SUNGROW
Clean power for all

System Manual

Energy Storage System

PowerStack-ST455kWh-110kW-4h

All Rights Reserved

About This Manual

This manual gives an introduction to the transport and storage, mounting, electrical connection, powering on/off, troubleshooting, and maintenance of the Energy Storage System ("ESS").

Target Group

This manual is intended for operators of the energy storage plant and qualified technical persons. The installation and operation must be performed only by qualified technical persons, who must:

- Have received professional training
- Have read through this manual carefully and have a good understanding of the relevant safety instructions
- Be familiar with applicable local standards and the relevant safety code for electrical system

How to Use This Manual

Read the manual and other related documents before performing any operation on the product. Documents must be properly kept and be available at all times.

To increase customer satisfaction, the product and its manual will be updated and improved constantly. If the manual you have received is slightly inconsistent with the real product, it is probably owed to a product update. In such a case, the real product should take precedence. You can find the latest manual at **support.sungrowpower.com**, or reach your sales for the manual.

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

Symbols in the Manual

To ensure the safety of life and property for users when using the product and to improve the efficiency of product use, the manual provides relevant safety information, which are highlighted by the following symbols.

Symbols that may appear in this manual are listed below. Please read carefully for 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.

Indicates supplementary information, emphasis on specific points, or tips related to the use of the product that might help to solve your problems or save your time.

Signs on the Product

Observe the safety signs on the product at all times, which include:

Sign	Explanation
	Hot surface! Do not touch. Otherwise, it may cause personal injuries.
	Disconnect the equipment from all the external power sources before maintenance!
	High voltages inside! Touching it may result in an electric shock.
	Danger of death due to high voltages! After the equipment is disconnected from the external power source, wait at least 5 minutes before touching any of its internal conductive parts.
	Beware of heavy weights! Lifting the heavy object directly may cause back injury. Please lift it with the assistance of proper tools.
	Beware of explosion.
	Beware of corrosion.
	Do not dispose of it together with household waste.
	No fires.

Sign	Explanation
	A medical facility should be set up nearby.
	If it gets in your eyes, flush your eyes immediately with running water or saline, and seek medical advice in time.
	Protective earthing (PE) terminal. This terminal should be connected for reliable grounding, to ensure the safety of the operator.
	Read the instructions before performing any operation on the product.
	Wear safety goggles.

1 Safety Precautions

1.1 Personnel Requirements

The hoisting, transportation, installation, wiring, operation, and maintenance of the equipment must be carried out by qualified electrical technicians in accordance with local regulations. Qualified technicians must:

- Have certain electrical wiring, electronic, and mechanical expertise, and be familiar with electrical and mechanical schematics.
- Be familiar with the composition and working principles of the equipment and its upstream and downstream equipment.
- Have received professional training in the installation and commissioning of electrical equipment.
- Be able to respond quickly and effectively to dangers or emergencies that may occur during the process of installation and commissioning.
- Be familiar with applicable local standards and specifications of the country/region where the project is located.

1.2 Electrical Safety

⚠ DANGER

- **Touching the power grid or the contact points and terminals in the devices connected to the power grid may lead to electric shock!**
- **The battery side or the power grid side may generate voltage. Always use a standard voltmeter to ensure that there is no voltage before touching.**

⚠ DANGER

- **Lethal voltages are present inside the product!**
- **Note and observe the warnings on the product.**
- **Respect all safety precautions listed in this manual and other pertinent documents.**
- **Respect the protection requirements and precautions of the lithium battery.**

⚠ DANGER

- **Electricity may still exist in the battery when the power supply of the equipment is disconnected. Wait 10 minutes to ensure the equipment is completely voltage-free before any operation.**

⚠ WARNING

- **All hoisting, transportation, installation, wiring, operation, and maintenance must be carried out complying with the relevant codes and regulations of the country where the project is located.**

⚠ WARNING

- **Always use the product in accordance with the requirements described in this manual. Otherwise, equipment damage may occur.**

NOTICE

To prevent misuse or accidents caused by unrelated personnel, observe the following precautions:

- **Post prominent warning signs around the product to prevent accidents caused by false switching.**
- **Place necessary warning signs or barriers near the product..**

1.3 Battery Safety

⚠ WARNING

Do not leave the product in a low voltage or low SOC (State Of Charge) condition for a long period of time. Loss of capacity due to the following conditions is not covered by the warranty.

