

Operation & Maintenance Instruction

PowerStack-ST215kWh-100kW-2h/
ST225kWh-110kW-2h



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About This Manual

This manual describes the commissioning, troubleshooting, and maintenance of the energy storage system (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.sungrow-power.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.
	In case of contact with eyes, rinse the eyes immediately with running water or normal saline; and seek medical help in time.

Marks	Explanation
	It is required to wear goggles.
	This symbol indicates that the product can be recycled.
 Li-ION	This symbol indicates that lithium batteries can be recycled.

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1 System Description

1.1 System Description

The following standard liquid-cooled energy storage system is selected for illustration. The typical functional block diagram of the energy storage system is shown below, the core equipment mainly consists of power conversion system (PCS), power distribution cabinet (PMD), batteries, energy management system (EMS), local controller (LC), etc., and the auxiliary system mainly consists of liquid cooling system (LCS), fire suppression system (FSS), lighting system, etc.

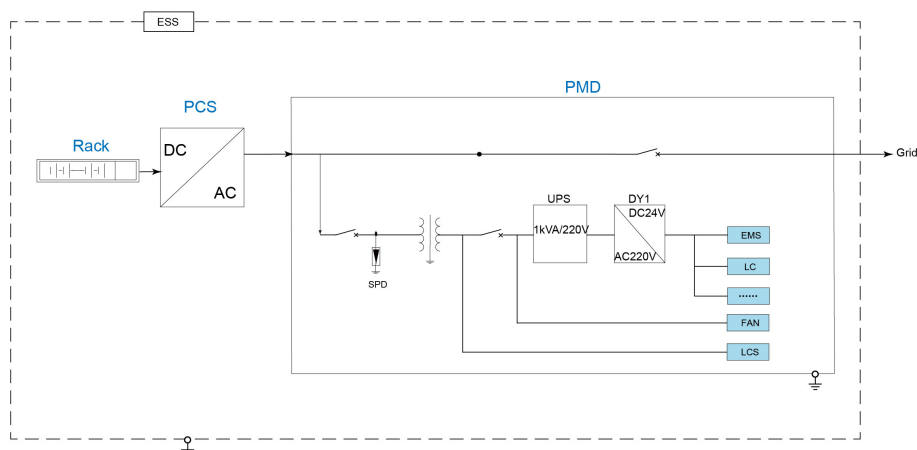


figure 1-1 Functional Block Diagram of Energy Storage System

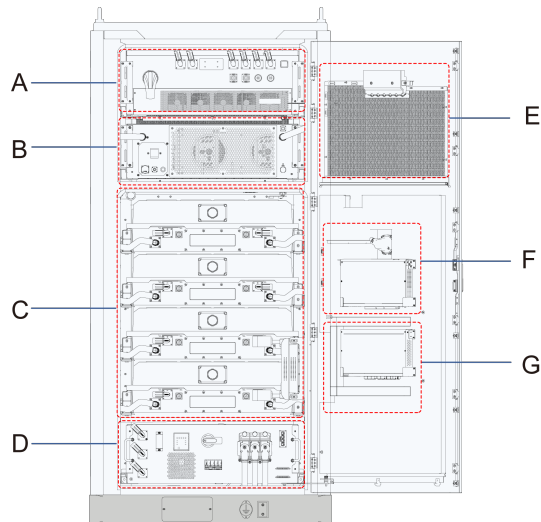
*The above pictures are for reference only, please refer to the actual product received!

1.2 System Configuration

A list of individual system configurations is shown below.

Model	No./Pcs	Notes
ST215kWh-100kW-2h	1	240S1P LFP battery + SC125CX + PMD + FSS + Temperature control system
ST225kWh-110kW-2h	1	256S1P LFP battery + SC125CX + PMD + FSS + Temperature control system

The main electrical equipment in the energy storage system (ESS) is shown schematically in the diagram below.

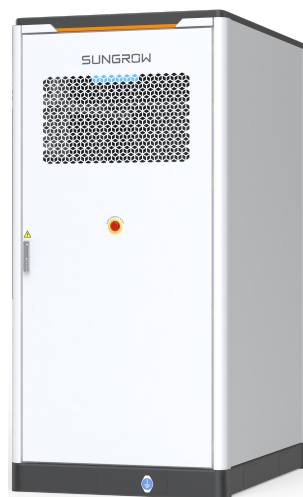


*The above image is for reference only. Please refer to the actual product you received!

table 1-1 Internal equipment description

No.	Name
A	Power conversion system (SC125CX)
B	Liquid cooling unit
C	Battery clusters (compartments)
D	Power distribution cabinet (PMD)
E	Stainless steel ventilation mesh
F	LC300
G	EMS300CP

The physical diagram of the ESS is shown below.



*The above image is for reference only. Please refer to the actual product you received!

1.3 Communication Architecture

The system is mainly composed of EMS, LC, PCS and CMU.

- Each LC completes the acquisition of the liquid cooling system, battery, PCS, and related I/O nodes (including UPS utility inputs, lightning protectors, system emergency stops and hatch access control node status, etc.).
- A single system consists of LC summarizing system data and uploading it to the client EMS. and LC completes a series of functions such as system protection, alarm management, data monitoring, energy management, and so on.
- When it is necessary to realize the cascade of multiple systems, it is necessary to equip one additional EMS of our company, which communicates with LC, supports data on the cloud, and can be monitored remotely.

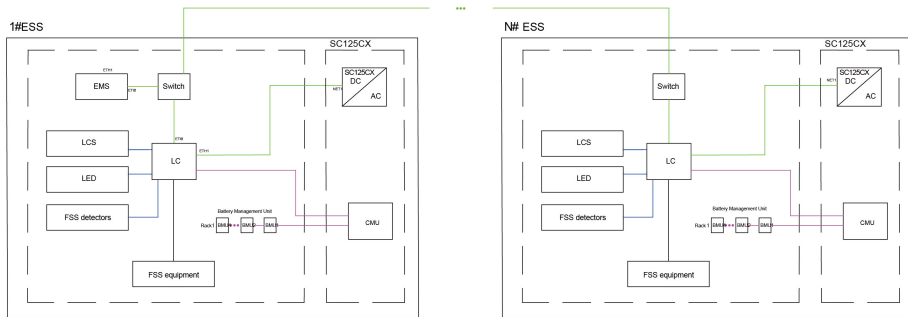


figure 1-2 Communication Architecture Diagram

*The above image is for reference only. Please refer to the actual product you received!

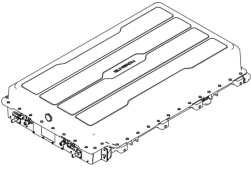
2 Introduction to System Subunits

2.1 Battery

Standardized and unitized battery modules are developed based on lithium iron phosphate cells. Battery modules are connected in series to form a battery cluster. The battery clusters are connected to the supporting power conversion system (PCS) to form energy storage systems(ESS) and store and release electric energy.

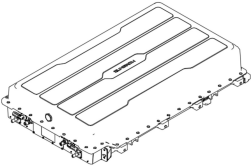
Battery Module

table 2-1 LFP battery parameters 1

LFP battery module	Parameter	Value*
	Model	P537AL-181/ P537BL-181
	Size (W*H*D (without terminals, spigots))*	(868 ± 5 mm) * (247 ± 5 mm) * (1442 ± 5 mm)
	Multiplying power	≤0.5 C
	Cell type	Prismatic aluminum shell LFP
	Combination	1P60S
	Weight (without coolant)*	(380 ± 11) kg
	Degree of protection	IP65

*Indicates that the parameter values are for reference only, please refer to the actual project!

table 2-2 LFP battery parameters 2

LFP battery module	Parameter	Value*
	Model	P573AL-181/ P573BL-181
	Size (W*H*D (without terminals, spigots))*	(868 ± 5 mm) * (247 ± 5 mm) * (1442 ± 5 mm)
	Multiplying power	≤0.5 C
	Cell type	Prismatic aluminum shell LFP
	Combination	1P64S
	Weight (without coolant)*	(400 ± 12) kg
	Degree of protection	IP65

*Indicates that the parameter values are for reference only, please refer to the actual project!

Battery Cluster

The battery cluster is composed of PACKs, fuse, etc.

Battery cluster parameters are shown as follows:

table 2-3 Battery cluster parameters 1

Parameter	Value*	Parameter	Value*
Model	R0215BL-AHAA	Rated power	107 kW
Nominal voltage	768 V	DC output voltage range	648 V ~ 876 V

*Indicates that the parameter values are for reference only, please refer to the actual project!

table 2-4 Battery cluster parameters 2

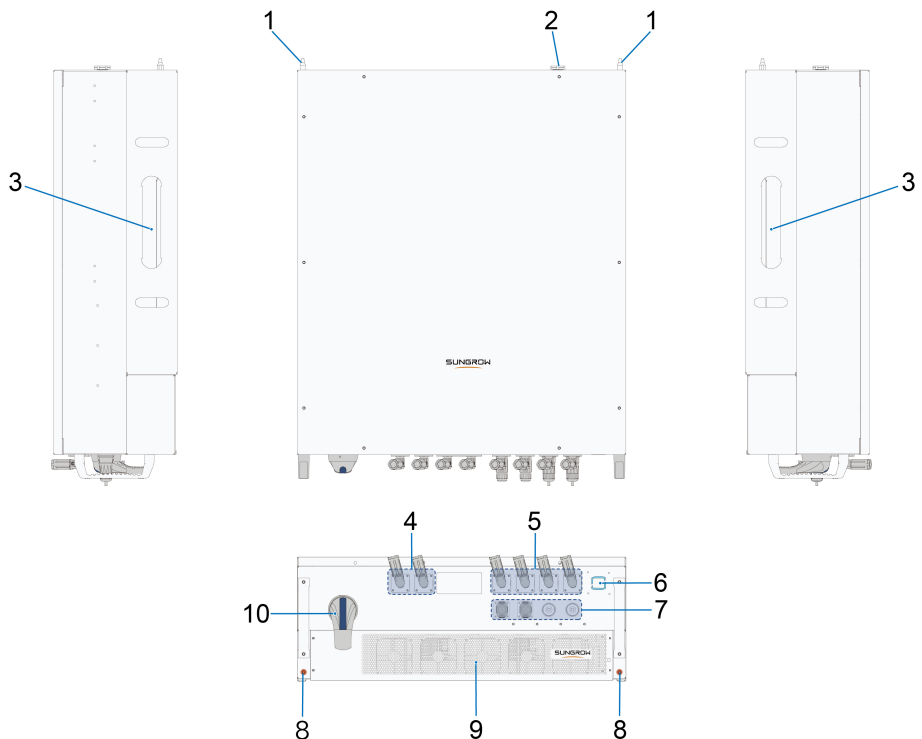
Parameter	Value*	Parameter	Value*
Model	R0229BL-AHAA	Rated power	114 kW
Nominal voltage	819.2 V	DC output voltage range	691.2 V ~ 934.4 V

*Indicates that the parameter values are for reference only, please refer to the actual project!

2.2 Power Conversion System (PCS)

One SC125CX is built into the energy storage cabinet for monitoring, energy transfer and signal interaction of the battery clusters.

The exterior of the SC125CX is shown in the figure.



*The figure shown here is for reference only. The real product may differ.

No.	Name	Description
1	Locating pin	Used to restrict the free movement of the PCS.
2	Vent valve	Resistant to dust and water; air permeable.
3	Guide rail	Used for the transport, installation, and removal of the device.
4	DC input port	DC wiring area.
5	AC output ports	AC wiring area.
6	LED indicator	Indicates the current operating status.
7	Communication ports	Communication wiring area.
8	*Additional grounding terminal	Terminal used for additional protective grounding, as specified in EN 50178.
9	Air inlet cover	Fans are installed at the back of the cover plate, used for forced cooling.
10	DC switch	Used to disconnect the equipment from the battery safely.

2.3 Power distribution box (PMD)

The energy storage cabinet contains 1 distribution box with the following main functions.

- Connect the PCS AC measurement output to the client.
- Provides auxiliary power to the system.
- Communicate with the LC through the network port for data transmission and control of the liquid-cooled unit.

The appearance of the distribution box is shown in the figure.

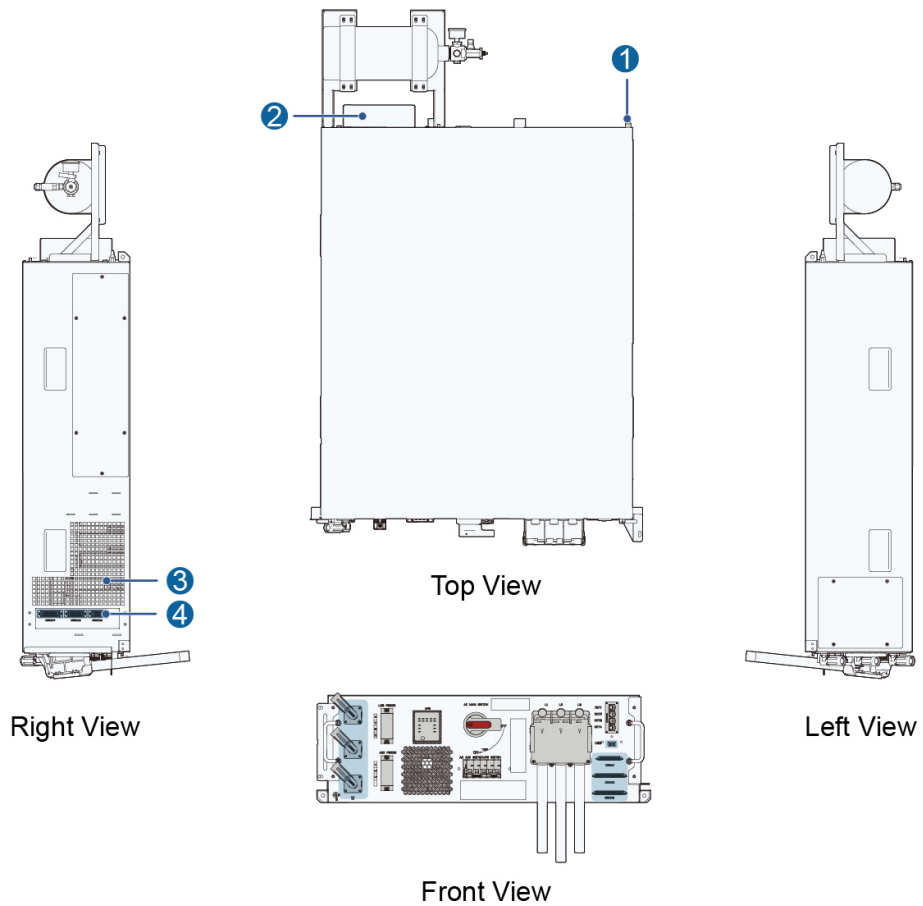


figure 2-1 External Design of Power Distribution Box

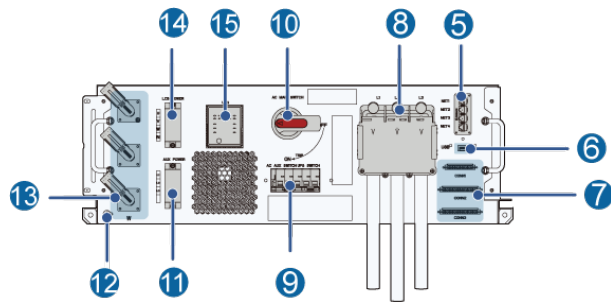


figure 2-2 Operation Panel

*The figure here is for reference only and the real product may differ.

No.	Name	Description
1	Locating pin	Used to restrict the free movement of the power distribution box.
2	Air outlet	Used to exhaust the circulating hot air from the power distribution box.

No.	Name	Description
3	Air inlet	Used to bring circulating cool air into the power distribution box.
4	Connection ports 4–6	Used for power supply or communication wiring of the 24Vdc device inside the cabinet.
5	Communication port	Used for the communication wiring of the equipment.
6	USB port	Port for system operation log transfer.
7	CONN1–3	Ports for FSS, LC, and EMS.
8	AC output port	Used for AC output wiring of the equipment.
9	Miniature circuit breaker (MCB)	Q1 AC auxiliary power supply and UPS control switch.
10	AC MAIN SWITCH	Used to disconnect the equipment from the loads safely.
11	*AUX POWER	Used for external power supply wiring.
12	Additional protective grounding terminal	Terminal used for additional protective grounding, as specified by EN 50178.
13	AC input port	Connected to PCS AC side.
14	LCS POWER	Used for power supply wiring of the liquid cooling unit.
15	UPS	Uninterruptible power supply.

*The system is provided with an internal power supply as standard equipment.

2.4 Local Controller (LC)

LC mainly realizes the response to the upper computer scheduling, monitors the system faults and alarms, collects the data of the sub-devices to ensure that the system can be operated safely and normally, and at the same time manages and schedules the sub-devices, such as the PCS, batteries, and medium-voltage modules.

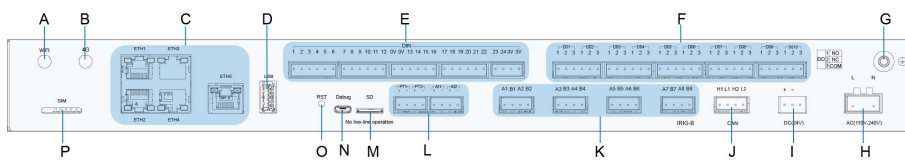


figure 2-3 Wiring Port Schematic

*The figure is for reference only and the actual product shall prevail!

