C&I Liquid Cooling Energy Storage System

User Manual

2023.06

V1

Preface

Dear users, thank you for choosing our products! Please be sure to read this User Manual carefully before using this product.

By reading this manual carefully, you will better understand the characteristics of this product, use and maintain this product correctly, ensure the safety of use and the best performance of this product, so as to obtain the maximum benefit of use.

The pictures provided in this manual are for demonstration purposes only, and detailed information may vary slightly depending on the product version and market region. This manual has been prepared in accordance with the status of our energy storage system at the time of its commissioning. The product form and technical specifications may evolve continuously. This manual will be revised accordingly when the product is updated, and the revised items will not be notified.

If the system fails due to your negligence, improper use or unauthorized disassembly or hacking of the control program, you will lose your warranty rights; any direct or indirect warranty claims resulting from this will not be accepted by our company after-sales service.

Contents

1. Overview

1.1 Main content

This manual describes the product, transportation, installation, operation, maintenance and troubleshooting of the standard liquid-cooled energy storage system. Before using this product, please be sure to read this manual carefully and operate the energy storage system according to the methods described in this manual, otherwise it may cause equipment damage or personal injury.

1.2 Target audience

This manual applies to personnel involved in the transportation, installation and other operations related to this product, and the personnel involved must meet the following requirements: Proficiency in electrical, electronic, mechanical engineering and other professional knowledge, proficiency in understanding electrical schematics, structural drawings, etc.; Understanding of the products, fundamentals, working principles, and control logic of the energy storage industry; Have a professional electrician construction certificate and qualification recognized by the law I the region where this product is used, and be familiar with the relevant laws and regulations in this region; Have the ability to deal with emergency emergencies and handle relevant pieces according to the laws and regulations of the region where this product is used; Proficiency in the content of this manual, professional skills and a high degree of responsibility. The manual contains important information; please read it carefully before operating and maintaining the system. Please keep this manual and other information in the product components together to ensure timely access by the operator and maintenance personnel**.**

1.3 Manual warning flag definition

In order to protect the user's personal and property safety when using this product and to improve the user's efficiency of this product, these manual details the relevant information and adds relevant symbols to enhance the explanation. The following logos may appear in this article and represent the following:

Symbol	Description
Danger	Used to warn of an emergency hazardous situation that, if not avoided, would result in death or serious personal injury.
Warning	Used to warn of potentially hazardous situations that, if not avoided, could result in death or serious personal injury.
Caution	Used to warn of potentially hazardous situations that, if not avoided, could result in moderate or minor personal injury.
Notice	Used to communicate equipment or environmental safety warnings that, if not avoided, could result in equipment damage, data loss, reduced equipment performance, or other unpredictable results. "Caution" does not refer to personal injury.
	Indicates additional information in the manual that emphasizes or supplements the content, and may also provide tips or tricks to optimize the use of the product, help you solve a problem or save you time.
	This symbol means that the product contains high voltage hazards inside and touching it may result in electric shock hazards.
	This symbol means that the product contains a high temperature hazard and should be avoided to avoid personal injury.
	This mark means that the product is protection ground (PE), need to connect the grounding wire, please link firmly and reliably to ensure the safety of the operator.
	This mark means the product is forbidden to open here, and there is a major danger to open casually.
	This mark means the product is forbidden to touch, random touch may lead to equipment failure, there is a greater danger.

2. Safety instructions

2.1 Safety instructions

Please strictly comply with the terms of the safety regulations in this product manual. In order to avoid possible casualties and property damage during the use of this product, and to improve the service life and efficiency of this product, please be sure to read the safety specifications carefully.

2.2 Operator requirements

Professionally qualified electricians are required to operate and maintain this product, and complete professional electrical equipment is required; Ability to evaluate assigned tasks and identify hazardous events that may arise; The ability to rescue injured persons at the first opportunity; Knowledge of the relevant maintenance standards for the product; Compliance with local laws, regulations and standards;

2.3 Electrostatic protection

The accumulation of static electricity may cause electric shock, fire, explosion, electronic device failure and damage, etc. Energy storage systems with circuit boards or other electrostatic sensitive components, in order to prevent or reduce the harm of static electricity, it is necessary to do a good job of electrostatic protection, and thus inhibit the generation of static electricity, accelerate the leakage of static electricity, electrostatic neutralization. The prevention methods include, but are not limited to: in the process of replacing components, all equipment devices that have not been installed should be kept in bags with anti-static shielding, and temporarily removed equipment devices placed on foam pads with anti-static features; do not touch solder points, pins or exposed circuits;

3. Product introduction

3.1 Liquid-cooled energy storage system Overview

Liquid-cooled outdoor battery cabinet system contains battery packs, BMS, thermal management system, fire protection system, electrical system, cabinet, etc.

