environment, away from fire and heat sources, avoid direct sunlight, high temperature, high humidity, contact with corrosive substances, violent vibration and other conditions.

4. Must be stored in a separate space.

5. do not place the battery in a high electrostatic environment, so as not to cause the battery protection device failure.

6. no stacking, this series of products do not allow stacking.

7. it is prohibited to store in the state of connected load or hidden load, that is, it is prohibited to have any form of discharge behavior when storing.

8. After long-term storage, if the battery is found to be bulging, cracking, voltage lower than 2.0V and other abnormal conditions, if the situation occurs, the battery may be damaged, please contact the relevant technical department of the company immediately for technical support.

5.Transportation and Storage

5.1Notes

⚠ Caution
Failure to comply with this manual's transportation and storage requirements may void the warranty.

5.2 Mode of Transportation

It is suitable for transportation by vehicle and ship. During transportation, it should be covered with an awning, protected from the sun, and loaded and unloaded carefully.The packaging box containing the product can be transported by any means of transportation. During loading and unloading, the battery should be handled with care and prevented from being thrown, rolled, or pressed. During transportation, it should be avoided from direct rain, snow, and mechanical impact.

5.3 Transportation Requirements

All equipment in the container has been installed and fixed in the container before leaving the factory, and the container can be lifted and transported as a whole during transportation.

⚠ Attention

During the entire process of loading, unloading and transportation, the outdoor cabinet operation safety regulations of the country/region where the project is located must be followed!

- Containers and any machinery used in the operation should be maintained.
- All personnel engaged in loading, unloading and bolting should receive appropriate training, especially safety training.

The following conditions must be met for transporting mobile equipment: The appliance door is locked.

Select a suitable crane or lifting tool according to the site conditions. The selected tool must have sufficient load-bearing capacity, arm length and rotation radius.

If it is necessary to move on a slope, etc., additional traction equipment may be required.

Clear all existing or potential obstacles during the move, such as trees, cables, etc.

Whenever possible, equipment should be transported when weather conditions are good.

Be sure to set up warning signs or warning tapes to prevent non-staff from entering the lifting and transportation area to avoid accidents.

When transporting by land, be sure to use ropes or fasteners to secure it to the transport vehicle to avoid displacement and collision during transportation.

5.4 Storage Requirements

To prevent condensation inside the container or the bottom of the container from being soaked by rainwater during rainy seasons, the container should be stored in a higher place.

The container base must be raised, and the specific height should be reasonably determined according to the on-site geological and meteorological conditions. At the same time, heating should be provided for the internal equipment of the container when the ambient temperature is too low.

Store the container on a dry, flat, solid surface with sufficient load- bearing capacity and without any vegetation. The storage surface must be flat, without stagnant water, uneven or bumpy.

Before storage, ensure that the container doors and internal equipment are locked.

Storage environment temperature: -30 ℃ ~+40 ℃ ,recommended storage temperature: -10 ℃ ~+25 ℃.

When storing at other temperatures, adjust according to the following data.

Temperature range	Attenuation adjustment factor
26 ℃ ~40 ℃	0.1 % /month
41 ℃ ~50 ℃	0.3 % /month
51 ℃ ~60 ℃	0.6 % /month

Long-term storage of batteries will cause capacity decay, so long-term storage of batteries is not recommended. In addition,even if the battery is stored at the recommended optimal storage temperature, If the battery enters a deep discharge state, this will cause the chemical reaction inside the battery to become unbalanced, which may lead to permanent damage to the battery. The longer the storage time, the greater the irreversible decay. For specific decay values, please refer to the technical agreement.

Storage environment relative humidity: 0~95%, non- condensing.

The air inlet and outlet of the container energy storage system should be effectively protected, and effective measures should be taken to prevent rain, sand and dust from entering the interior.

Regular inspections: At least once every half month, check whether the cabinet and the internal equipment are intact.

Before installing a container energy storage system for long-term storage (storage time exceeds half a year), you should open the door of the container for a visual inspection to check if there is condensation inside the container. Ensure that the container and internal equipment are intact. At the same time, you

need to power on and start the system for inspection. If necessary, you must have a professional perform a test before installation.

Pay attention to the harsh environment around you, such as sudden cold, sudden heat, collision, etc., to avoid damage to the pack.

Perform regular inspections to prevent insects and rodents from gnawing on internal cables.

Calculated from the date of shipment from Renepoly company, the energy storage system with a storage period of more than 5 months under the above conditions must undergo a complete charge and discharge to bring the system SOC to 30%~40%, and the SOC must remain consistent after recharging.

⚠ Attention

During the entire process of mechanical installation, the relevant standards and requirements of the project location must be strictly observed.

6. BESS Installation

6.1 Pre-installation Inspection

6.1.1 Check the delivery items

Check that all items are included in the delivery against the enclosed packing list.

6.1.2 Check equipment

Check whether the energy storage system actually received is consistent with what is stated in the order agreement.

Check the exterior and interior to ensure there is no damage.

If you find any problems or have any questions, please contact the transporter or our company in time.

⚠ Attention

- Only complete and undamaged devices may be installed!

Before installation, please ensure:

- The box itself is intact and has no damage.
- All equipment in the box is intact and without any damage.

6.2 Installation Environment Requirements

6.2.1 Site selection requirements

When selecting an installation site, the characteristics of the site's climate environment, geological conditions (such as stress wave emission, groundwater level), etc. should be fully considered.

The surrounding environment should be dry and well ventilated.

Make sure there are no trees around the installation location to prevent strong winds from blowing down branches or leaves that may block the door or air inlet of the energy storage integrated system.

Keep away from areas where toxic and harmful gases are concentrated; keep away from flammable, explosive and corrosive items.

To avoid noise, the equipment should be installed away from residential areas.

6.2.2 Foundation requirements

⚠ Attention

The equipment is heavy, so before building the foundation, we should first conduct a detailed investigation of the installation site conditions (mainly geological conditions and environmental climatic conditions, etc.). Only on this basis can we start the design and construction of the foundation.

An unreasonable foundation construction plan will bring great difficulties or troubles to the placement of equipment, opening and closing doors, and subsequent operation. Therefore, the installation foundation must be designed and constructed in accordance with certain standards in advance to meet the requirements of mechanical support, cable routing, and subsequent maintenance and inspection.

The construction of the foundation shall at least meet the following requirements:

The bottom of the foundation pit for building the foundation must be compacted and filled.

The foundation must be sufficient to provide effective load-bearing support for the equipment.

Raise the container to prevent rainwater from eroding the base and interior of the container. It is recommended that the foundation be about 300- 500 mm higher than the horizontal ground at the installation site.

Appropriate drainage measures need to be constructed incombination with local geological conditions.

Cable routing should be taken into consideration when constructing the foundation.

According to the position and size of the cable inlet and outlet at the bottom of the container, sufficient space should be reserved for the main cable, auxiliary cable and communication cable trough during foundation construction.

Determine the specifications and quantity of cable troughs based on cable model, number of incoming and outgoing lines, and routing.

After all cables are connected, the cable entries and exits as well as the joints are sealed with refractory putty or other suitable material to prevent rodent entry.

6.2.3 Installation space requirements

To ensure better heat dissipation and maintenance of the equipment, it is recommended that the distance from obstacles in the length direction of the box be no less than 3000mm, and the distance from obstacles in the width direction of the container be no less than 3000mm.

6.3 Lifting and Transportation

6.3.1 Precautions for lifting

⚠ Attention

- During the entire process of lifting the equipment, operations must be carried out strictly in accordance with the safety operating procedures of the crane. It is strictly forbidden to stand within 5m to 10m of the operating area, especially under the crane arm and under the hoisted or moved machine, to avoid casualties.

- In case of adverse weather conditions, such as heavy rain, fog, strong wind, etc., the lifting work should be stopped.

When lifting the equipment, at least the following requirements must be met:

(1) Site safety must be ensured during lifting.