Item	Remark	Name	Description
A	WIFI	WIFI communication port	Reserved function
B	4G	4G communication port	Reserved function

Item	Remark	Name	Description
C	ETH1~ETH5	Ethernet port	The ports can be connected to the master station in the background via devices such as the switch and router, and can be used for devices downstream (it can be configured to connect the PV inverter, the PCS, or the like)
D	USB	USB port	Software upgrade port
E	DIN	Digital input	Dry contact input port
F	DO1~DO10	Digital output	Relay output ports (relay specification: 250Vac/3A or 30Vdc/3A)
G		Grounding port	Used for grounding
H	AC (110V~240V)	AC power supply port	Connected to 110~240Vac power supply (50/60Hz), and current $\leq 0.5A$
I	DC(24V)	DC24V power supply port	The current is $\leq 2.0A$, and the insulation of the switch power supply used for this port needs to be reinforced
J	CAN	CAN communication port	Reserved function
K	A1B1~A8-B8	RS485 communication port	Support 8 inputs of RS485, or can be connected to the slave station devices or the background
L	PT1、PT2、AI1、AI2	Analog input	Reserved function
M	SD	SD card port	Reserved function
N	Debug	Debugging port	Used to debug the controller
O	RST	Reset port	Used for hardware reset of the controller
P	SIM	SIM card port	Reserved function

2.5 Temperature Control System

The design of the temperature control system includes the heat dissipation of the PCS, liquid-cooled unit, PACK and distribution box. The PCS compartment and the liquid-cooled unit compartment adopt air-cooled cooling, the battery compartment adopts liquid-cooled cooling, and the distribution compartment adopts forced convection with the battery compartment to dissipate heat.

- PCS and liquid-cooled units share a common air inlet and adopt the method of forced air-cooling to dissipate heat in the way of forward air and rear air outlet.

- The PACK delivers coolant to the battery's liquid-cooled plates through the liquid-cooled piping to complete the heat exchange of the battery system.
- The front and rear of the distribution box are equipped with a spoiler fan, which utilizes the heat leakage from the liquid-cooling plates and liquid-cooling lines in the battery compartment for heat exchange.

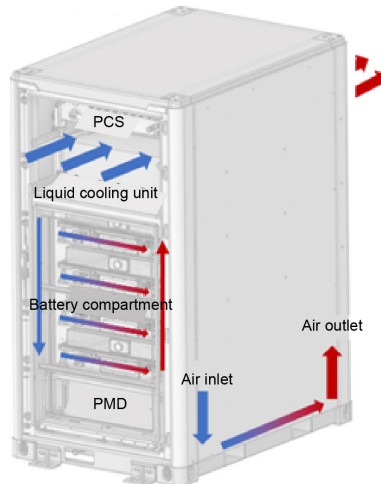


figure 2-4 Schematic diagram of heat dissipation method

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

Liquid cooling system is the core of the whole energy storage cabinet temperature control design, liquid cooling system has two levels of piping, the first level of piping is responsible for transporting the coolant processed by the liquid cooling unit to the second level of piping of each PACK, and the diode road is responsible for transporting the coolant to the liquid cooling plate of each PACK, which ultimately realizes the cooling or heating of the PACK.

2.6 Fire Suppression System (FSS)

The fire suppression system of the energy storage battery cabinet is installed inside the outdoor cabinet, and each outdoor cabinet is installed with an independent fire suppression system. The fire suppression system inside each outdoor cabinet can work independently without interfering with each other.

The fire suppression system of the energy storage battery cabinet contains three parts: detection and alarm system, fire extinguishing system, and backup system.

NOTICE

The detector requires regular maintenance, the maintenance program is to use a hair dryer to remove the dust inside the detector. After removing the dust, use the sensible test equipment to check the smoke concentration of the detector, and the smoke concentration less than 3mg/m³ is qualified. Installation conditions up to IP54, maintenance cycle is 3 months; installation conditions up to IP65, maintenance cycle is 12 months; installation conditions up to IP66, maintenance cycle is 36 months.

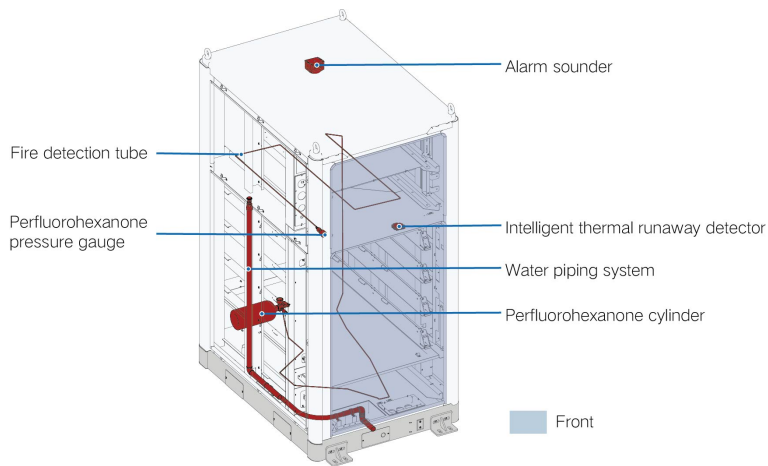


figure 2-5 Fire extinguishers

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

table 2-5 Introduction to the main components of FSS

No.	Items	Description
1	Detection and alarm system	Detection and alarm system can minimize the likelihood of fires by detecting fires at the earliest possible stage. - The detection and alarm system consists of a thermal runaway smart detector and an audible and visual alarm. - Thermal runaway intelligent detector can detect both temperature and gas concentration, and send out an alarm signal when the temperature or combustible gas concentration in the outdoor cabinet reaches the alarm threshold. - The alarm signal is uploaded to the LC, which controls the current outdoor cabinet shutdown and audible and visual siren activation.
2	Fire extinguishing system	The fire extinguishing system for the storage battery cabinet is a perfluorohexanone fire detection tube type fire extinguishing device. - When the temperature inside the outdoor cabinet reaches 170°C, the fire detection tube will automatically rupture, and the perfluorohexanone fire extinguisher can be released from the rupture of the fire detection tube to the inside of the outdoor cabinet to extinguish the fire. - At the same time as the perfluorohexanone extinguisher is released, the pressure switch feeds the extinguishing agent release signal back to the LC, which controls the current outdoor cabinet shutdown and audible and visual alarm activation.
3	Backup system	In addition to the fire suppression system, the storage battery cabinet also has a backup system in case the fire continues to spread after the fire suppression system has been activated. If the fire continues to spread after the fire extinguishing system has been activated, the customer can activate the backup system to extinguish the fire after the outdoor cabinet has been de-energized. ⚠ WARNING The user is required to have a fire hose that is properly connected to the water line inside the cabinet. Otherwise this backup system cannot be used. The water pressure at the reserved connection of the backup system should be not less than 0.079MPa

No.	Items	Description
		and the total flow rate should be not less than 81.55L/min.
		When the temperature around the sprinkler nozzle reaches 68°C, the glass ball of the sprinkler nozzle automatically breaks and the nozzle opens. The water flows into the battery compartment through the pipelines inside and outside the outdoor cabinet, submerging the battery packs in the battery compartment, thus achieving the effect of cooling and fire extinguishing. The pipe diameter of the reserved interface of the water pipeline is DN25, the pipeline outside the outdoor cabinet needs to be designed and installed by the customer, and connected with the reserved interface inside the outdoor cabinet. • Manual fire extinguishing: For the situation that there are fire engines or other movable equipments at the scene. It is necessary to lay a good water supply pipeline at the scene in advance, one end of the water supply pipeline is connected with the reserved interface in the outdoor cabinet, and the other end is connected with the fire truck or other movable equipment to extinguish the fire by manually filling the water. • Automatic fire extinguishing: for the case where there is a fire fighting pool on site. One end of the water supply pipeline is connected to the reserved interface in the outdoor cabinet, and the other end is connected to the fire fighting pool, and the water in the fire fighting pool automatically flows into the water supply pipeline to extinguish the fire.

3 Commissioning

3.1 Check Before Power-up

Personnel requirements

- Personnel engaged in on-site commissioning must have no severe physical or sensory defects and must possess a certificate recognized by the relevant national labor safety inspection authority after undergoing training, examination, and qualification evaluation conducted by the relevant authorities before performing electrical operations.
- They must be proficient in first aid for electric shock.
- The on-site commissioning personnel should be focused and should always consider all lines as "live" before confirming that they are neutral with a multimeter. They should not touch the lines with their bare hands.
- Before commissioning, the personnel should carefully check whether the tools they use are safe and reliable and wear necessary PPE in order to avoid accidents during work.

Checking energy storage cabinet

- Check the positive and negative battery RACK wiring, PCS, PMD, RACK fuse, etc. should be wired correctly.
- Check the battery RACK, PCS, PMD, RACK fuse and other wiring wiring should not be loose.
- Check that the communication wiring of the battery RACK, PCS, PMD, and liquid-cooled unit control box should be reliably connected.
- Check that the battery RACK, PCS, PMD, and liquid cooling unit should be reliably grounded.
- Check for coolant leakage from the battery PACK as well as the liquid cooling pipes.
- The load switch on the PCS and PMD should be in the open state.

3.2 Powering on Steps

Before powering up, the equipment must be comprehensively and meticulously inspected to ensure that all indicators are in line with the requirements before powering up.

- The power and communication wiring of the ESS have been completed.
- The outdoor temperature is in the range of -30°C to 50°C.



It is not recommended to power on the equipment at temperatures below -30° C. If the temperature is too low, it will take 24 hours or more for the system to heat the cells. During this period, the system cannot operate normally.

Step 1 Turn the PCS DC load switch handle to "ON" and the cabinet emergency stop is reset.

Step 2 Turn on the QF1 (AC MAIN SWITCH) on the panel to power the AC side of the system.

Step 3 Turn on the Q1 (AC AUX SWITCH) on the panel to power on the auxiliary power supply.

Step 4 Turn on the Q2 (UPS SWITCH) on the panel, and press the power button on the UPS. The system auxiliary power supply will start working (devices including the switch and LC have all been powered on).

Step 5 Long press the UPS switching power supply to turn on the UPS power supply, at this time the auxiliary power supply is complete.

Step 6 Open the liquid-cooled unit panel and close the liquid-cooled unit switch.

Step 7 Start up the system through the control software.

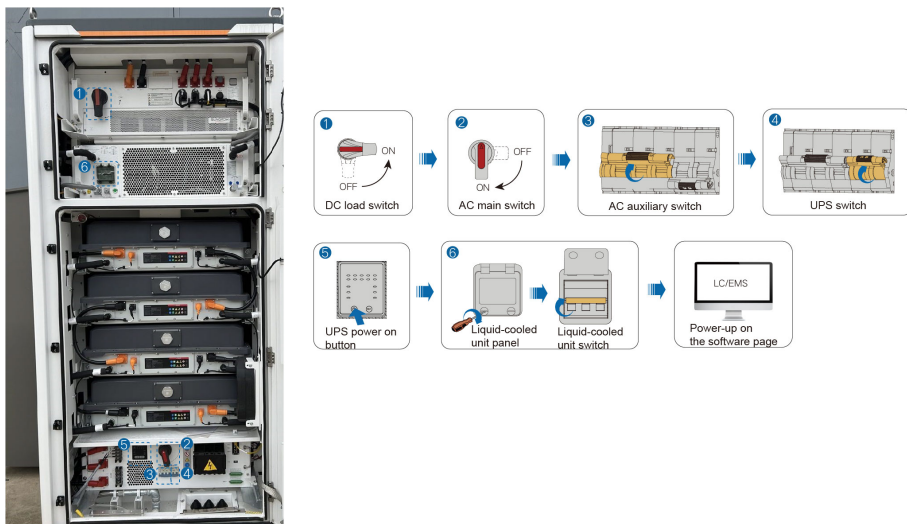


figure 3-1 Powering on Steps

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

- - End

WARNING

If the circuit breaker is de-energized during power-up, pause to close the other circuit breakers and immediately check the lower load of the de-energized circuit breaker for short circuits, etc.



- Auxiliary power supply supplies power to devices such as switches, LCs, and fans.
- The liquid cooling unit may have been closed before leaving the factory, and when powered on, only the closing status needs to be checked.

3.3 Pre-run Preparation

- Check and repair the faults displayed by the system after powering up.
- Verify whether the software version is correct.
- Go to the web interface of LC respectively, and check whether the parameter configuration files are correct. Never modify the configuration parameters.
- When the system is stored in a low-temperature environment for a long period of time without power, and the temperature of the battery cell is below the charging/discharging starting conditions, the energy storage system cannot be started directly. Before starting the system, connect the auxiliary power supply, and switch on the liquid cooling unit to warm up the battery cells. The warm-up time depends on the original temperature of the cells. In case of extreme low temperature (e.g. the cell temperature is -30 °C), it may be necessary to switch on the liquid cooling unit two days in advance to warm up the battery cells.

3.4 Commissioning

3.4.1 Commissioning of Communication Functions

Step 1 Reassign the sub-device addresses according to the address assignment requirements on site.



It is recommended to modify the IP address with which the LC is connected to the EMS according to the customer's requirements, while the default IP addresses of other sub-devices should not be modified.

Step 2 The data of LC devices and sub-devices should be readable on the background monitoring (EMS) interface.

Step 3 The system stop/start commands and charging/discharging power commands issued through the backend monitoring (EMS) interface should be able to realize the corresponding functions.

Step 4 Modifying control parameters on the background monitoring (EMS) interface should result in the corresponding functions.

-- End

3.4.2 Start-stop Function Debugging



The content described in this subsection is based on the standard version of the interface as an example, the actual interface may be adjusted, the actual interface shall prevail.

Pre-login preparation

- Configure the IP address of the PC to be in the same network segment as the IP of the device.

- Connect the PC to the ETH2 port of the device.
- The IP address of the ETH2 port is 192.168.0.100 by default, and you can configure the PC's IP to be 192.168.0.99 with a subnet mask of 255.255.255.0.

Step 1 Log in to the LC Web interface.

- 1 Use an Ethernet cable to connect the PC to the device.
- 2 In the PC address bar, enter the IP address of the LC, e.g. 192.168.0.100, and enter the login page as shown below.



Please refer to the actual project configuration for IP address!

- 3 Enter your username and password. Click **Login**.



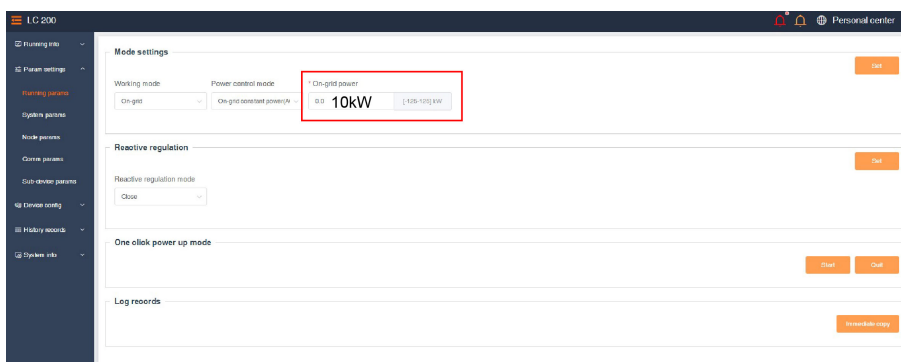
The system has two user roles **operator** and **admin**.
User passwords need to be obtained by contacting Sungrow.

- 4 In the upper right corner of the interface, select the desired language.

Step 2 Click the Start button on the LC main interface and observe whether the power, voltage, current and temperature of the sub-device are normal.

Step 3 Click “Param settings→Running params→Mode settings” to gradually add power to full power operation.

- 1 The discharge power of 10kW is given first.



- 2 Click “Running info→PCS info” to view the current system power value of the PCS.

Working mode		Working status		Charging/Discharging status	
Active power	50W	DC power	50W	Reactive power	50W
DC voltage	V	DC current	A	A-B line voltage	V
B-C line voltage	V	C-A line voltage	V	Phase A current	A
Phase B current	A	Phase C current	A	Alarm running status 1	
Fault status 1		Fault status 2		Daily charge energy	50Wh
Daily discharge energy	50Wh	Total charge energy	50Wh	Total discharge energy	50Wh
Daily charge minutes	min	Daily discharge minutes	min	Total charge time	s
Total discharge time	s	Grid frequency	Hz	Power factor	
Apparent power	50VA	Current number of black start tests		ASPM version	
OSP version		OSPD version			

Step 4 Repeat the operation in step 3, and the grid power is given as 50kW, 125kW, -10kW, -50kW, -125kW, respectively, and check whether the PCS power is the set value.

Step 5 If the trial runs with no alarms and no faults, the trial is normal and LC shutdown can be used.

-- End

3.4.3 Charge/Discharge Cycle Commissioning

Step 1 The background monitor performs a full charge-discharge cycle based on the actual charge/discharge status of the battery RACK in the battery container, and calibrates the battery SOC to ensure balanced SOC.

Step 2 Observe the voltage, current, temperature and other parameters of battery RACK and single cells, which should be normal during charging and discharging.

Step 3 Observe the DC/AC power converter unit voltage, current, and temperature data, which should be normal.

Step 4 Observe whether there is a large deviation in the cell voltage difference, temperature difference and SOC of the RACK.

-- End

4 Routine Maintenance

4.1 Precautions Before Maintenance

WARNING

- Do not open the door to maintain the device 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.