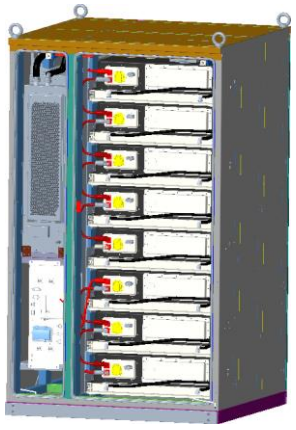
3.2 Technical parameters of energy storage system

Table 1 Technical parameters of liquid-cooled outdoor battery cabinet

Projects	**Parameters**	
Rated energy storage capacity	215kWh	344 kWh
Battery nominal capacity	280Ah	
Rated charge/discharge power	0.5P	
Configuration	1P240S	1P384S
Nominal voltage	768V	1228.8V
Voltage Range	672V~864V	1075.2V~1382.4V
Battery Pack	5pcs	8pcs
Dimension(W×D×H)	1300×1300×2300mm	
Operating ambient temperature	-20℃～50℃	
Operating environment	≤95% relative humidity, non-	

humidity	condensing
Cooling method	Liquid cooling
Fire Fighting Media	Aerosols/ Perfluorohexanone
Anti-corrosion grade	C3
Protection level	IP54

3.3 Structure diagram of liquid-cooled energy storage system



344kWh: 8 battery PACK

Figure 1: 344kWh Liquid-cooling outdoor battery cabinet

3.4 Energy storage system Primary diagram

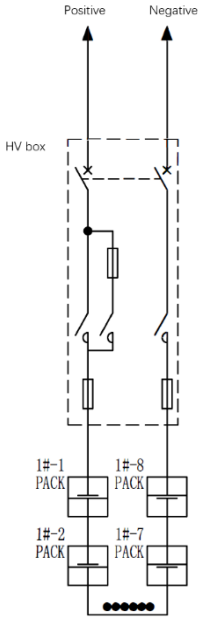


Figure 2: Primary diagram of 344kWh Liquid-cooling battery cabinet

4. Lifting, transportation and storage

4.1 Lifting operation

4.1.1 Lifting precautions

	**Warning:** In the whole process of lifting, it is necessary to operate in strict accordance with the safety operation procedures of the crane. No one is allowed to stand within 10 meters of the operation area, especially under the lifting arm and under the lifting or moving machine to avoid casualties. In case of bad weather conditions, such as heavy rain, fog, strong wind, etc., lifting should be stopped.

4.1.2 Preparation before lifting

1. Crane preparation

Please choose the crane according to the total weight, the recommended model: 8 tons ~ 12 tons.

2. Spreader preparation

Wire rope, hooks, rings, etc.

4.1.3 Lifting process

1. When loading and unloading, a crane of suitable tonnage must be used; when lifting, nylon slings (straps) or wire ropes can be used;

2. The cabinet shall be lifted vertically and shall not appear to be dragging on the ground and

shall not be dragged and pushed on any surface;

3. After lifting 300mm, pause and check the connection of the spreader, and continue lifting only after the connection is firmly established;

4. The whole lifting process should be carried out slowly, pay attention to the balance state of the box, do not move too fast;

5. In the entire lifting process, below standing below outdoor cabinets and cranes are strictly prohibited;

4.1.4 Liquid-cooled energy storage system lifting schematic

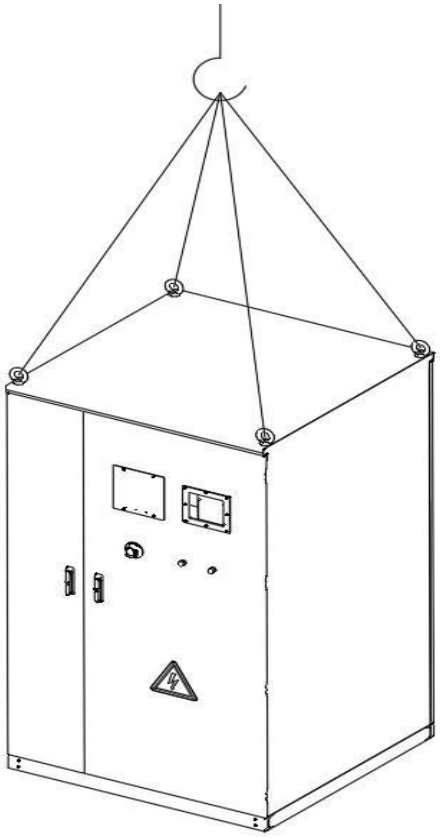


Figure 3 Liquid-cooled energy storage system lifting schematic

4.2 Forklift operation

When forklifts are used for forklift operations, the following conditions must be met:

- The forklift used should have sufficient load capacity (at least 8 tons is recommended).
- The forks of the forklift used should be inserted into the full depth of the outdoor cabinet, i.e. the length should be at least 1300mm.
- In the fork up, down and moving process, ensure operation slow and smooth. There must be

a test fork.