(2) During lifting and installation operations, there should be professional personnel on site to direct the entire process.

(3) The strength of the sling used should be sufficient to bearthe weight of the equipment.

(4) Make sure all sling connections are secure and that thesling sections connected to the corner fittings are of equal length.

(5) The length of the sling can be adjusted appropriate ly according to the actual requirements on site.

(6) During the entire lifting process, the equipment must be kept stable and not tilted.

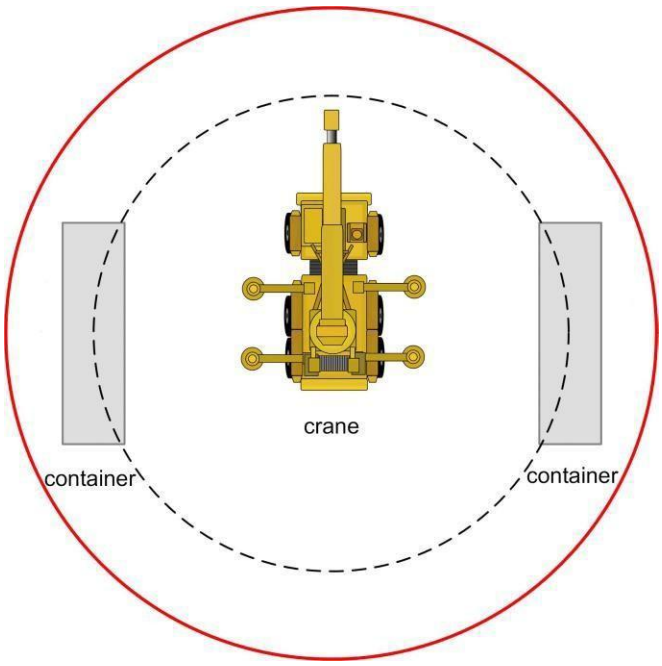
(7) Please lift the top four corners of the container.

The following figure shows the crane operation during the lifting process. In the figure, the inner dotted circle indicates the crane operation range. When the crane is working, it is strictly forbidden to stand in the outer solid circle!

Figure 4 .4 Schematic diagram of crane operation

6.3.2 Lifting operation

During the lifting of the equipment, each operation link should be carried out



according to the following requirements:

(1) The equipment should be lifted vertically and should not be dragged on the ground during lifting.

(2) After the lifting rope is fully stressed, the lifting action should be suspended and the connection between the lifting equipment, rope and equipment should be checked. Lifting can only be carried out after confirming that the connection is firm.

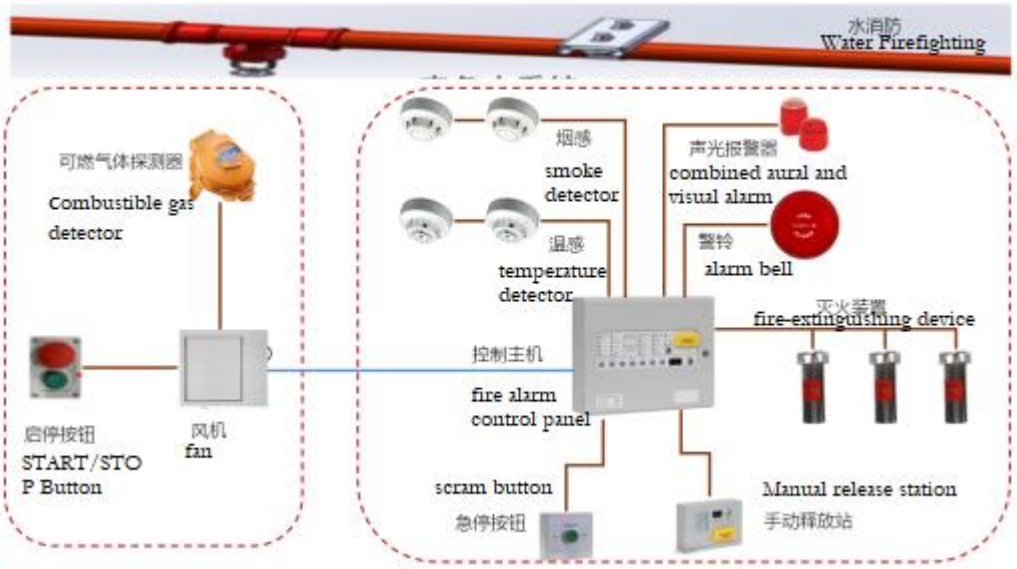
(3) After the equipment is in place, it should be placed gently and land steadily.

(4) The site for temporary storage of equipment should be solid and flat, with good drainage and no obstacles or protrusions.

7. Fire fighting system

7.1 Overview of Fire protection Systems

The battery container is equipped with a set of automatic gas fire extinguishing system, which consists of a gas fire extinguishing controller, smoke detector, temperature detector, combustible gas detector,ventilation system, sound and light alarm, alarm bell, gas discharge indicator, emergency start Figure and stop, and hot gas aerosol fire extinguishing device.



7-1 Topology of the fire extinguishing system

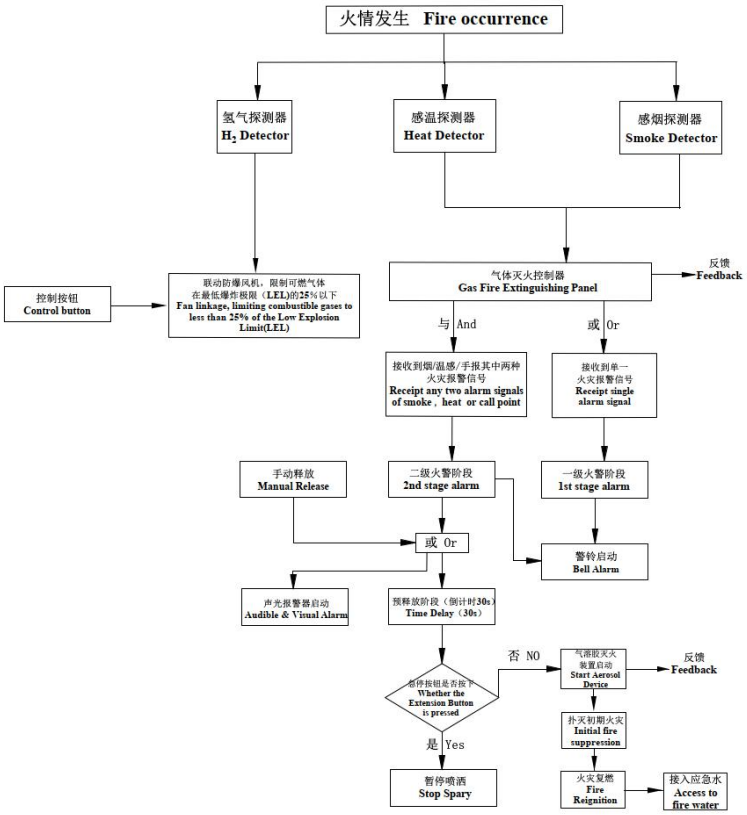


Figure 7-2 Logical diagram of the fire extinguishing system

7.2 Design basis and working principle

Design basis:

1. according to EN15276-2-2019 "Fixed fire extinguishing systems - hot gas aerosol fire extinguishing systems - Part 2: Design, installation and maintenance" 8.3.2 electric fire detection systems shall comply with the relevant provisions of EN 54; The power supply shall be independent of the power supply in the hazardous area and shall include an emergency backup power supply that can be automatically switched and configured in the event of a failure of the main power supply.

2. The automatic detection system shall be based on CEN/TS 54-14 or EN12094 according to 8.2.1 of EN15276-2-2019 "Fixed Fire Fighting Systems - Hot gas aerosol fire extinguishing systems - Part 2: Design, Installation and Maintenance"; In 8.3.3, the fire protection system is manually operated by a control device located outside or near the main exit of the protected space; 8.4.2 Electrical automatic control and delay devices shall comply with EN 12094-1; 8.4.4 To warn people of the impending emissions, the discharge shall be delayed for at least 10 seconds, and the delay device shall be in accordance with EN12094-1 or EN 12094-2; Aerosol systems shall contain control and indicating equipment in accordance with EN 12094-1.