WARNING

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

NOTICE

In the event of heavy snowfall at the project site, please clear the snow from the top of the equipment and the surrounding area in a timely manner.



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

4.2 Container Maintenance

4.2.1 Appearance Repair



Check if the protective paint sprayed on the enclosure of the product fell off or peeled off. If so, repair it timely.

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

Solutions

Select different repair solutions based on the damage conditions.

Conditions	Solutions
Surface dirt that can be wiped off	"4.2.1.1 Detergent Cleaning"
Finish paint falls off, and the primer is intact	"4.2.1.2 Finish Paint Repair"
Primer is damaged, and the base material is exposed	"4.2.1.3 Double-Layer Paint Repair"

4.2.1.1 Detergent Cleaning

For dust or stains on the product surface, you can wipe them off using water and alcohol.

Prepared by Users

table 4-1 Cleaning Tools

No.	Item
1	Cleaning cloth
2	Water
3	Alcohol or other non-corrosive detergents

Step 1 Wet the cleaning cloth (or other scrubbing tools) with water, and scrub the dirty parts on the surface.

Step 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.)



-- End

4.2.1.2 Finish Paint Repair

For minor scratches or surface paint chalking, where the finish paint has peeled off, but the base material is not exposed, finish paint repair is needed to restore the product appearance.

Finish Paint Selection and Mixing

table 4-2 Finish Paint Selection and Mixing

Brand and Model	Chemical Component	Mixing Ratio	Thinner	Drying Time (Minimum)
Jotun Finish Coat	Two-component chemically cured aliphatic	Main component : Hardener= 10:1 (Volume Ratio)	Jotun Thinner No.10	5°C 24h
Hardtop XP or Hardtop XPL				10°C 12h
				23°C 5h
				40°C 3h
AkzoNobel Finish Paint	Two-component acrylic polyurethane paint	Main component : Hardener= 6:1 (Volume Ratio)	International GTA056	5°C 24h
Interthane 990				25°C 6h
				35°C 4h



- Confirm with SUNGROW before using paints of other brands or models.
- When using a two-component paint, first thoroughly agitate each component individually, and then mix them in the specified proportions for stirring.
- Add the thinner only after the paint and hardener have been mixed.
- Do not use paint that has exceeded its shelf life.

Prepared by Users

table 4-3 Cleaning Tools

No.	Item
1	400 mesh/600 abrasive paper
2	Cleaning cloth
3	Alcohol
4	Brush
5	Finish paint
6	Film thickness meter

Environment Requirements

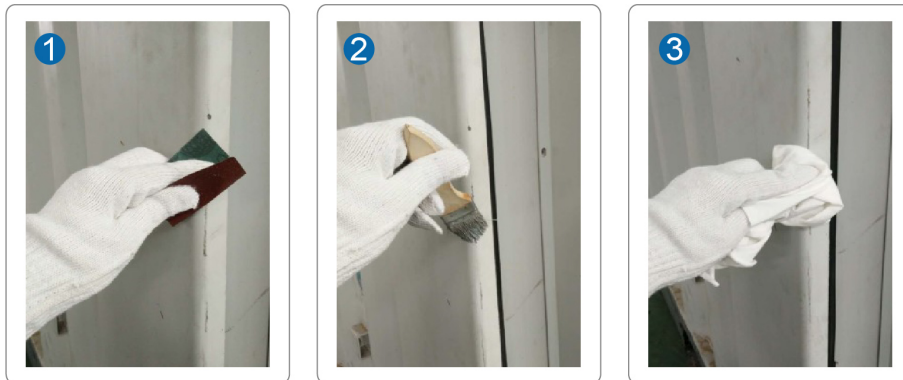
- Ambient temperature: 5°C–40°C
- Base material temperature: 5°C–60°C
- Relative humidity: 10%–85%RH

Repair Steps

Step 1 Polish the paint surface with blistering or scratches with an abrasive paper to expose the gray primer. Use a film thickness meter to measure the primer thickness, which must be at least 150μm.

Step 2 Use a clean brush to remove any residue from the surface.

Step 3 Use a piece of clean cloth dipped in alcohol or detergent to remove the surface powder.



Step 4 Repair the finish paint.

- 1 Prepare the finish paint with the same color as the appearance.

Common finish paint colors

i RAL7035 (Streamer Grey) 	RAL9003 (White) 	RAL7016 (Dolphin Grey) 
---	--	--

- 2 Mix the finish paint according to the paint model and the requirements of "[table 4-2 Finish Paint Selection and Mixing](#)".
- 3 Apply the finish paint using a brush in a crosshatch pattern. Once the paint fully dried, measure the film thickness using a film thickness meter. Ensure that the single coat thickness falls between 50μm–100μm.



- 4 When applying multiple layers of paint, wait for each layer to dry completely before applying the next. The total thickness of the primer and finish paint must be at least 240μm.

Step 5 Inspect the paint to ensure it has a uniform color, smooth transitions, and meets the required film thickness.

- - End

4.2.1.3 Double-Layer Paint Repair

If the rusted area is large, or there are deep scratches or dents that expose the base material, perform a double-layer paint repair, including both a primer and a finish paint.

Primer and Finish Paint Selection and Mixing

table 4-4 Primer and Finish Paint Selection and Mixing

Brand and model	Chemical Component	Mixing Ratio	Thinner	Drying Time (Minimum)
Jotun Primer	Two-component epoxy paint	Main component : Hardener= 3.5:1 (Volume Ratio)	Jotun Thinner No.17	5°C 30h
Jotamastic 90				10°C 10h
				23°C 3h
				40°C 1.5h
AkzoNobel Primer	Two-component epoxy paint	Main component : Hardener= 5.67:1 (Volume Ratio)	International GTA220	5°C 36h
Interseal 670HS				10°C 16h
				25°C 10h
				40°C 4h
Jotun Finish Coat	Two-component chemically cured aliphatic	Main component : Hardener= 10:1 (Volume Ratio)	Jotun Thinner No.10	5°C 24h
Hardtop XP or Hardtop XPL				10°C 12h
				23°C 5h
				40°C 3h
AkzoNobel Finish Paint	Two-component acrylic polyurethane paint	Main component : Hardener= 6:1 (Volume Ratio)	International GTA056	5°C 24h
Interthane 990				25°C 6h
				35°C 4h



- Use primers and finish paints from the same manufacturer.
- Confirm with SUNGROW before using any paint from a different manufacturer.



- When using a two-component paint, first thoroughly agitate each component individually, and then mix them in the specified proportions for stirring.
- Add the thinner only after the paint and hardener have been mixed.
- Do not use paint that has exceeded its shelf life.

Prepared by users

table 4-5 Cleaning Tools

No.	Item
1	400 mesh/600 mesh abrasive paper
2	Cleaning cloth
3	Alcohol
4	Brushes with different sizes
5	Grinder (conical and cylindrical polishing heads)
6	Wall putty
7	Finish coat
8	Primer
9	Film thickness meter

Environment Requirements

- Ambient temperature: 5°C–40°C
- Base material temperature: 5°C–60°C
- Relative humidity: 10%RH–85%RH

Repair Steps

Step 1 Use a grinder or abrasive paper to smooth uneven areas on the surface, achieving a smooth finish with a metallic luster. Ensure a uniform transition from rusted areas to intact coating.

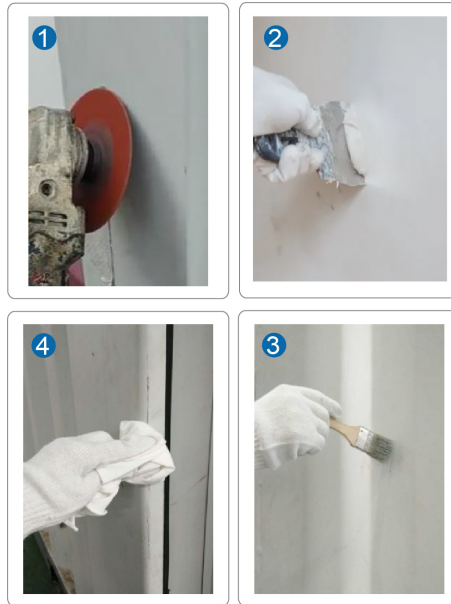


Uneven areas refer to burrs, metal fragments, slag, gaps, and sharp edges on the product.

Step 2 For deeper defects such as scratches or dents, repair them with wall putty to ensure a flat surface.

Step 3 Use a clean brush to remove any residue from the surface.

Step 4 Use a piece of clean cloth dipped in alcohol to remove the surface powder.



Step 5 Repair the primer.

- 1 Prepare the primer with the same color as the appearance.

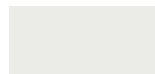


Common finish paint colors

RAL7035 (Streamer Grey)



RAL9003 (White)



RAL7016 (Dolphin Grey)



- 2 Mix the primer according to the paint model and the requirements of "[table 4-4 Primer and Finish Paint Selection and Mixing](#)".
- 3 Apply a primer with a small brush, and use a film thickness meter to ensure the coating thickness in corners and gaps is between 70μm–80μm.
- 4 After the first layer dries, apply another layer of primer using a brush in a crosshatch pattern. Once it is dry, check that the dry film thickness is within 100μm–300μm.

Step 6 Refer to "[4.2.1.2 Finish Paint Repair](#)" for finish paint repair.

Step 7 Inspect the paint to ensure it has a uniform color, smooth transitions, and meets the required film thickness.

-- End



When using spray paint, follow these steps:

- 1 Carefully cover the area outside the damaged spot (extending 800mm outward) using masking paper.
- 2 Spray the exposed area with the paint. After the paint dries, check that the dry film thickness is within the range of 100μm–300μm.

4.2.2 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.

4.2.3 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.

4.3 Battery Maintenance

4.3.1 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.

4.3.2 Maintenance

- 1 PACK operating temperature: The working temperature should be kept between -30°C–50°C. The temperature charging and discharging should be 15°C–30°C and typically 25°C.
- 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 30%–40%.
- 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 container 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.
- 15 PACK A and PACK B are prohibited from replacing each other.

⚠ 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.**

4.4 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 that the HMI of the liquid-cooled unit does not report a warning.	Check if the unit reports a "low water tank level" alarm and replenish the fluid when this alarm is received.	Slotted screwdriver, Phillips screwdriver, water pump, water pipe, clamp.

⚠ WARNING

If the battery container 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.

4.5 FSS Equipment Maintenance and Repair

The fire suppression system should be inspected and maintained on a regular basis by a full-time staff member who has been specially trained and qualified by examination. The fire

extinguishing system shall be inspected as stipulated in the inspection category and inspection records shall be kept. Problems found during inspection should be dealt with promptly.

NOTICE

- The backup power design for the fire alarm control panel (FACP) in the PowerTitan 2.0 energy storage system meets the requirements specified in the EN54-14 and NFPA855 standards regarding the standby operation duration of the backup power for the fire alarm control panel.
- The FACP utilizes lead-acid batteries as its backup power source. When the main power supply is disconnected, the FACP will continue to operate using the batteries. If the main power remains disconnected for more than 24 hours, the backup power to the FACP should be promptly disconnected to prevent over-discharge and damage to the batteries.
- If the standby operation time of the battery exceeds 24 hours, a charging and discharging test should be conducted on the battery. If the battery is unable to charge or discharge, it needs to be replaced.

4.5.1 Gaseous Fire Extinguishing System

System check

Monthly inspections shall comply with the following requirements:

- The extinguishing agent storage containers and all system components such as container valves, connecting tubes, valve actuators, nozzles, signal feedback devices, etc. should be free of collision deformation and other mechanical damages, the surfaces should be free of rust and corrosion, the protective coatings should be intact, the nameplates and signboards should be clear, and the guards, seals, and safety signs of the manually operated devices should be intact.
- The pressure in the extinguishing agent and driving gas storage vessel shall not be less than 90% of the design storage pressure.

The gaseous fire extinguishing system shall be fully inspected once per quarter and shall comply with the following provisions:

- The type and distribution of combustibles, and the openings in the protective zone shall be in accordance with the design.
- The fixing of equipment, extinguishing agent delivery piping and supports and hangers between storage units shall be free from looseness.
- The connecting pipe should be free of deformation, cracks and aging. If necessary, send them to statutory quality inspection organizations for testing or replacement.
- Each nozzle orifice should be free of clogging.
- When there is damage and blockage in the fire extinguishing agent conveying pipeline, tightness test and blowing should be carried out according to relevant regulations.

System maintenance

Cylinders should be sent to a professional inspection organization for inspection every 3 years, and the service life of cylinders is 20 years. In the course of use, the cylinder is found to have one of the following conditions, should be carried out in advance of the regular inspection:

- There is serious corrosion or damage or there are doubts about its safety and reliability.
- Inventory or put into service after being out of service for more than 1 inspection cycle.
- Cylinders related standards require early periodic inspection of other cases, as well as inspectors believe that there is a need for early inspection.

NOTICE

Cylinders and their accessories should not be disassembled by non-professionals.

4.5.2 Cylinder Pressure Drop Handling

Gas fire extinguishing equipment in the common pressure gauge disk is generally divided into red zone and green zone. The green zone is the normal pressure range, and the red zone is the abnormal pressure range, including low pressure and overpressure, of which low pressure is the most common.

When the pointer is in the low-pressure area, there are two general types:

- Pressure leakage and pressure drop in the storage vessel.
- A pressure leak at the gauge connection resulted in a pressure drop; there was no pressure drop in the storage vessel.

Cylinder pressure drop handling

When the pressure gauge switch is closed, the inflatable head and hexagonal valve seat close fit, at this time the gas inside the cylinder can not be connected with the pressure gauge interface, the pressure value displayed is only the pressure value of the gas stored between the end of the pressure gauge and the inflatable head cavity, not the actual pressure inside the storage vessel. Therefore, the pressure drop in the pressure gauge under the locked state of the pressure gauge switch does not necessarily mean that the pressure drop in the storage vessel.

When the scene found that the pressure gauge drop pressure, first check whether the pressure gauge is tightened, and the pressure gauge and hexagonal nut connection whether there is a gasket (generally white or transparent color), if there is a gasket will be the pressure gauge switch to open (with a wrench stuck in the pressure gauge after the hexagonal nut can be rotated counterclockwise for about a quarter of a turn), at this time to see whether the pressure gauge pointer position is normal. If the pressure value returns to normal, close the pressure gauge switch (tighten the hexagonal nut behind the pressure gauge clockwise).

NOTICE

If you still find that the pressure value is not normal, it may be caused by damage to the pressure gauge or leakage of cylinders, etc., turn off the pressure gauge switch first and notify the equipment manufacturer in time, so that the manufacturer can deal with it as soon as possible to ensure normal operation of the system.

5 Common Maintenance Operations

5.1 Safety Instructions

WARNING

- Do not install or remove power cord with power on. Turn off the power switch before installing and removing the power cord.
- Perform the maintenance only after the power is off and do not switch on the power during operation. For certain operations required when the system is running (e.g., the liquid cooling unit is running), make sure that the equipment has been wired correctly before switching on the power.
- The voltage may be generated on the battery side or the grid side. Always use a standard voltmeter to confirm that there is no voltage before touching.
- If you disconnect the DC power supply of the battery container, the battery will not power off immediately. Wait for 10 minutes and ensure that the device is not powered on before operation.

WARNING

- Personal protective equipment (PPE) is required for maintenance, troubleshooting and other tasks. The maintenance personnel must wear safety goggles, helmets, insulated shoes, and gloves.
- Place conspicuous warning signs around the equipment to prevent accidents caused by false switching. Set up warning signs or safety warning tapes in the vicinity of equipment.

WARNING

- The coolant is toxic, so avoid oral intake or long-term skin contact. If you get the coolant into the eyes due to accidentally, please flush your eyes with clean water immediately, and go to the hospital for treatment promptly.
- The coolant and its package must not be discarded at will, but should be disposed of as per the relevant local laws and regulations.
- Protective equipment such as goggles are required when working with coolant (glycol solution) or performing maintenance on the liquid cooling pipes.

NOTICE

- Operators should have certain expertise on electronics, electrical wiring, and mechanics and be familiar with electrical and mechanical schematics. And they should be familiar with the composition and working principle of battery container and its front-end and back-end devices.
- Operators should have received specialized training on the installation and commissioning of electrical equipment.
- Operators should be able to respond to hazardous or emergency situations during installation or commissioning.
- Operators should be familiar with the relevant standards and codes of the country/region where the project is located.

NOTICE

- The lifting, transportation, installation, wiring, operation, and maintenance of equipment must comply with the relevant laws and regulations of the region where the project is located.
- If you need to walk on top of the equipment, please follow the procedures for working at heights.

5.2 Coolant Filling and Drainage Operations

5.2.1 Liquid Cooling System Introduction

liquid-cooled cabin

The liquid-cooled unit compartment is shown below.