- **Battery discharge cell voltage is below 2.7V for 120 consecutive hours.**
- **Any cell cluster SOC is 0% for 120 consecutive hours.**
- **Battery discharge cell voltage ≤2V.**

⚠ WARNING

Over or under voltage fault & alarm (detailed information can be found in the Communication protocol > BSC200 Info-3x table > CMU (Battery Cluster Management Unit) fault word and CMU alarm word).

- **Fault: “Cell over voltage fault”, “Cell under voltage fault”, “Total over voltage fault”, “Total under voltage fault”.**
- **Alarm: “Cell over voltage alarm”, “Cell under voltage alarm”, “Total over voltage alarm”, “Total under voltage alarm”.**

End users must assign a high priority to above listed faults and alarms reported by the SUNGROW LC (Local Controller). When an alarm or fault is triggered, the user interface should prominently highlight these issues. Furthermore, end users should promptly contact SUNGROW for timely resolution to prevent battery warranty loss due to over-discharge or overcharge.

NOTICE

- **In order to avoid triggering the warranty expiration condition, when the “Cell Under-voltage Fault” or “Cell Over-voltage Fault” is triggered, the user must contact the local team of SUNGROW within 24 hours and follow the requirements of SUNGROW to carry out the next operation.**
- **If the system is configured with the “Active power up” function, When the Battery Energy Storage System Container minimum rack SOC reaches the threshold for this function (the threshold can be set from 0 to the lower SOC protection value, and the threshold does not exceed 5% SOC), the system will charge the battery with low power until the SOC reaches a safe threshold (5% SOC) automatically, The recharging power can be set within the range of 100 kW to 150 kW. During Active power up, when the EMS (Energy Management System) issues a charging instruction, the LC controller will prioritize the EMS charging instruction. When the EMS issues a discharging instruction, the LC controller will respond according to the specific system SOC value. SUNGROW will enable this function by default when the device is shipped from the factory, In order to minimize the risk of under-voltage of the battery that may void the warranty, SUNGROW recommends that users do not turn off the “Active power up” function.**

NOTICE

- **If the system will not be in operation for an extended period (7 days or more), it's recommended to increase the SOC lower limit protection value to above 10% SOC. Additionally, it is important to regularly monitor the system's SOC to avoid the risk of over discharge which will cause warranty expiration.**
- **During maintenance or shutdown, if the SOC of any battery cluster is 0%, the SOC needs to be charged to 15% and above within 120 hours.**
- **If the SOC of any battery cluster is 0% during operation, the SOC needs to be charged to 5% and above within 2 hours. Or when the SOC reaches 0%, a command can be issued by the host computer EMS to change the system mode to recharge mode.**

For safe use of the product, the technician should carefully read and strictly observe the safety requirements. SUNGROW shall not be liable for product functional abnormality, component damage, personal safety accident, property loss, or other damage caused by the following reasons:

- Batteries are not charged as required, thus resulting in battery capacity loss or irreversible damage.
- Batteries are damaged or dropped, or have leaked, due to improper operations or failure to perform operations as required.
- Batteries are damaged due to overdischarge as they have not been powered on in time.
- Batteries are damaged due to the use of improper equipment for charging and discharging.
- Batteries are frequently overdischarged due to improper maintenance; battery capacity is incorrectly expanded; or batteries have not been fully charged for a long time.
- Battery operation parameters are not correctly set.
- Batteries are damaged because their operating environment does not meet the requirements.
- The customer uses the batteries beyond the scenarios specified in this manual, including but not limited to, connecting extra loads.
- Batteries are not maintained in compliance with the requirements specified in the system manual.
- The product is damaged due to the customer's continued use of batteries beyond the warranty period.
- The product is damaged due to the use of defective or deformed batteries.
- Use the batteries provided by SUNGROW together with other batteries, including but not limited to batteries of other brands or batteries of different rated capacities.
- Product damage or property loss are caused due to storing or installing batteries together with flammable/explosive materials.