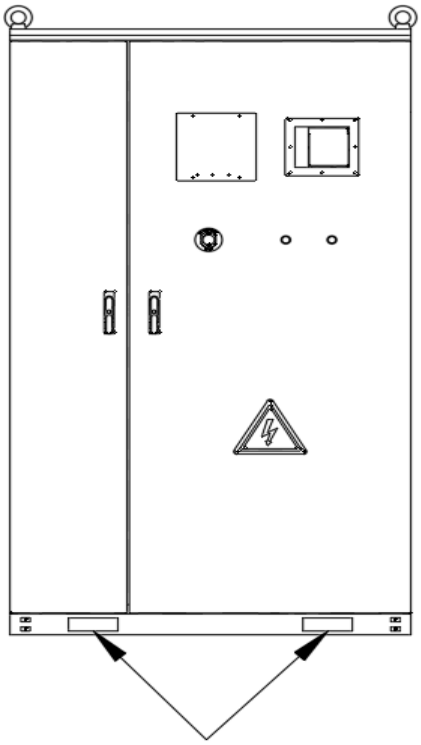


Figure 4 Slot location diagram

4.3 Transportation

The outdoor cabinet of liquid-cooled energy storage system is suitable for land and sea transportation, which should be sheltered and protected from sunlight during transportation, civilized loading and unloading, and the direct shower of rain and snow and mechanical impact should be avoided during transportation.

4.3.1 Transportation environment requirements

According to the battery characteristics, the energy storage system should meet the following requirements during storage and transportation in order to maximize the protection of the battery performance: Average daily storage temperature: ≤20℃; Humidity: ≤95%, non-condensing.

4.3.2 Liquid-cooled energy storage system factory preparation

1. The equipment should be packed in wooden box before leaving the factory, and the air bubble film should be twined to prevent cabinet from collision;

2. If necessary, add steel belt outside the box to facilitate shipping;

3. For sea freight, it should meet the MSDS certification and label with the 9 types of dangerous goods marks.

4.3.3 Road shipping

1. Obeying traffic rules;

2. Because the outdoor cabinet equipment is equipped with batteries inside, speeding is prohibited. On flat tarmac, highway speed limit of 70km/h, slow down at curves, speed limit of 50km/h; town road speed limit of 40km/h, avoid emergency start, avoid emergency braking;

3. Please drive with special care on any road surface such as non-flat tarmac, and the speed limit is 50km/h;

4. Prohibit transportation on bad and bumpy roads;

5. The goods are tied firmly; before departure, check the tying situation once; in transit, check the tying situation every 4 hours.

 Caution	Please always keep in mind the mechanical parameters of the energy storage system during transportation and handling: Liquid-cooled outdoor cabinet: Size (L×W×H) 1400×1400×2450mm Weight about 3100kg

4.4 Storage

The system should be stored in a dry warehouse, not exposed to the sun and rain. No harmful gas, flammable, explosive products and corrosive chemicals are allowed in the warehouse, avoid mechanical shock, heavy pressure and strong magnetic field, avoid direct sunlight, not less than 2m from heat source, at least 50cm from wall, window or air inlet.

Average daily storage temperature: ≤ 20°C;

Allowable storage temperature: short-term storage temperature range (within 1 month): -20～45°C; long-term storage temperature: -20°C～35°C;

Storage humidity: ≤95%, non-condensing; Under these specified conditions:

It is recommended that the battery be discharged and replenished every 3 months to ensure that

the battery SOC remains within the range of 20 to 50% SOC;

Capacity verification tests and re-tests are required every 12 months.

 Alarm	During the storage process of liquid-cooled energy storage systems, JinkoSolar shall not be liable for any damage to the system caused by the user's failure to comply with the storage methods and requirements specified in this manual

5. Foundation construction

When siting foundations, please follow the following principles:

1. The climatic environment, soil and geological conditions (such as stress wave emission situation, groundwater level) and other characteristics of this liquid-cooled energy storage system installation site should be fully considered.

2. The surrounding environment is dry, well ventilated and away from flammable and explosive areas.

3. The foundation soil needs to have a certain degree of compactness. It is recommended that the relative compactness of the soil at the installation site is ≥98%. If the soil is loose, please make sure to take measures to ensure the foundation is stable.