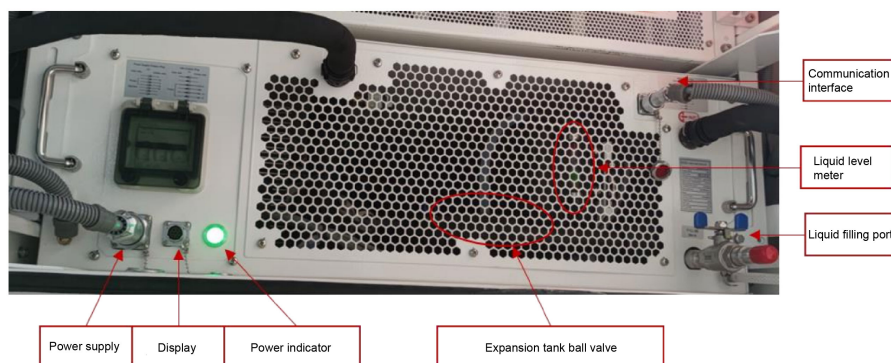


figure 5-1 Liquid-cooled unit panel

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

PMD

The liquid cooled unit power supply interface is integrated in the distribution box panel as shown below.



figure 5-2 PMD panel

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

5.2.2 Coolant Change Intervals

Object	Standard	Period	Tools
Coolant	1. The coolant has obvious impurities; 2. The coolant color is significantly darker; 3. The coolant PH value is below 7.3.	5–6 years	Water pump, hose, hose clamp, slotted screwdriver Note: Please contact Sun-grow Customer Service to replace hardware facilities

Operating Instructions for Coolant PH Testing

Step 1 A shutdown command is given using the LC software and the system is shut down.

Step 2 Disconnect the system AC power supply upper switch and use a multimeter to test the AC main circuit terminals on the distribution box panel for power loss (L1/L2/L3).

Step 3 Disconnect the three switches “AC main switch”, “AC auxiliary switch” and “UPS switch” on the panel of the distribution box.

Step 4 Long press the UPS power switch for about 3s to turn off the UPS power.

Step 5 Disconnect the switch on the panel of the liquid-cooled unit.

Step 6 Remove the sealing screw of any filler.

Step 7 Slowly open the valve by gently screw it (not fully open) and release about 10 ml coolant.



Step 8 Test the coolant sample with the PH test paper or PH meter to obtain the current coolant PH value. When the value is below 7.3, it is required to change the coolant (drain and refill the system).

-- End

5.2.3 Safety Precautions

WARNING

Normally coolant is not a health hazard, excessive exposure may cause irritation to the eyes, skin and breathing.

Personal protection

Wear personal protective equipment (PPE) when changing coolant. PPE should comply with relevant national standards, including but not limited to the following protective equipment.

Protective parts	Protective equipment
Respiratory protection	Under normal conditions of use, it is generally not necessary to wear respiratory protection equipment. If the engineering control facility does not maintain the air concentration at a level sufficient to protect the health of personnel, choose respiratory protection equipment suitable for the conditions of use and in compliance with relevant legal requirements. If you need to wear a safety filter mask, please choose a suitable mask and filter combination. Choose a filter suitable for a mixture of particulate/organic gas and vapor [boiling point >65 °C (149 °F)].
Hands protection	Use oil-resistant, chemical-resistant protective gloves.

Protective parts	Protective equipment
Eyes protection	Please use protective goggles.
Skin and body protection	Use non-permeable protective clothing and safety shoes.

Disposal considerations

Waste types	Disposal measures
Coolant	Discharges are made in accordance with local regulations and are not disposed of haphazardly.
Rubbish remnant	Separate and recycle, and if it meets the relevant regulations, it can be burned or reused.
Containers	Dispose of in accordance with all applicable local and national regulations. Use recovery/recycling where feasible, otherwise incineration is the recommended method of disposal. Empty containers may contain hazardous residues. Do not cut, puncture or weld on or near to the container. Labels should not be removed from containers until they have been cleaned. Contaminated containers must not be treated as household waste. Containers should be cleaned by appropriate methods and then re-used or disposed of by landfill or incineration as appropriate. Do not incinerate closed containers.

Accidental release measures

When a coolant leak occurs, refer to the following measures to deal with it.

- Immediately contact a professional to have uninvolved persons evacuated quickly to safety.
- Cut off the source of the spill as far as possible and prevent it from entering spaces such as sewers, drains and bodies of water.
- When cleaning up spilled liquids, wear protective equipment to protect your body from contact with the spilled or released material.
- Use sand, mud or other materials that can be used as barriers to set up barriers to prevent diffusion. Recover liquid directly or store in absorbent. Clean the contaminated area with detergent, water and a hard broom. Put the collected liquid in a disposable container.

First aid measures

Contact method	Measures
Inhalation	Move to fresh air. If breathing has stopped, give artificial respiration first aid. Seek medical attention.
Skin contact	Take off contaminated clothing. Rinse the skin thoroughly with soap and water. Seek medical attention if skin inflammation or rash occurs.

Contact method	Measures
Eyes contact	Flush eyes with plenty of water for at least 15 minutes. Seek medical attention.
Ingestion	If ingested, but conscious, water or milk to drink and actively seek medical help, do not induce vomiting unless instructed by healthcare patients. If you cannot get help from a doctor, please send the patient and the container and label to the nearest medical emergency center or hospital. Do not give any food to unconscious patients.

5.2.4 Tooling Introduction

The filling-draining kit includes a handle, a pressure gauge, a drain valve, a pump working switch, a power indicator, a pump working indicator, a power supply storage compartment, and a pipeline storage compartment.

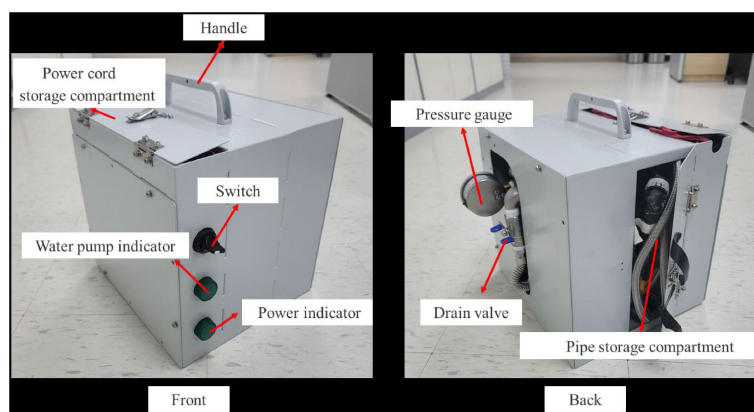


figure 5-3 Filling-draining Kit

The power cord storage compartment contains a 5 m-long power cord (which is longer than the distance between the distribution cabinet and the main pipe filler port), and the pipeline storage compartment contains a refilling pipe and a liquid suction pipe. At one end of the refilling pipe, there is a quick plug connector matching the main pipe filler port and a ball valve V5.

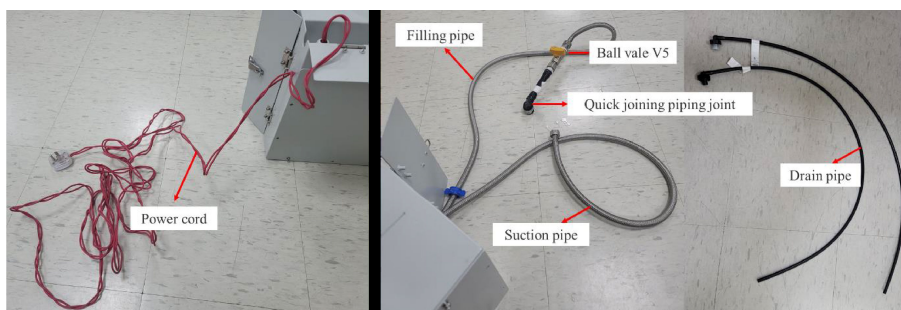


figure 5-4 Power Cord and Pipeline

The technical parameters of the filling-draining kit are shown in the table below.

table 5-1 Technical Parameters of Filling-draining Kit

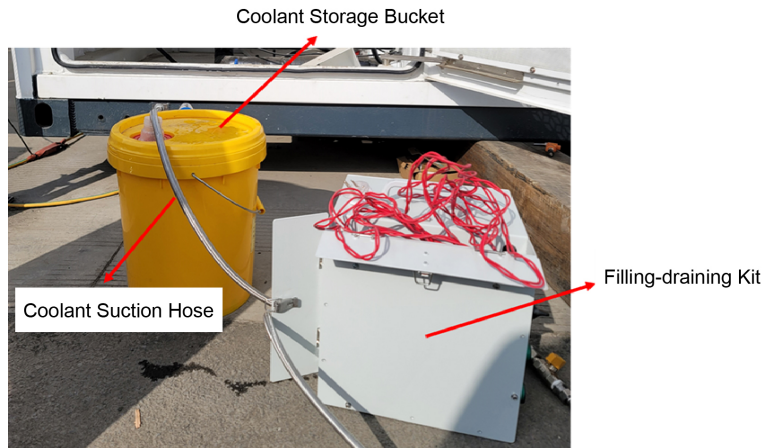
No.	Parameter Name	Parameter Value
1	Dimensions	270mm*300mm*300mm
2	Weight	≤10kg
3	Rated Voltage	24V DC
4	Load Current	≤4A
5	Power	≤96W
6	Flow Rate	12L/min
7	Headlift	2.5Bar
8	Other Functions	Non-return function, line storage compartment can be stored at the same time the pipeline supporting the drain tube.

5.2.5 System Drainage

Step 1 Verify that the system auxiliary power supply is connected and that the liquid cooled unit power switch is connected.

Step 2 Remove the plug from the system drain port.

Step 3 Prepare a coolant storage bucket by removing the suction hose from the fill and drain tool line storage compartment and plugging it into the bucket.

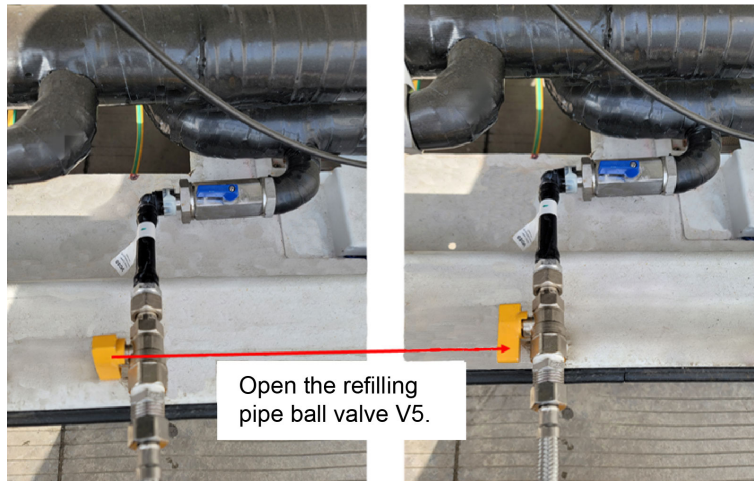


Step 4 Open the battery compartment liquid-cooling line ball valve that needs to be drained.

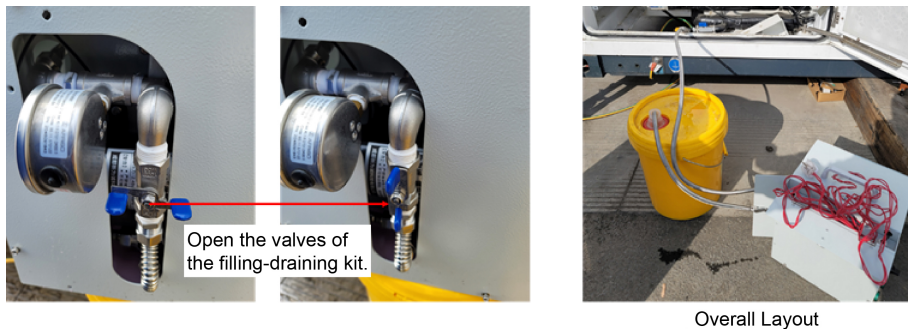
Step 5 Remove the line drain plug by squeezing the ends of the drain plug catch.

Step 6 Remove the fluid injection tube from the fluid injection and drainage tooling line storage compartment, insert the quick-connect fitting into the system drain port, and push the snap of the quick-connect fitting into place.

Step 7 Open the ball valve V5 of the fluid injection and discharge workpiece injection tube.



Step 8 Open the liquid injection and discharge device discharge valve, at this time there is coolant outflow.



Overall Layout

Step 9 If no liquid comes out of the suction tube within 30s, the system drainage is considered to be finished. Remove the suction tube, plug the plug and lock the clips.

Step 10 Line maintenance is completed, coolant change is performed, and system fill operation is executed.

-- End

5.2.6 System Refilling

Step 1 Check the liquid-cooled unit expansion tank ball valves V1 and V2 to make sure they are open.

Step 2 Check the battery cluster ball valves V3 and V4 to ensure that they are fully open.

Step 3 Open the exhaust valve (the exhaust valve knob is loosened to open).

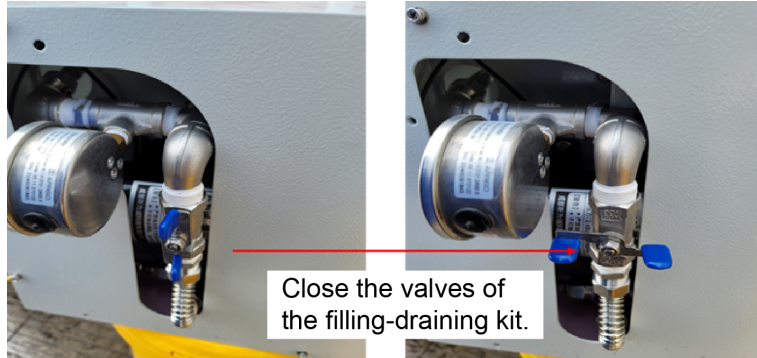
Step 4 Check the drain port D1 to ensure that it is in a blocked condition.

Step 5 Prepare 1 bucket of coolant by removing the suction hose from the fluid fill and drain tooling line storage compartment and plugging it into the bucket.

Step 6 Remove the fluid injection tube from the fluid injection and drainage tooling line storage compartment, insert the quick-connect fitting into the fluid injection port of the liquid-cooled unit, and push the snap of the quick-connect fitting into place.

Step 7 Open the liquid injection port valve of the liquid cooling unit, and open the liquid injection pipe ball valve V5 of the liquid injection and discharge equipment.

Step 8 Close the fluid injection and discharge unit drain valve.



Step 9 Connect the plug of the liquid injection and drainage equipment to the power distribution box, and the power indicator of the liquid injection and drainage equipment will light up after the power is connected.

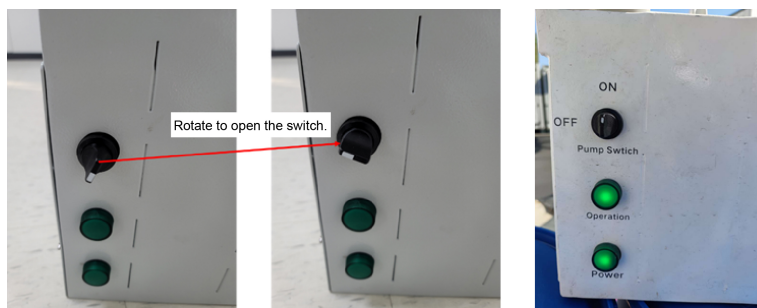
Step 10 Close the liquid-cooled unit circuit breaker switch, at which time the liquid-cooled unit power indicator lights up.

Step 11 The liquid-cooled unit will have a delayed start after power-up, and will require one shut-down operation at the LC interface.

Step 12 Adjust the liquid-cooled unit mode to high-speed operation mode.

- 1 Click "**Parameter Setting**→**System Parameter**" and enter the Liquid Cooling Unit Commissioning Parameters module. Set Liquid Cooling Unit Commissioning Mode set to **enable**.
- 2 Set Control Mode to **Pump Cycle**, set Pump Speed to 80%.

Step 13 Turn on the switch of the liquid injection and discharge equipment, at this time, the pump working indicator of the liquid injection and discharge equipment lights up and starts to inject liquid.



Step 14 Observe the level of the glass tube in the level window to the upper limit H line and stop filling.

Step 15 Close the valve of the liquid injection port, and shut down the liquid-cooled unit after 1min of power-on operation (the first liquid injection will show a rapid decline in the liquid level, and the liquid level will be reduced to below the lower limit of the L line, i.e., shutting down the unit).

Step 16 Repeat step 13~15 for 3 times, after-sales personnel pay attention to observe the coolant residual amount in the barrel, the coolant needs to be used up firstly close the switch of the injection and discharge tooling, and then carry out the replacement of coolant.

Step 17 High-speed operation for 20min, if leakage is found, the system needs to be drained and pipeline inspection or replacement, can not be inserted and removed with pressure pipeline, re-fill operation; if no leakage occurs, high-speed operation leakage check through, the next step.

Step 18 Adjust the liquid-cooled unit mode to low-speed operation mode.

- 1 Click "**Parameter Setting**→**System Parameter**" and enter the Liquid Cooling Unit Commissioning Parameters module. Set Liquid Cooling Unit Commissioning Modeset to **enable**.
- 2 Set Control Mode to **Pump Cycle**, set Pump Speed to 30%.

Step 19 Run at low speed for 60min and turn off the machine.

Step 20 In the shutdown state, the liquid level of the glass tube of the expansion tank of the liquid-cooled unit is between the center line and the H line, and the outlet pressure is more than 0.4 Bar, then the liquid injection is finished; if the liquid level is lower than the center line or the outlet pressure is too small, open the valve of the liquid injection port to replenish the coolant, and stop injecting the liquid when the liquid level is between the center line and the H line.

Step 21 Close the valve of the liquid injection port of the unit after the liquid injection is completed, and close the ball valve V5 of the liquid injection pipe of the liquid injection and drainage workpiece.

Step 22 Adjust the liquid-cooled unit parameters to the factory mode.

- 1 Click "**Parameter Setting**→**System Parameters**", enter the Liquid Cooling Unit Commissioning Parameters module, set the Pump Speedset to 66%.
- 2 Set Control Mode to **Remote Mode** and Liquid Cooled Unit Commissioning Mode to **Disabled**.