- Personal safety accidents and property loss are caused by battery-related operations performed by non-qualified personnel, or by personnel not wearing qualified protective equipment during operations.
- Batteries are damaged due to improper behaviors, such as eating, drinking, and smoking near the battery.

1.4 Hoisting and Transportation

⚠ WARNING

When walking on the top of the equipment, be sure to follow the standard procedure for working at heights.

1.5 Installation and Wiring

⚠ WARNING

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

⚠ WARNING

Only equipment designated by SUNGROW can be used. Failure to use equipment designated by SUNGROW may cause damage to the protection function and injury to personnel.

1.6 Operation and Maintenance

⚠ DANGER

Dismantling or burning the battery may cause it to catch fire.

⚠ WARNING

Personal protective equipment is required for maintenance and service of the equipment.
Maintenance personnel must wear protective equipment such goggles, helmets, insulated shoes, gloves, etc.

⚠ WARNING

There are no user-maintainable parts inside the battery unit.
Only personnel approved by SUNGROW can remove, replace and dispose of the batteries. Users are not allowed to maintain batteries without guidance.

⚠ WARNING

To avoid electric shock, do not perform any other maintenance operations beyond those described in this manual.
If necessary, contact Sungrow Customer Service for maintenance.

⚠ WARNING

To ensure continuous fire protection, replacement of internal components should only be performed by professional personnel.

⚠ WARNING

Protective tools such as goggles are required when carrying out coolant (glycol solution) or liquid cooling pipeline maintenance.

NOTICE

Do not spray paint any internal or external component of the product.
Do not use cleaning agents to clean the product or expose it to harsh chemicals.

1.7 Product Disposal

When the equipment or its internal components reach end-of-life, do not dispose of it together with household wastes. Some components inside the equipment can be recycled, while some may pollute the environment.

Contact an authorized local facility for collection.

2 Product Description

2.1 Product Overview

The electrical equipment, communication device, temperature control device, and fire suppression system of the ESS all adopt an integrated design. For electrical equipment, the LFP battery system is designed with a liquid cooling system, while the DC/AC power converter unit adopts forced air cooling for heat dissipation. The battery system and the DC/AC power converter unit are integrated into an all-in-one outdoor-type cabinet. For communication devices, the LC integrates the functions of BSC, and the CMU is built into the DC/AC power converter unit. The integrated design makes the entire system more compact in structure and easy to maintain.

With an all-in-one design, the ESS allows flexible configuration and easy installation and O&M, with only a small space required. It also supports ancillary service functions such as demand control, gaining revenue from peak-to-trough price spread, demand response, and virtual plant.

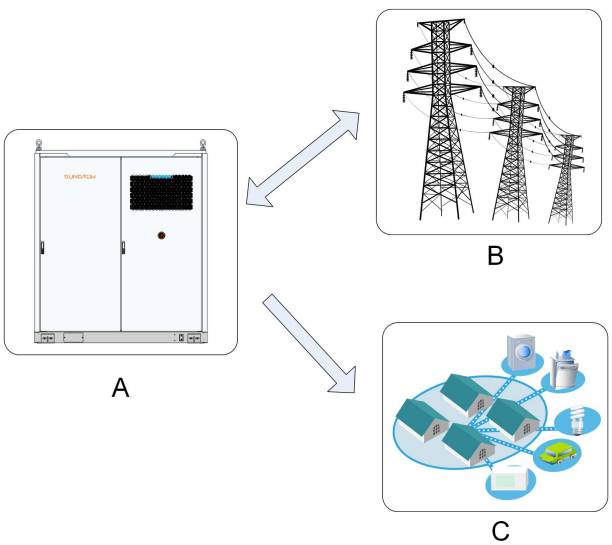


Figure 2-1 Typical Application of the ESS

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

No.	Name
A	ESS

No.	Name
B	Utility grid
C	Loads

2.2 External Design

2.2.1 ESS External Design

The external design of the ESS is shown in the figure below.