3. according to IEC 62933-5-2 "Fire Danger Protection" for S-U BESS need to have a fire detection system, sound and light fire alarm system, and in the fire control facilities near the energy storage system equipped with smoke, temperature detection and sound and light alarm system.

4. according to NFPA2010 "Fixed aerosol fire extinguishing system Standard" 6.2.1.2 should be used automatic detection and automatic start system; 6.2.3.7 Manual release device of the system shall be provided; 6.2.5.3.1 Sound and visual alarm devices shall be set up in the protection area before the fire extinguishing device is discharged.

5. according to NFPA855 "Standard for the Installation of Stationary Energy Storage Systems" A 9.6.5.6 requirements for batteries that may produce flammable gas under failure conditions such as thermal runaway, fire and abnormal failure, provide explosion control solutions in NFPA69 to mitigate this hazard.

6. according to NFPA69 "Explosion-proof system Standard" Chapter 8 by reducing fuel concentration to explosion-proof.

7. according to NFPA855 9.6.5.6 requirements, meet NFPA72 "National Code for Fire Alarm and System" in the prefabricated cabin body combustible gas concentration reached 10% of LFL, prefabricated cabin energy storage system should send an alarm signal, the system to ensure that flammable gas does not exceed the gas mixture or a single component of the LFL 25%

8. according to EN15276-2-2019 "Fixed fire extinguishing systems - Hot aerosol fire extinguishing systems - Part 2: Design, installation and maintenance" 6.5.1 requirements, all ventilation systems should be closed before starting the hot aerosol system.

According to the above standard requirements, in order to ensure the compliance of the scheme design, point-type smoke fire detectors and point-type heat fire detectors are used as fire detectors, equipped with fire sound and light alarms, manual release stations, emergency start and stop buttons, alarms, gas fire extinguishing controllers and cabin-level thermal aerosol fire extinguishing devices as automatic fire fighting systems. Combustible gas detectors + explosion-proof ventilation systems are configured as explosion-proof systems for the electrochemical energy storage prefabricated cabin fire fighting system

Operating principle：

When the smoke or temperature detector in the protection area gives an alarm, the alarm bell outside the protection area will be activated immediately to remind the personnel to respond; When the smoke detector and temperature detector simultaneously detect the fire or artificially find the fire and press the emergency start button, the two-stage fire alarm is triggered, the alarm bell and the sound and light alarm are started, the gas fire extinguishing controller sends a signal to the fire extinguishing device after delay, the fire extinguishing device starts, implements the fire extinguishing, and gives a feedback signal.

Combustible gas detectors are used to detect combustible gases that may leak in the energy storage system, and send alarm signals to the fire control system, start the ventilation system to quickly discharge these gases, reduce the gas concentration, and reduce the risk of explosion or fire. Explosion-proof exhaust fans are designed to prevent electrical equipment from generating sparks or high temperatures during operation, thereby avoiding igniting combustible gases. It is usually linked with a combustible gas detector, and once the detector detects that the concentration of combustible gas exceeds the standard, the explosion-proof exhaust blower will automatically start.

7.3 Fire fighting system maintenance guide

Regular maintenance content:

1. Fire protection system data file establishment;
2. Check the host inspection function (indicator).
3. Check the active/standby power switchover.
4. Detect the integrity of the wiring, whether it falls off, and whether the identification plate falls off;
5. Smoke sensor, temperature sensor, flammable detector working status detection, troubleshooting;
6. Detector and sound and light alarm bell and other equipment cleaning work;
7. Detector smoke test, high temperature test, hydrogen sense alarm test;

8. Test of emergency start-stop button and stop button;

9. Test the linkage logic function (test whether the function works properly).

Note: Check whether the equipment is clean and whether the line is falling off, and test it every 2 months. If there is a fault, only the line is faulty or the equipment is faulty. If the line is faulty, check the line and the equipment can only be replaced. So test it.

Test tool: smoke temperature gun. (Be careful not to get too close).

8. Air conditioning system

8.1 Product Overview

This unit is designed for energy storage projects to provide temperature-stable, accurate cooling media for these applications.The working principle and system composition of the liquid cooling unit are shown in the following figure:：

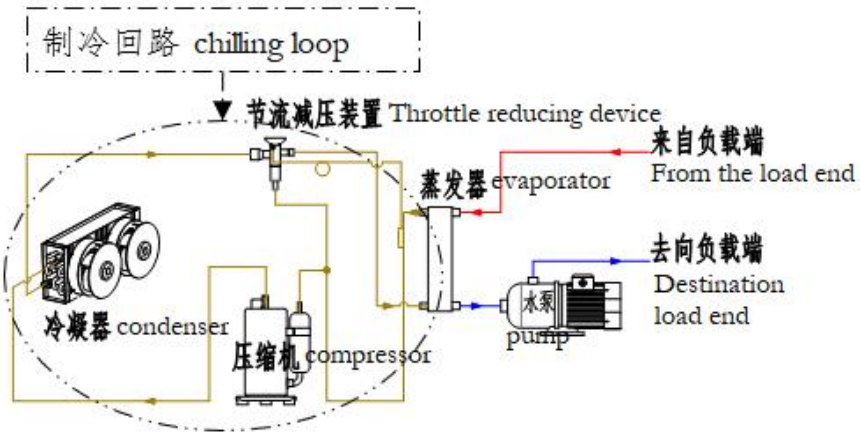


Figure 81 Working principle of the liquid cooling unit

The main components of the refrigeration system: evaporator, compressor, condenser and expansion valve. The refrigerant is used to cool the load.

Description of refrigerant circuit:

The refrigerant, such as R410a, passes through the evaporator, compressor, condenser, and expansion valve in a closed system and back to the evaporator.

The refrigerant in the evaporator absorbs the heat of the load (such as glycol mixture) and vaporizes into steam, while producing cold capacity.

The compressor absorbs the gaseous refrigerant from the evaporator and compresses it.

The compressed high temperature and high pressure refrigerant enters the condenser and is cooled by the cooling medium (such as air). The condenser condenses the refrigerant and releases heat.

The cooled refrigerant enters the expansion valve and the pressure is reduced.

The cooling medium returns to the evaporator, and the gas/liquid mixture is transformed into a gaseous state again, absorbing heat and achieving refrigeration.

Cooling medium loop description:

The pump extracts the cooling medium (such as glycol mixture) from the load and is cooled by the refrigeration system before being transported to the load.

The high temperature cooling medium enters the evaporator for heat exchange. The cooling medium cooled by the evaporator continues to circulate.

Heat exchange cycles over and over again.

For example, the refrigerant system is also equipped with a reservoir (for small refrigeration systems, there is often no reservoir) and a filter dryer.