Step 23 Push out the snap of the filler tube quick-connect fitting and pinch the quick-connect fitting to pull it out.



Step 24 Unplug the power supply from the injection and drainage unit and the computer network cable socket, and store the piping and power cable in the corresponding storage compartments of the unit.



Step 25 Use a rag to clean any coolant left in the case.

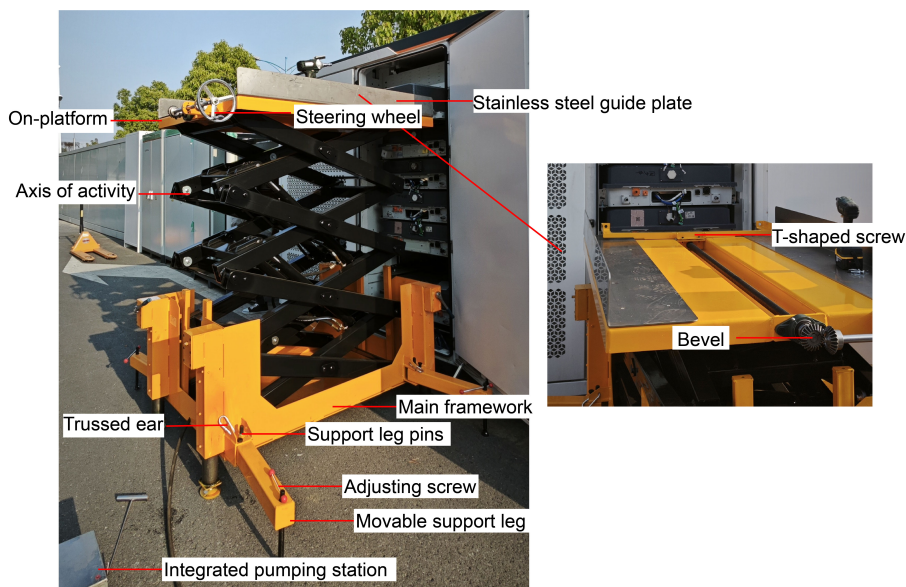
-- End

5.3 Battery Module Replacement

5.3.1 Tooling Introduction

5.3.1.1 Liquid-cooled Maintenance Tooling

The components of the maintenance tooling are shown in the figure below.



*The figure is for reference only. The actual tooling may be different.

The technical data of the maintenance tooling are listed in the table below.

table 5-2 Technical Data of Maintenance Tooling

Parameter	Description	Parameter	Description
Machine code	B-J-022739	Maximum lifting height	3800 mm
Carrying capacity	1200 kg	One-piece pump hydraulic hose extension length	Distance to device 800 mm
Platform size	1500 mm * 1035 mm	Hook opening	φ14
Transit mode	Crane	Lifting inclination	≤5°

5.3.1.2 Transport Tooling

The maintenance tooling should be used in conjunction with the transport tooling. The transport tooling is shown below, the machine code is B0J00326.

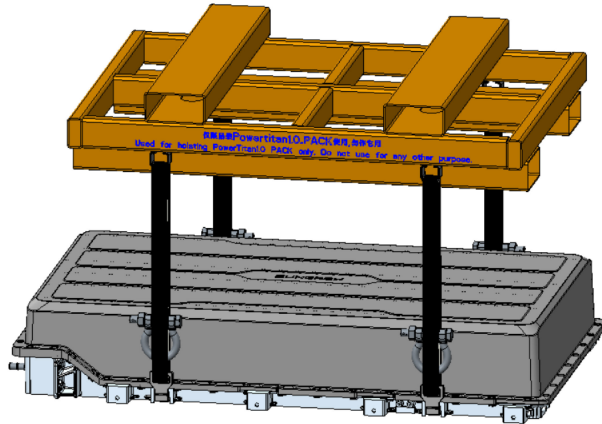


figure 5-5 Transport Tooling

*The figure is for reference only. The actual tooling may be different.

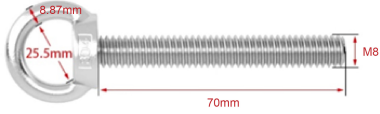
NOTICE

The height of the PACK must not exceed the height of the ground by 1.5 m to prevent the risk of falling.

5.3.1.3 Other Tools

It is suggested to prepare the appropriate tools, including but not limited to those listed below, to ensure the maintenance work can be completed smoothly.

Tools	Description
	• A 5t forklift that runs on oil is recommended; • For dirt and gravel roads that are prone to collapsing, it is recommended that off-road tire forklifts or pre-paved steel plates be used based on an assessment of the strength of the road surface to prevent the tires from sinking into the road surface, making it difficult to move forward with maintenance work.
Forklift	
	-
Safety helmet	
	-
Safety shoes	
	-
Safety gloves	

Tools	Description
	• M8*70 eye bolt (4pcs) ; • Included in the maintenance tooling configuration.
Eye bolt	
	-
Screwdriver	
	An electric M8 socket is recommended (torque adjustable).
M8 socket	
	It is recommended to use an allen wrench set.
Allen wrench	

*The figures are for illustration only.

5.3.2 Replace PACK

5.3.2.1 Precautions

DANGER

High voltages! Danger of electric shock!

- Do not touch any live part!
- Before installation, make sure the outdoor cabinet and its internal components are all voltage-free.
- Do not place the product on the surface of flammables.

WARNING

During maintenance, do not step on the lead screw assembly of the tooling, to avoid getting it damaged.

WARNING

- Do not open the door and maintain the system on rainy, humid, or windy days. SUNGROW shall not be held liable for any possible outcome arising from failure to observe this instruction.
- Avoid opening the cabinet door on days with rain, snow, heavy fog, or high humidity. Besides, after closing the cabinet door, make sure the sealing strip around the door does not curl.
- To avoid accidents, maintenance work is not recommended in snow or rain, as the ground may be slippery and tires may easily get stuck.

WARNING

- The maintenance work must only be performed by qualified engineers, Please comply with the requirements in “Safety Precautions” in this manual. SUNGROW shall not be held liable for any personal injury or property damage arising from failure to follow the safety instructions.
- To ensure the safety of maintenance personnel and the smooth completion of maintenance work, follow strictly the instructions provided in this manual throughout the whole process.

NOTICE

Do not carry people on the tooling, and after the maintenance work is completed, the tooling should be well protected by the matching protective cover.

5.3.2.2 Site Requirements

NOTICE

- Cables should be pre-buried below the ground surface with cable trench covers with a bearing capacity of not less than 50kN.
- The upper surface of the cable trench cover should be at the same height as the ground to ensure ease of passage for forklifts.
- The design layout of the site within the power station should take into account the passage of forklift trucks, and the strength should meet the requirements of forklift trucks (with a total weight of 50kN) to ensure that the forklift trucks are able to drive into any box between the boxes.
- The minimum maintenance spacing for maintenance fixtures is 2.5m.

5.3.2.3 Preparation

5.3.2.3.1 System Drainage

The system needs to be drained before replacing the PACK, refer to "[5.2.5 System Drainage](#)" for the procedure.

5.3.2.3.2 System Power-off

Power off the whole system before replacing the PACK.

Preparation: Log in to the LC interface, turn off the system via the control software (you may press the emergency stop button on the cabinet in case of an emergency or other special situation).

Step 1 Open the liquid cooled unit panel and disconnect the liquid cooled unit switch.

Step 2 Disconnect the UPS power supply by pressing the UPS switched power off button.

Step 3 Disconnect Q2 (UPS SWITCH) on the PMD panel.

Step 4 Disconnect Q1 (AC AUX SWITCH) on the PMD panel to disconnect the auxiliary power supply.

Step 5 Turn QF1 (AC MAIN SWITCH) on the PMD panel to “OFF” to disconnect the AC side of the system.

Step 6 Turn the PCS DC load switch handle to “OFF” to de-energize the DC side of the system.

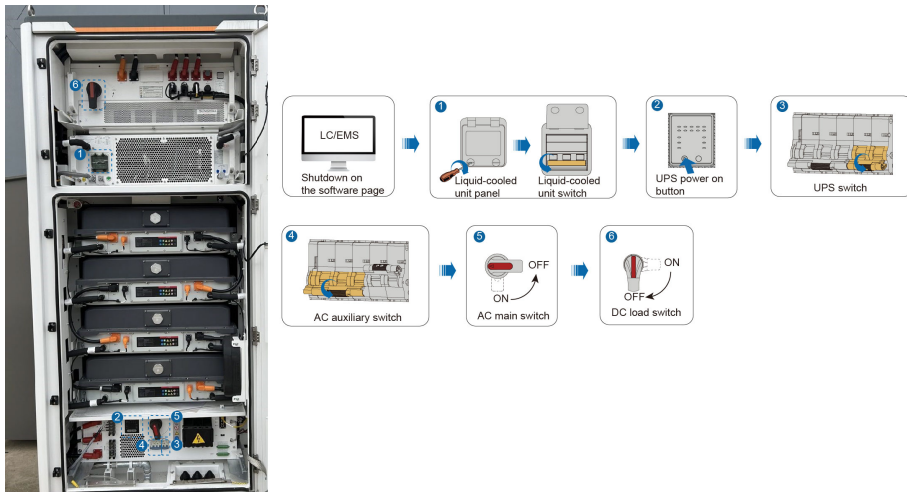


figure 5-6 Powering off Steps

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

- - End

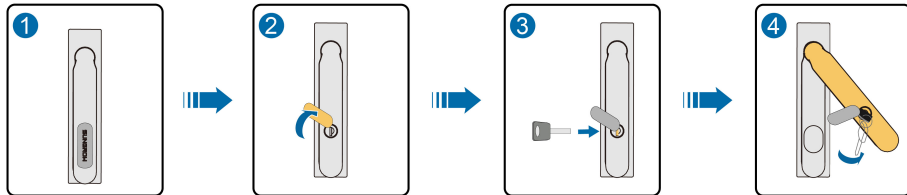
NOTICE

- **Perform maintenance only after the power is off, and ensure the system will not be powered again during the maintenance operation. For some operations that need to be performed with power on, ensure that the wiring has been completed properly before powering on.**
- **Protective measures must be taken during electrical maintenance, such as wearing insulated gloves or insulated shoes.**

5.3.2.3.3 Open Cabinet Door

Step 1 Open the cabinet door.

- 1 Toggle the protective cover on the handle clockwise to expose the keyhole.
- 2 Insert the door key and turn it clockwise.
- 3 Rotate the handle counterclockwise to open the front door.



Step 2 Open the door to the full, at an angle of 120°.

-- End

5.3.2.3.4 Pull Out the Liquid Cooling Line

Step 1 Pull out the liquid-cooling line of the PACK to be maintained and move the line to the inside of the rail to prevent the PACK from interfering with the push-pull process.



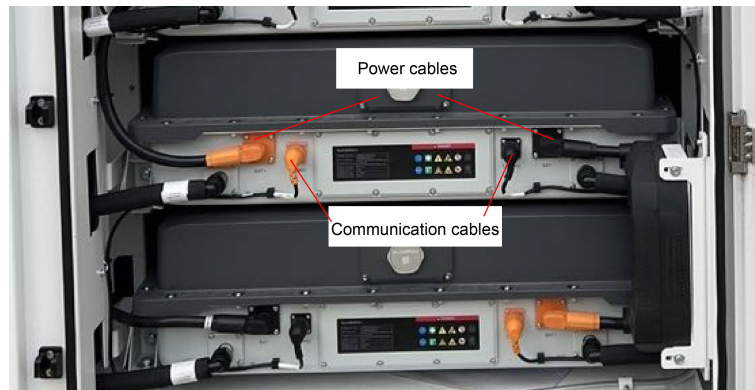
figure 5-7 Liquid Cooling Piping Schematic

*Pictures are for reference only, please refer to the real thing!

- - End

5.3.2.3.5 Remove Cables

The locations of the power and communication cables on the PACK are shown below.



*Pictures are for reference only, please refer to the real thing!

NOTICE

After unplugging the power cables and communication cables, they need to be kept in a safe place for backup.

Step 1 Press the button on the positive and negative terminals of the power cable to pull the cable.

Step 2 Twist the positive and negative terminals of the communication cable and pull the cable.

-- End

5.3.2.3.6 Remove Fuses

If the PACK to be maintained is located on layers 3 and 4, the intercluster fuses need to be removed.

Intercluster fuse locations are shown below.

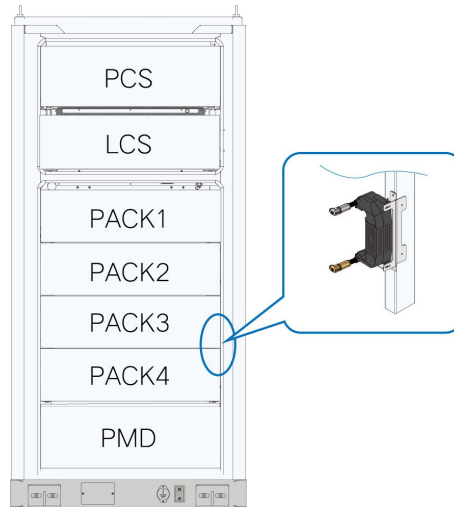


figure 5-8 Fuse location

*Pictures are for reference only, please refer to the real thing!

NOTICE

After removing the fuse, it needs to be kept in good condition for spare parts.

Step 1 Remove the screws from the fuse mounting hole locations.

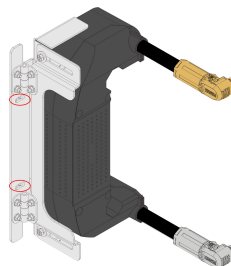


figure 5-9 Fuse mounting holes

Step 2 Unplug the cable between the fuse and the PACK and remove the fuse.

-- End

5.3.2.3.7 Remove PACK Fixing Corners

Step 1 Use an M8 socket to remove the M8 screws at the PACK corner pieces.

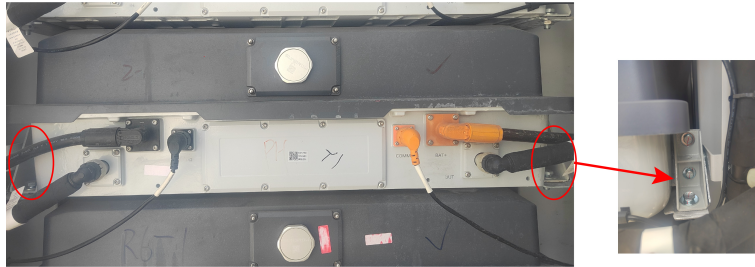


figure 5-10 M8 screw position schematic

*Pictures are for reference only, please refer to the real thing!

Step 2 Remove the PACK retaining corner pieces and keep them for safekeeping.

Step 3 Install the M8 eyebolt screws (2pcs, included in the tooling configuration) in the original holes of the PACK.

-- End

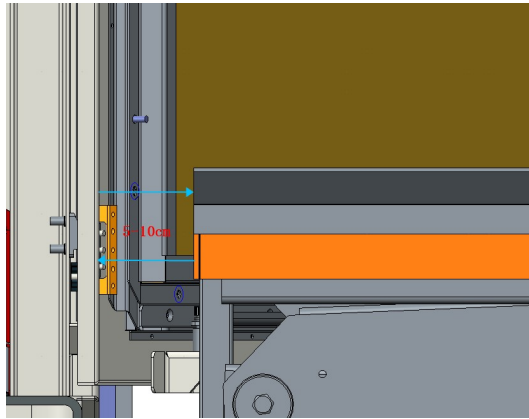
5.3.3 Tooling Setup

5.3.3.1 Initial Setup

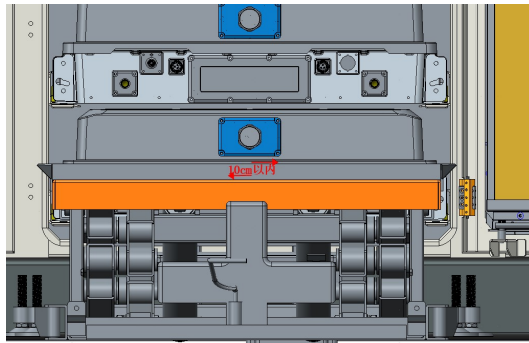
Put the tooling in place first, for further adjustment and calibration.

Step 1 The platform is lifted and transported to land in front of the hatch.

The platform surface is spaced 5~10cm from the container, as shown in the following figure.



The platform rails are centered with the container door within 10cm of the bilateral deviation, as shown in the figure below.



Step 2 Platform support foot spreading: the recommended angle of spreading is 60°~90°.

-- End

5.3.3.2 Tooling Adjustment

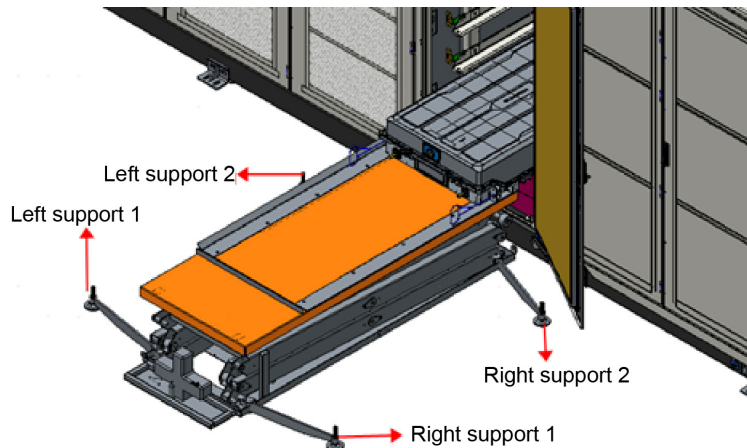
Make small adjustments to the tooling so that the PACK can be put into the cabinet smoothly.

