SUNGROW
Clean power for all

Operation & Maintenance Instruction

Liquid-cooling Energy Storage Systems

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About This Manual

This manual describes the commissioning, troubleshooting, and maintenance of the ESS.

Target Group

This manual is for operators of the power storage plant and qualified technical personnel.

The ESS must and can only be installed by professional technicians who meet the following requirements:

- Has been trained
- Read this manual thoroughly and understand the safety instructions related to operations
- Be familiar with local standards and relevant safety regulations of electrical systems

How to Use This Manual

Please read this manual carefully before using the product and keep it properly at a place for easy access.

In order to provide customers with the best usage experience, the products and product manuals are always in the process of improvement and upgrade. If the manual received is slightly inconsistent with the product, it may be a result of product version upgrade, and the actual product shall prevail.

Contents of the manual may be updated and amended continuously, so it is possible that there may be some errors or slight inconsistency with the actual product. Please refer to the actual product purchased, and the latest manual can be obtained from **support.sungrowpower.com** or sales channels.

The figures in this manual are for reference only. The actual product received may differ.

Symbol Explanations

To ensure the safety of the users and their properties when they use the product and to make sure that the product is used in an optimal and efficient manner, this manual provides users with the relevant safety information highlighted by the following symbols.

Below is a list of symbols that are used in this manual. Review them carefully to make better use of this manual.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a moderately hazardous situation which, if not avoided, will result in death or serious injury.

⚠ CAUTION

Indicates a slightly hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a potential hazard which, if not avoided, will result in device malfunction or property damage.

"NOTE" indicates additional information, emphasized contents or tips that may be helpful, e.g., to help you solve problems or save time.

Symbol on Products

Always note hazard warnings on the machine body, including:

Marks	Explanation
	High voltage inside! Risk of electric shock by touching it!
	This symbol indicates a protective ground terminal which needs to be firmly grounded to ensure the safety of operators.
	Read the instructions before performing any operation on the product.
	Live parts! Do not touch them until 5 minutes after disconnection from the power sources.
	Pay attention to the danger. Do not operate this product in the live status!
	Pay attention to heavy objects. Lifting of heavy objects may lead to back injuries. Please lift heavy objects with appropriate tools.
	Pay attention to explosion.
	Pay attention to corrosion.
	Do not dispose of this product as household waste.
	No fire.
	There should be a medical center nearby.

Marks	Explanation
	In case of contact with eyes, rinse the eyes immediately with running water or normal saline; and seek medical help in time.
	It is required to wear goggles.

Abbreviations

Complete designation	Abbreviations
Battery Energy Storage System	BESS
Energy Storage System	ESS
Battery Connection Panel	BCP
Battery Supply Panel	BSP
Power Conversion System	PCS
DC/DC Converter	DC/DC
Fire Suppression System	FSS
Supervisory Control And Data Acquisition	SCADA
Liquid Cooling System	LCS
Local Controller	LC
Energy Management System	EMS
Switching Mode Power Supply	SMPS
Battery Module	PACK
Battery Cluster	RACK
Battery Management Unit	BMU
Battery Cluster Management Unit	CMU
Battery System Management Unit	SMU
Battery Management System	BMS
Switch Gear	S/G
State Of Charge	SOC
State Of Energy	SOE
State Of Health	SOH
State Of Safety	SOS

Unless otherwise specified, devices in this manual are referred to as the abbreviations above.

Contents

1 Introduction

The typical functional block diagram of ESS is shown below. The core equipment mainly consists of PCS, medium voltage transformers, DC/DC converters, BCP, BSP, batteries, battery management systems, energy management systems, local controllers, etc. The auxiliary systems mainly consist of LCS, FSS, lighting systems, etc.

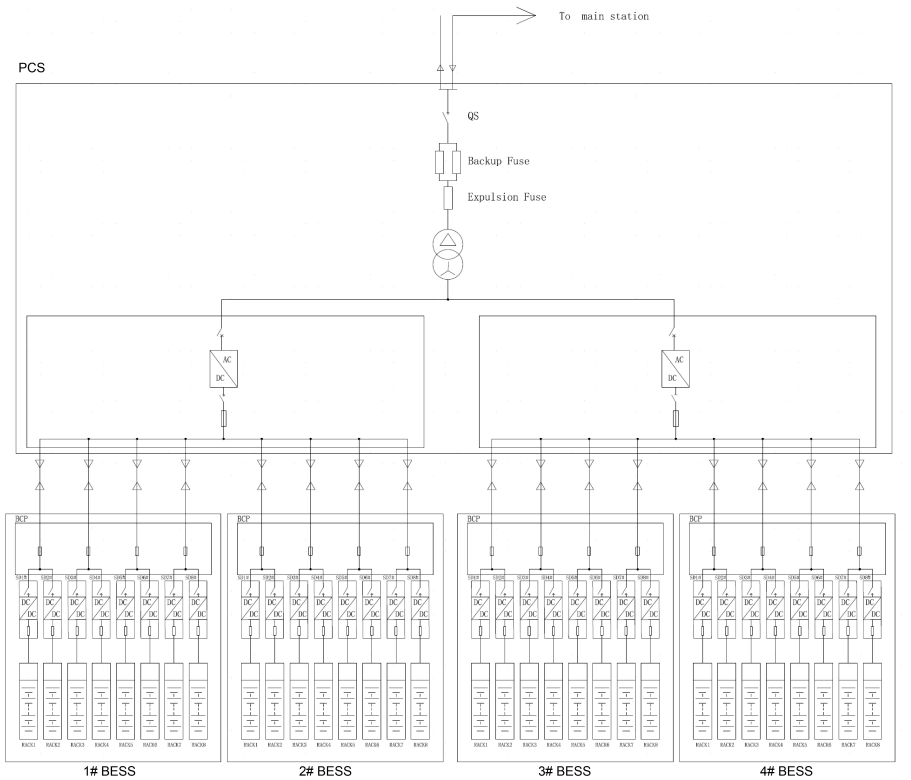


figure 1-1 Functional block diagram of ESS

*The above pictures are for reference only, please refer to the actual product received!

2 Commissioning

2.1 Inspection Before Powering up

Before powering up the equipment, check the following items carefully.

- Check that the positive and negative wiring of the battery RACK and the DC/DC power cable are correctly wired.
- Check that the battery RACK, DC/DC and battery terminal cabinet power circuit wiring should not be loose.
- Check that there are no short circuits between the positive and negative terminals of the converging branches in the BCP.
- Check that the external supply cable on the AC side of the BSP is wired correctly.
- The circuit breaker in the BSP and the load switches SWITCH1 & SWITCH2 on the DC/DC should be in the open position.
- Check for coolant leaks in the battery PACK and in the cooling ducts.
- Confirm that the PCS DC side is correctly connected to the BCP DC side cable of the BESS to avoid a reversal of the connection cable order.
- The guard inside the unit is securely mounted.
- The emergency stop button is in the released position.
- Check to ensure there is no earth fault.
- Check that the communication lines are in order according to the communication diagram.
- Use a multimeter to check that the AC and DC side voltages meet the starting conditions and that there is no risk of overvoltage.
- Check to ensure that no tools or parts have been left inside the appliance.

2.2 Powering on Steps

step 1 Power on the secondary circuit.

NOTICE

Before powering on, make sure that the temperature and humidity of the debugging site are within the calibration range of the product nameplate.

1 Close the AC load switch of the transformer in accordance with the high voltage operation specification.

2 Close the DC/DC load switches SWITCH1 and SWITCH2 in the BESS, close the miniature circuit breakers of the BESS in turn according to the electrical drawings, and check whether the voltage is normal. For specific steps, please refer to the system manual of the specific project.

NOTICE

In the process of closing the circuit breaker, if the circuit breaker trips, check whether the lower load is short-circuited.

step 2 Power on the main circuit.

1 Power on the BESS.

i. Confirm that all communication control devices such as DC/DC, system BSC, LC, and switches have been powered on normally and have no faults.

ii. Close all DC/DC load switches SWITCH1 and SWITCH2 in the BESS in turn.

iii. The rest of the power-on operations of the system are automatic operations without manual control.

If the BSC device address settings in the two BESSs conflict, first disconnect the network cable from the BESS to the LC1000 cabinet, and re-assign the device addresses according to the site address assignment requirements.

For the address configuration of LC and BSC devices, please refer to the corresponding on-site software configuration and debugging files.

2 Power on the PCS.

DANGER

- **Manual closing operation of the DC load switch is prohibited.**
- **Make sure that the DC load switch is off before applying power to the DC side.**
- **In off-grid situations, it is necessary to ensure that the DC load switch is in stored energy when first starting the converter; otherwise, a manual charging operation is required first.**

i. Before starting up the PCS, ensure that the following requirements are met before starting up the equipment.

- All connections are done by strictly following the installation manual and circuit diagram.
- The protection cover inside the device has been installed securely.

- The emergency stop button is released and the Start/Stop switch is in Start position.
- Grid main switch is in OFF position.
- Measure the DC and AC voltages with multimeter to check if they meet the PCS startup requirements and there is no over-voltage hazard.
- The cabinet door is closed and the key is removed and stored by appointed personnel.

ii. Starting up the PCS, please refer to the PCS manual configured for the specific project for specific steps.

a). Make sure that the AC circuit breaker and DC load switch of the PCS are disconnected.

b). Make sure the cables on the AC and DC side are connected correctly.

c). Measure the voltage of the battery to be connected to ensure it is within the allowable range. Connect the battery to the DC side copper bar of the PCS.

d). According to the actual requirements of the site, close the internal power switch Q3 or the external power switch Q2. Note that Q3 and Q2 cannot be closed at the same time. After the power indicator is on, select the operation mode and operation parameters on the web operation parameter interface as required. For specific steps, please refer to the PCS manual configured for the specific project.

- - End

2.3 Pre-run Preparation

- Check and fix the faults displayed by the system after power-up.
- Verify that the software version is correct.
- Enter the web interface of the BSC and LC respectively to confirm that the parameter profiles are correct and that modifications to the configuration parameters are prohibited.

2.4 Commissioning

2.4.1 Communication Commissioning

step 1 Re-allocate the addresses of each sub-device according to the on-site address allocation requirements.

step 2 Read battery RACK, BSC, LC data through the background monitoring interface, and it should be able to read normally.

step 3 DC/DC stop/start commands and PCS stop/start commands are issued through the background monitoring interface, which should be able to achieve corresponding functions.

step 4 Modifying the control parameters through the background monitoring interface should be able to achieve the corresponding functions.

- - End

2.4.2 Charge-Discharge Commissioning

step 1 Control the PCS startup through the background monitoring interface, close the ring network cabinet, issue the PCS startup command, the PCS should be able to start normally, and issue the PCS shutdown command, the PCS should be able to stop normally.

step 2 Through the background monitoring interface, take 100kW as the step, increase the PCS power to the actual maximum dischargeable power, run for 10min, the intelligent unit board should be able to distribute the power to the PCS normally. Observe that the voltage, current, temperature and other parameters of the battery RACK in the battery container should be normal. Observe all DC/DC voltage, current, and device temperature rise parameters. There should be no abnormality. Observe PCS voltage, current, and device temperature rise parameters. Set the PCS power to 0kW.

step 3 Through the background monitoring interface, take 200kW as the step, increase the PCS power to the actual maximum rechargeable power, run for 10min, the intelligent unit board should be able to distribute the power to the PCS normally. Observe that the voltage, current, temperature and other parameters of the battery RACK in the battery container should be normal. Observe all DC/DC voltage, current, and device temperature rise parameters. There should be no abnormality. Observe PCS voltage, current, and device temperature rise parameters.

step 4 Set a battery SOC upper limit value, charge with the actual maximum power that can be charged, and observe that when the set SOC upper limit value is reached, the DC/DC corresponding to RACK should be in a hot standby state.

step 5 Set a battery SOC lower limit value, discharge with the power that can actually discharge the maximum power, observe that when the set SOC lower limit value is reached, the DC/DC corresponding to RACK should be in a hot standby state.

step 6 The background monitoring interface issues the PCS startup command, the PCS should be able to start normally, and the communication between the background and the PCS should be cut off, and the PCS should be able to stop.

- - End

The upper/lower limit values set in steps 4 and 5 refer to the actual state of charge of the battery RACK, select a value that can be reached in a short time, and change the parameter back to the original setting value after the test is completed.

2.4.3 Charge-Discharge Cycle Commissioning

step 1 The background monitoring performs a full charge and full discharge cycle to calibrate the battery SOC according to the actual charge/discharge situation of the battery RACK in the battery container.

step 2 Observe that the voltage, current, temperature and other parameters of the battery RACK during the charging and discharging process should be normal.

step 3 Observe that the PCS voltage, current, and device temperature rise parameters should be normal.

- - End

3 Routine Maintenance

3.1 Precautions Before Maintenance

WARNING

- **Do not open the door to maintain the batteries in rainy, humid or windy days. SUNGROW shall not be held liable for any damage caused by violation of the warning.**
- **Avoid opening the container door when the humidity is high in rain, snow or fog, and make sure that the seals around the container door do not curl when the door is closed.**

In fair weather, it is recommended to open the container door to dehumidify the equipment.

WARNING

- **To avoid electric shock, do not perform any other maintenance operations beyond this manual.**
- **If necessary, contact SUNGROW customer service for maintenance.**

3.2 Maintenance Item and Period

3.2.1 Maintenance (Every two years)

Item	Check method
System status and cleaning	Check the following items, and correct immediately those failing to meet the relevant requirements: • Check whether there is any damage or deformation of the container and internal devices. • Check if there is abnormal noise during operation of internal devices. • Check whether the temperature in the container is excessively high. • Check whether the humidity and the amount of dust inside the container are within the normal range. Clean the equipment if necessary. • Check whether the air inlet and outlet of the BESS are blocked.
Warning marks	Check whether the warning labels and marks are clearly visible and free of stains and damage. Replace them if necessary.
Ground of the shielded layer of cables	Check whether the cable shielding layer is in good contact with the insulation sleeve and whether the copper bus bar is firmly fixed.
Surge protection device and fuse	Check whether the SPD and fuse are properly fastened.
Corrosion	Check whether there is oxidation or rust inside the container.

3.2.2 Maintenance (Once a year)

Item	Check method
Outside the container	Check the following items, and correct immediately those failing to meet relevant requirements: • Check whether there are flammable objects on the top of the container. • Check whether the welding points between the container and the foundation steel plate are firm and whether there is corrosion. • Check whether there is any damage, flaking paint or sign of oxidization on the enclosure. • Check whether the lock of the cabinet door can be unlocked flexibly. • Check whether the sealing strip is fixed properly.
Inside the container	Check whether there are foreign objects, dust, dirt, and condensed water inside the integrated energy storage system.

Item	Check method
Air inlet and outlet	Check the temperature of the radiator and the amount of dust accumulated. Clean heat-dissipation modules with a vacuum cleaner if necessary.
Wiring and cable layout	Completely power off the devices inside the BESS before checking. For any non-conformances found during inspection, correct them immediately. • Check whether the cable layout is normal and whether there is a short circuit. For any non-conformances found during inspection, correct them immediately. • Check whether all cable entry are well sealed. • Check whether there is water seepage inside the BESS. • Check whether the power cables are loose, and fasten them again by the torque specified previously. • Check whether the power cables and control cables are damaged, especially if the surface contacting the metal surface is cut. • Check whether the insulation tapes on the power cable terminals fall off.
Ground connection and equipotential connection	• Check whether the ground connection is correct and the grounding resistance shall be no more than 4Ω. • Check whether the equipotential connection inside the integrated BESS is correct.
Fan	• Check the running status of fans. • Check whether fans are blocked. • Check if there is abnormal noise during operation of the fans.
Screw	Check whether internal screws fall off.

3.2.3 Maintenance (Every half a year to once a year)

Item	Check method
Safety function	• Check whether the shutdown key on the touchscreen and the emergency stop button work normally. • Simulate shutdown. • Check the warning marks and other device marks, and replace them timely when they are fuzzy or damaged.
Software maintenance	Check the settable parameters on the Web.

Item	Check method
Internal components inspection	• Check the cleanness of the circuit board and other elements and components. • Check the temperature of the radiator and the amount of dust accumulated. Clean heat-dissipation modules with a vacuum cleaner if necessary. • Replace the air filter screen when necessary. **Note!** It is necessary to check ventilation of the air inlet. Otherwise, fault may occur due to overheating if the module cannot be cooled effectively.
Device maintenance	• Carry out regular inspection for corrosion of all metal components (once per half a year). • Check the contactors (auxiliary switches and micro-switches) annually to ensure the good mechanical operation. • Check the running parameters (especially voltage and insulation).