8.2 Control Configuration

Home Screen

Some of the keys and ICONS are explained below:

Button	Description
	The user identification screen is displayed, and you can select User, Project, and manufacturer
	You can query the output, input, historical fault, and system version information on the Query page
	When you enter the timing information query, it will be displayed on the main screen when you set the timing switch. Otherwise, it will be hidden
	Query the current fault information. When the system is faulty, it blinks on the main screen. You can click to query the current fault information. If no fault occurs, the icon is hidden
	Starting the unit: The button alternates gray and green After the unit starts: the button appears green Turning off the unit: The button alternates gray and green
	Return to the previous page

	Return to main screen

work interface

Some of the keys and ICONS are explained below:

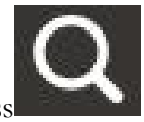
Button	Button name	Description
	Compressor1	This icon indicates that compressor 1 is started. If compressor 1 is not started, it is not displayed
	Compressor2	This icon indicates that compressor 2 is started. If compressor 2 is not started, it is not displayed
	Pump	This icon indicates that the water pump is started. If the water pump is not started, it is not displayed

trouble interface

When the unit fails, the main interface  will blink, then click to silence the sound and enter the following interface:

Button	Description
	After eliminating the fault, press this button to reset the fault
	Eliminate system alarm sounds
	Turn the page to query fault information. In gray, you cannot press. In green, you can press
	Turn the page to query fault information. In gray, you cannot press. In green, you can press
	Query the description of the current key

interactive query interface

On the home screen, press  , The following query page is displayed：

query and pivot

Output query

Input query

Historical fault query

Version number query

User identification interface

Home screen press  The user identification page is displayed

User parameter setting

Set user parameters. The following table describes the user parameters and their meanings:

No	Parameter name	Factory Value	Setting Range	Remarks
1	Working mode	Manual	Manual; Auto; Remotely	manual mode: On/off control by start/stop. Automatic mode: In standby, delay the automatic start of the unit. Remote Mode: When the remote control switch is closed, the delayed automatic start unit.
2	Preset temperature in constant temperature mode	30	【Set lower limit of temperature】~【Set upper limit of temperature】	This parameter is limited by the manufacturer's parameters [set the upper limit of temperature] and [set the lower limit of temperature]. This parameter is not displayed when the cooling mode is room temperature homology.
3	485 Mailing address	1	1~32	485 Network communication address
4	Baud rate	9600	9600/4800/19200	485 Network communication baud rate
5	Set speed of pump	91.2	0~100.0%	The AO1 output function is the water supply pump and the output specification is voltage or current

8.3 Liquid cooling system coolant refill

Replenishment means replenishment of coolant when the coolant is insufficient during the operation of the liquid cooling unit. The operation steps are as follows:

1. When the low liquid level IN the replenishment tank alarms, the coolant storage tank is connected to the filling port in the refrigerator for filling.

2. When the liquid is added to the highest level mark, stop filling the liquid.

Note: It is normal that gas and liquid may flow out of the exhaust valve at the same time. If only liquid continues to flow out, close the valve at the lower part of the exhaust valve, manually turn off the exhaust valve, rinse the inside with water for 2 to 3 times, and then reinstall it.

Attention

During use, the quality of the coolant should be regularly tested and treated to avoid precipitation and other anomalies, which will affect the performance of the liquid cooling unit.

The glycol concentration will increase during the long-term use of the liquid cooling unit, which will reduce the cooling efficiency of the liquid cooling unit. It is recommended to check the glycol concentration in the circulating system of the unit every six months. If the glycol concentration is too high, restore the value to the normal range by completely replacing the coolant.

8.4 Fault analysis and processing

Fan failure

Table 8.4-1 lists common fan faults and maintenance methods.

Table 8.4-1 Fan faults

fault phenomenon	Possible cause	Check and repair
The external circulation fan does not operate	The liquid-cooling unit is not powered on	Check the power input of the liquid cooling unit for electricity.
	Excessive lightning strike, circuit breaker trip	Check whether the internal circuit breaker of the liquid-cooled unit is closed.
	Abnormal power input of liquid cooling unit (such as power over voltage or under voltage)	Check whether there are corresponding alarms in the liquid cooling unit
	The liquid cooling unit is in the standby state	Normal scene. After the liquid cooling unit is charged and standby for 30s, enter the automatic control logic.
	Fan stuck	Check if there is any foreign object stuck in the fan.
	Terminal loose	Check whether the fan connector is loose.
	The compressor is not started	See Compressor Not started in Refrigeration Fault.
	Control board failure	Replace the control board.
	Fan failure	Replace the fan.
Abnormal ring of the external circulation fan	The fan bearing is worn	Replace the fan.
	Fan blade scratches on other objects	Check whether there are any cables interfering with the fan blades.

Refrigeration system failure

Table 8.4-2 lists common faults and maintenance methods of refrigeration systems.

Table 8.4-2 Cooling faults

Fault phenomenon	**Possible cause**	**Check and repair**
The compressor is not started	Not on (standby)	Check the main power switch and check the operation display screen whether it is turned on.
	The circuit connection is loose	Tighten the circuit connector.
	Circuit is open or short circuit	Check the open circuit or short circuit, and repair the main power supply.
	Frequency converter fault	Replace the frequency converter
The compressor does not work	Control board damage	Replace the control board.
	Compressor motor is faulty	Replace the compressor.
	No cooling demand	Check the output status of the effluent temperature compressor on the display interface. Check the operation in the operation state.
	Downtime delay	The compressor has a minimum downtime under normal conditions, and if the temperature increases to the opening point during this period, the compressor will still delay the opening time.
High exhaust pressure	The condenser is dirty and blocked	Clean the condenser with compressed air or a vacuum cleaner equipped with a brush head.
	The external circulation fan does not operate	Refer to "fan fault" and "External circulation fan not running" fault for handling.

The cooling medium circulation system is faulty

Table 8.4-3 lists the common faults and maintenance methods of the cooling medium circulation system.

Table 8.4-3 Faults of the cooling medium circulation system

fault phenomenon	**Possible cause**	**Check and repair**
The inner water ring pump does not start	Not on (standby)	Check the main power switch and check the operation display screen whether it is turned on.
	The circuit connection is loose	Tighten the circuit connector.
	Water pump frequency converter failure	Replace the water pump frequency converter.
	Pump body failure	Replace the circulating water pump.
The electric heater is not working	No heating demand	Check whether the outlet water temperature and the heating setting point are set reasonably.

	The circuit connection is loose	Tighten the circuit connector.
	Electric heating for overheat protection	After waiting for a period of time, restart the electric heating, and observe whether the electric heating is working normally.
	Pipeline electrical heating failure	Replace the electric heater.

Fault handling

Table 8.4-4 lists the faults to be detected and displayed

Fault name	**testing conditions**	**fault treatment**	**Fault display**	**remarks**
System 1 low pressure	at any time	Stop the compressor 1.	03: System 1 low pressure alarm: compressor fluorine deficiency or ambient temperature is too low, please repair!	①If charging for the first time, the alarm will sound after the same alarm status is maintained for 30 consecutive seconds. ②If it is not the first charging and the ambient temperature is ≥15° C, the alarm will occur after the same alarm status continues for 4 minutes. ③If it is not the first time charging and the ambient temperature is ≥15℃, the alarm will be triggered after the same alarm status is maintained for 6 minutes.
System 2 low pressure	At any time (double-pressure machine)	Stop the compressor 2.	03: System 2 low pressure alarm: compressor fluorine deficiency or ambient temperature is too low, please repair!	① If the first power, continuous 30s after the same alarm state. ②Non-first power and ring temperature 15℃, lasting 4 minutes after the same alarm state alarm. ③Non-first power and ring temperature 15℃, lasting 6

				minutes after the same alarm state alarm.
Pressure machine 2 overload	At any time (double-pressure machine)	Stop compressor 2.	01: Press machine 2 overload fault	
Fluid failure	at any time	Alarm, only stop the fill water pump	04: liquid level fault: the liquid volume is too small, please repair!	The alarm will be triggered only after the [liquid level detection delay] is continued, and it can be automatically reset after the fault is eliminated.
Water supply pump overload	at any time	The whole machine shutdown	10: Water feed pump overload	Manual reset after fault elimination
Phase order failure	at any time	The whole machine shutdown	00: Phase order error: Please change the phase order!	Manual reset after fault elimination
Flow failure	Delay detection after startup	Alarm, compressor stops	05. Liquid circuit fault	Manual reset after fault elimination
Fluid temperature probe failure	at any time	When the [Runtime Control Mode] is in water discharge, an alarm will sound and the compressor will stop. Otherwise, an alarm will sound without stopping the compressor.	11: liquid temperature probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
The recoil probe fails	at any time	When the [operating control mode] is water return, an alarm will sound and the compressor will stop. Otherwise, an alarm will sound without stopping the compressor.	11: Return fluid probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
Evaporation inlet 1 probe fault	at any time	Stop compressor 1.	11: Evaporation inlet 1 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected

Evaporation inlet 2 probe fault	At any time (double-pressure machine)	Stop compressor 1.	11: Evaporation inlet 2 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
Condensation 1 probe is faulty	at any time	Alarm without shutdown.	11: Condensation 1 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
Evaporation outlet 1 probe fault	at any time	Stop compressor 2.	11: Evaporation outlet 1 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
Evaporation outlet 2 probe fault	At any time (double-pressure machine)	Stop compressor 2.	11: Evaporation outlet 2 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
Condensation 2 probe fault	at any time	Alarm without shutdown.	11: Condensation 2 probe fault: please check the probe!	Automatic reset after the temperature probe is properly connected
The liquid temperature is too high	5 minutes after the compressor operation.	Alarm without shutdown.	08: High liquid temperature: liquid temperature More than [high liquid temperature alarm point]!	The liquid temperature is lower than the alarm value-1℃ automatic reset
The liquid temperature is too low	Unit operation.	Alarm without shutdown.	08: the liquid temperature is too low: the liquid temperature Below the [liquid temperature is too low]!	The liquid temperature is higher than the alarm value of + 1℃ automatic reset
System 1: A high-voltage fault	at any time	Stop compressor 1 and restart automatically after fault reset. If the number of alarms is greater than 3 times within 1 hour, the high pressure of alarm system 2 will be locked.	02: Press 1 high voltage fault	1: The temperature is less than the [condensation temperature over the high temperature] can be done manually 2: The high voltage switch 1 can be manually reset after it is invalid When the two systems alarm at the same time, and they are not in the cooling mode of the heat exchanger, the fan is stopped

System 2: A high-voltage fault	At any time (double-pressure machine)	Stop compressor 1 and restart automatically after fault reset. If the number of alarms is greater than 3 times within 1 hour, the high pressure of alarm system 2 will be locked.	02: Press 2 high voltage fault	1: Temperature is less than [condensation temperature over high point] automatic reset. 2: The high voltage switch 2 can be automatically reset after being invalid When the two systems alarm at the same time, and they are not in the cooling mode of the heat exchanger, the fan is stopped
Water supply pressure sensor fault	Anytime (using the water supply pressure)	Alarm without shutdown.	12: Water supply pressure sensor fault	Correct connected pressure sensor, automatically reset
Rewater pressure sensor fault	Always available (using the backwater pressure)	Alarm without shutdown.	12: The backwater pressure sensor is faulty	Correct connected pressure sensor, automatically reset
Main board IIC error	at any time	The whole system shutdown	Main board IIC failure: please contact the manufacturer!	Power up again, if not eliminated, please contact the manufacturer
Inverter 1 communication fault	at any time	Stop compressor 1.	frequency converter 1 communication fault: please check frequency converter and wiring!	After correctly connecting the frequency conversion 1 communication line, automatically reset
Return water pressure is low for the fault	at any time	Alarm, cannot start when in standby state, does not stop after starting	18: The water pressure is too low	Continuous [flow detection delay] after the alarm, automatic reset.
Low temperature difference alarm	at any time	Exit the heat exchanger mode	19: Low temperature difference of heat exchanger	
Communication timeout with the rear panel	at any time	Alarm without shutdown.	Communication timeout with the rear board: Please check the communication line and power on again!	Check the communication wiring between the display screen and the control panel
Water supply pressure is too	at any time	Alarm without shutdown.	20: Water supply pressure is too high	self-reset

high				
Expansion fan 1 is overloaded	at any time	Alarm-stops extended fan 1	Expansion fan 1 is overloaded	Manual reset, expansion fan 1~6 all overload stop compressor
Expansion fan 2 to overload	at any time	Alarm-stops extended fan 2	Expansion fan 2 to overload	Manual reset, expansion fan 1~6 all overload stop compressor
Expansion fan 3 is overloaded	at any time	Alarm-stops extended fan 3	Expansion fan 3 is overloaded	Manual reset, expansion fan 1~6 all overload stop compressor
Expansion fan 4 is overloaded	at any time	Alarm-stops extended fan 4	Expansion fan 4 is overloaded	Manual reset, expansion fan 1~6 all overload stop compressor
Expansion fan 5 is overloaded	at any time	Alarm-stops extended fan 5	Expansion fan 5 is overloaded	Manual reset, expansion fan 1~6 all overload stop compressor
Expansion fan 6 is overloaded	at any time	Alarm-stops extended fan 6	Expansion fan 6 is overloaded	Manual reset, expansion fan 1~6 all overload stop compressor

8.5 Maintenance

8.5.1 Periodic check

Maintenance items	**Maintenance standards**	**Maintenance cycle**	**detection mode**	**Error Handling**
Reliability of the power cables and signal cables of the wiring panel	No loose electrical cables and signal cables	Six months	Visual inspection	After power off for 10 minutes, use a screwdriver to tighten any loose cables.
	Electrical cables and signal cables have no aging, damage, abnormal heating and other abnormalities	Six months	Visual inspection	Replace the power cable and signal cable after 10 minutes of power-off.
	No dust at the wiring panel	Six months	Visual inspection	Remove the dust with a brush after 10 minutes of power off.

Maintain the air switch to work properly	Automatic clutch during abnormal circuit (such as short circuit)	Six months	Visual inspection	Replace the maintenance air switch 10 minutes after power off. The air switch is located in the electric control box.

8.5.2 Regular maintenance

Maintenance items	Maintenance standards	Maintenance cycle	detection mode	Error Handling
cooling medium	PH and the concentration of each electrolyte meet the requirements No dirt, precipitation, and algae generation	Six months	Visual inspection by the coolant detector	Replace the coolant after 10 minutes of power-off.

Explain

The above maintenance periods are recommended only. You can adjust them according to the actual performance of the coolant. The maintenance period of coolant with better stability can be relatively extended.

To replace the cooling medium in the liquid cooling unit, perform the following steps:

1. Wait at least 10 minutes after the power is switched off.

2. Drain the liquid in the cooling system through the drain port.

9. Control cabinet system

9.1 Control cabinet system overview

The battery container is equipped with a complete control cabinet system, which consists of electrical components such as circuit breakers, air switches, terminals, relays, UPS, contactors, etc., to realize the functions of power supply, safety emergency stop, internal communication and external communication of various equipment in the container.

9.2 Safety emergency stop function

The function of the safety emergency stop system is to achieve the purpose of system shutdown by actively triggering the emergency stop system or linkage triggering the emergency stop system in the

event of an emergency, such as a fire or abnormal operation of the system. This prevents the system from continuing to run when an emergency occurs, leading to more serious situations.