Step 1 Platform leveling adjustment (support feet).

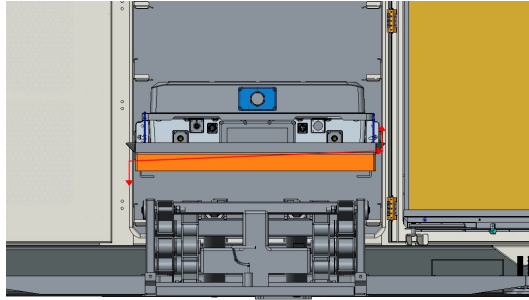
- 1 The weight of the product is about 500kg and the weight of the battery pack is about 400kg. If the ground is not sufficiently dense (insufficient support), it is necessary to place steel plates/ sleepers and other accessories under the support feet in advance.
- 2 Insufficient floor leveling, the platform surface needs to be leveled by adjusting the height of the support feet. 4 support feet height adjustment range 0~30cm.



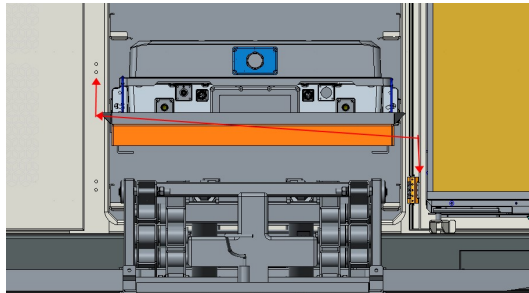
- 3 When adjusting the level, it is necessary to pay attention to the platform surface leveler situation in real time, on the various adjustment programs are introduced as follows:



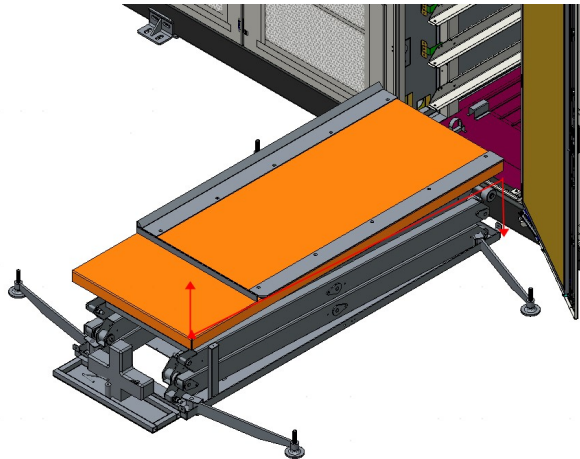
- i. The platform surface is low on the left and high on the right, raising the height of the left 1 foot or lowering the height of the right 1 foot.



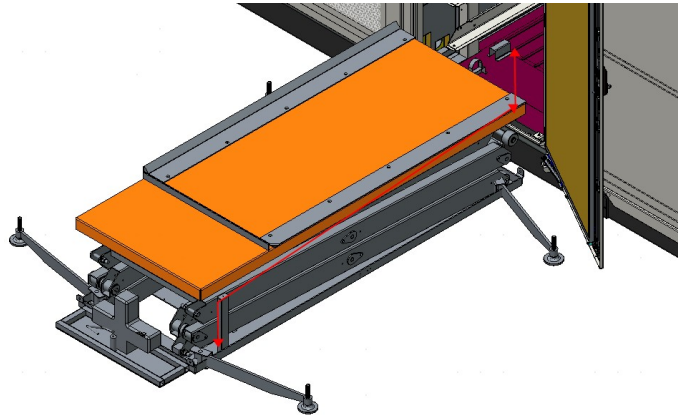
- ii. The platform surface is high on the left and low on the right, lowering the height of the left 1 foot or raising the height of the right 1 foot.



- iii. The platform is high in the front and low in the back, lowering the height of Left 1, Right 1 and raising the height of Left 2, Right 2.

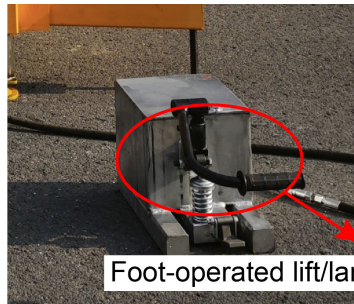


- iv. The platform is low in the front and high in the back, raising the height of Left 1, Right 1 and lowering the height of Left 2, Right 2.



Step 2 The platform is highly elevated.

Foot lifting, the platform surface is lower than the battery pack to be replaced by 1~3cm (recommended), 1cm is suitable.



Foot-operated lift/landing structure

-- End

5.3.4 PACK Mounting

5.3.4.1 Remove Old PACK

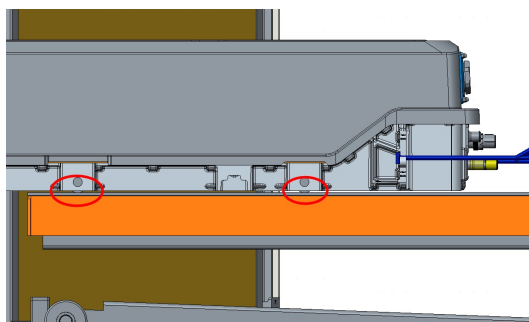
Step 1 Pull out the PACK action.

- 1 Connect the T-bar to the battery pack.
- 2 Turn the steering wheel to pull out the battery pack.



- 3 When the battery pack extends out of the container door frame, observe the bottom of the battery pack on the side to see if the relative height of the battery pack to the platform surface is appropriate.
- 4 Fine-tune the height of the platform surface to ensure that the first roller of the battery pack falls on the platform surface.
- 5 In the process of pulling out, with the movement of the battery pack, the center of gravity of the platform changes, which will bring about changes in the level of the platform surface, the following is an introduction to explain the adjustment program and ideas for various situations:
 - Stage 1 early stage of platform bearing: at the early stage of platform bearing, the front end is sinking, at this time, it is easy to lift the platform 5~8mm for pulling out.
 - Stage 2 Medium Platform Bearing: As the battery pack is pulled out, there will be a situation where the bottom of the front of the battery pack rests against the platform and cannot be pulled out further.

At this time, the platform surface is lowered by 5~8mm and the first roller/second roller status is observed as shown below.



A status is as follows: need to lower the left 2 feet, right 2 feet height.



B state is as follows: need to raise the left 2 feet, right 2 feet height.



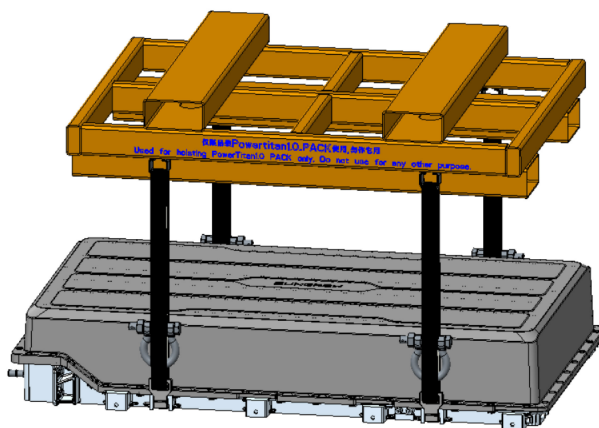
- Stage 3 End of platform bearing: It is recommended that the platform as a whole be as follows.



Step 2 Forklift trucks and PACK transfer equipment are used to transfer used PACKs to pre-arranged locations.

NOTICE

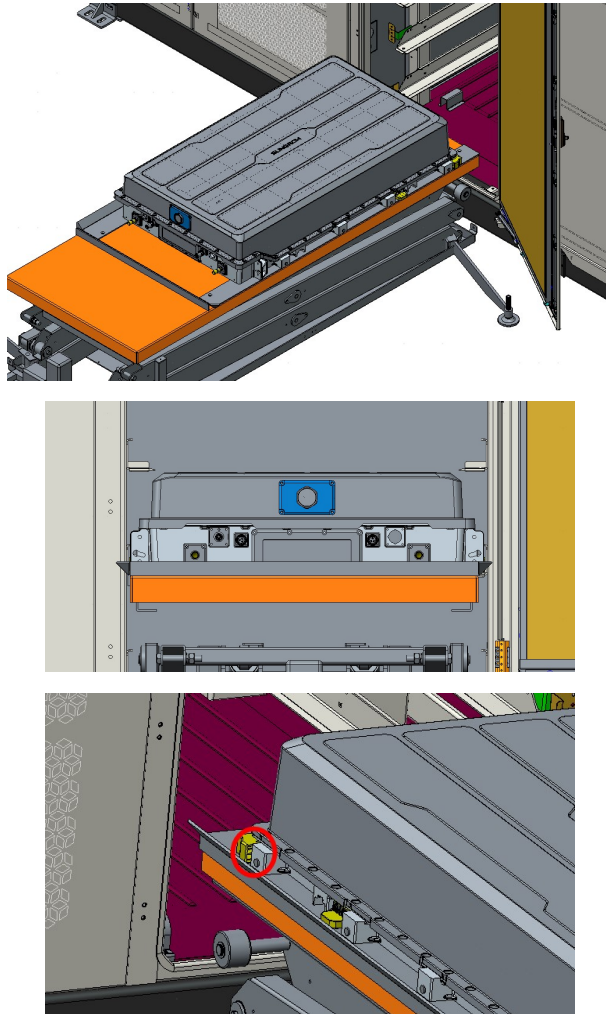
The height of the PACK must not exceed the height of the ground by 1.5m to prevent the risk of falling.



-- End

5.3.4.2 Mount New PACK

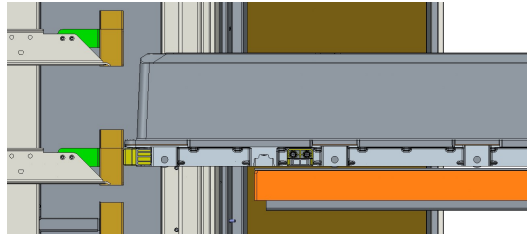
Step 1 Status Confirmation: After the new PACK is dropped to the platform surface, observe whether the PACK is aligned with the container, which can be confirmed by the guide block at the end of the PACK. If the deviation between left and right is large, it needs to be adjusted (lifting), as shown in the following figure.



Step 2 Platform surface adjustment: Platform flatness change and demand when pushing in is opposite to pulling out. The initial state is that the platform surface is higher than the corresponding guide rail by 1cm (recommended), the initial platform surface is recommended as shown in the figure below (lifting the left 1 foot, right 1 foot height).



- Initial state: the platform surface is higher than the guideway surface.



- Push-in state troubleshooting: refer to the pull-out roller state troubleshooting scheme.

-- End

5.3.5 Follow-up Work

5.3.5.1 Fix PACK Corner Fittings

Step 1 Secure the corner fittings in the corresponding positions on the PACK.



figure 5-11 Positions of screws

*The figure is for reference only. The actual tooling may be different.

Step 2 Using a socket tool, install the M8 screws at the PACK corner pieces.

-- End

5.3.5.2 Install Fuse

Fuses between RACKs are shown in the figure below.

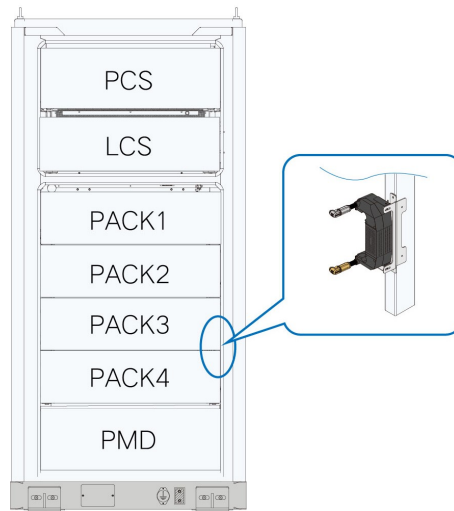


figure 5-12 Positions of Fuses

*The figure is for reference only.

Step 1 Fit the M6 screws on the fuse, but do not tighten them now.

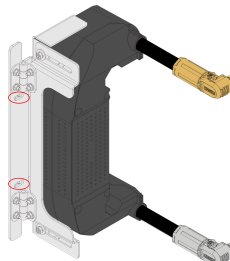


figure 5-13 Fuse mounting holes

Step 2 Insert the plugs that come with the fuse into the PACK bases properly.

⚠ WARNING

When the aviation plug is connected in place, you will hear a "click". Please make sure the connection is secure.



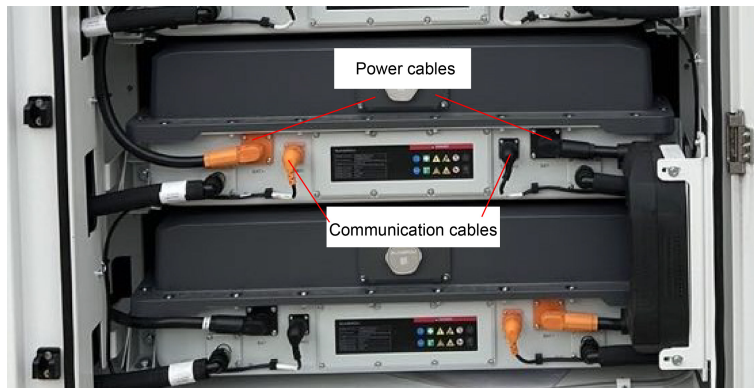
- Insert the positive aviation plug into the positive on the PACK base, and the negative plug into the negative on the base. Orange indicates positive, and black indicates negative. When the aviation plug is connected in place, you will hear a "click".
- When connecting the power cable, you can adjust the position of the fuse properly.

Step 3 After the connection is completed, tighten the screws that are fit in Step 1.

-- End

5.3.5.3 Connect Cables

Step 1 Connect the power cables between the PACKs.



*Pictures are for reference only, please refer to the real thing!

WARNING

When the aviation plug is connected in place, you will hear a "click". Please make sure the connection is secure.



Insert the positive aviation plug into the positive on the PACK base, and the negative plug into the negative on the base. Orange indicates positive, and black indicates negative.

Step 2 Connect the communication cables between the PACKs.

-- End

5.3.5.4 Installation of Liquid Cooling Lines

Preparation before installation: check whether there are foreign objects at the interface, if there are foreign objects need to be cleaned with pure water.

Step 1 Remove the line from the inside of the rail.

Step 2 Insert liquid-cooled line quick-connect fittings.



figure 5-14 Liquid Cooling Lines Schematic

*Pictures are for reference only, please refer to the real thing!

-- End

5.3.5.5 System Power-on

After the PACK replacement operation is complete, perform a system power-up.

Preparation: Before powering up, it is necessary to carry out a comprehensive and detailed inspection of the equipment to ensure that all indicators are in line with the requirements before powering up.

Please refer to "[3.2 Powering on Steps](#)" for the power-up procedure.

5.3.5.6 Close Cabinet Door

Inspect the wirings thoroughly and carefully after all works have been completed. In addition, make sure you:

- Lock the door of the outdoor cabinet. Then, remove the key and keep it in a safe place.
- Confirm that there is no obstruction or blockage by foreign objects at the air inlets and outlets.

WARNING

- **Moisture may get in if the product is not properly sealed.**
- **Rodents may get in if the product is not properly sealed.**

5.4 Replace PMD

Step 1 System shutdown, refer to "[5.3.2.3.2 System Power-off](#)".

Step 2 Remove the A/B/C three-phase AC cable airline plug from the distribution box panel.



figure 5-15 Three-phase AC cable schematic

*Pictures are for reference only, please refer to the real thing!

Step 3 Remove the liquid-cooled unit power supply wiring.



figure 5-16 Liquid-cooled unit power supply schematic

*Pictures are for reference only, please refer to the real thing!

Step 4 Remove the network cables from the network port.



figure 5-17 Network port schematic

*Pictures are for reference only, please refer to the real thing!

Step 5 Remove the CONN1~CONN2 terminal wiring from the front of the distribution box panel.



figure 5-18 CONN1~CONN2 terminal schematics

*Pictures are for reference only, please refer to the real thing!

Step 6 Remove the wiring from the CONN3 to CONN4 terminals on the right side of the distribution box.



figure 5-19 CONN3~CONN4 terminal schematics

*Pictures are for reference only, please refer to the real thing!

Step 7 Remove the set screws at the handles on each end of the distribution box.



figure 5-20 Fixing screw schematic

*Pictures are for reference only, please refer to the real thing!

Step 8 Remove the distribution box grounding cable.

Step 9 Transfer the distribution box by dragging it out through the folding handles on the panel of the distribution box to the front of the cabinet behind the pads and padded blocks

Step 10 Place the new distribution box in the front of the cabinet on pads and blocks, the actual position is adjusted according to the site.

Step 11 Lift the end of the distribution box by means of the grommets on both sides of the box, resting on the distribution box rails and pushing the box into place.

Step 12 Install the M6 fixing screws at the handles on both ends of the distribution box with a torque of $7.5 \pm 0.5 \text{ N} \cdot \text{m}$.

Step 13 Restore all wiring to the distribution box.

-- End

5.5 Replace PCS

Step 1 System shutdown, refer to "5.3.2.3.2 System Power-off".