6. Equipment installation

6.1 Installation Instructions

The internal equipment of liquid-cooled energy storage system has been reliably connected and tested before leaving the factory. It is necessary to install and fix the outdoor cabinet box, connect external power cables, connect the external signal cables, and connect the outdoor cabinet grounding at the project site. The installation process is shown below:

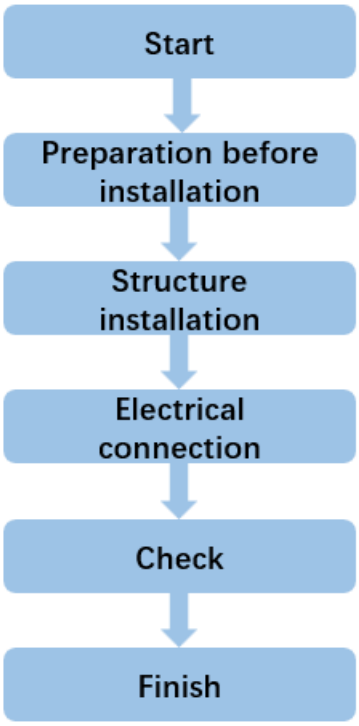


Figure 5 Installation process of liquid-cooled energy storage system

The installation process of liquid-cooled energy storage system is described in detail as shown in Table 6-1 below:

Table 6-1 Detailed description of the installation process

Installation Regulations	Installation Description
Pre-installation preparation	● Check the appearance of the liquid-cooled battery outdoor cabinet ● Inspect the liquid-cooled battery outdoor cabinet for damage or dislodgement of devices ● Verify that all parts are intact and not missing ● Confirm that the installation environment meets the requirements ● Confirm the availability of equipment for lifting outdoor cabinets at the project site
Structural installation	● Use a crane to move the liquid-cooled battery outdoor cabinet to the prefabricated foundation

Installation Regulations	Installation Description
	● Fixed outdoor cabinets according to project requirements
Electrical connection	● Connection point ● Connection of external communication and power cables

6.2 Pre-installation preparation

6.2.1 Installation environment requirements

Liquid-cooled energy storage system box installation environment should meet the following requirements:

Table 6-2 Environmental requirements for installation of liquid-cooled energy storage system cabinet

Projects	Requirements
Installation site	Surface inclination ≤ 1° Seismic resistance > 8
Ambient temperature	-20~+50℃
Relative Humidity	≤95%, no condensation
Altitude	≤2000m

6.2.2 Liquid-cooled battery cabinet installation steps

6.2.2.1 Liquid-cooled battery cabinet box fixed connection

（1）Use a crane (recommended lifting capacity: 8 tons - 12 tons) (or forklift, recommended forklift capacity of 8 tons or more) to slowly lift (or forklift) the whole liquid-cooled energy storage system to the prefabricated foundation, please refer to chapter 4.1 of this manual for the specific operation method of loading operation;

（2）After the liquid-cooled energy storage system is lifted and installed, the outdoor cabinet is fixed according to the project requirements;

（3）The weld seam needs to be treated for corrosion protection after welding is completed.

6.2.2.2 Liquid-cooled outdoor battery cabinet ground connection

At the project site, the installer needs to connect the grounding body prefabricated on the foundation to the grounding copper strip inside the outdoor cabinet via M10 bolts. The grounding point of the cabinet is shown in Figure 6:

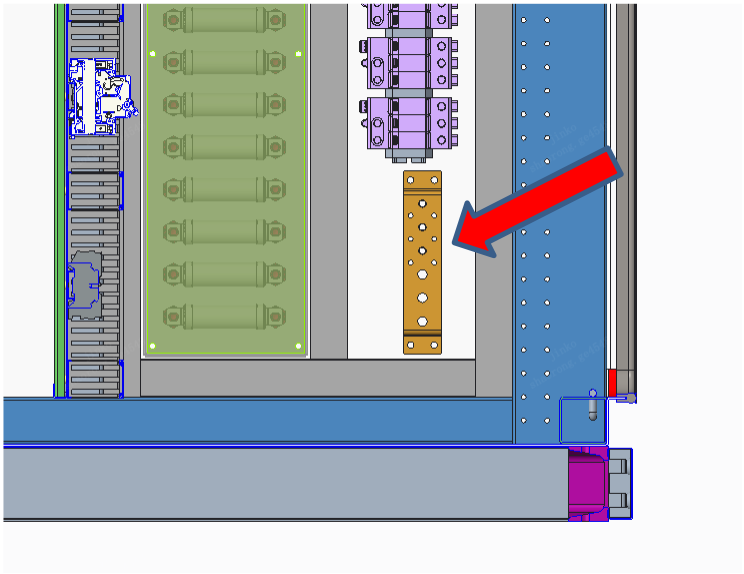


Figure 6 Liquid-cooled energy storage system box grounding point

6.3 Electrical connections

Liquid-cooled energy storage system battery outdoor cabinet has been completed before the factory, the user needs to connect the cables between the battery cabinets and the PCS.