9.3 Electrical schematic diagram of control cabinet

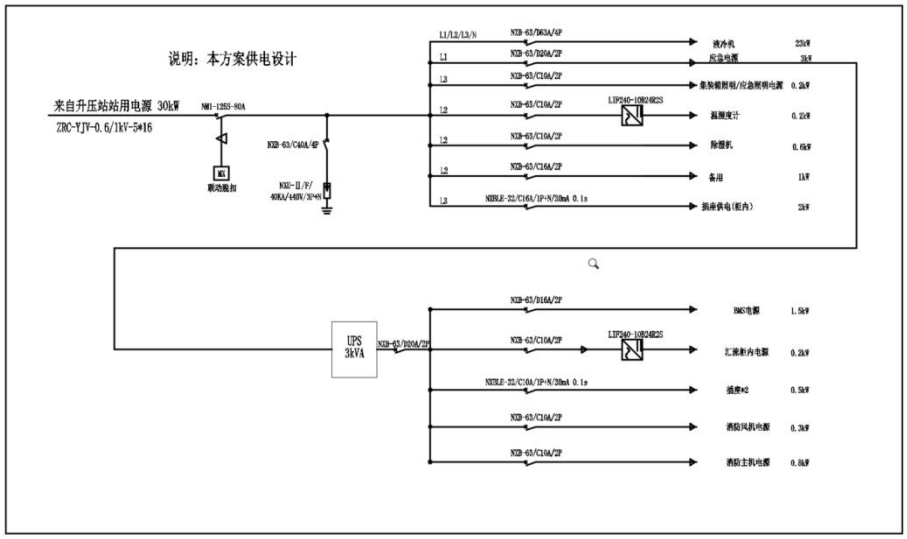


Diagram 9-1 Auxiliary power supply system

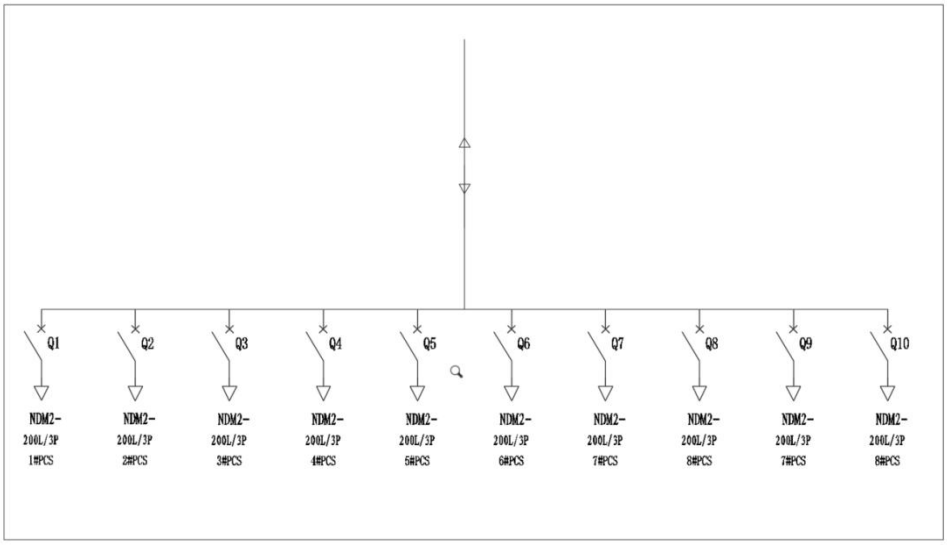


Diagram 7-2 Ac bus system diagram

9.4 Daily maintenance

Factors such as operating environment (such as temperature, humidity, dust, salt spray, interference, etc.), aging and wear of internal components will increase the failure rate of the system. In order to reduce the failure rate and extend the service life of the system, daily care and maintenance are required.

Daily maintenance and operation	General rules of use	The product should not work / place in an environment beyond the temperature and humidity range;
		The product should not be subjected to external force such as

maintenance		squeezing, impact, or falling;
		Products should not be used beyond their own technical parameters;
		When you find that there may be defects or problems with the product, communicate with professionals in a timely manner;
	Level I BMS module	Before each power-on, try to confirm that the connector is well inserted and not loose;
		Check and confirm that the voltage of the power supply is within the scope of the specification;
		If the battery pack is not working for a long time (more than 1 month), check whether the voltage of the unit and the group end is in the normal range before charging the module;
		When necessary to connect CAN card for software operation, confirm that the corresponding channels CANH and CANL organization are 60 Ω before power on, and insert the USB line and then power on.
	Secondary BMS module	Before each power-on, try to confirm that the connector is well inserted and not loose;
		Check and confirm that the voltage of the power supply is within the scope of the specification;
		Check whether the contactors and fuses (if any) are normal before each power on;
		When necessary to connect CAN card for software operation, confirm that the corresponding channels CANH and CANL organization are 60 Ω before power on, and insert the USB line and then power on.
	The Level-III BMS module	Should often keep the screen clean, beware of bumping;
		During long-distance transportation, it is recommended to assemble and assemble the carton with foam protection and restore it on site.
	current sensor	Current sensor (shunt or Hall) that is not used for a long time (more than 1 month), you need to check that the sensor is free of rust and dust;
	wiring harness	If the wiring harness has not been used for a long time (more than 1 month), you need to recheck to make sure that the wires and connectors are not damaged, unplugged, or rusted.;

Component replacement	Module replacement	During part replacement and maintenance, timely and sufficient communication with professionals is required.
maintenance routine	According to the actual situation of the project, it is recommended to check the voltage situation of the battery pack regularly, and carry out charge and discharge maintenance;	
	According to the actual situation of the project, it is recommended to check the status of BMS module, wiring harness, NTC and other accessories regularly;	
	According to the actual situation of the project, it is recommended to check and confirm the working / storage environment of the battery and BMS regularly;	
	According to the actual situation of the project, it is recommended to check the structural fixation status of the battery pack and BMS regularly.	

10. Power Conversion System

10.1 PCS Overview

The Power Conversion System (PCS) controls the charging and discharging process of batteries. PCS is composed of bidirectional AC/DC converter, control unit, etc., receives control instructions through communication interface, sends the instructions to the power part to realize charge/discharge control of the battery, and then adjusts the active power and reactive power of the power grid.

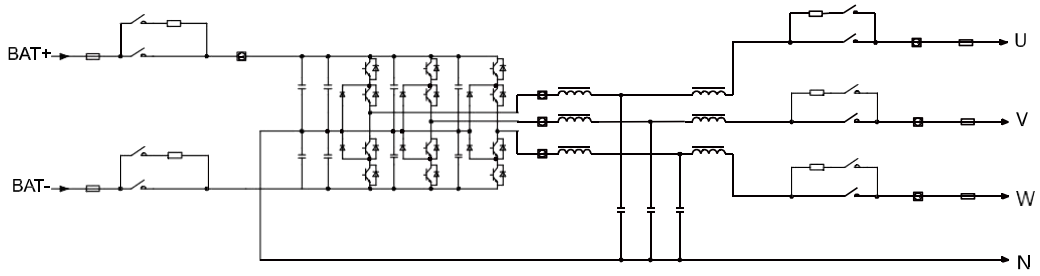


Figure 10-1 PCS Original topology view

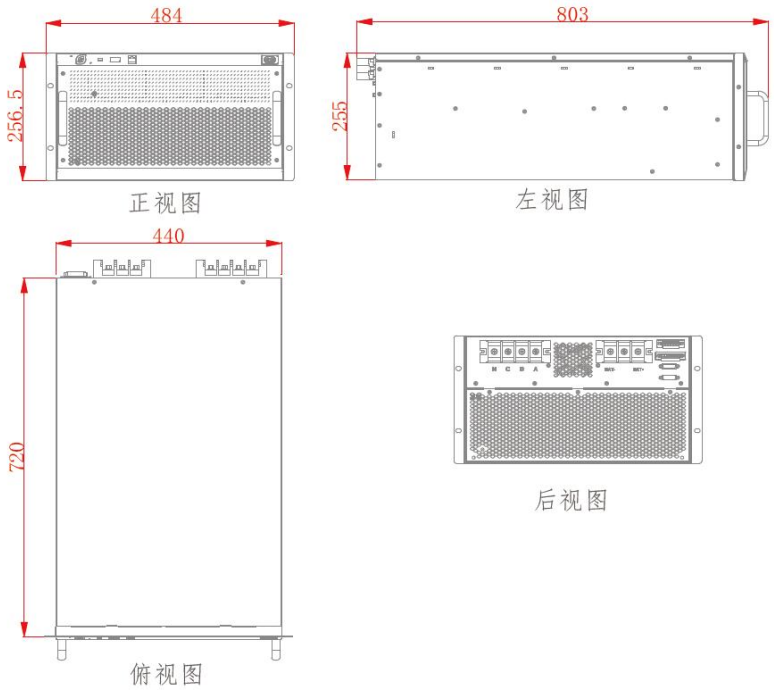


Figure 10-2 Dimensions of PCS

10.2 Product Features

Efficient conversion:

1. The standby battery has zero power consumption;
2. Charge and discharge conversion time ≤100ms;
3. Maximum conversion efficiency 98.5%.