Step 2 Remove the DC side airline plug from the PCS panel.



figure 5-21 DC side air plug schematic

*Pictures are for reference only, please refer to the real thing!

Step 3 Remove the A/B/C three-phase AC side airline plug.



figure 5-22 AC side air plug schematic

*Pictures are for reference only, please refer to the real thing!

Step 4 Remove communication cables.**figure 5-23** Communication cable schematic

*Pictures are for reference only, please refer to the real thing!

Step 5 Remove the set screws at the handles on each end of the PCS.**figure 5-24** Fixing screw schematic

*Pictures are for reference only, please refer to the real thing!

Step 6 Remove the PCS grounding cable.**figure 5-25** Grounding cable schematic

*Pictures are for reference only, please refer to the real thing!

Step 7 Using a forklift, maintenance tooling, or other maintenance-friendly equipment, lift the maintenance equipment into place and then drag the PCS out to the maintenance equipment using the handles on the PCS panel. After lowering the maintenance equipment to the ground, transfer the PCS.

Step 8 Transfer the new PCS to the maintenance equipment, lift the maintenance equipment into place, and push the PCS into the cabinet.

Step 9 Install the M6 set screws at the handles on both ends of the PCS with a torque of $7.5 \pm 0.5 \text{ N}\cdot\text{m}$.

Step 10 Restore all wiring to the PCS.

-- End

5.6 Replace Liquid-cooled Unit

Step 1 System drainage, refer to "5.2.5 System Drainage".

Step 2 System shutdown, refer to "5.3.2.3.2 System Power-off".

Step 3 Remove the electrical supply plug from the liquid cooled unit panel.



figure 5-26 Schematic diagram of the power supply plug

*Pictures are for reference only, please refer to the real thing!

Step 4 Remove the communication plug.



figure 5-27 Communication plug schematic

*Pictures are for reference only, please refer to the real thing!

Step 5 Remove the inlet and outlet pipes.



figure 5-28 Schematic diagram of inlet and outlet pipes

*Pictures are for reference only, please refer to the real thing!

Step 6 Remove the set screws at the handles on both ends of the liquid-cooled unit.



figure 5-29 Fixing screw schematic

*Pictures are for reference only, please refer to the real thing!

Step 7 Remove the grounding cable.

Step 8 After lifting the maintenance equipment into place using a forklift, maintenance tooling, or other maintenance-friendly equipment, drag the liquid-cooled unit out to the maintenance equipment using the handle on the panel of the liquid-cooled unit. After lowering the maintenance equipment to the ground, transfer the liquid-cooled unit.

Step 9 Transfer the new liquid-cooled unit to the maintenance equipment, lift the maintenance equipment into place, and push the liquid-cooled unit into the cabinet.

Step 10 Install the M6 fixing screws at the handles on both ends of the liquid-cooled unit with a torque of $7.5 \pm 0.5 \text{ N} \cdot \text{m}$.

Step 11 Restore all wiring to the liquid-cooled unit.

-- End

5.7 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.

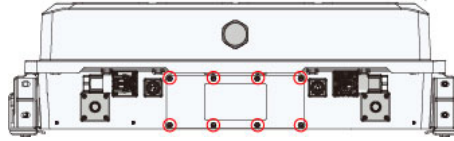


figure 5-30 Front cover

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.

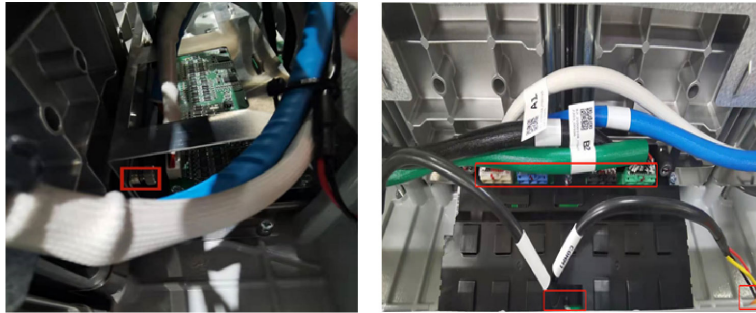


figure 5-31 BMU board mounting position

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

5.8 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

6 Troubleshooting

6.1 Overview

When an abnormal change occurs in the battery container, it is recommended that preliminary troubleshooting be performed first through the troubleshooting.

If problems cannot be resolved according to this manual, please contact us. We need the following information in order to provide you with better assistance.

- The SN, the manufacture date, and the software version of the device
- The manufacturers, the models, and the configuration information of the devices connected to this device
- Brief fault description
- Pictures of the fault site

WARNING

The ground cable must be grounded well, otherwise, fatal electric shock may occur to the operators!

6.2 PCS Troubleshooting

Log in to the LC web interface, and in the navigation bar, click “**Operation Information→PCS Information**” to view Fault Status or alarm operation status.

Fault name	Fault condition	Treatment	Caveat
Busbar average undervoltage	- Threshold 1: $V_{thres_hold1} = (\text{minimum operating voltage } 580V - 30V) \times 0.9 \text{ times} - 50V$ - Threshold 2: $V_{thres_hold2} = \text{peak line voltage} + 8V$ - Threshold 3: $V_{thres_hold3} = \text{peak line voltage} - 20V$ - Threshold 4: $V_{thres_hold4} = \text{Battery under-voltage protection value issued by ARM}$	The following protections are shielded in open loop, short-circuit loop, and non-operational states: Wait for the fault to clear, restart the machine, if the fault still exists, please contact SUNGROW.	After protection, if the battery voltage V_{dc} is greater than $\max\{V_{thres_hold2} + 2V, V_{thres_hold4} + 5V\}$, delay 1min to clear the fault.
	1 Bus capacitance voltage V_{bus} Below V_{thres_hold1} , delayed 1ms protection (fast protection).		
	2 When grid-connected charging, V_{bus} is lower than $\max\{V_{thres_hold3}, V_{thres_hold4}\}$, delay 1s protection.		
	3 When grid-connected charging, V_{bus} is higher than $\max\{V_{thres_hold3}, V_{thres_hold4}\}$ but lower than V_{thres_hold2} , and if the charging power exceeds $0.7P_n$, or the charging current exceeds the charging		

Fault name	Fault condition	Treatment	Caveat
	current limit, the protection is delayed for 1s.		
	4 When Vbus is lower than $\max \{V_{\text{threshold2}}, V_{\text{threshold4}}\}$ in other states, delay 1s protection.		
High bus voltage	- Threshold 1: $V_{\text{threshold1}}$ = maximum voltage 1550V - Threshold 2: $V_{\text{threshold2}}$ = battery overvoltage protection value issued by ARM 1 Bus capacitor voltage Vbus is higher than $V_{\text{threshold1}}$, delayed 1ms protection (fast protection). 2 Vbus is greater than $V_{\text{threshold2}}$ with a 50ms delay for protection.	Check if the busbar overvoltage setting value is correct, if the setting is correct the fault still exists, please contact SUNGROW.	After protection, if Vbus is less than $\{V_{\text{threshold2}} - 20V\}$, delay 30s to clear the fault.
Grid undervoltage	1 LVRT is turned on, and protection is triggered after low voltage ride-through timeout. 2 LVRT shutdown, in accordance with the 5-level undervoltage protection threshold and the corresponding delay time, if the islanding protection has been triggered then block this entry.	The machines are usually reconnected to the grid when the grid returns to normal. 1 Measure the actual grid voltage and contact the power company if the grid voltage is indeed lower than the set value. 2 Check the protection parameter settings of the converter. 3 If the grid voltage is normal,	1 The fault is cleared immediately when an update to the operating mode or rated frequency setting is detected. 2 In case of VF mode or VSG mode, after triggering the protection and shutting down the power, the delay is 30s to clear the fault. 3 After protection, if the recovery threshold is met, delay the grid

Fault name	Fault condition	Treatment	Caveat
Grid over-voltage		troubleshoot the AC wiring for tightness.	recovery time (1min) issued by the ARM to clear the fault.
		4 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	4 If islanding protection is triggered, the fault is cleared immediately.
	1 When HVRT is on, protection is triggered by a high voltage ride-through timeout.		
	2 HVRT shutdown is performed in accordance with the 5-level overvoltage protection threshold and delay time, and this is blocked if islanding protection has been triggered.	The machines are usually reconnected to the grid when the grid returns to normal.	
	3 In VF mode, if the presence of a power grid is detected, the protection is delayed for 1min.	1 Measure the actual grid voltage and contact the power company if the grid voltage is indeed higher than the set value.	The grid voltage is lower than the set grid overvoltage recovery value for longer than the set grid recovery time.
	4 Three-phase line voltage instantaneous value after taking the maximum value, if it exceeds the threshold (rated line voltage peak *1.45 times), the delay time of 1ms protection (fast protection).	2 Check the protection parameter settings of the converter. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	In off-grid mode: after the protection is turned off and maintained for 30s, it is automatically restored.
	5 Australian standard applies, effective after turning on the overvoltage enable switch for 10 minutes,		

Fault name	Fault condition	Treatment	Caveat
	if the voltage exceeds the threshold set by ARM (default 440V) delay 10min protection.		
AC under-frequency	The grid frequency is lower than the protection value of level 1~5, and the time exceeds the setting time of under-frequency protection. Off-grid mode: You need to wait for the output voltage to stabilize the output before enabling the AC under-frequency function, and the protection action is consistent with the grid-connected. You need to wait for the output voltage to stabilize the output before enabling the AC under-frequency function, and the protection action is consistent with the grid-connected.	The machine will normally be reconnected to the grid when the grid frequency returns to normal. 1 Observe the actual grid frequency in the interface (or actually measure it at the AC output), if the grid frequency is really lower than the set value, please contact the power company. 2 Check the protection parameter settings of the converter. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	• In grid-connected mode: the frequency is higher than the underfrequency recovery value, the continuous time is greater than the set grid recovery time, and the fault is eliminated. • In off-grid mode: after powering off and maintaining 30s, it resumes automatically.

Fault name	Fault condition	Treatment	Caveat
Excessive communication	The grid frequency is higher than the protection value of level 1~5, and the time exceeds the setting time of over-frequency protection. Off-grid mode: It is necessary to wait for the output voltage to stabilize the output before enabling the AC over-frequency function, and the protection action is the same as that of grid-connected. It is necessary to wait for the output voltage to stabilize the output before enabling the AC over-frequency function, and the protection action is the same as that of grid-connected.	The machine will normally be reconnected to the grid when the grid frequency returns to normal. 1 Observe the actual grid frequency in the interface (or actually measure it on the AC output), if the grid frequency is indeed higher than the set value, please contact the power company. 2 Check the protection parameter settings of the converter. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	• In grid-connected mode: the frequency is lower than the overfrequency recovery value, and the continuous time is greater than the set grid recovery time. • In off-grid mode: after the protection is turned off and maintained for 30s, it is automatically restored.
AC relay failure	Judge and protect according to the steps of self-test of AC side relay, if 3 consecutive self-tests fail, then protect.	Wait for the PCS to return to normal, if the fault persists it will need to be manually powered down to clear it.	Wait 3 minutes to force recovery. Maximum of 5 recoveries, more than that will require a power down reset

Fault name	Fault condition	Treatment	Caveat
Island protection	Passive Silos:		
	1 If the peak voltage is less than 0.25 times, or the frequency jump is more than 0.3Hz, the delay time is 200ms to protect.	1 Check that the power supply to the grid is normal.	1 The fault is cleared immediately when an update to the operating mode or rated frequency setting is detected.
	2 If the peak voltage is less than 0.2 times, delay 5s protection.	2 Troubleshoot the AC wiring for tightness.	2 In case of VF mode or VSG mode, after triggering the protection and shutting down the power, the delay is 30s to clear the fault.
	Active Silo:	3 Check that the AC wiring is connected to the correct terminals.	3 After protection, if the peak voltage is greater than 0.7 times and the Rms value is greater than 0.5 times, delay the grid recovery time (1min) issued by the ARM to clear the fault.
	• The maximum value of frequency deviation Δf is counted every 400ms, and an alarm is generated immediately when the condition Δf is greater than or equal to 8Hz is established (Japanese grid: alarm is generated with a delay of 500ms when the condition Δf is greater than or equal to 5Hz is established).	4 Check that the AC circuit breaker is closed. 5 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	
Leakage current protection	No detection in VSG mode, multi-computer parallel mode, high and low wear state; power-on delay for a period of time before starting detection. • Threshold 1: 30ms, 120ms, 240ms sliding window filter values. • Threshold 2:	1 Check to see if the battery pack is in rainy, wet weather; if it is, there is no need for concern. 2 Please check the battery pack for poor contact. 3 Check the protection parameter settings of the converter.	Static leakage current value is lower than the set value, wait for 1 minute to force recovery.

Fault name	Fault condition	Treatment	Caveat
	1 30ms sliding window filter value over 150mA, or 120ms sliding window filter value over 60mA, or 240ms sliding window filter value over 30mA protection. 2 Detect leakage current value greater than 0.9 times the protection threshold, delay 240ms protection. 3 When enabling RCD self-test, detect leakage current sampling between the upper limit and lower limit, otherwise delay for a period of time after the protection.	4 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	
Output overload	The national standard requires that the 1.1 times overload running time is not less than 10min, and the 1.2 times overload running time is not less than 1min. - Threshold 1: $L_{thres_hold1}=1.15P_n$ - Threshold 2: $L_{thres_hold2}=1.2P_n$ - Threshold 3: $L_{thres_hold3}=1.15I_n$	Wait for the inverter to return to normal.	Wait 3 minutes to force a recovery.

Fault name	Fault condition	Treatment	Caveat
	- Threshold 4: Lthreshold4=1.2In 1 Detecting that the apparent power is greater than Lthreshold1 or the three-phase maximum current Rms value is greater than Lthreshold3, the protection is delayed for 10min. Detecting that the apparent power is greater than Lthreshold1 or the three-phase maximum current Rms value is greater than Lthreshold3, the protection is delayed for 10min. 2 Detecting that the apparent power is greater than Lthreshold2 or the three-phase maximum current Rms value is greater than Lthreshold4, the protection is delayed for 1min. Detecting that the apparent power is greater than Lthreshold2 or the three-phase maximum current Rms value is greater than Lthreshold4, the protection is delayed for 1min.		
DC over-current	Detect the DC current exceeding the threshold value 318A (212*1.5), delay 200ms to protect.	Generally no need to deal with will be automatically recovered, if the failure is repeated, please contact SUNGROW.	Wait 3 minutes to force a recovery.

Fault name	Fault condition	Treatment	Caveat
AC transient over-current	Three-phase current instantaneous value exceeds the threshold 537A (190*2*1.414), delay 1ms protection.	Generally no need to deal with will be automatically recovered, if the failure is repeated, please contact SUNGROW.	Wait 3 minutes to force a recovery.
Abnormal ambient temperature	Ambient temperature greater than 82°C.	Generally the machine will re-connect to the network after the internal temperature returns to normal, if the fault recurs: 1 Check if the ambient temperature of the inverter is too high. 2 Check that the machine is in an easily ventilated area. 3 Check if the machine is in direct light, if so please shade it properly. 4 Check if the fan is operating normally, if not replace the fan. 5 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	Ambient temperatures below 67°C are restored.

Fault name	Fault condition	Treatment	Caveat
Hardware failure- Hardware failure	1 The three-phase AC voltage is detected when the ring is opened, and if the negative sequence component is greater than 0.5 times the positive sequence component, it is protected.	Generally no need to deal with will be automatically recovered, if the failure is repeated, please contact SUNGROW.	Wait 3 minutes to force a recovery.
	2 Detect HW_FAULT (GPIO88) is low, delay 1ms to protect.		
Insulation impedance		Generally do not have to deal with will automatically recover, if repeated, so that the machine can not be normal network:	
	1 Masked when the ISO permanent protection function is not enabled, or when the slave of a multiple machine is in direct parallel.	1 Check if the machine setting ISO impedance protection value is too high, and confirm that it meets the requirements.	Wait 3 minutes, force recovery, and retest.
	2 To carry out ISO detection and calculation, if it is lower than the protection threshold, then retest, cumulative judgment 3 times are not satisfied, protection.	2 Check whether the environment is in cloudy and rainy days, and measure whether the insulation impedance value of the positive and negative terminals of the battery box to ground is too low.	
		3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	

Fault name	Fault condition	Treatment	Caveat
AC surge protector failure	AC lightning protector node signal anomaly lasting 200ms.	1 Check if the lightning arrester is loose or damaged, if it is damaged, replace the arrester. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	After protection, if the feedback IO level is high, delay 30s to clear the fault.
Analog Bias Abnormal	In the initialization phase of power-on, when the offset calibration of AD is completed, the AD values of three-phase current and DC current are detected, and if the accumulated three times are over the limit, protection is provided.	1 Reboot PCS. 2 Check for loose internal connections and a failed current sensor. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	Cannot be cleared automatically, need to check manually, troubleshoot and restart after power on.
Battery polarity reversed	If the collected battery voltage Vdc is less than -100V, delay 500ms to protect.	Check that the DC side wiring is correct.	Cannot be cleared automatically, need to check manually, troubleshoot and restart after power on.