3.3 Maintenance of Liquid Cooling System

The following provides the recommended maintenance periods. The actual maintenance period shall be adjusted reasonably in consideration of the specific installation environment of the product.

Factors like the power plant scale, the location, and the site environment can affect the maintenance period of the product. It is necessary to shorten the maintenance period and increase the maintenance frequency in the event of heavy sandstorm or dust in the operation environment.

Item	Content	Check method	Maintenance tools
Fan	Check whether the fan blades cannot rotate or are damaged. If so, replace the fan.	1. The fan blade rotates smoothly without abnormal noise; 2. No damage to fan blade. Note: Check this item at least half a year. Blade damage inspection is not mandatory.	Screwdriver with long handle
Water pump	1. Check whether over 5% of the cooling air inlet hole of the water pump is blocked. If so, clear it with a brush; 2. Visually inspect the pump body (not the joint parts) and check whether there is obvious water dripping (except condensate). If so, replace the sealing ring of the pump.	1. The water pump runs smoothly without abnormal noise; 2. There is no obvious dripping on the pump body (except condensate).	Brush
Water system	Check the high and low pressure of the water system through HMI. The high pressure should be 2.8bar and the low pressure should be 0.2 bar. 1. If the high pressure is higher than 2.8bar, check whether the filter of the water system is dirty and blocked; 2. If the low pressure is lower than 0.2 bar, replenish the water in the system.	High pressure < 2.8bar; Low pressure > 0.2 bar	Slotted screwdriver, Phillips screwdriver, water pump, water pipe, clamp.

⚠ WARNING

If the BESS has a "communication failure or failure of the liquid-cooled unit", please contact the after-sales service personnel in time to ensure the functional integrity of the system.

3.4 Container Maintenance

3.4.1 Cleaning Container Appearance

Clean the top and then the sides. Wash it directly, or wash and flush with water simultaneously.

Check the container appearance:

Case 1：Dirt on surface caused by water spots and dusts can be cleaned.

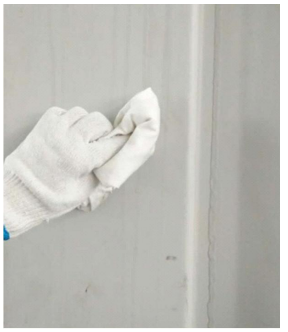
Case 2：Surface dirt and damaged finish, which cannot be cleaned.

Case 3：Primer is damaged, and the base material is exposed.

Maintenance Steps for Case 1:

Material:

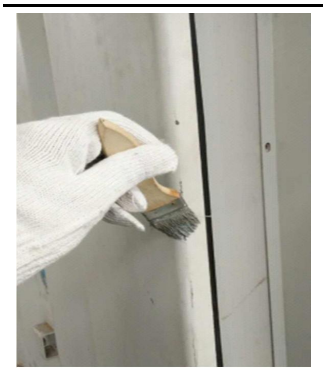
- Cleaning cloth
- Water
- Alcohol or other non-corrosive detergent

Graphics	Description
	1. Wet the cleaning cloth (or other scrubbing tools) with water, and scrub the dirty parts on surface. 2. If the dirt cannot be cleaned with water, scrub with 97% alcohol till the surface is acceptable. (Or try to use non-corrosive detergents that are generally used locally)

Maintenance Steps for Case 2:

Material:

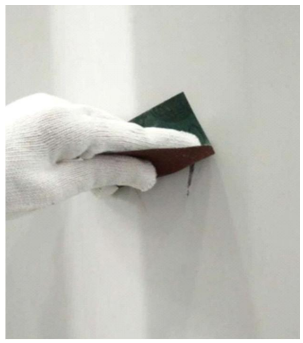
- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Brush
- Paint

Graphics	Description
	1.Polish the paint surface with blistering or scratches with an abrasive paper for a smooth surface.
	2.Wet the cleaning cloth with water or 97% alcohol, and scrub the damaged parts to remove surface stains.
	3.Perform paint repair for the scratched parts with a soft brush after the surface is dried; brush the paint as uniform as possible.

Maintenance Steps for Case 3:

Material:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Zinc primer
- Brush
- Paint

Graphics	Description
	1. Polish the damaged parts with an abrasive paper to remove rust and other burrs for a smooth surface
	2. Wet the cleaning cloth with water or 97% alcohol, and scrub the damaged parts to remove surface stains and dust.
	3. Spray the parts with base material exposed with zinc primer for protection after drying of the surface. Ensure to spray to cover the bare base material completely.
	4. Perform paint repair for the damaged parts with soft brush after the primer is dried, and brush the paint uniformly.

Check whether the protective paint sprayed on casing of the product is fallen off or peeled off; if so, repair it timely.

Spray a special protective paint to the exterior of the product every 3 ~ 5 years.

3.4.2 Checking Door Locks and Hinges

Check whether the door locks and hinges of the container can be used normally after cleaning. Lubricate the door lock holes and hinges properly when necessary.

3.4.3 Checking Sealing Strips

If the sealing strip is in good condition, it can effectively prevent water seepage inside the container. Therefore, carefully check the sealing strip and replace it immediately if there is any damage.

3.5 Battery Maintenance

3.5.1 Regular Maintenance and Maintenance Cycle

Below is the recommended maintenance cycle. The actual maintenance cycle should be adjusted according to the specific installation environment of this product.

The power station scale, installation location and on-site environment affect the maintenance cycle of this product. In sandy or dusty environments, it is necessary to shorten the maintenance cycle and increase the frequency of maintenance.

NOTICE

Loss of capacity due to the following two conditions for more than 120 consecutive hours during maintenance or shutdown is not covered by the warranty.

- **Battery discharge voltage below minimum battery voltage of 2.7V.**
- **0% SOC for any battery cluster.**

Maintenance performed once every two years

Inspection item	Inspection method
Battery cluster status and cleanliness	Check the following items. In case of nonconformity, take corrective actions immediately: • Check the battery cluster and internal devices for damage or deformation. • Check the internal devices for abnormal noise during operation. • Check whether the temperature inside the battery cluster is too high. • Check whether the internal humidity and dust of the battery cluster are within the normal ranges. If necessary, clean the battery cluster. • Check whether the air inlet and outlet of the battery cluster are blocked.
Warning sign	Check whether the warning sign and label are legible and dirty. If necessary, replace them.
Wire and cable	Check whether the switch gear and battery module are connected correctly and whether the battery modules are also connected correctly.
Corrosion	Check the battery cluster for internal oxidation or rust.

Maintenance performed once a year

Inspection item	Inspection method
Switch gear and battery module box	Check the following items. In case of nonconformity, take corrective actions immediately: • Check whether there are flammable objects at the top of the battery cluster. • Check whether the battery cluster is secured at the fixing point on the foundation plate and whether there is rust. • Check the box for damage, paint peeling, oxidation, etc. • Check whether there are foreign objects, dust, dirt and condensate inside the battery cluster.
Wire and cable layout	The inspection must not be carried out until all internal devices of the battery cluster are powered off! In case of nonconformity found in inspection, take corrective actions immediately: • Check the cable layout for short circuit and compliance with the specifications. If case of any abnormality, take corrective actions immediately. • Check whether all wire inlets and outlets of the battery cluster are sealed properly. • Check the battery cluster for internal seepage of water. • Check whether the power cables and copper busbars are loose, and tighten them according to the aforesaid torque. • Check the power cable and communication cable for damage, especially cut marks on the surface exposed to the metal surface.
Grounding	Check whether the grounding is correct. The grounding resistance should not be greater than 4Ω.
Fan	• Check the fan for faults (e. g. locked rotor and stalling). • Check the fan for abnormal noise during operation.
Screw	Check whether screws inside the battery cluster fall off or are rusted.

Maintenance performed once every six months

Inspection item	Inspection method
Ambient temperature and humidity inspection	• Check whether the temperature in the ambient temperature record is within the operating range. • Check whether the humidity in the ambient humidity record is within the operating range.
Function inspection	• Check the operating status of the DC contactor: Send the Start/Stop command in the power-off status and check whether the system works properly. • Measure whether the 24V output voltage is within the range in the specification. • Check whether the current, voltage and temperature in the operation record of the battery cluster are within the operating ranges.

3.5.2 Maintenance Precautions

For safe and efficient maintenance of the system, maintenance personnel must carefully read and observe the following safety requirements:

1 Have the electrician certificate issued by the Work Safety Supervision Bureau, and receive professional training before assuming their work.

2 Follow relevant safety precautions, use necessary tools, and wear personal protective equipment.

3 Do not wear metal accessories such as jewelry or watches.

4 Never touch the high-voltage positive and negative electrodes of the energy storage system by both hands at the same time under all circumstances.

5 Prior to the maintenance of the energy storage system, disconnect all high-voltage and low-voltage switches.

6 Do not clean this product directly with water. If necessary, use the vacuum cleaner to clean it.

7 Plug and remove cables in accordance with the specifications, without brute force or violent operation.

8 After maintenance is completed, clean tools and materials in time and check whether there are metal objects left inside or at the top of the product.

9 In case of any doubt on operation and maintenance of this product, contact the Customer Service Center of SUNGROW instead of operation without permission.

3.5.3 Maintenance

1 Operating temperature: The working temperature should be kept between 0℃~45℃. The temperature charging and discharging should be 15℃ to 30℃ and typically 25℃.

2 The RACK should not be charged or discharged with high magnifying power. The continuous charging and discharging current of a single rack should not exceed the rated current.

3 When the energy storage system is not used in a long time, it should be charged once every six months, until its SOC is 50% to 80%.

4 When the system is used after long-term storage, it should be fully charged at least once to restore the best performance of the battery.

5 Regularly check whether the air duct of the cooling system is blocked and clean the system. In particular, clean the air inlet and outlet of the fan and use a vacuum cleaner if necessary, to maintain free air circulation inside the cabinet. Before dust removal, the power supply must be cut off. It is forbidden to rinse the system with water.

6 Regularly check whether the fastening bolts of the high-voltage cables and connecting busbars of the energy storage system are loose, whether the contacts are in good conditions, and whether the terminal surfaces are severely corroded or oxidized.

7 Regularly check the protective covers of high-voltage positive and negative electrodes of the PACK for ageing, damage and missing.

8 Regularly check cables for loosening, ageing, damage and fracture and inspect whether the insulation is in good conditions.

9 Regularly check the battery cabinet for pungent odor and high-voltage connections for burning odor.

10 Regularly check whether the voltage, temperature and other data of the monitoring upper computer are correct and whether there are fault alarms in the alarm column.

11 Regularly check whether the status and alarm indicators of the energy storage system are in good conditions and whether they work properly.

12 Regularly check whether the emergency stop button of the energy storage system can be used, in order to quickly shut down the system in an emergency.

13 Regularly check whether the fire extinguishers are in good conditions and within the validity period.

14 Never use different types of battery modules in series or parallel.

⚠ WARNING

- **The battery is potentially dangerous, so appropriate protective measures must be taken during operation and maintenance!**
- **Incorrect operation may cause severe personal injury and property damage!**
- **Use the appropriate tools and protective equipment during battery operation.**
- **Battery maintenance must be performed by those who have battery expertise and received safety training.**

3.6 PCS Maintenance

3.6.1 Safety Rules

⚠ WARNING

Only qualified personnel can perform the work described in this chapter.
Do not leave any screws, washers or other metallic parts inside the PCS to avoid damages to the PCS.

⚠ WARNING

Disconnection of the switches in no way implies that there is no voltage of the cable connection terminals inside the AC and DC cabinet. To avoid the risk of electric shock before opening the cabinet door,

- **Disconnect the switches;**
- **Disconnect the upstream and downstream switches of the PCS.**

⚠ WARNING

Wait at least 5 minutes after PCS stops before any work on the PCS.

⚠ WARNING

During the operation of the equipment, personnel should wear protective earplugs when approaching.

3.6.2 Maintenance and Interval

Recommended routine maintenance work and maintenance interval are shown in the following table.

Item	Method	Interval
Save software data	• Read Web interface data; • Save running data, parameters and logs to a disk or a file; • Check each parameter setting; • Update software	Once a month
System general running status and environment	• Check the PCS for visible damages or deformation; • Check the PCS for any abnormal noise during running; • Check each parameter of the PCS during normal operation; • Check the principal components; • Check if the enclosure temperature is normal with the thermal imager; • Check the air inlet and outlet; • Check the ambient humidity, dust and air inlet filter; **Notice**! Check the air inlet and outlet. The equipment may be damaged by overheating.	Every six months
System cleaning	• Check whether the circuit board and the component are clean; • Check the temperature and dust of the heat-sink. Use pressurized air and open the fan to clean the module if necessary; • Replace the air filter.	From every six months to annually depending on the dust deposits.
Power circuit connection	• Check whether the power cable connections are loose. Retighten them with the torque specified in the manual if necessary; • Check if the power cables and control cables, especially the surface in contact with the metal are damaged; • Check if the wrap belt of the connection terminals is strip-off.	Six months after commissi-oning for the first time and then once every six month to a year

Item	Method	Interval
Terminal and cable connection	• Check whether the screws of the control terminals are loose. Refasten them with screwdriver if necessary; • Check whether the terminals of the main circuit are in poor contact and whether the screws are hot; • Check if the connection busbar or screws are discoloring. • Visual check the device terminal connection and cable layout	Once per year
Fan maintenance and replacement	• Check if there is crack in the fan blade; • Check if there is abnormal noise during the running of the fan; • Replace the fan if necessary	Once per year
Switches maintenance	• Routine check of the corrosion of the metal components • Annually check the contactors (auxiliary switches and micro-switches) to ensure the optimal operation; • Check the running parameters (Voltage and insulation especially)	From every six months to annually
Safety function	• Check the emergency stop button and the Web stop function; • Simulation shutdown and check the shutdown signal communication signal; • Check the warning labels and other markings for damage or unclearness. Replace them if necessary.	From every six months to annually
Software maintenance	• Optimize software • Check each parameter setting	From every six months to annually

⚠ WARNING

Wait at least 5 minutes after the PCS discharge completely since the DC bus contains capacitance. Before cleaning, make sure, with multimeter, the internal PCS is discharged completely to avoid electric shock.

⚠ WARNING

Almost all maintenance work requires no internal protective cover during maintenance. Make sure to reassembly the cover and fasten all the screws after the maintenance work.
Make sure all bolts are securely fixed.

The frequency of maintenance operations could be increased according to the environmental conditions of the place where the PCS is located, plant capacity and on-site situations.

3.6.3 Filter Checking and Cleaning

1 Read the safety instructions carefully.

2 Open the cabinet door.

3 Check the air filter. If it needs to be replaced, remove it with a screwdriver. Please notice the direction of the filter cotton.

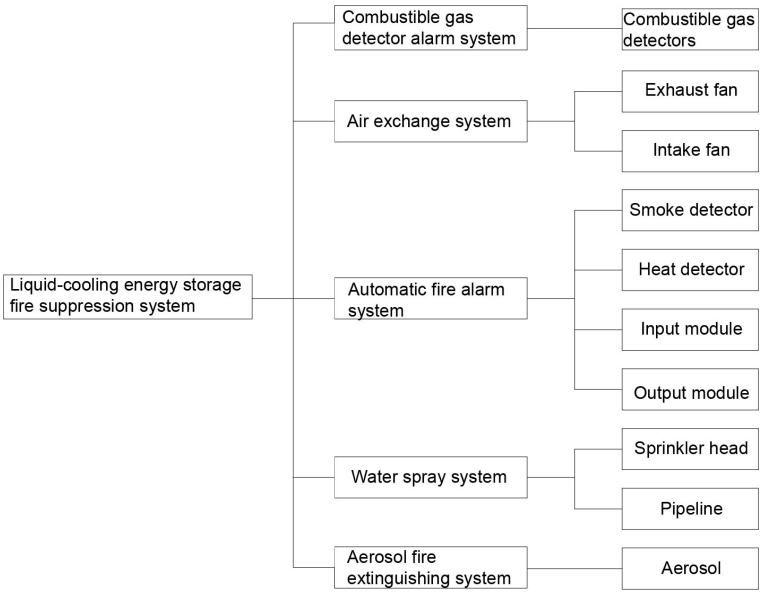
4 Check the cabinet cleanness. If necessary, clean the cabinet with soft rag or vacuum cleaner.

5 Close the cabinet door.

3.7 Fire Suppression System Maintenance

3.7.1 Overview

Liquid-cooling energy storage fire suppression system includes combustible gas detector alarm system, accident ventilation system, automatic fire alarm system, water spray system, aerosol fire extinguishing system (optional), etc.



NOTICE

The fire protection system shall conduct linkage tests on the above systems at least every year to ensure the stable operation of the fire protection system. If the local fire protection authority has other regulations, the laws and regulations of the local jurisdiction should be followed.