Flexible application:

Compatible with three-phase three-wire/four-wire system, customized communication bus can monitor all module data.

Battery friendly:

1. Different battery clusters can work completely independently, avoiding circulation between battery clusters and extending service life.
2. Supports the 30+BMS protocol.

All features:

1. Support pure grid-connected, pure off-grid, and off-grid switching operation mode;
2. Support high and low wear, island, black start;
3. In off-grid working mode, support 100% three-phase unbalanced load;
4. Support reactive power compensation, harmonic control, three-phase imbalance compensation.

Easy maintenance:

1. In the series solution, the fault branch does not affect the operation of other branches.

Safe and stable:

1. Perfect fault protection function;
2. Low battery circulation, multi-parallel automatic current sharing;
3. Support stable operation in the power grid environment with 20% THDu.

10.3 Technical Specification

direct current side	
Operating voltage range (V)	615~950（3W+PE）/650~950（3W+N+PE）
Full-load voltage range (V)	615~950（3W+PE）/680~950（3W+N+PE）
Number of input roads	1
maximum current (A)	170
AC side (grid connection)	
rated voltage (V)	230/400
voltage deviation	-15%~+15%
AC output type	(3W + PE) three-phase three line / (3W + N + PE) three-phase four line
Rated output power (kW)	105
Maximum output power (kW)	116
maximum current (A)	167
Rated Grid Frequency (Hz)	50/60
power factor	0.99
Power factor range	1 (advance) ~1 (lag)
Current distortion rate	<2% (rated power)
direct component	0.50%
overload capacity	110% Long term
maximal efficiency	98.50%
AC-side side (off-grid)	
Rated output voltage	230/400
AC voltage harmonic	<3% (linear load)
rated frequency (Hz)	50/60
Rated output power (kW)	105
Maximum apparent	116

power (kVA)	
Maximum output current (A)	167
protection feature	
Functional	AC overcurrent protection, AC overvoltage protection, AC surge protection, AC short circuit protection, DC back connection protection, DC surge protection, overtemperature protection, etc
Conventional parameters	
Dimensions (W× ×D×H mm)	Post-maintenance: 440×720×255
	Front maintenance: 500×770×270
above sea level (m)	4000m (> 2000m Derate use)
working emperature	-30℃ ~55℃ (> 45℃ Derate use)
Storage temperature	-45℃～70℃
humidity	5% RH to 95% RH, with no condensation
cooling-down method	Intelligent forced air cooling
levels of protection	IP20
communication interface	CAN/RS485
Power grid support	L / HVRT, active and reactive power control

10.4 Care and Maintenance

1、Daily maintenance

Due to the influence of ambient temperature, humidity, dust and vibration, the components inside the converter will age, which may lead to potential faults of the converter or reduce the service life of the converter. Therefore, it is necessary to carry out daily and regular maintenance work on the converter.

The input and output of the converter are strong current, and necessary safety precautions must be taken before maintenance begins.

Before maintenance, ensure that both the DC and AC power supplies are disconnected.

The converter has an energy storage capacitor. After powering off the converter, wait for more than 10 minutes to ensure that the converter is in no power state before performing maintenance.

To avoid unexpected hazards, wear insulation protective equipment during maintenance.

Before performing maintenance, strictly follow the correct operation rules.

Only qualified personnel can maintain the converter.

After the power supply is disconnected, hang a warning sign at the disconnected place to prevent anyone from powering on the power supply during maintenance.

Pay attention to cleaning and corrosion prevention, in harsh environmental conditions should shorten the maintenance interval.

More frequent maintenance may be required, depending on site conditions.

If DC power distribution components are susceptible to adverse environmental conditions, you are advised to shorten the maintenance interval.

You are advised to periodically check the appearance to determine whether maintenance is required.

If the product is not used for a long time (more than 6 months), please contact our after-sales engineer if you need to use it.

2、Routine inspection items

Daily inspection items shall be carried out according to the following points:

①The input and output voltage, current and operating status of the converter are monitored in real time, and observations are made by designated personnel at designated locations. If the converter is found to be operating abnormally or the voltage and current are abnormal, maintenance must be carried out in a timely manner.

② Listen to the converter for any abnormal noises

③ There is no peculiar smell inside the converter.

④ Read the internal temperature of the converter and observe that the temperature is within the normal range.

3、Periodic inspection items

Regular three month inspection is mainly for routine inspection and daily operation of the difficult to check the place.

① Check that the converter is not damaged or rusted.

② The temperature measuring instrument is used to detect the internal temperature of the converter.

③ Check that the ventilation, ambient temperature, humidity, dust and other environment around the converter meet the requirements.

④ Check the phenomenon of aging and damage of the cable without layer, and increase the corresponding insulation measures if it occurs install or replace the cable.

⑤ Check that there are no signs of aging or burning on the wiring bolts, and shake them with your hand to confirm that they are screwed the state of tightness.

11. Routine Maintenance

11.1 Instructions before Maintenance

⚠ Attention

• Please do not open the door for maintenance of the container energy storage system in rainy, humid or windy weather. If this is not avoided, Renepoly company not assume any responsibility for the losses caused.

• Avoid opening the door when it is raining, snowing or foggy and the humidity is high. After the door is closed, make sure that the sealing strips around the door are not curled.

⚠ Attention

To reduce the risk of electric shock, do not perform any maintenance or repair operations other than those described in this manual.

If necessary, contact Renepoly company personnel for maintenance and repair.

11.2 Container Maintenance List and Period

11.2.1 Maintenance (every two years)

Project List	Inspection Method
System standard cleaning	Check the following items and correct them immediately if they do not meet the requirements: • Check whether the container and internal equipment are damaged or deformed. • Check whether there is any abnormal noise during the operation of the internal equipment. • Check whether the temperature inside the container is too high. • Check whether the humidity and gray scale inside thecontainer are within the normal range. Clean if necessary. • Check whether the air inlet and outlet of the container are blocked.
Warning signs	Check that warning signs and labels are clearly visible and not damaged. Replace if necessary.
Cable shield grounding	Check whether the cable shielding layer is in good contact with the insulation sleeve; whether the grounding copper busbar is fixed in place.
Lightning protection equipment and fuses	Check whether the lightning protection equipment and fuses are well tightened.
Corrosion	Check the inside of the container for oxidation or rust.

11.2.2 Maintenance (once a year)

Project List	Inspection Method
Outside the container	Check the following items and correct them immediately if they do not meet the requirements: ·Check whether there are flammable objects on the top of the container. ·Check whether there is rust on the container and foundation steel plate. ·Check whether the container is damaged, has paint peeling, or is oxidized. ·Check whether the container door lock can be opened flexibly. Check whether the sealing strips are well fixed.
Inside the container	Check whether there is foreign matter, dust, dirt, or condensed water inside the container.
Air inlet and outlet	Check the heat sink temperature and dust. If necessary, use a vacuum cleaner to clean the heat sink.
Wiring and CableRouting	Wait until the internal equipment of the energy storage system is completely powered off before starting the inspection! During the inspection, correct any non-conformities immediately upon discovery. ·Check whether the cable arrangement is standardized and whether there is a short circuit. If there is any abnormality, correct it immediately. ·Check whether all the cable entry and exit holes of the container are well sealed. ·Check whether there is water seepage inside the box. ·Check if the power cable connection is loose and re- tighten it according to the previously specified torque. ·Check whether the power cables and control cables are damaged, especially whether there are any cuts on the surface that comes into contact with the metal surface. ·Check whether the insulation tape of the power cable terminal is loose.
Grounding and equipotential bonding	• Check whether the ground connection is correct and the ground resistance value shall not be greater than 4 Ω. • Check whether the equipotential connection inside the energy storage system is correct.
Screws	Check whether there are any screws dropped inside the container.