Fault name	Fault condition	Treatment	Caveat
AC current imbalance	In grid-connected mode and without triggering voltage ride-through, take the difference between the maximum and minimum values of the three-phase current Rms values, and if it is greater than 0.15 times the rated value, the protection will be delayed by 200ms (700ms in Japan).	1 Wait for the machine to return to normal. 2 If the fault persists, contact SUNGROW.	Three-phase current difference is less than 5% of rated current for 20s.
DC surge protector failure	DC lightning protector node signal anomaly lasting 200ms.	1 Check if the lightning arrester is loose or damaged, if it is damaged, replace the arrester. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	After protection, if the feedback IO level is high, delay 30s to clear the fault.
DC soft start failure	In the charging phase of the startup, after closing the charging contactor K0 and negative bus contactor K3, if the difference between the battery and capacitor voltage is greater than 80V for 2min, it is protected.	Restart the machine if the fault persists, contact SUNGROW.	After protection and shutdown, a 3min delay clears the fault.

Fault name	Fault condition	Treatment	Caveat
AC voltage imbalance	1 Shielded when islanding protection is triggered. 2 Take the difference between the maximum and minimum values of the three-phase line voltage Rms value, if it is greater than the threshold value (ARM down), delay for a period of time (RAM down) protection.	Generally the machine will re-connect to the grid when the grid returns to normal, if the fault recurs: 1 Measure the actual grid voltage at the AC output, if the grid voltage imbalance is indeed higher than the set value, please contact the power company. 2 Check that the grid voltage unbalance parameters are reasonable. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	1 Immediately clears the fault when an update to the operating mode or rated frequency setting is detected. 2 In case of VF mode or VSG mode, after triggering the protection and shutting down the power, the delay is 30s to clear the fault. 3 If islanding protection is triggered, the fault is cleared immediately. 4 Take the difference between the maximum and minimum values of the three-phase line voltage Rms values, and if it is less than $0.02U_n$, delay the grid recovery time (1min) issued by the ARM to clear the fault.
Inverter open-loop self-test fault	In the start-up phase to the AC soft start link, if more than 30s can not complete the AC soft start, protection.	After several attempts to start the machine, if the fault persists, contact SUNGROW.	After protection and shutdown, the delay is 3min to clear the fault, but more than 5 times will not clear the fault automatically.

Fault name	Fault condition	Treatment	Caveat
Carrier synchronization fault	- Non-parallel mode, or non-direct parallel mode, shielding. - IO signal protection: carrier communication IO low, after 200ms delay: - If currently in the running state, protection. - If currently in other state, and the battery voltage Vdc is greater than 200V, then the protection will be delayed for another 5min.	- Try powering down the machine and restarting it. - Check for loose carrier synchronization wires. - Confirm that this is not the cause and that the fault persists, contact SUNGROW.	- Non-parallel mode, or non-direct parallel mode, clears the fault. - Carrier communication IO goes high with a 10s delay to clear the fault.
Bus voltage imbalance	If the half-bus voltage exceeds the protection threshold value of 617.5V, or the difference between the positive and negative bus voltages exceeds the protection threshold value of 200V, the protection is delayed for 1s.	Generally wait a few minutes to return to normal the machine will be re-connected to the network, if the failure is repeated, please contact SUNGROW.	After protection, if the half-bus voltage returns to within the protection threshold, or the difference between the positive and negative bus voltages returns to within the protection threshold, the fault is cleared with a delay of 30s.
GFRT operation	After entering high and low wear, an alarm is triggered.	- This is an alert and the machine can still continue to run without risk. - Restart the machine and if the fault persists, contact SUNGROW.	- Clear the alarm when you exit the run. - Delay 2s to clear the alarm when exiting high and low wear.

Fault name	Fault condition	Treatment	Caveat
Charging conditions not met	Charging conditions are not met (in grid-connected constant current mode or constant power mode, the battery voltage is higher than the upper limit of the charging voltage +2V, and the current or power command is charging), the delay time is 3s protection.	1 This is an alarm to check if the setup parameters are satisfied. 2 Check if the actual battery output voltage is abnormal. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	When the charging condition is satisfied, the alarm is cleared with a delay of 300ms.
Discharge conditions not met	Discharge conditions are not satisfied (in constant current mode or constant power mode, the battery voltage is lower than the lower limit of discharge voltage -2V, and the current or power command is discharged), the delay time is 3s protection.	1 This is an alarm to check if the setup parameters are satisfied. 2 Check if the actual battery output voltage is abnormal. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	When the discharge condition is satisfied, the alarm is cleared with a delay of 300ms.
Fan abnormality	Running mode fan drive pulse duty cycle is greater than 0.2, fan speed is 0 for 10s.	Check the fan. Please turn off the machine, disconnect the power to remove foreign objects, and replace the fan if it is damaged.	Fan speed is not zero.

Fault name	Fault condition	Treatment	Caveat
Module temperature too high	The maximum IGBT temperature exceeds the threshold value of 107°C and is protected by a 100ms delay.	Generally the internal temperature or module temperature returns to normal the machine will be re-connected to the network, if the fault recurs:	
		1 Check to see if the ambient temperature is too high. 2 Check that the machine is in an easily ventilated area. 3 Check if the machine is in direct light, if so please shade it properly. 4 Check if the fan is operating normally, if not replace the fan. 5 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	After protection, if the maximum IGBT temperature is less than 70°C, delay 5s to clear the fault.
Direct current contactor failure	1 Only the initial power-up execution, and the contactor self-test switch enable, then judge K1, K3, if there is adhesion, then protection.	1 Check the related contactors K1 and K3 for abnormalities. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	After protection and shutdown, the delay is 3min to clear the fault, but more than 3 times will not clear the fault automatically.
	2 The charging stage of the startup, if the difference between the battery and capacitor voltage is greater than 30V for		

Fault name	Fault condition	Treatment	Caveat
	2min after closing the main contactor K1, it is protected. 3 During the operation phase, when the difference between the bus voltage V_{bus} and the battery voltage V_{dc} is detected to be more than 50V, the protection is delayed for 100ms.		
Direct current component exceedance	After enabling this protection and without triggering voltage ride-through, if the DC component of the detected AC current exceeds the issued protection threshold, the protection is protected after delaying the issued protection delay time.	1 Check that the relevant protection parameters are set correctly. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	After protection and shutdown, if the DC component of the detected AC current is lower than the issued protection threshold * 0.5, the fault is cleared with a delay of 10s.
Address code duplication fault	1 Masking when the host is not in parallel mode. 2 Detect the phase flag error of the host in parallel mode, delay 1s to protect.	1 Check for duplicate address code settings. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	-

Fault name	Fault condition	Treatment	Caveat
Parallel communication failure	Non-parallel mode, or shielded when the host is in parallel mode.	1 Try powering down and rebooting.	1 Non-parallel mode, or clear the fault if you are a host in parallel mode.
	1 If the Run state is present, the cumulative number of communication failures is greater than 10 and protected. 2 If it is any other state, the cumulative number of communication failures is greater than 3000 and protected.	2 Check for loose parallel communication wires. 3 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	2 After protection, if the cumulative number of communication failures is less than, delay 30s to clear the fault. After protection, if the cumulative number of communication failures is less than, delay 30s to clear the fault.
AC incoming phase sequence error	Country code is national standard, or VSG operation mode, the grid phase sequence is detected as negative sequence, protection.	Check the wiring of the AC three-phase port ABC and access it in the positive sequence.	Cannot be cleared automatically, need to check manually, troubleshoot and restart after power on.
Battery current sampling abnormality	Detecting that the difference between the active power on the AC side and the active power on the DC side is more than 10% of the rated power, the protection is delayed for 500ms.	1 Check that the battery current sampling circuit and wiring are normal. 2 Confirm that this is not the cause and that the fault persists, contact SUNGROW.	Cannot be cleared automatically, need to check manually, troubleshoot and restart after power on.

6.3 Battery Fault Diagnosis

Fault Name	Trigger	Handling Method
Cell over voltage fault	The voltage of a single cell continuously exceeds the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception. 3. Check the voltage sampling line for exception.
PACK over voltage fault	The voltage of PACK continuously exceeds the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception. 3. Check the voltage sampling line for exception.
Total over voltage fault	The total voltage of PACK continuously exceeds the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception. 3. Check the voltage sampling line for exception.
Cell under voltage fault	The voltage of a single cell continuously falls below the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception. 3. Check the voltage sampling line for exception.
PACK under voltage fault	The voltage of PACK continuously falls below the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception.
Total under voltage fault	The RACK voltage continuously falls below the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check the cell voltage for exception. 3. Check whether there is any exception in the high-voltage acquisition circuit and hardware of the CMU mainboard.

Fault Name	Trigger	Handling Method
Cell low temperature fault	The cell is continuously charged or discharged at low temperatures (below the set fault threshold).	1. Check whether heat production is enabled for the liquid cooling unit. 2. Check whether the battery compartment is well sealed. 3. Check the cell temperature sensor connection for exception.
Cell over temperature fault	The temperature of the cell continuously exceeds the set fault threshold.	1. Check whether cooling is enabled for the liquid cooling unit. 2. Check whether the battery compartment is well sealed. 3. Check whether the battery power terminal bar is in good condition. 4. Check for inveracious soldering of the cells in the PACK. 5. Check the cell temperature sensor connection for exception.
Over current fault	The current continuously exceeds the set fault threshold.	1. Check whether the BSC parameters are set correctly. 2. Check whether the power cable of the system is properly connected.
Voltage sample fault	Abnormal voltage sample, disconnected sampling line, and BMU hardware fault.	1. Check whether the BMU is damaged and replace it if so. 2. Check whether the voltage sampling line is disconnected.
Temperature sample fault	Abnormal temperature sample, disconnected sampling line, and BMU hardware fault.	1. Check whether the BMU is damaged and replace it if so. 2. Check whether the temperature sampling line is disconnected. 3. Check whether the temperature sensor fails.
Current sample fault	Abnormal temperature sample, disconnected sampling line, and CMU fault.	Check whether the current sampling line is disconnected.

Fault Name	Trigger	Handling Method
CMU-BMU communication fault	The communication line is disconnected or the BMU is damaged.	1. Check whether the communication lines are connected normally and in a correct sequence. 2. Check whether the first BMU without communication is damaged (the communication line connection skips this module). 3. Check whether CMU is damaged.
CMU-BSC communication fault	The communication line is disconnected, the BSC is damaged, or the CAN-matched resistor is not connected.	1. Check whether the communication lines are connected normally. 2. Check whether the CAN-matched resistor is installed. 3. Check whether CMU or the container BSC is damaged.
Fuse fault	Short circuit or long-term overload, loose feedback line, fuse quality problem, or CMU fault.	1. Measure the fuse for an open circuit and replace it in case of any exception. 2. Check whether the line is disconnected or loose.
Total voltage difference fault	The difference between the cumulative total voltage and the sample total voltage exceeds the set fault threshold, or there is an exception in the total voltage sampling loop, indicating a CMU fault.	1. Troubleshoot other system faults such as communication fault and voltage sampling fault. 2. Check whether the total voltage sampling line is loose.
Cell over voltage alarm	The voltage of a single cell continuously exceeds the set alarm threshold.	1. When charging has stopped for 5 minutes (or the system starts discharging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception. 4. Check the voltage sampling line for exception.

Fault Name	Trigger	Handling Method
PACK over voltage alarm	The voltage of PACK continuously exceeds the set alarm threshold.	1. When charging has stopped for 5 minutes (or the system starts discharging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception.
Total over voltage alarm	The total voltage of RACK continuously exceeds the set alarm threshold.	1. When charging has stopped for 5 minutes (or the system starts discharging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception.
Cell under voltage alarm	The voltage of a single cell continuously falls below the set alarm threshold.	1. When discharging has stopped for 5 minutes (or the system starts charging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception. 4. Check the voltage sampling line for exception.
PACK under voltage alarm	The voltage of PACK continuously falls below the set alarm threshold.	1. When discharging has stopped for 5 minutes (or the system starts charging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception.

Fault Name	Trigger	Handling Method
Total under voltage alarm	The total voltage of RACK continuously falls below the set alarm threshold.	1. When discharging has stopped for 5 minutes (or the system starts charging), check whether the alarm is automatically released. 2. Check whether the BSC parameters are set correctly. 3. Check the cell voltage for exception.
Cell voltage difference alarm	The difference between the max cell voltage and the min cell voltage collected from the RACK continuously exceeds the set alarm threshold.	1. Check whether the system power level is too low, and the alarm will be automatically released when the power level is restored. 2. Check for cell imbalance (refer to Sungrow Maintenance Manual for imbalance). 3. Check BMU for exception (replace it if so). 4. Check the cell voltage for exception. 5. Check whether the voltage sampling flat cable is disconnected.
Pack voltage difference alarm	The difference between the highest PACK voltage and the lowest PACK voltage continuously exceeds the set alarm threshold.	1. Check the PACK cells for over-discharge and over-charge. 2. Check BMU for exception (replace it if so).
Cell temperature difference alarm	The difference between the max cell temperature and the min cell temperature collected from the RACK continuously exceeds the set alarm threshold.	1. After the DC/AC power converter unit operating power drops, check whether the alarm is released automatically. 2. Check the liquid cooling unit is turned on normally. 3. Check for loose power connection bars. 4. Check for inaccuracy soldering of the cells in the PACK.

Fault Name	Trigger	Handling Method
Cell low temperature alarm	The cell is continuously charged or discharged at low temperatures (below the set alarm threshold).	1. Judge whether the container system has not been fully started, and check the alarm is released automatically when the system is started. 2. Check whether heat production is enabled for the liquid cooling unit. 3. Check the temperature sensor for exception. 4. Check whether the battery compartment is well sealed.
Cell over temperature alarm	The temperature of the cell continuously exceeds the set alarm threshold.	1. After the DC/AC power converter unit operating power drops, check whether the alarm is released automatically. 2. Check whether cooling is enabled for the liquid cooling unit. 3. Check the temperature sensor for exception. 4. Check whether the battery compartment is well sealed. 5. Check whether the battery power terminal bar is in good condition. 6. Check for inaccuracy soldering of the cells in the PACK.
Over current alarm	The current is continuously over the set alarm threshold.	1. Whether the RACK is unbalanced. If the first installation is unbalanced, the system should be on standby for ≥ 24 hours. 2. Whether the alarm occurs in the case of low discharge SOC and disappears automatically when SOC is restored. It is recommended to reduce the depth of discharge. 3. Test whether the system power connection bar is normal, whether the battery system has a large temperature difference, and whether there is any exception in the liquid cooling unit.

*If the fault persists after the above operations, contact Sungrow.

6.4 LC Troubleshooting

Login LC Web, click  on the interface to view the fault alarm information.

Name	Reason	Troubleshooting advice
LC-CMU comm fault	Communications blackout	- Immediately shut down the faulty system and disconnect its external power supply. - Check for loose communication cables.
LC-PCS comm fault	Communications blackout	- Immediately shut down the faulty system and disconnect its external power supply. - Check for loose communication cables.
Host computer comm fault	Communications blackout	- Immediately shut down the faulty system and disconnect its external power supply. - Check for loose communication cables.
CMU faults/alarms	RACK fails/alarms	View the specific fault through the CMU information screen.
PCS faults/alarms	PCS malfunction/alarm	- View PCS specific faults. - Refer to the "PCS Troubleshooting" section for processing.
Node faults/alarms	Node input signals are different from the default configuration signals (configuration items)	- Checks against a list of node failure alerts. - Check the connection status of the signal cable.
Thermal runaway warning fault	The thermal runaway warning generates a warning signal or the thermal runaway warning itself fails	The fault disappears when the thermal runaway warning device does not have a warning signal and there is no communication failure.
Thermal runaway warning device communication failure	Communication failure between thermal runaway warning and LC	- Testing the communication line between the thermal runaway warning device and the LC. - The fault disappeared when communication between the thermal runaway alarm and LC was restored.

Name	Reason	Troubleshooting advice
SOC upper limit 1 alarm	RACK maximum SOC value greater than or equal to SOC ceiling level 1 value	- Check that the SOC parameters are set correctly. - Attempts to discharge to less than the SOC limit 1 recovery value.
SOC upper limit 2 alarm	RACK maximum SOC value greater than or equal to SOC ceiling level 2 value	- Check that the SOC parameters are set correctly. - Attempt to discharge to less than the SOC limit 2 recovery value.
SOC lower limit 1 alarm	RACK minimum SOC value less than or equal to SOC lower limit level 1 value	- Check that the SOC parameters are set correctly. - Attempt to charge to a value greater than the SOC limit 1 recovery value.
SOC lower limit 2 alarm	RACK minimum online SOC value less than or equal to SOC lower limit level 2 value	- Check that the SOC parameters are set correctly. - Attempt to charge to a value greater than the SOC limit 2 recovery value.
Auxiliary sub-Device alarms	Communication alarms or alerts on auxiliary sub-devices	To troubleshoot the corresponding auxiliary sub-device.

*If the above does not solve the problem, please contact SUNGROW.

7 Appendix

7.1 Abbreviations

Abbreviation	Definition
B	
BESS	Battery Energy Storage System
BM	Battery Module
BC	Battery Cluster
BMS	Battery Management System
BMU	Battery Management Unit
BSC	Battery System Controller
E	
ESS	Energy Storage System
EMS	Energy Management System
F	
FSS	Fire Suppression System
L	
LCS	Liquid Cooling System
LC	Local Controller
P	
PCS	Power Conversion System
PMD	Power Distribution Cabinet
S	
SOC	State Of Charge

7.2 Quality Assurance

When product faults occur during the warranty period, 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.



Product data such as product dimensions are subject to change without prior notice. The latest documentation from SUNGROW should take precedence in case of any deviation.

7.3 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>

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Sungrow Power Supply Co., Ltd.
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