NOTICE

The maintenance of the fire protection system should be operated by SUNGROW after-sales technical support or local personnel/institutions with fire protection system commissioning qualifications. If the operation is performed by an organization other than SUNGROW, the customer must contact SUNGROW's after-sales technology for on-site support, so as to quickly restore the energy storage system after the successful completion of the test.

3.7.2 Visual Inspection

An external inspection should be carried out on the combustible gas detectors, smoke detector, heat detector, input/output modules, intake/exhaust fans, sprinkler heads, pipeline, aerosols and other fire fighting equipment in the battery compartment.

The inspection will include the following.

- The equipment is in good condition in terms of appearance, whether it is broken or not, and whether it has been crushed by surrounding equipment.
- The device status indicator is normal.

3.7.3 Linkage Testing

Tools: a fire test lance, automatic fire alarm controller (programmed), a mobile phone with SensePoint software installed, a canister of 10% LEL (or 50% LEL) methane gas.

step 1 Combustible gas & BSC communication & control logic.

1 The BSC reads the combustible gas concentration values (distinguishing between left and right) via RS485 communication and uploads the LC display to the customer.

2 The BSC reads the combustible gas detector fault signal via RS485 communication, displays the equipment fault in the detector interface (distinguishing between left and right displaying 1# or 2# fault), displays the combustible gas detection equipment communication fault in the main interface, and at the same time controls the DCDC stop in the battery box, without stopping the liquid-cooled unit.

3 The BSC can read combustible gas detector concentrations, faults, primary and secondary alarm information.

step 2 Automatic fire alarm system communication & control logic.

1 Normal system status: When the fire protection system is connected to the test host, the combustible gas detector is energised and the equipment status is qualified as follows.

- The combustible gas detector indicator flashes green intermittently.
- The smoke and heat detector patrol lights flash green intermittently.
- The input module patrol indicator flashes green intermittently.
- The output module patrol indicator flashes red intermittently.
- The BSC status has no alarms and the combustible gas detector concentration is 0.
- No equipment or wiring faults in the fire system mainframe.

2 Linkage function test.

i. Blow a standard sample of CH4 at 10% LEL (or 50% LEL) into the suction or test inlet of the combustible gas detector. When stable.

- The red light of the combustible gas detector is always on.
- The BSC concentration is displayed at 10% LEL (50% LEL) and a high concentration alarm is displayed (error range ±10%).
- The red light of the "combustible alarm module" is always on and the light of the "fan control module" in the corresponding compartment is illuminated by a red light linked to the main unit.
- The fan inlet and exhaust louvres open normally, the exhaust fan operates normally, visually inspect the wind direction and open up status.

NOTICE

For factory testing, the latest calibration time and test time of the detector used should not exceed 180 days and should be recalibrated and qualified before it is used for testing. If the detector is faulty or does not read correctly, the detector and calibration time should be checked and the latest calibration time and test time of the detector used should not exceed 360 days.

ii. Aiming a smoke gun at a smoke detector to trigger a smoke alarm.

- The smoke sensor indicator is always on in red and the "detector fire output module" indicator is lit in red via the host computer linkage.
- The fire mainframe displays the fire alarm information.
- Observe the BSC control system shutdown procedure.

iii. Aim the temperature gun at the smoke detector to trigger the temperature alarm.

- The temperature sensor indicator is always on in red and the "detector fire output module" indicator is lit in red via the host computer linkage.
- The fire mainframe displays the fire alarm information.
- Observe the BSC control system shutdown procedure.

iv. Removal of any of the smoke or temperature detectors.

- The fire mainframe displays the corresponding fault message.
- The "detector fault output module" indicator lights up red via the main unit linkage.
- Observe the BSC control system shutdown procedure.

- - End

4 Common Maintenance Operations

4.1 Coolant Filling and Drainage Operations

4.1.1 Coolant Replacement Intervals

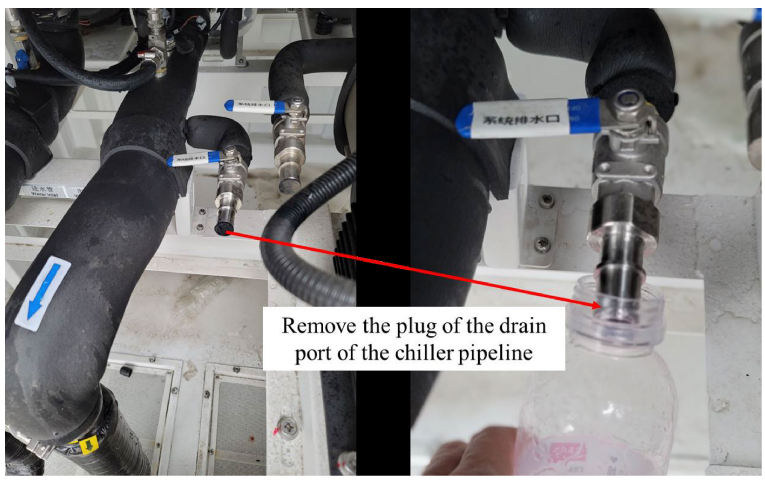
Object	Standard	Period	Tools
Coolant	1. There are obvious impurities in antifreeze. 2. Antifreeze turns from pink to dark red. 3. Coolant PH value less than 7.3.	5~6 years	Water pump, hose, hose clamp, slotted screwdriver. Note: Please contact Sungrow Customer Service to replace hardware facilities.

Coolant PH Value Test

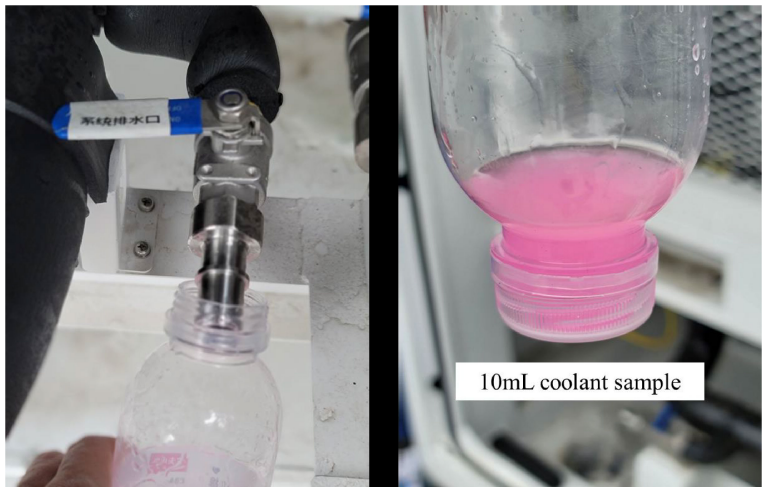
step 1 Power down the system: Open the door of the power distribution cabinet in the BSP cabinet, and turn off the system circuit breaker (flick the lever down).

step 2 Open the door of the chiller.

step 3 Remove the plug of the drain port of the chiller pipeline.



step 4 Slightly loosen the valve (not fully open) and release the coolant of about 10ml.



step 5 Use a PH test strip or PH measuring instrument to test the coolant sample. If the coolant PH value is less than 7.3, the coolant in the whole system shall be drained and refilled.

- - End

4.1.2 Safety Precautions

General Safety

- Any personal injury caused by misoperation should be dealt with immediately, and first aid or medical care must be obtained immediately.
- Please strictly abide by the local safety regulations and laws and regulations to avoid accidents. The safety precautions in the manual do not represent all the safety precautions that should be followed, but only serve as a supplement to local safety regulations.
- It is not allowed to make any changes to the equipment without the agreement and consent of the manufacturer.
- Children and personnel with limited cognitive and coordination ability are not allowed to operate, maintain, clean the device or use it as a toy.
- It is forbidden to install or remove the power cord with power. Please turn off the power switch before installing or removing the power cord.
- Perform maintenance after the power is off and ensure that the power supply would not be connected during the operation. For some operations that need to be performed with power on (e.g., check the running status of the chiller), ensure that the whole wiring has been completed correctly before connecting the power.
- Protective measures must be taken during electrical maintenance, such as wearing insulating gloves or insulating shoes.
- The coolant in the BESS is toxic. Avoid taking it orally or long-term skin contact. If it enters the eye accidentally, rinse the eye with clear water immediately and go to the hospital for treatment in time.

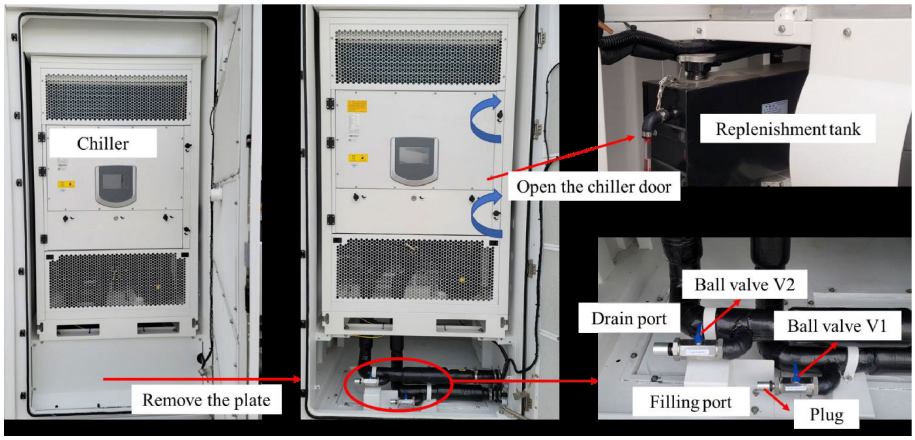
Coolant Recycling

The coolant and packaging shall not be discarded at will. The disposal of scrap must comply with relevant requirements.

4.1.3 System Components Introduction

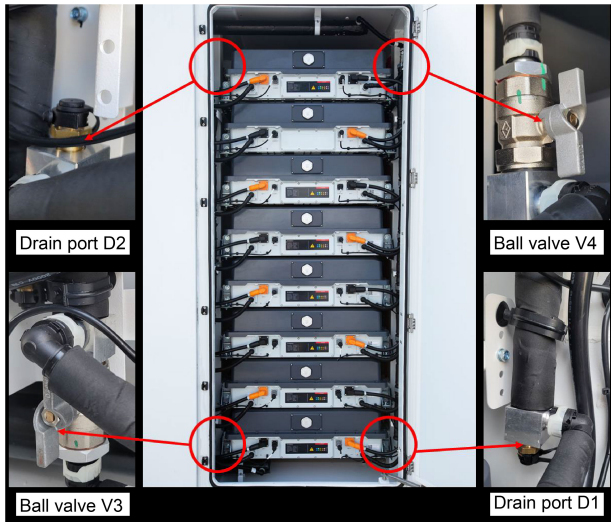
Chiller Cabinet

The chiller cabinet is composed of a chiller and the system coolant filling and drain port. Removing the sealing plate under the chiller to operate ball valves V1 and V2 to fill and drain the coolant in the whole system. Open the door of the chiller to maintain the internal replenishment tank, as shown below.



Battery Cabinet

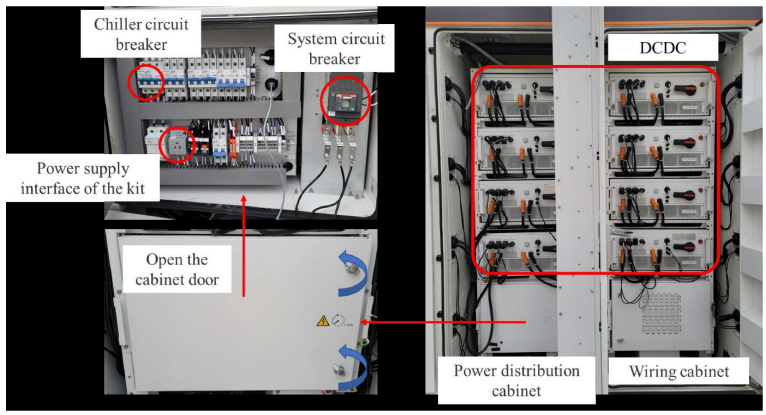
A battery cabinet contains 3 columns of battery Packs. A single column of Pack is shown below. The left is an inlet pipe, the right is an outlet pipe, and at the ends of the inlet and outlet pipes are ball valves V3, V4 and drain ports D1 and D2.



Batteries are connected to each pipe by quick joining piping joints.

DCDC Cabinet

The DCDC cabinet is composed of 8 DCDCs, a power distribution cabinet at the lower left, and a wiring cabinet at the lower right. The system circuit breaker, the circuit breaker of the chiller, and the power supply interface of the coolant filling and drainage kit are all located in the power distribution cabinet.



4.1.4 Coolant Filling and Drainage Kit

The coolant filling and drainage kit consists of a handle, a pressure gauge, a drain valve, a water pump switch, a power indicator, a water pump indicator, a power cord storage compartment and a pipe storage compartment.

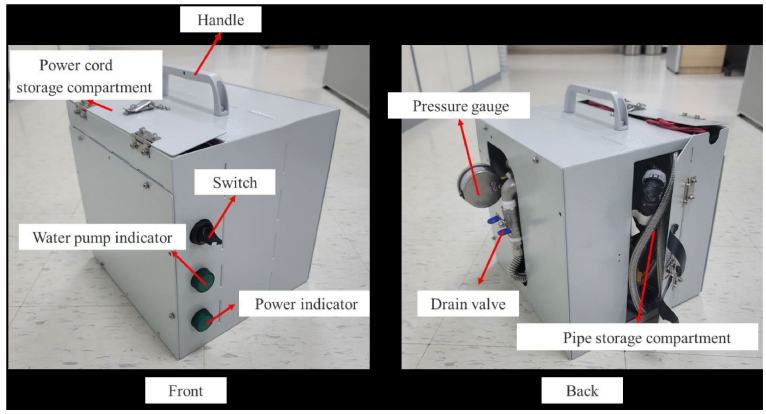


figure 4-1 Coolant Filling and Drainage Kit

The power cord storage compartment contains a 5 m long power cord (the length of the cord is greater than the distance between the power distribution cabinet and the system coolant filling port). The pipe storage compartment contains a coolant filling pipe and a suction pipe.

One end of the coolant filling pipe is a quick joining piping joint with a ball valve V5 matched with the system coolant filling port. The special coolant drain pipe can also be stored in the compartment.

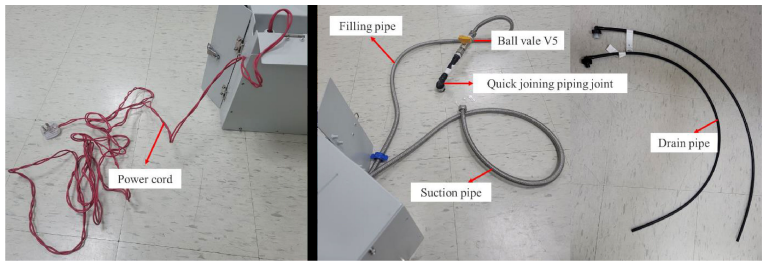


figure 4-2 Power Cord and Pipes in Kit

Relevant technical parameters of the kit are shown in the table.

table 4-1 Technical Parameters Of Coolant Filling And Drainage Kit

No.	Parameter	Parameter Value
1	Dimensions	270mm*300mm*300mm
2	Weight	≤10kg
3	Rated voltage	24V DC
4	Load current	≤4A
5	Power	≤96W
6	Flow	12L/min
7	Head	2.5m
8	Other functions	Non-return design. The pipe storage compartment can also store the matched drainage pipe.

4.1.5 System Drainage

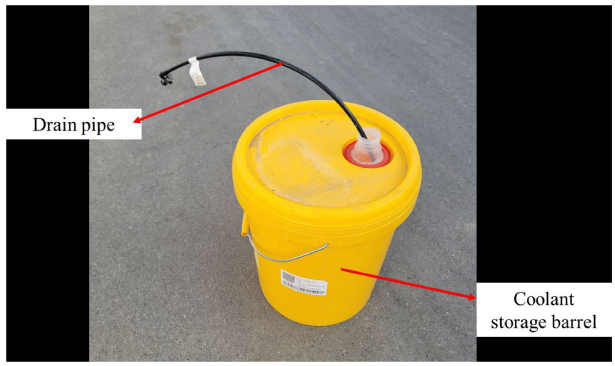
4.1.5.1 Single-column Drainage

When only the pack modules in a row need to be replaced, a single-column drainage can be performed.

step 1 Turn off the system circuit breaker in the BSP cabinet, and the system is powered off.

step 2 Close branch ball valves V3 and V4.

step 3 Prepare the coolant barrel and put one end of the drain pipe into the barrel.



step 4 Squeeze both ends of the plug at the drain port D1, and remove the plug at the drain port D1.

step 5 Insert the other end of the drain pipe into the drain port D1 until hearing a crisp click sound. The coolant has flowed out at this time.

step 6 Squeeze both ends of the plug at the drain port D2, and remove the plug at the drain port D2. Insert one end of the other drain pipe into the drain port D2 until hearing a crisp click sound.

step 7 If no liquid flows out of the drain pipe within 30 s, the single-column coolant drainage is finished.

step 8 Remove the drain pipe at drain port D1&D2 and install the plug.