6.3.1 Liquid-cooled outdoor battery cabinet interface

The bottom of the liquid-cooled outdoor cabinet is equipped with PCS side DC cable port, external communication line port, auxiliary power supply port and grounding row, and the detailed location of the openings is shown in Figure 7:

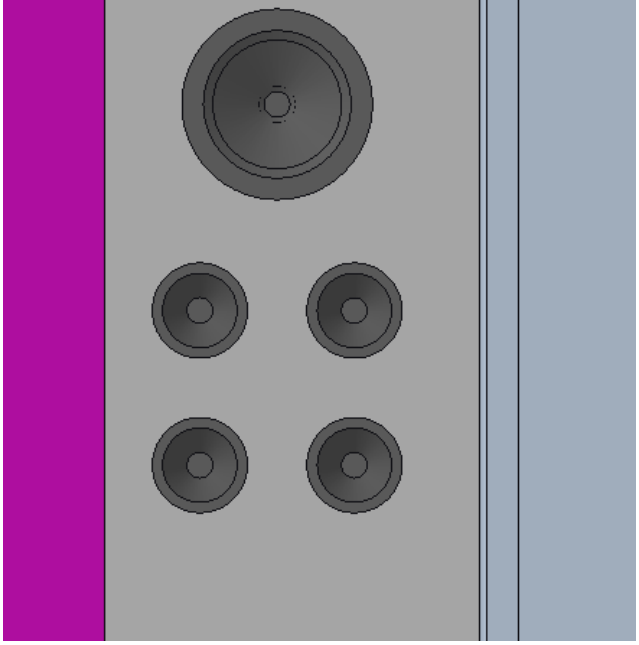


Figure 7 Schematic diagram of the bottom opening of the liquid-cooled outdoor cabinet

6.3.2 Electrical Wiring

6.3.2.1 Cable wiring

6.3.2.1.1 DC cable wiring

The recommended terminal block type for DC cables is shown in below:

Table 6-4 DC cable terminal block type recommendation table

Projects	Description
DC cable wiring	2*3/0AWG power cables, respectively, connected to DC+ and DC-, using a total of 2 performance level 8.8 M10×30 bolts, spring pad, flat pad and performance level 8 M10 hexagonal nuts to lock the terminals and copper row, and use a 17 socket wrench to tighten, tightening torque recommended value: 41~51N-m
Terminal type	AWG3/0-3/8 (10.4)

6.3.2.1.2 DC cable wiring procedure

Step 1: Confirm that all the output switches of PCS, high-voltage distribution box are disconnected;

Step 2: Peel off the end of the cable insulation, the length of the peeled cable insulation should be the depth of wired copper nose crimp hole plus 5mm;

Step 3: Equipped with suitable wiring copper nose for crimping according to the selected cable specification;

（1）the stripped wire exposed copper core part into the wiring copper nose pressure wire hole

（2）the use of terminal crimping machine will be wired copper nose crimp, the number of crimp should be more than two channels

Step 4: Installation of heat-shrinkable tubing;

（1）Select the heat-shrinkable sleeving that matches the size of the cable, and the length of the heat-shrinkable sleeving should exceed the wiring copper nose crimp tube by about 2cm

（2）the heat-shrinkable sleeve in the wiring copper nose, to completely cover the wiring copper nose pressure wire hole is appropriate

（3）Use a heat gun to heat the heat-shrinkable tubing so that it is shrunken by heat.

Step 5: Wiring

Select and wiring copper nose matching screws, spring pad, flat pad and nuts and wiring copper row for connection fixed, and according to the recommended torque for locking fixed.

6.3.2.1.3 Auxiliary and communication cable wiring between cabinets

The communication interface of liquid-cooled outdoor battery cabinet and the auxiliary power supply interface are located as shown in Figure 10 below, and the site needs to be wired according to the electrical wiring diagram.

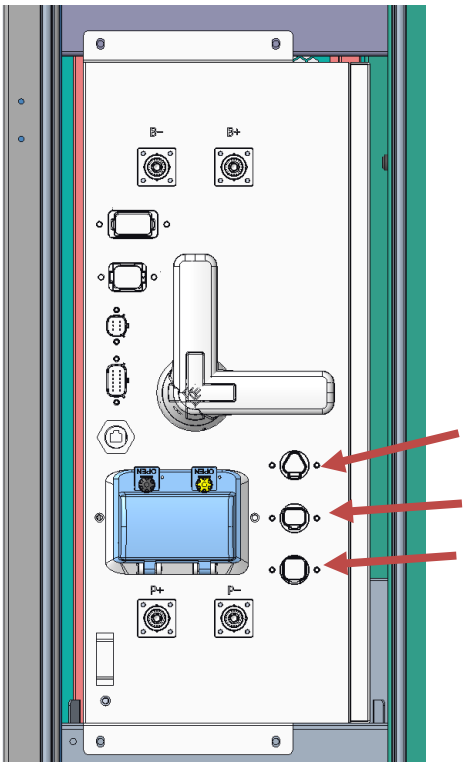


Figure 11 Battery cabinet auxiliary power and communication wiring schematic

7. Product operation

7.1 Pre-power check

(1) Check whether the DC disconnect switch on the panel of the high-voltage distribution box is in the disconnected state;