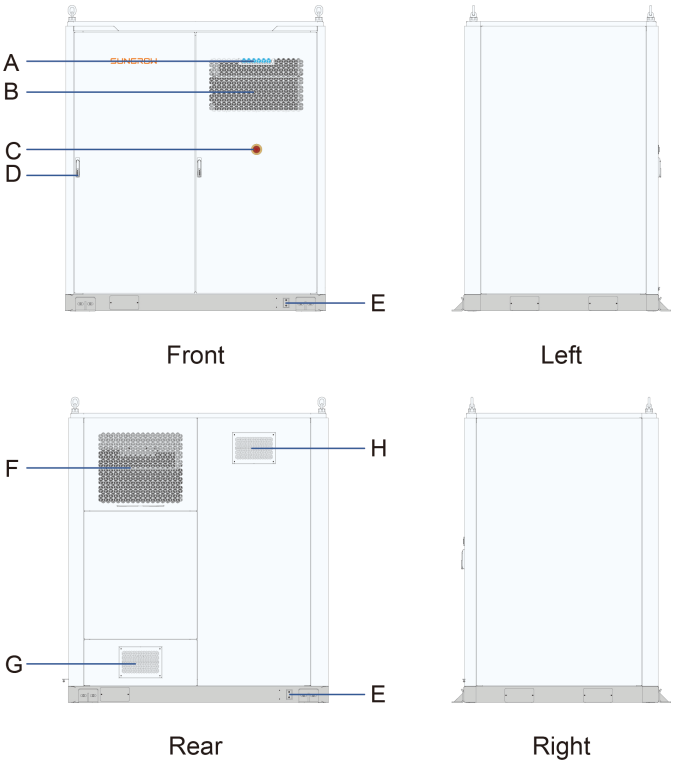


Figure 2-2 External Design

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

No.	Name
A	LED indicator
B	Air inlet
C	Emergency stop button
D	Door lock

No.	Name
E	Grounding point
F	Air outlet
G	Fire inlet (Optional)
H	Fire outlet (Optional)

NOTICE

The nameplate contains critical parameter information related to the ESS and should be protected against damages during transportation, installation, maintenance, overhaul, and other operations. Do not damage or remove the nameplate!

LED Indicator

The LED indicator is located at the top of the ESS cabinet. The description of the LED indicator status is shown as follows.

Table 2-1 LED Indicator Status

Indicator Status		Description
	Steady on	The system works normally (charging/discharging)
	Blink with fading effect at 2s intervals (breathing) 	The system is normal and currently not charging/discharging
	Steady on	There is a fault in the system (the auxiliary power supply is not disconnected)
	Off	The auxiliary power supply is disconnected

Emergency Stop Button

In case of an emergency, press this button, and the system will then stop running immediately.

DANGER

After the emergency stop button is pressed, the system will shut down and the DC contactor will open. However, the internal auxiliary power supply and the PCB board will still carry voltage. Do not touch them!

2.2.2 Mechanical Parameters

Overall Dimensions

The dimensions of the ESS are shown in the figure below.