- - End

4.1.5.2 System Drainage

When replacing the entire system coolant or replacing a large number of pack modules, the entire system needs to be drained.

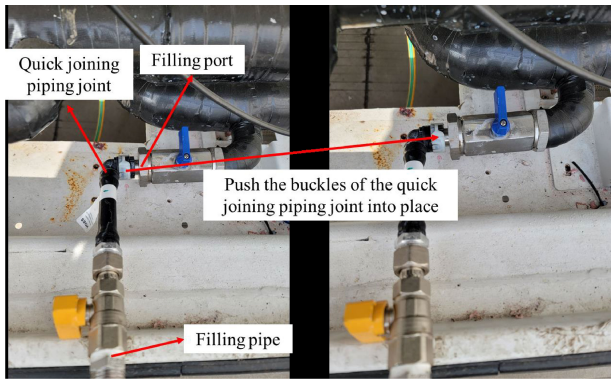
step 1 Turn off the system circuit breaker in the BSP cabinet, and the system is powered off.

step 2 Open the chiller cabinet door, use a screwdriver to remove the 6 M6 screws on the plate under the chiller, and remove the plate.

step 3 Remove the plug at the system filling port.

step 4 Prepare the coolant barrel, take out the suction pipe in the pipe storage compartment and put it into the barrel.

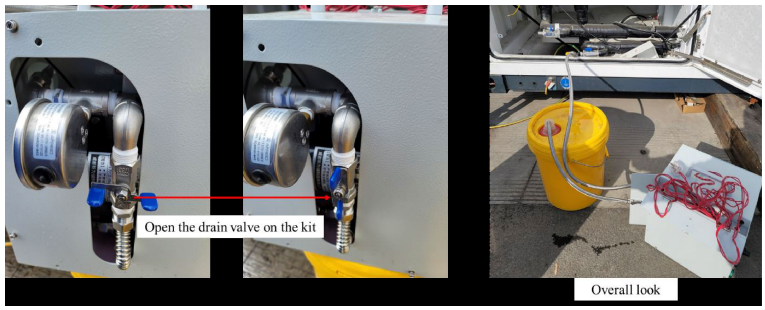
step 5 Take out the coolant filling pipe in the pipe storage compartment, insert the quick joining piping joint into the system filling port, and push the buckles of the quick joining piping joint into place.



step 6 Open the ball valve V1 at the system filling port.

step 7 Open the ball valve V5 on the coolant filling pipe in the kit.

step 8 Open the drain valve on the kit, and the coolant has flowed out at this time.



step 9 If no liquid flows out of the suction pipe within 30 s, the system coolant drainage is finished (It requires about 9 barrels to store the coolant in the whole system).

step 10 After the pipeline maintenance is completed or the coolant is replaced, fill the coolant of the whole system.

- - End

4.1.6 System Filling

step 1 Prepare the coolant filling kit and coolant.

step 2 Open the chiller cabinet door, use a screwdriver to remove the 6 M6 screws on the plate under the chiller, and remove the plate.

step 3 Remove the plug at the system filling port.

step 4 Prepare the coolant, take out the suction pipe in the pipe storage compartment and put it into the barrel.

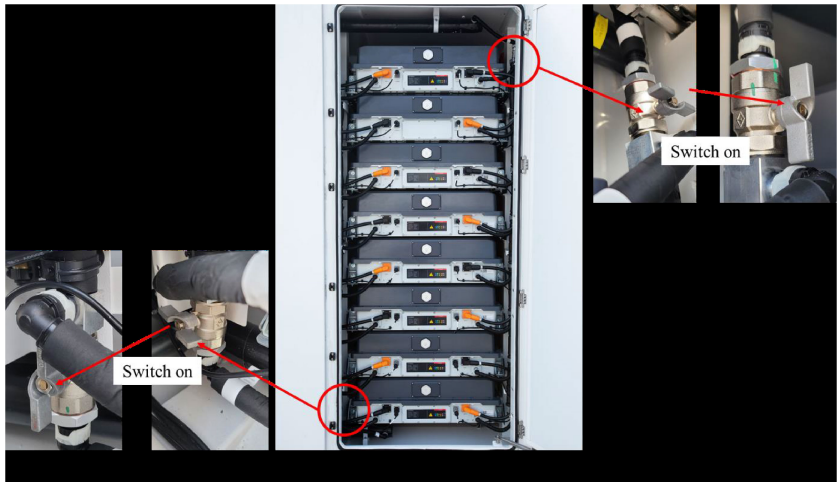
step 5 Take out the coolant filling pipe in the pipe storage compartment, insert the quick joining piping joint into the system filling port, and push the buckles of the quick joining piping joint into place.

step 6 Open the ball valve V1 at the system filling port.

step 7 Open the ball valve V5 on the coolant filling pipe in the kit.

step 8 Close the drain valve on the kit.

step 9 Open the branch ball valves (ball valves V3 and V4 closed when draining coolant in a single column).



step 10 Connect the plug of the kit to the power distribution cabinet in the DCDC cabinet, and the power indicator of the kit will light up.

step 11 Close the system circuit breaker, close the circuit breaker of the chiller.

step 12 Find the "Inp" (inlet coolant pressure) on the chiller display screen.

step 13 Switch on the coolant filling and drainage kit. The water pump indicator on the kit lights up and coolant filling starts.

step 14 Pay attention to the remaining amount of coolant in the barrel. When the coolant is used up, switch off the kit, and replace the coolant. About 9 barrels of coolant (18kg) are required to refill the system after system drainage.

step 15 When the "Inp" on the chiller display screen reaches 1.20Bar, switch off the kit.

step 16 Close the ball valve V1 at the system coolant filling port.

step 17 Open the chiller cabinet door and check whether the exhaust valve is open. (It is open by default. Turn the cap counterclockwise to open the exhaust valve, and the cap is loose if the exhaust valve is opened.)

NOTICE

Note that fins of the heat sink are sharp. Operated with protective gloves!

step 18 Switch the system to a low-speed circulation mode on the chiller display screen.

step 19 The chiller will be shut down after 10min of operation.

step 20 Switch the system to high-speed circulation mode on the chiller display screen.

step 21 When the chiller is started and operates for 20min, after-sales personnel shall check whether there is coolant leakage at the pipeline joints and valves. If so, drain the coolant

and replace the faulty components. It is strictly forbidden to plug and unplug the joints while the liquid pressure is still present.

step 22 Switch the system to a low-speed circulation mode on the chiller display screen.

step 23 The chiller will be shut down after 60min of operation.

step 24 Observe the "Inp" value on the chiller display screen. If it is lower than 0.9Bar, open the ball valve at the filling port. If it is higher than 0.9Bar, jump to Step 28.

step 25 Switch on the kit. The water pump indicator of the kit lights up and coolant filling starts.

step 26 When the "Inp" on the chiller display screen reaches 0.90Bar, switch off the kit.

step 27 Close the ball valve V1 at the system coolant filling port.

step 28 Open the drain valve on the kit and close it after 10s.

step 29 Close the ball valve V5 of the coolant filling pipe in the kit.

step 30 Push out the buckles of the quick joining piping joint of the filling pipe, pinch the quick joining piping joint and pull it out.

step 31 Install the plug of the system filling port.

step 32 Open the door of the chiller. Open the lid of the chiller replenishment tank. Align the quick joining piping joint of the coolant filling pipe with the coolant filling port of the replenishment tank.

step 33 Open the ball valve V5 of the coolant filling pipe.

step 34 Switch on the kit. The water pump indicator of the kit lights up and coolant filling starts.

step 35 Check the level gauge of the replenishment tank. It starts. reaches a high level, switch off the kit.

step 36 Close the ball valve V5 of the coolant filling pipe.

step 37 Close the lid of the replenishment tank and close the chiller door. Unplug the power supply plug of the kit, and store the pipes and power cord into corresponding storage compartments.

step 38 Clean the residual coolant in the container with a cleaning cloth.

step 39 Install the sealing plate under the chiller.

step 40 Switch the system to normal operation mode on the chiller display screen.

- - End

For more details on the process of filling and rainage, please refer to the "-Instruction Video for Liquid Filling and Drainage of BESS".**https://support.sungrowpower.com/VideoDetail?id=1544211330726580226**

4.2 Battery Module Replacement

4.2.1 Preparation

System power-off

A system level disconnection must be carried out prior to the PACK replacement operation: press the battery container emergency stop button, open the BSP cabinet door, switch off the system circuit breaker and stop all auxiliary power to the battery container.

NOTICE

- **Perform maintenance after the power is off and ensure that the power supply would not be connected during the operation. For some operations that need to be performed with power on , ensure that the whole wiring has been completed correctly before connecting the power.**
- **Protective measures must be taken during electrical maintenance, such as wearing insulating gloves or insulating shoes.**

Cable removal

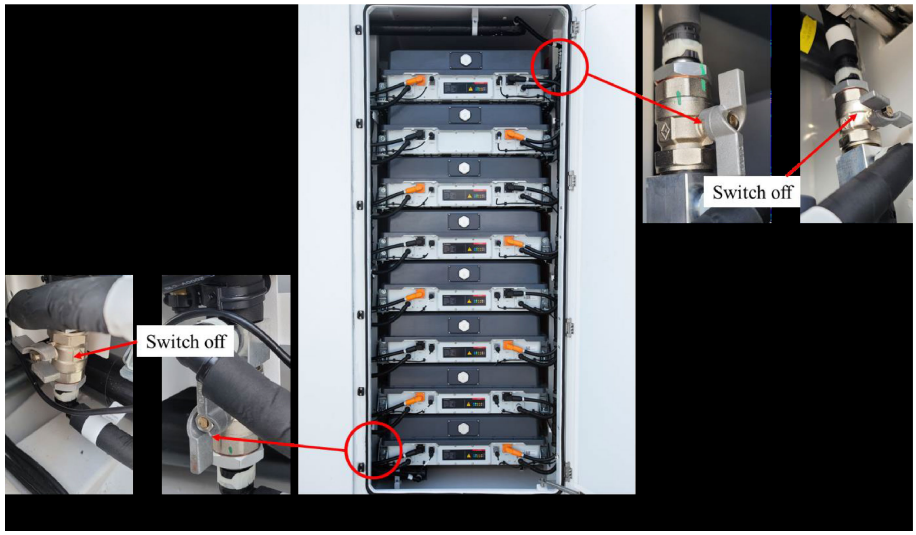
1 Remove the communication cable connecting the DC/DC to the battery cluster where the PACK is to be replaced.

2 Remove the positive and negative power cables connecting the DC/DC to the battery cluster where the PACK is to be replaced.

3 Remove the power cables connected between the Packs.

4.2.2 Close the Valves of the Branch Lines on Both Sides

Visually inspect the PACK, check the location of the leaking coolant PACK and close the valves on the left and right side of the inlet and outlet branches in the compartment where the PACK is located.



4.2.3 Connecting The Drainage Pipe

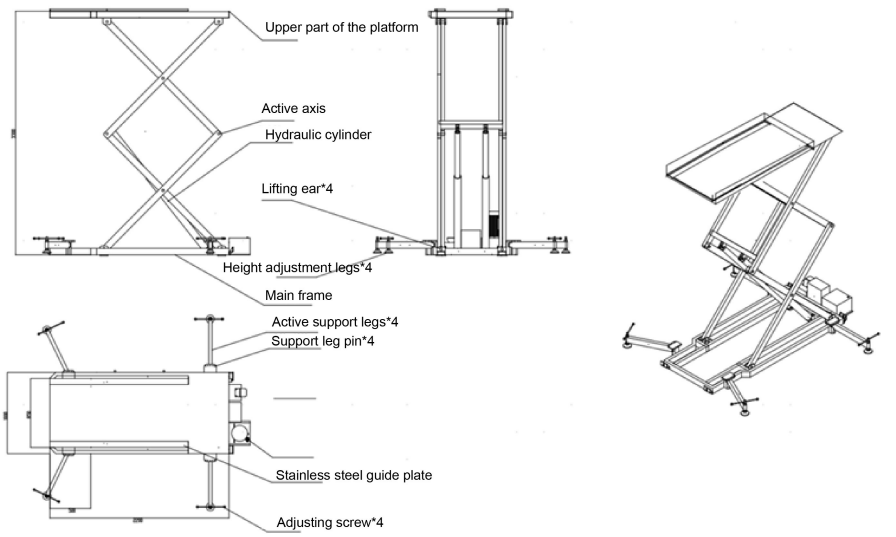
First locate the bottom pipe drain valve and remove the fixings by squeezing the valve pins by hand. The drain tube is inserted into the drain valve and the other end of the tube is inserted into a pre-prepared liquid collection bucket for temporary storage and re-use.

figure 4-3 Pin fixing at the bottom of the valve

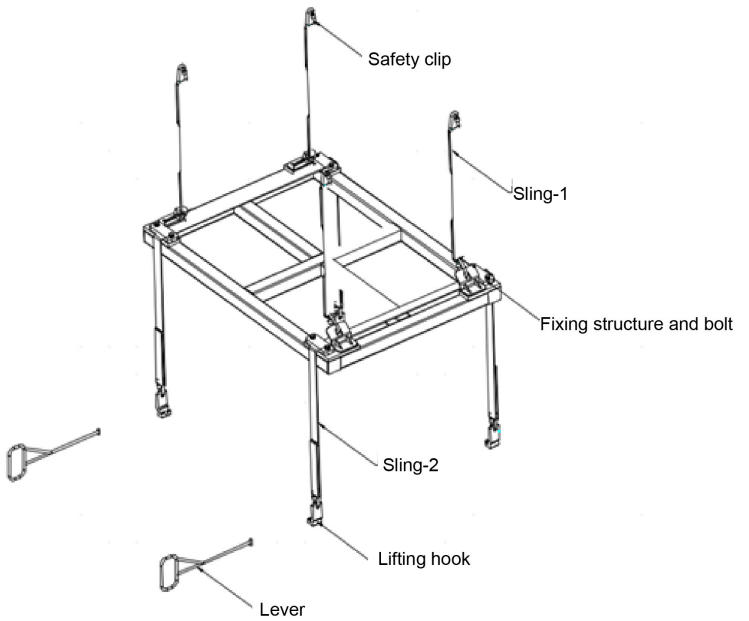
figure 4-4 Temporary liquid accumulation buckets

4.2.4 Tool Description

The hydraulic platform (hereinafter referred to as "platform") is as follows:



The hoisting assembly ("hoisting tool") is as follows:

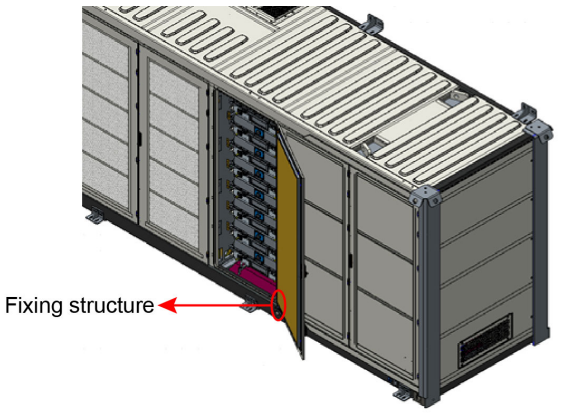


4.2.5 Replace the Faulty Pack

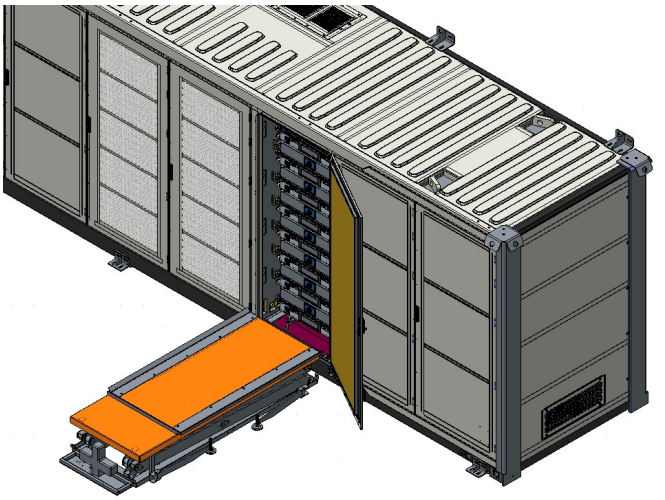
Preparation:

- Check whether tools are complete, the crane is in place, the cushion wood/cushion block is prepared as required on-site, and whether the personal protective equipment is well worn.
- Power down the system, pull out the power/signal plug-ins and drain the coolant in advance.