11.2.3 Maintenance (once every six months to a year)

Project List	Inspection Method
Security function	·Check the emergency stop button for stop function. ·Simulate downtime. ·Check the warning labels and other labels on themachine. If they are blurred or damaged, please replace them in time.
Software maintenance	View the configurable parameters of the Web.
Internal componentinspection	·Check the cleanliness of circuit boards and components. ·Check the heat sink temperature and dust. If necessary, clean the

	heat sink module, etc. with a vacuum cleaner. ·If necessary, replace the air filter. **Attention!** The ventilation of the air inlets must be checked. Otherwise, if the module is not cooled effectively, it may malfunction due to overheating.
Device maintenance	·Carry out regular inspections (six months) of all metalcomponents for corrosion. ·Annual inspection of contactors (auxiliary switches and micro switches) ensures that they are in good mechanical condition. ·Check operating parameters (especially voltage, insulation, etc.).

11.3 Maintenance Container

11.3.1 Check door locks and hinges

Check whether the door locks, hinges, etc. of the energy storage system can be used normally and are in good condition. If necessary, lubricate the door lock holes, hinges, etc.

11.3.2.Check the sealing strip

A sealing strip in good condition is an important guarantee for effectively preventing water seepage inside the container. It should be carefully checked and replaced immediately if damaged.

11.4 Battery Maintenance

11.4.1 Regular maintenance and maintenance period

The following is the recommended maintenance period. The actual maintenance period should be adjusted based on the specific installation environment of the product.

Factors such as the size of the power station, installation location and on-site environment will affect the maintenance period of the product. If the operating environment is windy or dusty, it is necessary to shorten the maintenance period and increase the maintenance frequency.

Notice

During maintenance or shutdown, the capacity loss caused by the followingtwo situations for more than 120 hours is not covered by the warranty.

- The battery discharge voltage is 2.7V lower than the minimum battery voltage.
- The SOC of any battery cluster is 0%.

Maintenance every two years

Project List	Inspection Method
Battery Cluster Statusand Cleaning	Check the following items and correct them immediately if they do not meet the requirements: ·Check the battery pack and internal devices for damage or deformation. ·Check whether there is any abnormal noise during the operation of the internal equipment. ·Check whether the temperature inside the battery cluster is too high. ·Check whether the humidity level inside the battery cluster is within the normal range. Clean if necessary. ·Check whether the air inlet and outlet of the battery cluster are blocked.
Warning signs	Check that warning signs and labels are clearly visible and not damaged. Replace if necessary.
Wiring and cables	Check the battery modules and whether they are connected correctly.
Corrosion	Check the battery pack for oxidation or corrosion.

Maintenance once a year

Project List	Inspection Method
Battery Cluster	Check the following items and correct them immediately if they do not meet the requirements: ·Check the top of the battery cluster for any flammableobjects. ·Check whether the fixing points of the battery clusterand the foundation steel plate are firm and whether there is any rust. ·Check whether the container is damaged, has paint peeling, or is oxidized. ·Check the inside of the battery Cluster for foreign matter, dust, dirt, and condensation.
Wiring and Cable Routing	Wait until the internal devices of the battery cluster are completely powered off before starting the inspection! During the inspection, if any non-conformities are found, please correct them immediately. • Check whether the cable arrangement is standardized and whether there is a short circuit. If there is any abnormality, correct it immediately. • Check whether all the cable entry and exit holes of the battery cluster are well sealed. • Check whether there is water seepage inside the battery pack. • Check whether the copper busbar connection is loose and tighten it again according to the torque specified previously. • Check whether the power cables and communication cables are damaged, especially whether there are any cuts on the surface that comes into contact with the metal surface.
Ground connection	·Check whether the fan has any faults, such as being blocked or stopped. ·Check whether the fan makes any abnormal noise during operation.

fan	Check whether there is oxidation or rust inside the fan.
Screws	Check whether there are any screws missing or rust inside the battery cluster.

Maintenance once every six months to a year

Check Content	**Inspection Method**
Ambient temperature and humidity check	·Check the ambient temperature record to see if the temperature is within the operating range. ·Check the ambient humidity records to see if it is within the operating range.
Functional check	·Check the DC contactor operating status: In shutdown condition, send an on/off command to check if the operation is normal. ·Measure the 24V output voltage to see if it is within the specification range. Check the battery cluster operation records to see if the current, voltage and temperature are within the operating range.

11.4.2 Maintenance precautions

In order to maintain the system safely and effectively, maintenance personnel are requested to carefully read and comply with the following safety requirements:

(1) You must hold an electrician certificate issued by the Safety Supervision Bureau and pass professional training before you can takeup the job.

(2) You must comply with relevant safety precautions, use necessary tools, and wear personal protective equipment.

(3) Wearing metal accessories such as jewelry or watches is strictly prohibited.

(4) Under no circumstances should you touch the high voltage positive and negative poles of the energy storage system with both hands at the same time.

(5) Before maintaining the battery energy storage system, disconnect all high-voltage and low-voltage switches.

(6) When cleaning, it is strictly forbidden to use water directly for cleaning. Use

a vacuum cleaner when necessary.

(7) When plugging and unplugging cables, the operation should be standardized and brute force or violence should not be used.

(8) After maintenance, please clean up tools and materials in time and check whether there are any metal objects left inside or on top of the equipment.

(9) If you have any questions about the operation and maintenance of the equipment, please contact the relevant personnel of GUANGZHOU RENEPOLY ENERGY TECHNOLOGY CO., LTD. Unauthorized operation is strictly prohibited.

11.5 Equipment Maintenance

(1) Recommended ambient temperature: 0 ℃ ~40 ℃ . The temperature control range during charging and discharging should be maintained at 15 ℃ ~30 ℃, with a typical value of 25 ℃.

(2) Avoid high-rate charging and discharging of the RACK. The continuous charging and discharging current of a single RACK should not exceed 140A.

(3) When the battery energy storage system is not used for a long time, the system should be fully charged and discharged every 5 months to bring the system SOC to 30%~40%. The SOC should remain consistent after charging.

(4) Before using a long-term system for the first time, fully charge and discharge the battery energy storage system at least once to restore the battery performance to its optimal state.

(5) Check the cooling system air duct regularly to see if it is blocked, clean the battery energy storage system regularly, and pay special attention to cleaning the fan air inlet and outlet. Use a vacuum cleaner to clean it if necessary to ensure that the air can flow freely inside. The power supply must be turned off before dust removal; flushing with water is strictly prohibited.

(6) Regularly check whether the fastening bolts of the high-voltage cables and connecting bars of the battery energy storage system are loose, whether the contact is good, and whether the terminal surface is severely rusted or oxidized.

(7) Regularly check whether the positive and negative high-voltage protective covers of the PACK are aging, damaged or missing.

(8) Check cables regularly to see if they are loose, aged, damaged or broken, and to see if their insulation is in good condition.

(9) Regularly check whether there is any pungent odor in the battery container and whether there is any burning odor at the high-voltage connection points.

(10) Regularly check whether the voltage, temperature and other data of the monitoring host computer are normal, and whether there are any abnormal alarms in the alarm bar.

(11) Regularly check the battery energy storage system status and alarm indicator lights to see if they are intact and functioning normally.

(12) Regularly check whether the emergency stop switch of the battery energy storage system is effective to ensure that the system can be stopped quickly in an emergency.

(13) Check the fire protection system regularly to see if it is in good condition and within its validity period.

(14) It is prohibited to use different types of battery modules in series or in parallel.

⚠ Attention

• Batteries are potentially dangerous and appropriate protective measuresmust be taken during operation and maintenance!
·Improper operation may result in serious personal injury and property damage!
·Proper tools and protective gear must be used when handling batteries.
·Battery maintenance must be performed by personnel with battery expertise and safety training.

RENEPOLY

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