(2) Check whether the series cables between each battery pack are connected reliably;

(3) Check whether the connection terminals of all communication and power supply cables are connected reliably;

(4) Check whether the communication and power supply harnesses and power cables on the high-voltage distribution box panel are properly connected;

7.2 Liquid-cooled energy storage system power-up procedure

Step 1: Turn on the liquid-cooled unit and observe whether the power supply is normal;

Step 2: Close the DC disconnect switch and 220VAC power supply switch of the high voltage box in the outdoor cabinet. Observe the indicator status on the high voltage box;

Power indicator: the light is on for normal power supply;

Fault indicator: the light is on to represent a fault in the system, including hardware failure, internal communication failure, battery failure, etc.;

Step 3: After the liquid-cooled battery outdoor cabinet is powered on, the two-stage BMS will close the main positive and negative relays after the self-test is completed, and power on is completed;

Step 4: The system enters a chargeable and dischargeable state after completing the above operations;

8. Battery system maintenance instructions

Explanation of terms:

Terminology	Description
Normal operation	Refers to the system that is working every day
Interval operation	Refers to systems that operate irregularly every month and cannot be guaranteed to work every day

leave it for a long time without use	Battery systems that have not started working for more than 3 consecutive months

8.1 System usage requirements

8.1.1 Normal operation system use requirements

Do battery maintenance on the system every twelve months to prevent causing battery damage, refer to section 8.3 for specific maintenance operations. Conducts inspections of the system every twelve months (refer to Appendix 1) and keeps records of the inspections.

8.1.2 Interval operation system use requirements

Use the same requirements as a normal operating system.

8.1.3 Long release without using the system requirements

Energy storage battery storage SOC range: 20% ~ 50%, to avoid the cell in less than 15% SOC long-term storage, the battery which is not used for a long time need to cut off the power consumption equipment. Conduct an inspection of the energy storage system every three months (refer to Appendix 1) and make inspection records. Do battery maintenance on the system every three months to prevent causing battery damage. Before the first use of the long-discharge system, at least one full charge is required to activate the battery system to restore the performance of the battery to its optimal state.

	If the energy storage system is not used for a long time, it will cause irreversible damage to the battery, so please make sure to perform regular maintenance.

8.2 Maintenance Precautions

Before the relevant personnel carry out maintenance and repair operations on the system, they must first disconnect the switch on the panel of the high voltage box to ensure that the disconnecting switch is in the OFF state and the firefighting is in the manual state, and after the maintenance and repair operations are completed, they need to ensure that the disconnecting switch is in the ON state and the firefighting is in the automatic state.

8.3 Battery Maintenance

In order to ensure the long-term safe and reliable operation of the liquid-cooled energy storage system, please read carefully and follow the following instructions for use:

Maintenance process:

When the battery needs to be stored for a long time, the battery needs to be charged to 20-50% SOC and placed in a special site for storage, and the storage conditions need to meet the requirements of 4.4. It is recommended that the battery be discharged and recharged once every 3 months to ensure that the battery SOC remains within the range of 20-50% SOC during the long storage period. It is recommended to check the specific situation of the battery in the system through BMS every 3 months, and the data can be shared to our company to help judge the battery status, and the maximum storage time should not exceed 6 months. Before the system is finally connected to the grid, if the ambient temperature is lower than 10℃, it is necessary to turn on the system to adjust the battery to normal temperature (25℃±3℃), and after resting for ≥10h, use 0.25C charge rate to fully charge the battery cell once, and then charge and discharge the product under actual working conditions.

	Check to ensure a safe environment, safe system, no alarms, and no malfunctions before performing battery maintenance operations

8.4 Liquid cooling system maintenance

The maintenance information of the electronic control system of the liquid-cooled unit is shown in Table 8-1:

Table 8-1 Liquid-cooled unit electric control system maintenance

Maintenance Projects	Maintenance Standards	Maintenance cycle	Detection method	Exception handling method
Reliability of the power cable and signal cable of the wiring panel	No loosening of electrical cables and signal cables	6 Months	Visual assessment	Tighten loose cables with a screwdriver after 10 minutes of power failure
	Electrical cables and signal cables without aging, damage, abnormal heat and other abnormalities	6 Months	Visual assessment	Replace the power cable and signal cable after 10 minutes of power failure
	No dust at the wiring panel	6 Months	Visual assessment	Clean the dust with a brush after 10 minutes of power failure
Maintaining the air switch in proper working order	Automatic clutching in case of circuit abnormalities (e.g. short circuit)	6 Months	Visual assessment	Replace the maintenance switch after 10 minutes of power failure. The maintenance air switch is located in the electrical control box
	The above maintenance intervals are only recommended values and can be adjusted according to actual planning			