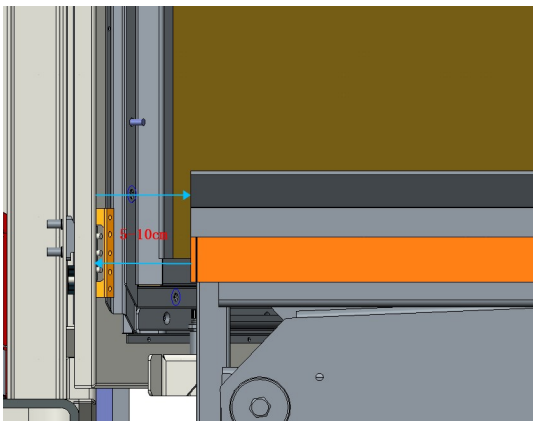
step 1 Open the door and secure it to the fixing point as shown in the figure below.



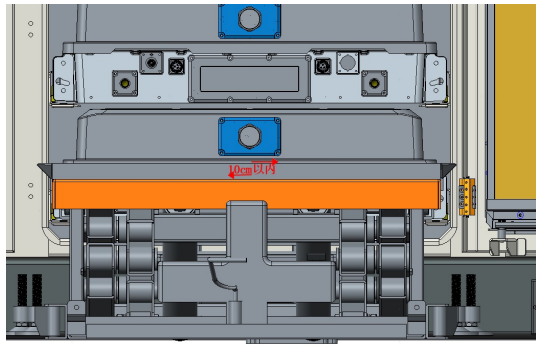
step 2 Hoist to move the platform and land it in front of the door.



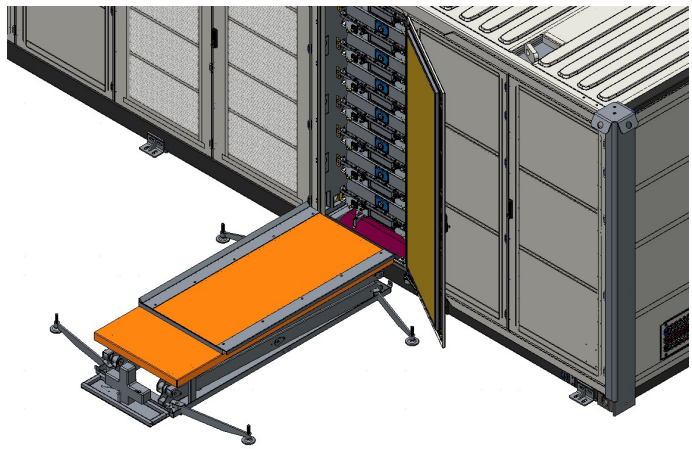
The distance between the platform and the container should be 5~10 cm, as shown in the following figure.



The deviation between the platform guide rail and the center of the container door should be within 10 cm, as shown in the following figure.



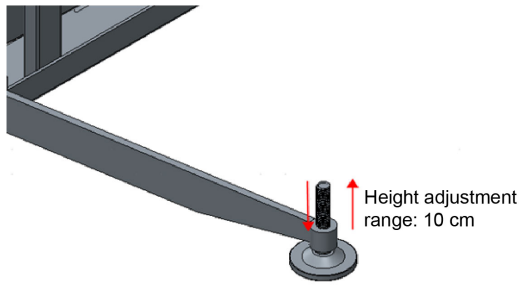
step 3 Unfold platform supports. The recommended angle of unfolding ranges from 60°~ 90°, and 90° is preferable.



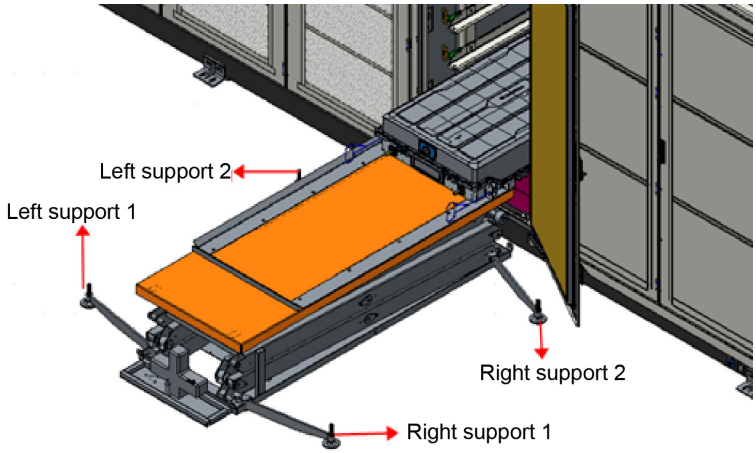
step 4 Level adjustment (supports).

1 The product weighs about 500 kg, and the battery Pack weighs about 400 kg. If the ground is not compact enough (cannot provide sufficient support), accessories such as steel plates or crossties should be placed under the supports in advance.

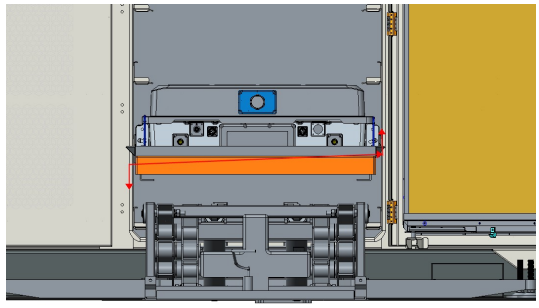
2 If the ground is not level enough, the platform surface must be leveled by adjusting the height of the four supports, which can be adjusted from 0 to 10 cm.



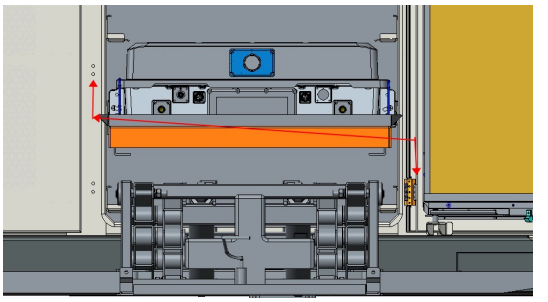
3 When adjusting the level, it is necessary to pay attention to the level of the platform surface in real time, and here are the adjustment suggestions for various non-level conditions.



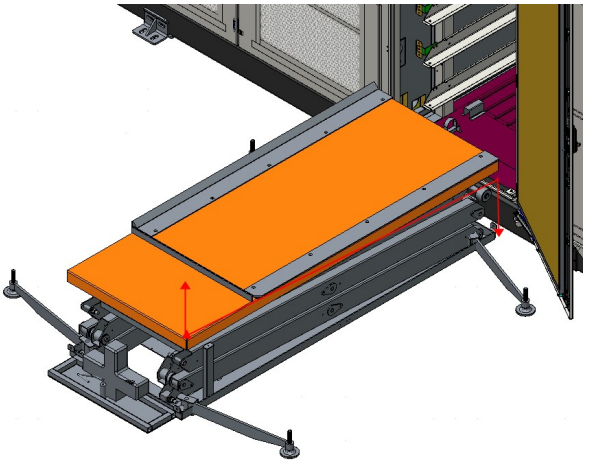
i. If the platform surface is low on the left and high on the right, raise left support 1 or lower right support 1.



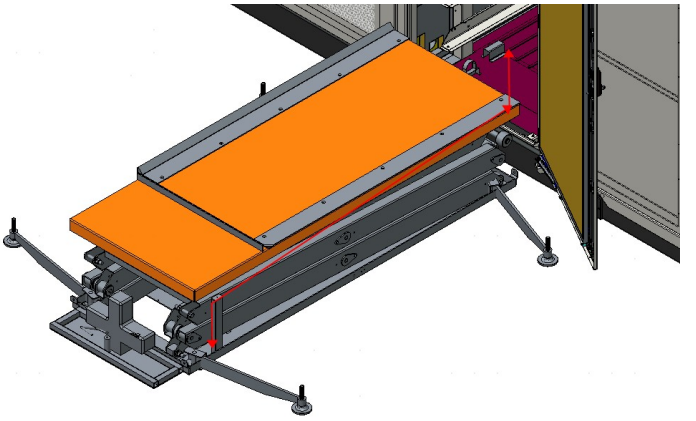
ii. If the platform surface is high on the left and low on the right, lower left support 1 or raise right support 1.



iii. If the platform surface is high at the front and low at the back, lower left support 1 and right support 1, and raise left support 2 and right support 2.

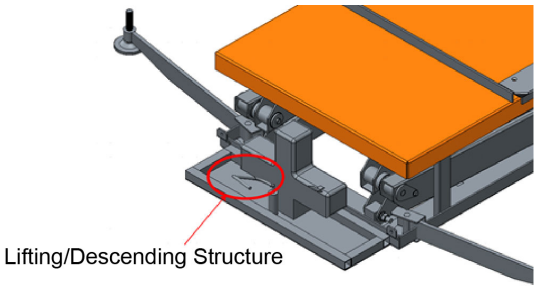


iv. If the platform surface is low at the front and high at the back, raise left support 1 and right support 1, and lower left support 2 and right support 2.



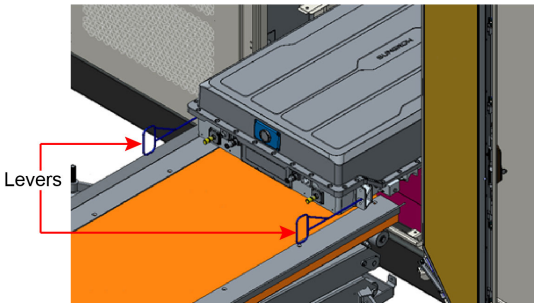
step 5 Height Adjustment.

Pedal the lifting/descending structure to raise the platform surface to a height 1-3 cm (-recommended) lower than the Pack to be replaced, and 1cm is preferable.

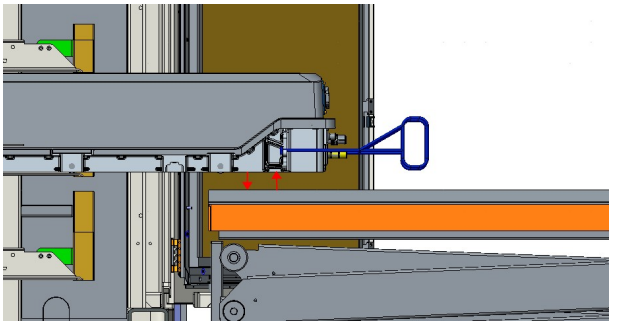


step 6 Pull out the PACK.

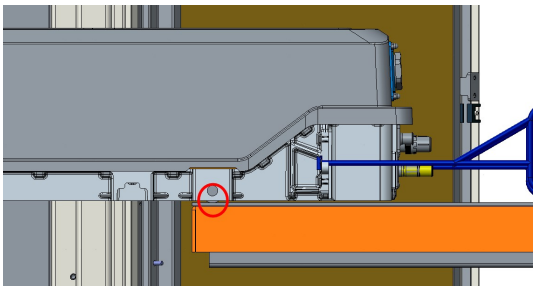
1 Pull out the PACK by levers.



2 When the battery Pack is about to be dragged out of the container, check from the side whether the distance between the bottom of the Pack and the platform surface is appropriate.

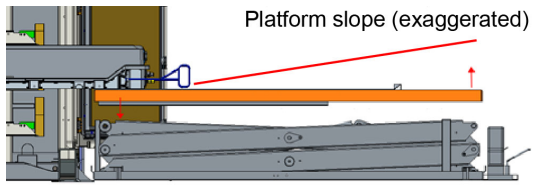


3 Slightly adjust the height of the platform surface to ensure that the first rollers of the Pack fall on the platform surface.

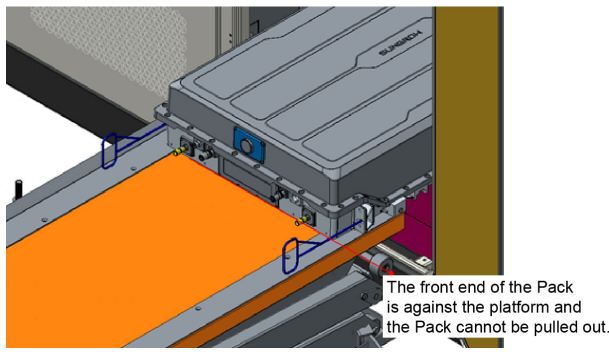


4 During the pull-out process, as the Pack moves, the center of gravity of the platform changes, which will bring about changes in the level of the platform surface. Here are the adjustment suggestions for various non-level conditions.

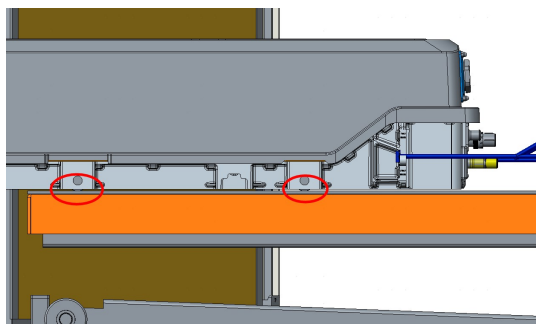
- Phase 1: Initial stage of platform bearing: At the initial stage of the platform bearing, the front end of the platform sinks. At this time, the platform surface should be lifted by 5-8 mm to facilitate pulling out the Pack.



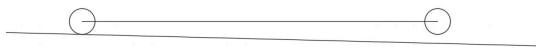
- Phase 2: Medium stage of platform bearing: As the Pack is pulled out, the bottom of the front end of the Pack will be against the platform, and the Pack cannot be pulled out.



Lower the platform surface by 5-8mm, and check the status of the first rollers/second rollers, as shown in the following figure.



If the rollers are in the status below, lower left support 2 and right support 2.



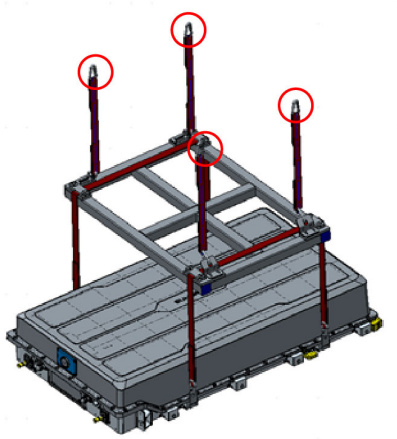
If the rollers are in the status below, raise left support 2 and right support 2.

- Phase 3: End of platform bearing: It is recommended that the Pack is placed stably and evenly on the platform as shown below.

step 7 Hoist and move the Pack: Fix the slings to the crane hook by top safety clips to lift and move the Pack.

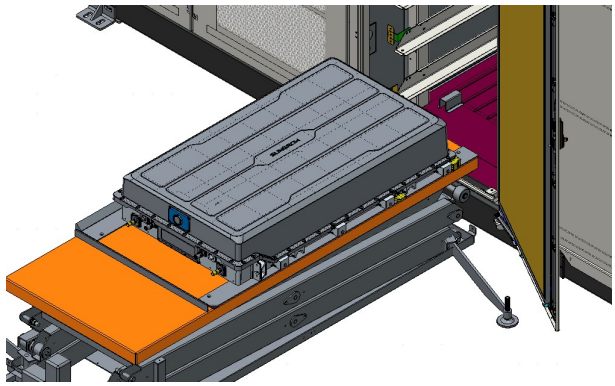
NOTICE

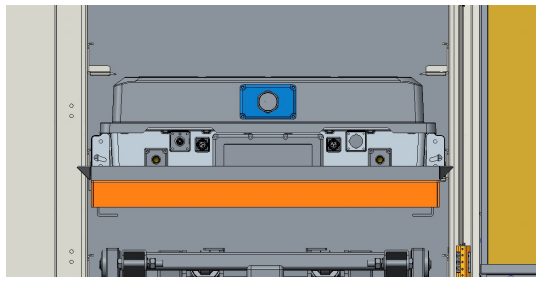
The PACK shall not be lifted by 1.5m higher than the ground to avoid falling.

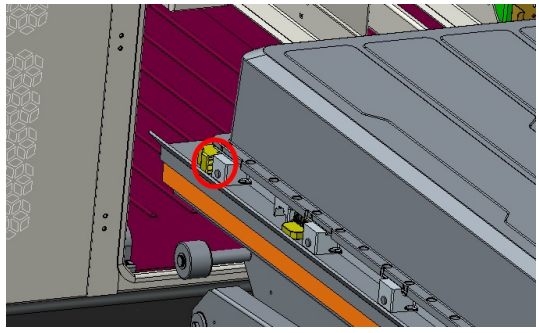


step 8 Push in a new PACK.