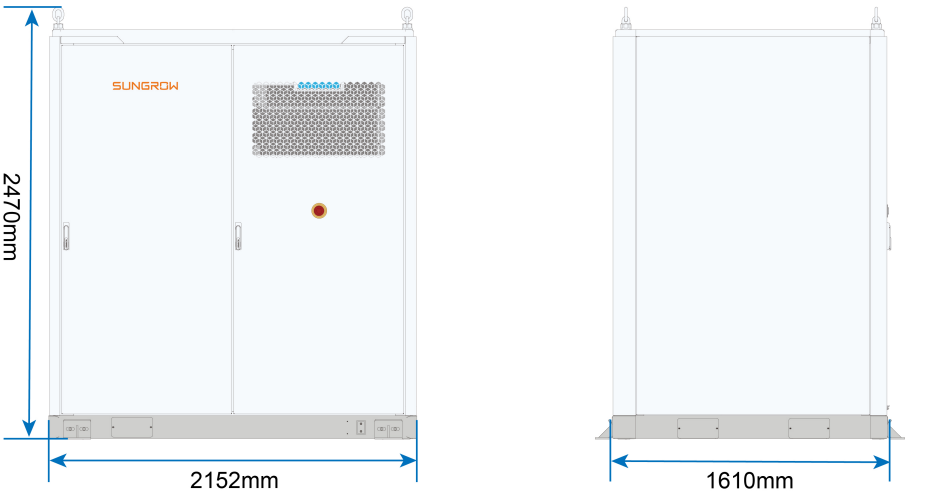


Figure 2-3 Overall Dimensions

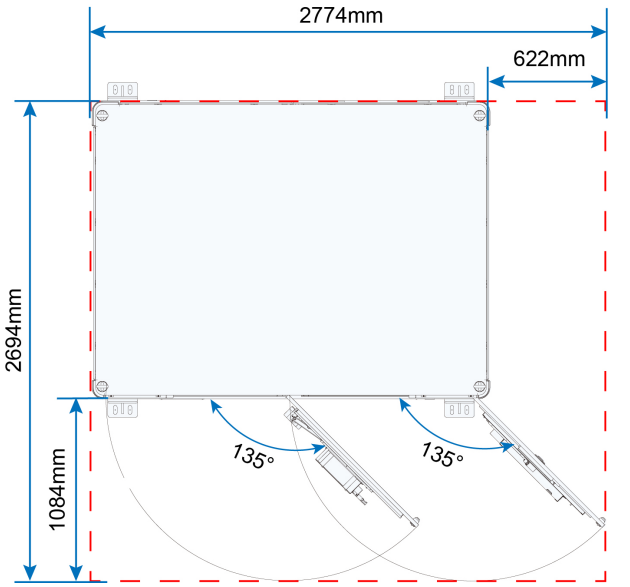


Figure 2-4 Dimensions of ESS with Its Door Fully Opened

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

2.2.3 Ventilation Design

The ESS has an air inlet at its front and an air outlet at its rear, as shown in the figure below.

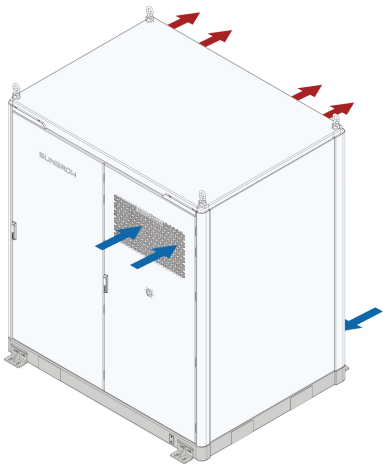


Figure 2-5 Air Inlet and Outlet

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

2.3 Internal Design

2.3.1 Internal Components

The major electrical equipment inside the ESS cabinet are shown in the figure below.

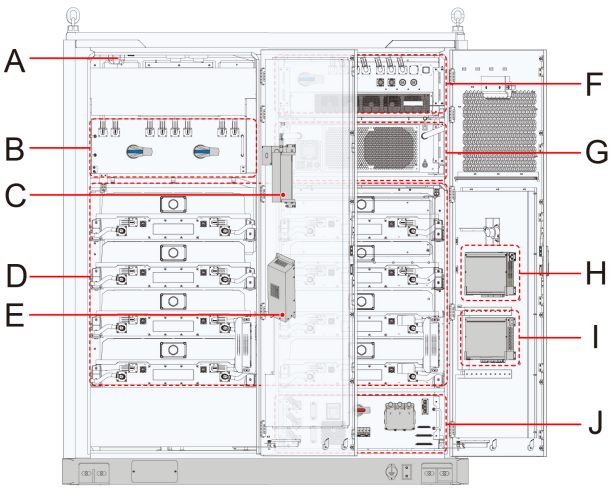


Figure 2-6 Internal Structure of ESS Cabinet

No.	Name
A	Fire suppression system (FSS)
B	Switch gear (S/G)

No.	Name
C	Aerosol
D	Battery RACK (compartment)
E	Dehumidifier(Optional)
F	DC/AC power converter unit (SC110CX)
G	Liquid cooling system (LCS)
H	Local controller (LC300)
I	Energy Management System (EMS300CP)(Optional)
J	Battery Power Supply Panel (BSP)

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

2.3.2 DC/AC power converter unit (SC110CX)

DC/AC power converter unit External Design

The external design of the SC110CX Power Conversion System is shown in the figure below.