8.4.1 Unit appearance maintenance

The maintenance information for the appearance of the liquid- cooled units is shown in Table 8-2:

Table 8-2 Appearance maintenance of liquid-cooled units

Maintenance items	Maintenance Standards	Maintenance cycle	Detection method	Exception Handling
Appearance of the unit	Unit is clean and free of dust and dirty	6 Months	visual assessment	Use a brush or cotton cloth to remove dust and dirt from the unit after 10 minutes of power failure.
	The above maintenance intervals are only recommended values and can be adjusted according to actual planning			

8.4.2 Filter maintenance

The maintenance information for the liquid-cooled unit filters is shown in Table 8-3:

Table 8-3 Liquid-cooled unit filter maintenance

Maintenance items	Maintenance Standards	Maintenance cycle	Detection method	Exception Handling
Filter cleaning	No clogging of the filter with dust and foreign objects	6 Months	visual assessment	After 10 minutes of power failure, remove the front

8.4.3 Fan maintenance

The maintenance information for the liquid-cooled unit fans is shown in Table 8-4:

Table 8-4 Liquid-cooled unit fan maintenance

Maintenance items	Maintenance Standards	Maintenance cycle	Detection method	Exception Handling
Reliability of blower operation	No dust in the fan, no foreign objects blockage at the air outlet	6 Months	Visual assessment	After 10 minutes of power failure, use a brush to clean the dust of the fan and clean the foreign matter at the air outlet
	Fan blades are not broken, turning the fan smoothly without strange noise	6 Months	Visual assessment	Fasten the fan after 10 minutes of power failure, check if there are internal cables etc. interfering with the rotation of the fan, and replace the fan if it fails

	The above maintenance intervals are only recommended values and can be adjusted according to actual planning

8.4.4 Condenser maintenance

The condenser maintenance information for liquid-cooled units is shown in Table 8-5:

Table 8-5 Liquid-cooled unit condenser maintenance

Maintenance items	Maintenance Standards	Maintenance cycle	Detection method	Exception Handling
Condenser cleaning	No dust and foreign objects blocking the condenser	6 Months	Visual assessment	Clean the condenser with compressed air or a vacuum cleaner with a brush head after 10 minutes of power cut-off

	The above maintenance intervals are only recommended values and can be adjusted according to actual planning

8.4.5 Cooling media maintenance

The maintenance information for the cooling media of liquid- cooled units is shown in Table 8-6:

Table 8-6 Liquid-cooled unit cooling media maintenance

Maintenance items	Maintenance Standards	Maintenance cycle	Detection method	Exception Handling
Cooling Media	The concentration is in accordance with the range, and the PH and the concentration of each electrolyte is required to meet the requirements. No fouling, sedimentation, algae, etc.	6 months	Coolant Tester visual assessment	Replace the coolant after 10 minutes of power cut-off
	The above maintenance intervals are only recommended values and can be adjusted by the user according to the actual performance of the coolant. The maintenance interval of the coolant with better stability can be relatively longer. The operation steps for replacing the cooling medium in the liquid cooling unit are as follows: 1. Wait at least 10 minutes after disconnecting the power. 2. Drain the liquid in the cooling system through the drain port. 3. Replenish the coolant and check the PH value and electrolyte concentration of the coolant.			

	Ethylene glycol is a substance that pollutes groundwater, so the equipment operator must comply with national and local regulations and must not discharge it at will.

8.5 Fire protection system maintenance

8.5.1 Routine inspection

The user should check the entire system once a month. The inspection should include:

- System: Perform a visual inspection of the system to confirm that the system is not damaged.
- Detector/Sensor: Confirm that the fire detector is in place, neat, unobstructed and functioning properly.
- Fire detection system: Ensure that the current identification light functions properly and that all alarm lights are off.
- Installation area: Ensure that no changes occur in the protection area that would prevent the proper function of the system (addition or removal of walls, windows, ventilation shafts, etc.).

8.5.2 Periodic inspection (every 6 months)

- Every six months there should be a comprehensive inspection of the entire fire suppression system. The inspection includes:
- Check for changes in the protective area, e.g., at openings, at installed partitions, etc.
- Visually inspect the system for signs of wear or corrosion or alteration.
- Check the functionality of the fire detection system against the manufacturer's specifications.