1 Status confirmation: After the new PACK is landed on the platform surface, check whether the PACK is aligned with the container, which can be confirmed by the guide block at the end of the PACK. If the Pack is not aligned with the container door, lift and adjust the Pack position, as shown below.

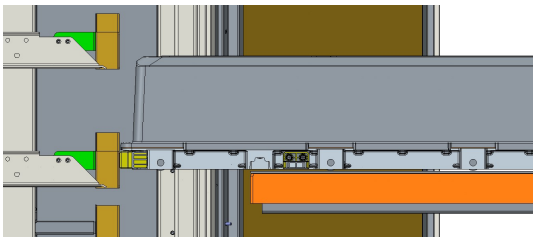






2 Platform surface adjustment: When the new Pack is pushed in, the platform levelness changes in an opposite way as the old Pack is pulled out. At the initial stage, the platform surface should be 1 cm (recommended) higher than the corresponding rail, as shown below (raise left support 1 and right support 1).

- Initial stage: The platform surface is higher than the guide rail surface.
-



- Push-in status inspection: Refer to the roller inspection steps for pulling out the Pack.

- - End

4.2.6 Operation after Pack Replacement

- Transfer the tools to the truck, drive the crane away, and recycle the cushion wood/ cushion block according to the situation.
- Connect the power/signal plug-ins, fill in the coolant, etc.

For the battery power/signal plug-in connection procedure, please refer to the "Battery Connection" section in the system manual of the project configuration.

Conduct cable wiring, pipe connection, commissioning and other operations according to the requirements in the “Coolant Filling and Drainage Operations”.

4.3 BMU Replacement

step 1 Removing the front cover of the PACK: Remove the 8 bolts from the front cover using the special tools and store the removed cover and bolts properly.

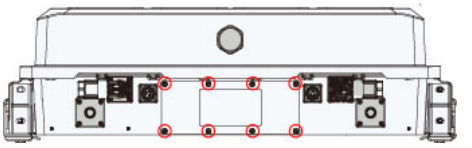


figure 4-5 Front cover

step 2 Remove the BMU board: Remove the BMU board fixing bolts and slowly pull out the communication cable terminals to avoid damaging the terminals and disconnecting the connection wires.

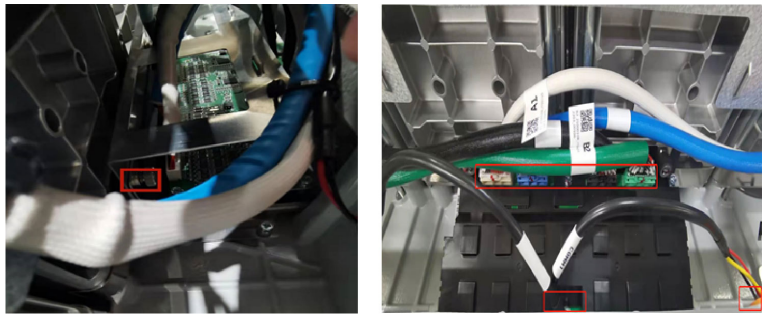


figure 4-6 BMU board mounting position

step 3 Replace the BMU board: re-insert the communication cable terminals to avoid the connection wires falling off the terminals, tighten the BMU board fixing bolts and re-install the front cover plate, taking care to check that the cover plate is sealed tightly.

- - End

4.4 Fuse Replacement

step 1 Removing the connection plugs: unlock the plugs and remove the plugs from the ends of the fuse that are connected to the pack.

step 2 Remove the two fixing bolts from the fuse.

step 3 After replacing the faulty fuse, reinstall the fuse in the reverse order of the above and plug in the connection to the battery pack tightly.

- - End

5 Troubleshooting

5.1 Overview

If any exception occurs to the Turnkey Station, it is suggested to preliminarily troubleshoot the product according to the troubleshooting methods described in this manual.
If the problem still persists or there is still any questions, please contact SUNGROW. It would be helpful if the following information is provided during a call.

- Model and S/N of the Turnkey Station and internal equipment.
- A brief description of the fault.
- A relevant photo is preferred.

5.2 PCS Faults and Corrective Measures

The fault information of the energy storage converter can be viewed via the LCD display on the control panel or the WEB interface, please select the specific viewing method according to the actual situation of the PCS.

Fault name	Triggering condition	Recovery condition	Corrective measures
DC Under-voltage	1. In grid-connected mode, the bus voltage is lower than the web set value for over 500ms. 2. The DC voltage is less than 100V for 920us.	The trigger condition of this fault disappears continuously for 4min without other faults.	Generally, the machine will reconnect to the grid when the DC voltage returns to normal. If the fault repeatedly occurs: 1. Check whether the battery voltage is lower than the minimum allowable voltage. If so, the fault occurs because of insufficient battery voltage. 2. Check the app protection parameter settings. 3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
DC over-voltage	1. If the bus voltage is higher than 1650V for 184us, the machine will stop for protection. 2. The busbar voltage is higher than the set over-voltage value for more than 50ms.	The trigger condition of this fault disappears continuously for 30s without other faults.	Normally, the machine will reconnect to the grid when the DC voltage returns to normal. If the fault repeatedly occurs (If the busbar voltage exceeds 1650V, the input side switch will be locked. To check and reset the switch, manually power off the machine): 1. Check whether the battery voltage is larger than the maximum allowable voltage. If so, the fault occurs because of the battery fault. 2. Check the app protection parameter settings. 3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.

Fault name	Triggering condition	Recovery condition	Corrective measures
AC Under-voltage	1. LVRT is disenabled, and the grid voltage is lower than the corresponding under-voltage value of level 1~5 for longer than the under-voltage protection setting duration. 2. LVRT is enabled, and the grid voltage is lower than the corresponding under-voltage value of level 1~5 for longer than the LVRT required duration. In off-grid mode: Enable the AC under-voltage function only after the output voltage is stable. The protection is as the same as that of grid connection.	The grid voltage is higher than the set grid under-voltage recovery value for longer than the set grid recovery duration. In off-grid mode: The fault will be automatically cleared 30s after protective shutdown.	Generally, the machine will reconnect to the grid when the grid returns to normal. 1. Measure the actual grid voltage. If the grid voltage is lower than the set value, please contact the power company. 2. Check whether the app protection parameters are correctly set. 3. Check whether the AC cable is firmly in place if the grid voltage is normal. 4. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
AC Over-voltage	1. LVRT is disenabled, and the grid voltage is higher than the corresponding over-voltage value of level 1~5 for longer than the over-voltage protection duration.	The grid voltage is lower than the set grid over-voltage recovery value for longer than the set grid recovery	Generally, the machine will reconnect to the grid when the grid returns to normal. 1. Measure the actual grid voltage. If the grid voltage is higher than the set value, please contact the power company. 2. Check whether the app protection parameters are correctly set.

Fault name	Triggering condition	Recovery condition	Corrective measures
	2. HVRT is enabled, and the grid voltage is higher than the corresponding over-voltage value of level 1~5 for longer than the LVRT required duration. In off-grid mode: Enable the AC over-voltage function only after the output voltage is stable. The protection is as the same as that of grid connection.	duration. In off-grid mode: The fault will be automatically cleared 30s after protective shutdown.	3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
AC Under-frequency	The grid voltage is higher than 50% of the rated voltage, the grid frequency is lower than the corresponding protection value of level 1~5 for longer than the under-frequency protection set duration. In off-grid mode: Enable the AC under-frequency function only after the output voltage is stable. The protection is as the same as that of grid connection.	In grid-connected mode: The frequency is higher than the under-frequency recovery value for longer than the set grid recovery duration. In off-grid mode: The fault will be automatically cleared 30s after protective shutdown.	Generally, the machine will reconnect to the grid when the grid frequency returns to normal. 1. Measure the actual grid frequency. If the grid voltage is lower than the set value, please contact the power company. 2. Check whether the app protection parameters are correctly set. 3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.

Fault name	Triggering condition	Recovery condition	Corrective measures
AC Over-frequency	The grid voltage is higher than 50% of the rated voltage, the grid frequency is higher than the corresponding protection value of level 1~5 for longer than the over-frequency protection set duration. In off-grid mode: Enable the AC over-frequency function only after the output voltage is stable. The protection is as the same as that of grid connection.	In grid-connected mode: The frequency is lower than the over-frequency recovery value for longer than the set grid recovery duration. In off-grid mode: The fault will be automatically cleared 30s after protective shutdown.	Generally, the machine will reconnect to the grid when the grid frequency returns to normal. 1. Measure the actual grid frequency. If the grid voltage is higher than the set value, please contact the power company. 2. Check whether the app protection parameters are correctly set. 3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
Islanding Protection	In grid-connected mode, LVRT is not enabled, and the AC voltage is lower than 55V for 500ms; LVRT is enabled, and the AC voltage is lower than 200V for longer than the maximum LVRT set duration.	The AC voltage is higher than 220 V for 10s.	1. Check whether the grid power supply is normal. 2. Check whether the AC cable is firmly in place. 3. Check whether the AC cable is connected to the correct terminal. 4. Check whether the AC circuit breaker is connected. 5. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.

Fault name	Triggering condition	Recovery condition	Corrective measures
Module Protection	There is a fault signal in the driver board, or there is an over-current in the hardware (-including AC/DC over-current), or the upper and lower switches are shorted.	The trigger condition of this fault disappears continuously for 3 minutes without other faults. The fault will be automatically cleared for 5 times at most. After that, one needs to manually power down the machine and reset the module protection.	Wait for the inverter to return to normal. If the fault persists, please contact SUNGROW to manually power down the machine and clear the fault.
Module Over-temperature	The maximum temperature of IGBT module is higher than 92℃ over 5s.	The maximum temperature of IGBT module is lower than 80℃, and returns to normal 10s later.	Generally, the machine will reconnect to the gird when the module temperature returns to normal. If the fault repeatedly occurs: 1. Check whether the ambient temperature of the inverter is too high. 2. Check whether the machine is placed in a well-ventilated place. 3. Check whether the machine is exposed to direct sunlight. Shield it if so. 4. Check whether the fan is running properly. Replace the fan if necessary.

Fault name	Triggering condition	Recovery condition	Corrective measures
			5. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
Reactor Over-temperature	Reactor temperature node is disconnected over 1s.	The fault will be cleared 10s after the node returns to normal.	Generally, the machine will reconnect to the grid when the internal temperature returns to normal. If the fault repeatedly occurs: 1. Check whether the ambient temperature of the inverter is too high. 2. Check whether the machine is placed in a well-ventilated place. 3. Check whether the machine is exposed to direct sunlight. Shield it if so. 4. Check whether the fan is running properly. Replace the fan if necessary. 5. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
Transformer Over-temperature	Transformer temperature node is disconnected over 1s.	The fault will be cleared 10s after the node returns to normal.	Generally, the machine will reconnect to the grid when the temperature returns to normal. If the fault repeatedly occurs: 1. Check whether the machine is placed in a well-ventilated place. 2. Check whether the machine is exposed to direct sunlight. Shield it if so. 3. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.

Fault name	Triggering condition	Recovery condition	Corrective measures
Leakage Current Protection	The DC leakage current is greater than the set value (-default value 5A) for 5s.	The DC leakage current is lower than 85% of the protection value.	1. Check whether it is humid or rainy where the battery pack is located. If so, no need to clear the fault. 2. Check whether the battery pack and AC/DC cables are firmly in place. 3. Check the app protection parameter settings. 4. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
Overload Protection	1. Three-phase AC output is 1.25 times larger than the rated current. 2. Or the load is 1.3 times larger than the rated value for 200ms. 3. Or the load is 1.13 times larger than the rated value for 10m. 4. Or the load is 1.15 times larger than the rated value for 1m.	The trigger condition of this fault disappears continuously for 10min without other faults.	Generally, the machine will reconnect to the grid when the internal temperature returns to normal. If the fault repeatedly occurs: Check whether the power output exceeds 1.15 Pn.

Fault name	Triggering condition	Recovery condition	Corrective measures
Fan 1 Fault	1. The communication is normal, and the fan is abnormal in operation mode. The actual duty cycle is insufficient, and the control duty cycle reaches 80% for 1min. 2. The communication and the power supply is normal, and the fan is abnormal in off mode for 10s. 3. The communication is abnormal, and the Tigbt is greater than 93 for 6s in operation mode. 4. The communication is abnormal, and the control power supply is normal in off mode for 20s.	The trigger condition of this fault disappears continuously for 10s without other faults.	1. Inspecting the fan of the inverter. To check the fan, shut down the inverter, disconnect the power supply, and remove any foreign particles. Replace the fan if it is damaged. 2. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
DC Over-current	The master-slave single DC current is higher than 1.5In for 100ms; The DC current is higher than the web set protection threshold.	The fault will be cleared 10s after the shutdown command is issued.	Generally, the fault will be cleared automatically and no further operation is required. If the fault repeatedly occurs, please contact SUNGROW.

Fault name	Triggering condition	Recovery condition	Corrective measures
AC Over-current	1. The peak phase current of the inverter unit is 1.5 larger than the rated current for 3ms. 2. Open-loop. If any three-phase peak current of the inverter unit is larger than 1.5In in off-grid mode for 184us, the machine will stop for protection.	The trigger condition of this fault disappears continuously for 4min without other faults.	Generally, the fault will be cleared automatically and no further operation is required. If the fault repeatedly occurs, please contact SUNGROW.
Ambient Temperatur-e Abnormal	The ambient temperature is higher than 63℃, or the DC cabinet temperature is higher than 73℃ for 40ms.	The ambient temperature is lower than 50℃ and the DC cabinet temperature is lower than 65℃ for 200ms.	Generally, the machine will reconnect to the grid when the internal temperature returns to normal. If the fault repeatedly occurs: 1. Check whether the ambient temperature of the inverter is too high. 2. Check whether the machine is placed in a well-ventilated place. 3. Check whether the machine is exposed to direct sunlight. Shield it if so. 4. Check whether the fan is running properly. Replace the fan if necessary. 5. If the fault is not caused by the foregoing reasons and still exists, please contact SUNGROW.
Hardware Fault	In off mode, the absolute value of the inverter DC	The trigger condition of this fault	Generally, the fault will be cleared automatically and no further operation is required. If the fault

Fault name	Triggering condition	Recovery condition	Corrective measures
	current is higher than 350A for 5s, or in operation mode, the DC voltage is lower than 100V for 500ms.	disappears continuously for 2min without other faults.	repeatedly occurs, please contact SUNGROW.

For further troubleshooting operations please refer to the PCS user manual for the specific project.

5.3 BESS Faults and Corrective Measures

5.3.1 CMU Fault/Alarm List

CMU: The Cluster Management Unit enables the daily management and monitoring of the battery clusters.

table 5-1 CMU Fault List

No.	Fault name	Common causes	Corrective measures
1	Cell over-voltage faults	Single cell voltage consistently exceeds set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
2	PACK over-voltage fault	PACK voltage consistently exceeds set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
3	Total voltage over-voltage fault	RACK voltage consistently exceeds the set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.

No.	Fault name	Common causes	Corrective measures
4	Cell under-voltage failure	Single cell voltage consistently below set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
5	PACK under-voltage failure	PACK voltage consistently below the set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
6	Total voltage under-voltage failure	RACK voltage consistently below the set fault threshold.	• Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the CMU motherboard high voltage acquisition circuit, hardware for abnormalities.
7	Low temperature failure of the battery cell	Continuous charging or discharging of the battery at temperatures below the set failure threshold at low temperatures.	• Check that the liquid-cooled unit is enabled for heating. • Check that the battery compartment is well sealed. • Check for abnormal core temperature sensor connections.
8	Over-temperature failure of the battery cell	Cell temperature consistently exceeds set failure threshold.	• Check that the liquid-cooled unit is enabled for cooling. • Check that the battery compartment is well sealed. • Check that the battery power connection row is in good condition. • Check for dummy soldering of the cores in the PACK. • Check if the individual temperature sensors are abnormal.
9	Overcurrent faults	Continuous current greater than set fault threshold.	• Check that the BSC parameters are set correctly. • Check the system power connection row for proper operation.

No.	Fault name	Common causes	Corrective measures
10	Current collection fault	• Current collection abnormalities. • Disconnected, loose or misconnected sampling wire. • CMU failure.	• Check that the current sampling wire is not disconnected.
11	Abnormal voltage collection	• Broken BMU voltage collection cable. • Loose voltage collection wire terminal.	• Check the BMU for damage and replace it if it is damaged. • Check that the voltage sampling cable is not disconnected.
12	Temperature acquisition anomaly	• BMU temperature sensing collection line disconnected. • Loose temperature sensing collection wire terminal.	• Check the BMU for damage and replace it if it is damaged. • Check that the sampling line is not dislodged. • Check that the temperature sensing has not failed.
13	CMU-BMU communication failure	The communication cable is disconnected and the BMU is damaged.	• Check that the communication lines are connected properly and that the communication lines are in the correct sequence. • Check that the first slave that is not communicating is not damaged (the communication line connection skips this module). • Check for damage to the CMU in the DCDC.
14	CMU-BSC communication failure	Communication cable disconnected, BSC damaged, CAN matching resistor not connected.	• Check that the communication lines are connected properly. • Check that the CAN matching resistor is installed. • Check for damage to the CMU in the DCDC as well as to the container BSC.

No.	Fault name	Common causes	Corrective measures
15	Fuse failure	• Short circuit, or prolonged overload. • Loose feedback wire. • Fuse quality issues. • CMU failure.	• Measure the fuse for an open circuit and replace it in case of abnormality. • Check that the wiring is not disconnected and loose. • If none of the above are abnormal, please replace the DCDC.
16	Total voltage differential failure	• The total accumulated voltage and the total sampled differential voltage are greater than the set fault threshold. • Total voltage sampling circuit abnormal. • CMU failure.	• Troubleshoot other system faults e. g. communication faults, voltage sampling faults. • Check that the total voltage sampling line in the switch is not loose. • If none of the above are abnormal, please replace the DCDC.

table 5-2 CMU Alarm List

No.	Alarm name	Common causes	Corrective measures
1	Cell overvoltage alarm	Single cell voltage consistently exceeds set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
2	PACK over-voltage alarm	PACK voltage consistently exceeds set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage.

No.	Alarm name	Common causes	Corrective measures
3	Total voltage over-voltage alarm	RACK voltage consistently exceeds the set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage.
4	Under-voltage alarm for battery cells	Single cell voltage consistently below set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage. • Check the voltage sampling line for abnormalities.
5	PACK under-voltage alarm	PACK voltage consistently below set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage.
6	Total voltage under-voltage alarm	RACK voltage consistently below the set alarm threshold.	• The charge is stopped for 5 minutes (or the system starts to discharge) and the alarm is checked to see if it resumes automatically. • Check that the BSC parameters are set correctly. • Check for abnormal cell voltage.

No.	Alarm name	Common causes	Corrective measures
7	Cell temperature difference alarms	RACK captures the difference between the highest cell temperature and the lowest cell temperature consistently greater than the set alarm threshold.	• After a drop in PCS operating power, check that the alarm is automatically restored. • Check that the liquid-cooled unit is turned on properly. • Check for loose power connection rows. • Check for dummy soldering of the cores in the PACK.
8	Differential cell voltage alarms	The difference between the highest cell voltage and the lowest cell voltage collected by RACK is consistently greater than the set alarm threshold.	• Determines if the system is too low and the alarm is automatically released when the power is restored. • Check for unbalanced batteries. • Check the BMU slave for abnormalities (replace it). • Check for abnormalities in the battery cells. • Check that the voltage sampling cable is not disconnected.
9	PACK voltage difference alarm	The voltage difference between the highest voltage PACK and the lowest voltage PACK is continuously greater than the set alarm threshold.	• Check the PACK cells for overdischarge and over-charge. • Check the BMU slave for abnormalities (replace it).
10	Low temperature alarm for battery cells	Continuous charging or discharging of the battery at temperatures below the set alarm threshold at low temperatures.	• Determine if the container system has not been fully started, and check if the alarm is automatically restored once the start-up is complete. • Check the temperature sensor for abnormalities. • Check that the liquid-cooled unit is enabled for heating. • Check that the battery compartment is well sealed.

No.	Alarm name	Common causes	Corrective measures
11	Cell over-temperature alarm	Cell temperature consistently exceeds the set value alarm threshold.	• The PCS runs at reduced power and then the fault is automatically restored. • Check the temperature sensor for abnormalities. • Check that the liquid-cooled unit is enabled for cooling. • Check that the battery compartment is well sealed. • Check that the battery power connection row is in good condition. • Check for dummy soldering of the cores in the PACK.
12	Over-current alarm	Current continuously greater than set alarm threshold.	• Whether RACK unbalance, first installation unbalance, system standby rest ≥ 24 hours. • Does the alarm occur when the discharge SOC is low and disappears automatically when the SOC recovers, it is recommended to reduce the discharge depth. • Check the system power connection row for proper operation, the battery system for large temperature differences and abnormal air conditioning cooling.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

5.3.2 BSC Fault / Alarm List

BSC: mainly collects signals from nodes such as temperature, fire, and UPS of the ESS.

table 5-3 BSC Fault List

No.	Fault name	Common causes	Corrective measures
1	Node 1~ Node 16 failure	Node input signals differ from the default configuration signals (configuration items).	• Check for loose node feedback signal wires and abnormal node feedback messages.
2	BSC-PCS communication failure	An abnormality was detected in the communication between the BSC and the PCS.	• Check that the PCS is powered up and operating correctly. • Check that the BSC and PCS communication lines are connected. • Check that the BSC and PCS addresses are configured correctly.
3	BSC-LC communication failure	An exception was detected in the communication between the BSC and the LC.	• Check that the BSC and LC communication lines are connected. • Check that the BSC and LC addresses are configured correctly.
4	Fault in the low voltage supply circuit	An abnormality was detected in the low voltage supply circuit.	• Check that the power supply to the contactor coil is disconnected. • Check that the UPS output 24V is normal. • Check for short circuits in the low voltage supply circuit.

table 5-4 BSC Alarm List

No.	Alarm name	Common causes	Corrective measures
1	Node 1~- Node 16 alarms	The node input signal is different from the default configuration signal (configuration item).	• Check for loose node feedback signal wires and abnormal node feedback messages.
2	BSC-DCDC communication alarms	The BSC communicates with the DCDC exceptionally.	• Check that the BSC and DCDC communication lines are connected. • Check that the BSC configuration DCDC address is correct. • Does the DCDC restore the factory settings.

No.	Alarm name	Common causes	Corrective measures
3	BSC-CMU communication alarms	The BSC communicates with the CMU exceptionally.	• Check that the BSC and CMU communication lines are connected. • Check the CMU matching resistor for abnormalities, the bus resistance value is approximately 62Ω.
4	BSC-Liquid-cooled unit communication alarms	The BSC communicates abnormally with the liquid-cooled unit.	• Check that the communication line between the BSC and the liquid cooling unit is connected.
5	BSC - Breathing light communication alarm	The BSC communicates abnormally with the breathing light.	• Check that the BSC is connected to the breathing light communication cable.
6	Tributary exception alarms	PCS branch fuse abnormal.	• Check the PCS fuse for damage. • Check whether the DCDC current sampling is abnormal. • Check whether the DCDC bus voltage collection is abnormal.
7	System water shortage alarms	The inlet water pressure of the liquid-cooled unit is below the set value.	• Check for deviations in the liquid-cooled unit water inlet sensor detection. • Check for lack of water in liquid-cooled units.
8	1# High condensate pressure alarm	Liquid cooled unit 1# high pressure above set point	• Check that the condenser is not dirty and clogged. • Check the high voltage sensor for damage or deviations in the detection value.
9	2# High condensate pressure alarm	Liquid cooled unit 2# high pressure above set point	• Check that the condenser is not dirty and clogged. • Check the high voltage sensor for damage or deviations in the detection value.

No.	Alarm name	Common causes	Corrective measures
10	Alarm for high discharge pressure	Liquid cooled unit discharge pressure is higher than set.	• Check the outlet pressure sensor for deviation. • Check that the external piping valves of the liquid-cooled unit are not dirty and blocked or closed.
11	Low water inlet pressure alarm	The inlet water pressure of the liquid-cooled unit is below the set value.	• Check that the water inlet pressure sensor has not failed. • Check the water inlet pressure sensor wiring for looseness and ageing. • Confirm whether the refrigerant is missing under the manufacturer's guidance.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

5.3.3 LC Fault / Alarm List

LC: To facilitate information management of the energy storage system, an optional local controller is used to collect information on the operation of the PCS, BCP and other equipment in the system and upload this information to the EMS.

table 5-5 LC Fault List

No.	Fault name	Common causes	Corrective measures
1	LC-PCS Comm Fault.	All PCS and LC communication exceptions under the system.	• Check if the LC and PCS networks are on the same LAN under the system. • Check the communication lines between LC and all PCS under the system. • Check if the LC configuration IP address matches the actual device.
2	LC-BSC Comm Fault.	All BSC and LC communication exceptions under the system.	• Check if the LC and BSC networks are on the same LAN under the system. • Check the communication lines between the LC and all BSC under the system. • Check if the LC configuration IP address matches the actual device.
3	BSC Fault.	One or more BSC failures.	• Troubleshoot BSC fault points and perform troubleshooting based on BSC fault points.

table 5-6 LC Alarm List

No.	Alarm name	Common causes	Corrective measures
1	LC-PCS Comm Alarm.	Abnormal communication between one or more PCS and LC under the system.	• Abnormal communication between one or more PCS and LC under the system. • Check the communication lines between LC and all PCS under the system. • Check if the LC configuration IP address matches the actual device.
2	BSC Unit Alarm.	One or more BSC alarms.	• Troubleshoot BSC fault points and perform troubleshooting based on BSC fault points.

No.	Alarm name	Common causes	Corrective measures
3	LC-BSC Comm Alarm.	One or more BSCs under the system communicating with the LC is abnormal.	• Check that the LC and SMU networks are on a LAN under the system. • Check the communication lines between the LC and all SMUs under the system.
4	LC-SPD Alarm	Alarm for SPD in LC control box.	• Check the SPD for abnormalities. • Check the auxiliary contact wiring of the SPD for abnormalities.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

5.3.4 FSS Fault List

table 5-7 FSS Fault List

No.	Fault name	Common causes	Corrective measures
1	Module invalid answer	The modules or detectors do not respond, or these devices do not work, or are not connected correctly.	• Check that the detector is working correctly connected and addressed on the signal return line.
2	Module address code duplication	There are multiple detectors or modules of the same type set to the same address.	• Correct the incorrect address.
3	Detector low threshold	The reading inside the detector chamber is too low and the detector does not work properly.	• Replace the detector with a new one.
4	Anomaly detection by detectors	The detector is dirty and needs cleaning.	• Cleaning the detector.

No.	Fault name	Common causes	Corrective measures
5	Hardware mismatch	In the controller database, the programming information for the devices at the specified address does not match these device types.	• For programming modifications or changes to external devices.
6	External power failure	The external power supply to the control module is powered down.	• Check if there is a DC power disconnection if there is a power line error.
7	Module open circuit	Module open circuit.	• Check that the 47k resistor is OK.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

5.3.5 Temperature Control System Fault/Alarm List

table 5-8 Temperature Control System Fault List

No.	Fault name	Common causes	Corrective measures
1	Fan failure	The blower does not operate properly.	• Circuit breaker tripped, check if the circuit breaker inside the chiller is closed. • If the power input is abnormal (e. g. overvoltage or undervoltage), check the chiller for corresponding alarms and refer to "Alarm Handling" to deal with them. • Blower stuck, check for foreign objects stuck in the blower. • Loose terminals, check for loose fan docking terminals. • Compressor does not start, see "- Compressor does not start" in "- Refrigeration fault repair". • Faulty control board, replace control board. • Fan failure, replace fan. • Worn fan bearings, replace fan. • The fan blades scrape other objects, check for interference with the fan blades by cables etc. • The fan fixing bolts are loose, retighten the fan fixing bolts.
2	Refrigeratio-n system failure	Does not cool and reports a cooling fault.	• No power on (standby), check the main power switch and check the operating display screen that it is switched on. • Loose circuit connections, tighten circuit connectors. • Circuit open or short circuit, check the circuit open or short circuit and repair the mains supply. • Inverter failure, replace the inverter. • Damaged control board, replace control board. • Faulty compressor motor, replace compressor.

No.	Fault name	Common causes	Corrective measures
			• Liquid temperature set too high, no cooling required, check inlet and return liquid temperatures and set appropriate control temperature. • Stop time delay, the compressor has a minimum stop time in normal conditions and if the temperature rises to the start point during this time, the compressor will still turn on with a delay. • The condenser is dirty and blocked, flush the condenser and end the cleaning when the water discharged from the drain hole is clear at the edge. • The external circulation fan does not run, refer to "Fan failure" in the "Fan does not run" fault to deal with.
3	Failure of the coolant circulation system	The coolant system does not circulate properly.	• Without power on (standby), check the main power switch and check the operating display screen that it is switched on. • Loose circuit connections, tighten circuit connectors. • Water pump inverter failure, replace water pump inverter. • No coolant causes the water pump to protect itself, check if there is coolant in the circulation system, if not make up for it. • Pump body failure, replace pump. • Heating setpoint too low, no heating required, check that the discharge temperature and heating setpoint are set reasonably. • Loose circuit connections, tighten circuit connectors. • Electric heating overheating protection, wait for a period of time and then restart the electric heating and observe if the electric heating is working properly. • Failure of the electric heating of the pipes, replacement of the electric heating.

No.	Fault name	Common causes	Corrective measures
			• Faulty refill pump, replace the automatic refill pump. • Refill pump is stuck, check for foreign objects in the refill tank and remove if there are any. If the refill pump is damaged replace it. • Loose terminals, check if the charge pump docking terminals are loose. • Worn shaft of the refill pump, replace the automatic refill pump. • Loose filler pump fixing screw, tighten screw.

table 5-9 Temperature Control System Alarm List

No.	Alarm name	Common causes	Corrective measures
1	System water shortage	Coolant leaks.	• Check for leaks in the coolant circulation system, repair and refill.
2	1# Condensing pressure too high alarm 2# Condensing pressure too high alarm	• The condenser is severely dirty and clogged. • The ambient temperature is too high. • Too much refrigerant.	• Flush the condenser and finish cleaning when the water draining from the drain hole becomes clear. • Check the ambient temperature. • Discharge a small amount of refrigerant.
3	1# Condensing overtemperature 2# Condensing overtemperature	• The condenser is severely dirty and clogged. • Clogging of the return air outlet of the unit with debris. • The fan is not working when the power is off.	• Flush the condenser and finish cleaning when the water draining from the drain hole becomes clear. • Remove debris from the return air outlet. • Check the working condition of the fan.

No.	Alarm name	Common causes	Corrective measures
4	1# Condensing overtemperature lockout 2# Condensing overtemperature lockout	• The condenser is severely dirty and clogged. • Clogging of the return air outlet of the unit with debris. • The fan is not working when the power is off.	• Flush the condenser and finish cleaning when the water draining from the drain hole becomes clear. • Remove debris from the return air outlet. • Check the working condition of the fan.
5	High discharge pressure	• There is a blockage in the coolant circulation system. • Excess coolant.	• Check for the presence of foreign bodies in the circulation system pipework. • Open the drain valve to drain a small amount of coolant.
6	Low water inlet pressure	Insufficient coolant.	• Connect the refill kit for refilling.
7	Water high temperature alarm	• Malfunction of compressor, electronic expansion valve, circulating water pump or fan. • Coolant leaks.	• Check the status of the compressor, electronic expansion valve, circulating water pump or fan. • Check for leaks and refill after repairs.
8	Water low temperature alarm	Circulating water pump or electric heating failure.	• Check the status of the circulating water pump and electric heating.
9	Mains power failure	• Incorrectly wired power supply causing reverse phase. • Loose wiring in one phase of the circuit breaker causes a phase loss. • Over- or under-voltage due to instability in the power supply grid.	• Connect the power cable to the unit correctly. • Fasten the electrical control wiring of the input power supply. • Check the power supply grid. If it is confirmed that the grid is the problem, it is recommended to have a voltage regulator.

No.	Alarm name	Common causes	Corrective measures
10	Electric heating failure Electric heating fault lockout	• Loose wiring or broken cables in the electrical control of the electric heating. • Electrical heating failure.	• Tighten the electric control wiring or replace the cable. • Replace the electric heating.
11	Ambient temperature sensing failure Discharge temperature sensing failure Inlet water temperature sensor failure Inhalation sensor failure Condensation temperature sensor failure Exhaust temperature sensor failure	• The electrical control wiring of the temperature sensor is loose or the cable is damaged. • Temperature sensor failure.	• Tighten the electrical control wiring or replace the cable. • Replace the temperature sensor.
12	1# high pressure pressure sensor failure 2# high pressure pressure sensor failure	• The electrical control wiring of the pressure sensor is loose or the cable is damaged. • Pressure sensor failure.	• Tighten the electrical control wiring or replace the cable. • Replace the pressure sensor.