9. Diagnosis of common abnormal problems

9.1 System alarm handling countermeasures

9.1.1 Liquid-cooled unit failure

9.1.1.1 Fan failure

Failure phenomenon	Possible causes	Inspection and maintenance
External circulation fan	Liquid cooling unit not powered up	Check if there is power at the power input of the liquid cooling unit.

does not operate	Have suffered a lightning strike, the circuit breaker tripped	Check if the circuit breaker inside the liquid cooling unit is closed.
	Abnormal power input to the liquid cooling unit (such as over- or under-voltage of the power supply)	Verify that the liquid cooling unit has the appropriate alarms.
	The liquid cooling unit is in standby mode	Normal scenario. The liquid cooling unit is powered up and after 30s of standby, it enters the automatic control logic.
	Fan jamming	Check for foreign objects stuck in the fan.
	Loose terminal	Check if the fan plug is loose.
	Control board failure	Replace the control board
	Fan failure	Fan replacement
External circulation	Wind turbine bearing wear	Fan replacement
fan noise	Fan blades scrape other objects	Check if there are cables, etc. interfering with the fan blades.

9.1.1.2 Cooling system failure

Failure phenomenon	Possible causes	Inspection and maintenance
Compressor does not start	Not powered on (standby)	Check the main power switch and check the operation display to make sure it is turned on.
	Loose circuit connection	Fasten the circuit connectors.
	Open circuit or short circuit	Check the circuit open or short circuit, and repair the main power supply.
	Inverter failure	Inverter replacement
	Control board damage	Replace the control board
	Compressor motor failure	Replace the compressor.
Compressor does not work	No cooling requirement	Check the output status of the liquid discharge temperature compressor on the display screen. Check that the operating interface is in the cooling state.
	Downtime delay	The compressor has a minimum stop time under normal conditions, and if the temperature rises to the on point during this time, the compressor will still turn on with a delay.
High exhaust pressure	Dirty condenser blockage	Clean the condenser with compressed air or a vacuum cleaner equipped with a brush head.

9.1.1.3 Cooling media circulation system failure

Failure phenomenon	Possible causes	Inspection and maintenance
Internal circulation	Not powered on (standby)	Check the main power switch, and check the operation display

Water cycle pump does not start		interface, whether it has been turned on.
	Loose circuit connection	Fasten the circuit connectors.
	Water pump inverter failure	Replace the pump inverter.
	Pump body failure	Replace the circulation pump. For details, see "10.4 Replacing the electric heater and circulating water pump".
Electric heater does not work	No heating requirement	Check whether the water outlet temperature and heating set point are set reasonably.
	Loose circuit connection	Fasten the circuit connectors.
	Electric heating overheating protection	Wait for a period of time and restart the electric heating, and observe whether the electric heating is working normally.
	Pipe electric heating failure	Replace the electric heater. For details, see "10.4 Replacing the electric heater and circulating water pump".

9.2 Emergency handling methods

9.2.1 Fire

Step 1: Evacuate the site to a safe area, set aside a safe isolation zone, and call the police according to the site conditions.

Step 2: Under the condition of ensuring personal safety, the following operations are conditionally carried out: If the wiring harness is smoking and on fire, use carbon dioxide or dry powder extinguishers to put out the fire If you accidentally inhale smoke, please move and seek medical attention as soon as possible.

Step 3: Notify the system manufacturer for further processing advice.

	If the fire is caused by charging or discharging abnormality, make sure to turn off the power at the first time, and then execute the firefighting action

9.2.2 Flooding

Step 1: Emergency evacuation of site personnel to a safe area, regardless of whether the system is powered on or not, and delineate a safe isolation zone.

Step 2: Notify the system provider and have it serviced after the water has worn off.

Step 3: Prohibit starting the system until the system manufacturer gives the result of the system safety determination.

Appendix I

Inspection items	Inspection method	Yes/No	Exception Logging
Is the fire extinguishing system complete	visual assessment		
Whether the fire extinguishing system is within the validity period	visual assessment		
Is the heat dissipation system complete	visual assessment		
Is the air duct of the cooling system blocked	visual assessment		
Whether the appearance of the electric cabinet is deformed	visual assessment		
Whether the appearance of the electric cabinet is rusted and broken	visual assessment		
Whether there is water vapor inside the electric cabinet	visual assessment		
Whether the low-voltage harness is loose or broken	visual assessment		
Is the high-voltage wire harness loose or broken	visual assessment		
Whether the wiring harness interferes with structural parts	visual assessment		
Is the high pressure connection corroded	visual assessment		
Are the structural parts fixed bolts loose or missing	visual assessment		

Is the maintenance switch (MSD) complete and reliably installed	visual assessment		
Is the water cooling tube broken	visual		
	assessment		
Is there a foul odor in the battery room	nose		
No irritating odor in the electric cabinet	nose		
Is there a burnt smell in the high pressure connection area	nose		
Availability of summary data	Monitoring upper computer		
Is the monomer voltage data complete	Monitoring upper computer		
Is the monomer temperature data complete	Monitoring upper computer		
Alarm bar with or without abnormal alarm	Monitoring upper computer		
Note: If you find any abnormalities during the inspection process, please give feedback and contact the relevant personnel to arrange for processing!			