No.	Alarm name	Common causes	Corrective measures
13	1# low pressure pressure sensor failure 2# low pressure pressure sensor failure	• Loose wiring or broken cable in the electrical control of the pressure sensor. • Pressure sensor failure.	• Tighten the electric control wiring or replace the cable. • Replace the pressure sensor.
14	1# High Voltage Alarm 2# High Voltage Alarm	• The ambient temperature is too high. • Loose wiring in the high voltage switch, or damaged cable. • The condenser is severely dirty and clogged. • The return air outlet is clogged with debris. • The fan is disconnected or working abnormally.	• Check the ambient temperature. • Tighten the electric control wiring or replace the cable. • Clean the condenser. • Clear the dirty blockage in front of the unit's return air outlet. • Repair or replace the fan when it is not due to a power outage.
15	1# Low voltage alarm 2# Low voltage alarm	• Refrigerant leaks. • The electronic expansion valve is working abnormally.	• Check for leaks and replenish refrigerant after repairs. • Replace the electronic expansion valve.

No.	Alarm name	Common causes	Corrective measures
16	1# High pressure lock 2# High pressure lock	• Ambient temperature is too high. • The high-voltage switch wiring is loose, or the cable is damaged. • The condenser is seriously dirty and clogged. • There is a debris blockage in the return air outlet. • The fan is powered off or working abnormally.	• Check ambient temperature. • Tighten the electrical control wiring or replace the cable. • Clean the condenser. • Clear the dirty blockage in front of the unit's return air outlet. • Repair or replace the fan when it is not due to a power outage.
17	1# Low voltage lockout 2# Low voltage lockout	• Refrigerant leaks. • The electronic expansion valve is working abnormally.	• Check for leaks and replenish refrigerant after repairs. • Replace the electronic expansion valve.

NOTICE

Lock-type alarms (such as "1# high voltage lock") need to be manually cleared by first powering off and then powering on the chiller, and other alarms are automatically cleared when the current scene does not meet the alarm conditions.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

5.3.6 DC/DC Fault List

table 5-10 DC/DC Fault List

No.	Fault name	Common causes	Corrective measures
1	Fan alarm fault	When the speed of one of the fans falls below 400 rpm for one minute.	• Check that the control board fan interface terminals are well connected; if they are, the fan itself may be the problem.
2	Bus-side soft start fault and contactor fault	• Busbar soft start fault: After the busbar side slow start contactor has absorbed, the voltage difference between the inner and outer side exceeds 150V and is maintained for 30s. • Busbar contactor fault: After the busbar side contactor has absorbed, the voltage difference between the inside and outside voltage exceeds 30V and is maintained for 30s.	• Check that the control board terminals are well connected, if they are, it may be a problem with the contactor body.
3	Battery side soft start failure and contactor failure	• Battery soft start fault: After the battery side slow start contactor has been activated, the voltage difference between the inner and outer side exceeds 150V and is maintained for 30s. • Battery contactor fault: After the battery side contactor has been absorbed, the voltage difference between the inner and outer side exceeds 30V and is maintained for 30s.	• Check that the control board and the battery side filter board terminals are well connected, if they are, the contactor body may be the problem.

No.	Fault name	Common causes	Corrective measures
4	Module over-temperature fault	The module temperature exceeds the protection value (Infineon: 87 degrees, Vinco: 97 degrees) and is maintained for 100ms.	• Check that the control board to power board terminals are well connected. If there is no abnormality, it may be that the module silicone has not been applied properly.
5	Average battery voltage failure	The total battery voltage in non-charging mode is below the under-voltage value.	Wait for the fault to run again, if it recurs, restart the machine, if the fault persists. • Check that the voltage at both ends of the battery meets the requirements. • Check that the sampling wire from the battery filter board to the control board is not disconnected. Confirm that it is not for the above reasons, consider whether the battery voltage sampling is abnormal and suggest replacing the control board and battery filter board.
6	Battery average over-voltage fault	Battery port voltage exceeds the set value.	Check if the battery overvoltage setting is correct, if the setting is correct the fault still exists, check if the voltage at both ends of the battery meets the requirements. Confirm that it is not for the above reasons, consider whether the battery voltage sampling is abnormal and suggest replacing the battery filter board and control board.

No.	Fault name	Common causes	Corrective measures
7	Battery-side voltage imbalance	Caused by an imbalance between the positive and negative battery voltage inside the machine.	The machine will normally run again after waiting a few minutes for it to return to normal, if the fault recurs. Check if the battery-side half-bus is short-circuited and if BAT+, BAT- and N on the volume control board are short-circuited. If it is the above problem, consider whether the IGBT module is straight through, suggest replacing the main power board; confirm that it is not the above reason, consider driving abnormality, check whether the wiring between the control board and the power is correct, if it is normal, suggest replacing the main power board and control board.
8	Battery-side current overcurrent	Battery-side current overcurrent.	Generally wait a few minutes to return to normal after the machine will run again, if the fault recurs: consider sampling abnormalities, check whether the shunt resistance is abnormal, no then replace the control board.

No.	Fault name	Common causes	Corrective measures
9	Busbar average undervoltag-e	The busbar voltage value is below the preset protection value.	The machine will normally run again after the bus voltage has returned to normal, if the fault recurs. • Check that the load switch is closed. • Verify that the bipolar mode is on. Confirm that it is not one of the above causes, consider the sampling line abnormal and recommend replacing the control board.
10	High busbar voltage	The average value of the busbar voltage in the machine is higher than the protection value.	The machine will normally run again after the bus voltage has returned to normal, if the fault recurs. • Check to see if the system voltage is configured too high. • Check that the voltage protection value is set correctly in the APP. Confirm that it is not one of the above causes, consider the sampling line abnormal and recommend replacing the control board.

No.	Fault name	Common causes	Corrective measures
11	Busbar voltage unbalance	Caused by a positive or negative voltage imbalance on the internal busbar of the machine.	The machine will normally run again after waiting a few minutes for it to return to normal, if the fault recurs. • Consider whether the PV-side half-bus is short-circuited, whether the PV-side module is straight through, and use a multimeter to measure whether PV+ and PV N or PV- and PVN are short-circuited. • Is the module driver abnormal, check the driver cable. If the above problem is found, it is recommended that the main power board be replaced.
12	Software version mismatch fault	The machine dipswitch does not match the set model.	If the fault occurs repeatedly: check whether the DIP switch of the machine matches the set model, if so, consider re-burning the program and set it as required.
13	Bus side current overcurrent	Bus side current overcurrent	If the fault recurs. • Check that the maximum charge and discharge current is set correctly. • In constant voltage mode, if the actual power is out of range, this may also cause this phenomenon, so it is recommended that the power is deployed appropriately. Confirm that it is not one of the above causes, consider the sampling line abnormal and recommend replacing the control board.

No.	Fault name	Common causes	Corrective measures
14	DC/DC inductor current 1 overcurrent	Inductive current 1 overcurrent.	If the fault recurs. If a fault occurs at the same time as a bus-side overcurrent or a battery-side overcurrent, consider whether the machine is operating in constant voltage mode and the system power allocation is greater than the maximum power of the machine, and suggest a reasonable power allocation. Confirmation of non-above reasons, consider sampling abnormalities, it is recommended to replace the main power board and control board, if still can not be solved, whether with the fault (DC/DC inductor current 6 overcurrent) at the same time, may be inductor inductance is too small resulting in ripple is large to exceed the inductor current threshold, then consider replacing the inductor L3 and L6.
15	DC/DC inductor current 2 overcurrent	Inductive current 2 overcurrent.	If the fault recurs. If a fault occurs at the same time as a bus-side overcurrent or a battery-side overcurrent, consider whether the machine is operating in constant voltage mode and the system is deploying more power than the machine's maximum power, and recommend reasonable power deployment. Confirmation of non-above reasons, consider sampling abnormalities, it is recommended to replace the main power board and control board, if still can not be solved, whether with the fault

No.	Fault name	Common causes	Corrective measures
			(DC/DC inductor current 6 overcurrent) at the same time, may be inductor inductor inductance is too small resulting in a large ripple to exceed the inductor current threshold, at this time consider replacing the inductor L2 and L5.
16	DC/DC inductor current 3 overcurrent	Inductive current 3 overcurrent.	If the fault recurs. If a fault occurs at the same time as a bus-side overcurrent or a battery-side overcurrent, consider whether the machine is operating in constant voltage mode and the system power allocation is greater than the maximum power of the machine, and suggest a reasonable power allocation. Confirmation of non-above reasons, consider sampling abnormalities, it is recommended to replace the main power board and control board, if still can not be solved, whether with the fault (DC/DC inductor current 6 overcurrent) at the same time, may be inductor inductor inductance is too small resulting in a large ripple to exceed the inductor current threshold, then consider replacing the inductor L1 and L4.
17	DC/DC inductor current 4 overcurrent	Inductive current 4 overcurrent.	Same as 16

No.	Fault name	Common causes	Corrective measures
18	DC/DC inductor current 5 overcurrent	Inductive current 5 overcurrent.	Same as 15
19	DC/DC inductor current 6 overcurrent	Inductive current 6 overcurrent.	Same as 14
20	DC/DC inductor current imbalance1	The current of the DC/DC inductor current 1 is unbalanced, and the hardware is abnormal.	Power off and restart, if the fault persists, replace the power board.
21	DC/DC inductor current imbalance2	The current of the DC/DC inductor current 2 is unbalanced, and the hardware is abnormal.	Power off and restart, if the fault persists, replace the power board.
22	DC/DC inductor current imbalance3	The current of the DC/DC inductor current 3 is unbalanced, and the hardware is abnormal.	Power off and restart, if the fault persists, replace the power board.
23	Battery contactor failure	Based on the detection logic, the relay is judged to be either broken or short-circuited (the voltage difference between the internal and external sampling voltage exceeds 30V).	• Check if the contactor is operating: replace the contactor. • Is the wiring correct. • Is the 12V supply normal and the slow start MOS board: replace the control board. • Test the power board BAT + and BAT- for a short circuit: Replace the power board.

No.	Fault name	Common causes	Corrective measures
24	Busbar contactor failure	Based on the detection logic, the relay is judged to be either broken or short-circuited (the voltage difference between the internal and external sampling voltage exceeds 30V).	• Check if the contactor is operating: replace the contactor. • Is the wiring correct. • Is the 12V supply normal and the slow start MOS board: replace the control board. • Test the power board PV+ and PV- for a short circuit: Replace the power board.
25	Battery soft-start failure	Soft-start failure on the battery side during start-up (voltage difference between internal and external sampling voltage exceeds 150V).	Reboot the appliance if the fault persists. • Battery-side full bus short \ Battery-side module straight through: Replace power board. • Confirm that it is not for the above reasons and the fault still exists, consider the soft start driver board damaged and recommend replacing the control board.
26	Busbar soft start fault	Bus-side soft-start fault during start-up (voltage difference between internal and external sampling voltage exceeds 150V).	Reboot the appliance if the fault persists. • PV-side bus short-circuited, PV-side module straight through: Replace power board. • Check that the wiring and 12V supply are normal: if the problem persists after replacing the core board, replace the control board. • Whether the slow start contactor operates or not: Replace the slow start contactor.

No.	Fault name	Common causes	Corrective measures
27	Reverse polarity on the bus side	In the non-running state, the bus voltage sampling is judged to be less than -200V for 1s.	Reboot the appliance if the fault persists. • After power failure, check that the wiring on the busbar (PV) side is correct. • Check that the polarity of the busbar is correct.
28	DC/DC hardware failure	Caused by a hardware protection signal being detected. Causes are: battery overcurrent, busbar overcurrent, busbar overvoltage, battery overvoltage, CPLD abnormality, inductor overcurrent, control electrical low voltage fault, battery overcurrent.	Usually recovers automatically without treatment, if the fault recurs. Consider battery overcurrent, busbar overcurrent, busbar overvoltage, battery overvoltage, CPLD anomaly, inductor overcurrent, control electrical low voltage fault, battery overcurrent.

No.	Fault name	Common causes	Corrective measures
29	Module temperature too high	Power module temperature exceeds protection value (Infineon: 87 degrees Vinco: 97 degrees).	The machine will normally run again after the internal temperature or module temperature has returned to normal, if the fault recurs. • Check that the ambient temperature of the machine is not too high. • Check that the machine is in a place where it can be easily ventilated. • Check that the machine is not in direct light, if so please shade it appropriately. • Check that the fan is running properly, if not replace the fan. Confirm that it is not for the above reasons, consider NTC sampling abnormalities and suggest replacing the main power board, or if that does not solve the problem, replace the control board.
30	Fault in bus-side lightning protector	Damage to the bus-side surge protector was detected.	Check if the lightning protector is loose or damaged and replace it if it is damaged.

No.	Fault name	Common causes	Corrective measures
31	Low battery insulation resistance	Battery insulation impedance to ground is less than the preset value.	Usually it will recover automatically without treatment, but if it occurs repeatedly, the machine will not start normally. • Check that the ISO impedance protection value set by the device is not too high and confirm that it meets the requirements. • Check if the battery impedance is too low on rainy days or in the morning and evening, and measure if the positive and negative battery insulation impedance values to ground are too low. Please contact Sungrow Customer Service to confirm that the fault is not due to the above reasons and that the fault still exists.
32	Analogue bias exception	• The bias value of the channel sample exceeds the theoretical reference value by 15%. • Before switching on, DC current, AC current sampling value exceeded the quota by 15%.	Restart the appliance and if the fault recurs. • Check for loose internal connections. • Is the core board indicator normal, if not then replace the core board. Confirm that it is not the above cause, re-burn the program, and if that does not solve the problem, replace the control board.
33	Parallel communica-tion failure	There is an abnormality in the parallel machine communication.	• Try a machine power down and restart. • Check that the parallel communication cable is not loose.

No.	Fault name	Common causes	Corrective measures
34	High ambient temperature	Abnormally high temperature in the chassis; High operating environment temperature.	The machine will normally run again after the internal temperature or module temperature has returned to normal, if the fault recurs. • Check if the ambient temperature of the machine is too high. • Check that the machine is in a place where it can be easily ventilated. • Check that the machine is not in direct light, if so please shade it appropriately. • Check that the fan is running properly, if not replace the fan. • Test the core board indicator is correct, if not normal please replace the core board, if normal re-burning program, if still can not solve, consider the ring temperature sampling abnormal, need to replace the control board.
35	Battery polarity reversed	In the non-running state, the battery-side voltage sampling is judged to be less than -200V for 1s.	If the fault recurs. • Check that the battery side wiring and input polarity are correct. • Check that the battery filter board and the control board are not plugged in backwards. Confirm that the above is not the cause, consider sampling anomalies and recommend replacing the battery filter board and control board.
36	Fan alarms	Times out when fan speed is detected below the minimum duty cycle speed.	To check the machine fan, turn off the machine, disconnect it from the power supply to remove

No.	Fault name	Common causes	Corrective measures
			foreign objects and replace the fan if it is damaged.

The corrective measures mentioned above are for reference only. In case of any fault, please contact the Customer Service Center of SUNGROW for professional solutions.

6 Appendix

6.1 Quality Assurance

When product faults occur during the warranty period, SUNGROW ENERGY STORAGE TECHNOLOGY CO., LTD.(SUNGROW) will provide free service or replace the product with a new one.

Evidence

During the warranty period, the customer shall provide the product purchase invoice and date. In addition, the trademark on the product shall be undamaged and legible. Otherwise, SUNGROW has the right to refuse to honor the quality guarantee.

Conditions

- After replacement, unqualified products shall be processed by SUNGROW.
- The customer shall give SUNGROW a reasonable period to repair the faulty device.

Exclusion of Liability

In the following circumstances, SUNGROW has the right to refuse to honor the quality guarantee:

- The free warranty period for the whole machine/components has expired.
- The device is damaged during transport.
- The device is incorrectly installed, refitted, or used.
- The device operates in harsh conditions beyond those described in this manual.
- The fault or damage is caused by installation, repairs, modification, or disassembly performed by a service provider or personnel not from SUNGROW.
- The fault or damage is caused by the use of non-standard or non-SUNGROW components or software.
- The installation and use range are beyond stipulations of relevant international standards.
- The damage is caused by unexpected natural factors.

For faulty products in any of above cases, if the customer requests maintenance, paid maintenance service may be provided based on the judgment of SUNGROW.

6.2 Contact Information

In case of questions about this product, please contact us.

We need the following information to provide you the best assistance:

- Model of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

For detailed contact information, please visit: **https://en.sungrowpower.com/contactUS**.

SUNGROW

Sungrow Power Supply Co., Ltd.

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