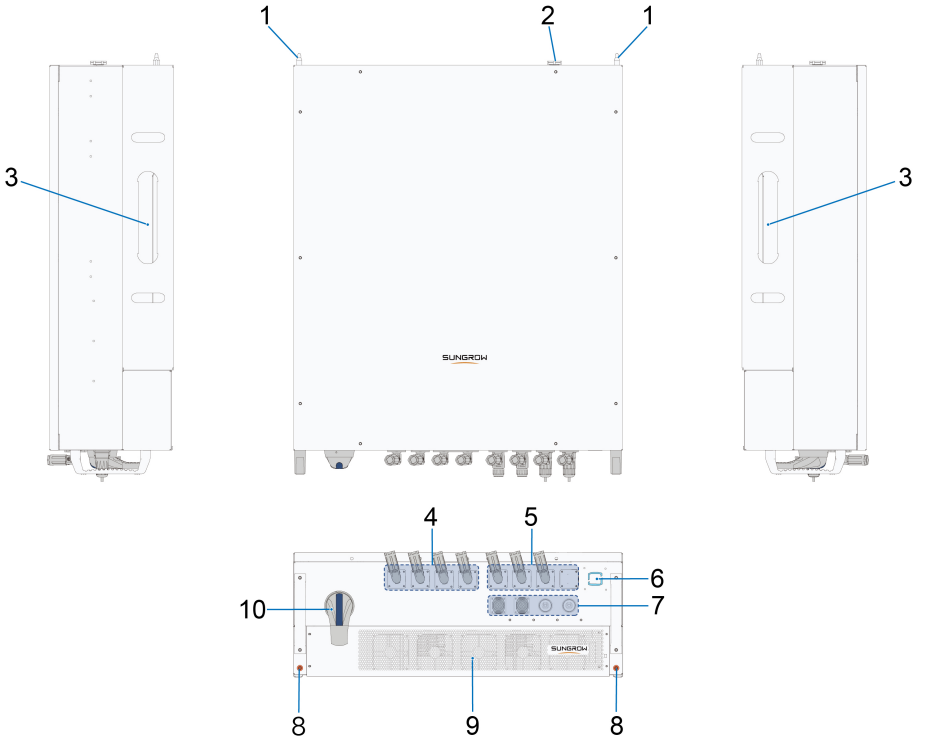


Figure 2-7 DC/AC power converter unit External Design

*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 DC/AC power converter unit.
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 wiring area	-
5	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.

⚠ WARNING

*** During product use, avoid DC positive/negative-to-ground short circuits and short circuits between positive and negative. Otherwise, it may lead to serious damages to the DC/AC power converter unit.**
In case a short circuit fault has occurred, the whole DC/AC power converter unit should be replaced.

LED Indicator Panel

The LED indicator panel serves as an interface for human-machine interaction and is used to indicate the current operating status of the DC/AC power converter unit.

Table 2-2 LED Indicator Status

Indicator	Status	Description
 Blue	Steady on	The device is running.
	Blink fast (Interval: 0.2s)	The device has connected to bluetooth and data communication is in process.

Indicator	Status	Description
		There is no fault in the device.
	Blink slow with fading effect (Interval: 2s) 	The device has been powered on and is in the emergency stop, standby, or startup state.
 Red	Steady on	A fault has occurred (the device cannot connect to the grid).
	Blink	The device has connected to bluetooth and data communication is in process. There is a fault in the device.
 Off	Off	The AC and DC sides are both disconnected from power.

2.3.3 Battery Power Supply Panel (BSP)

External Design

The external design of the BSP is shown in the figure below.

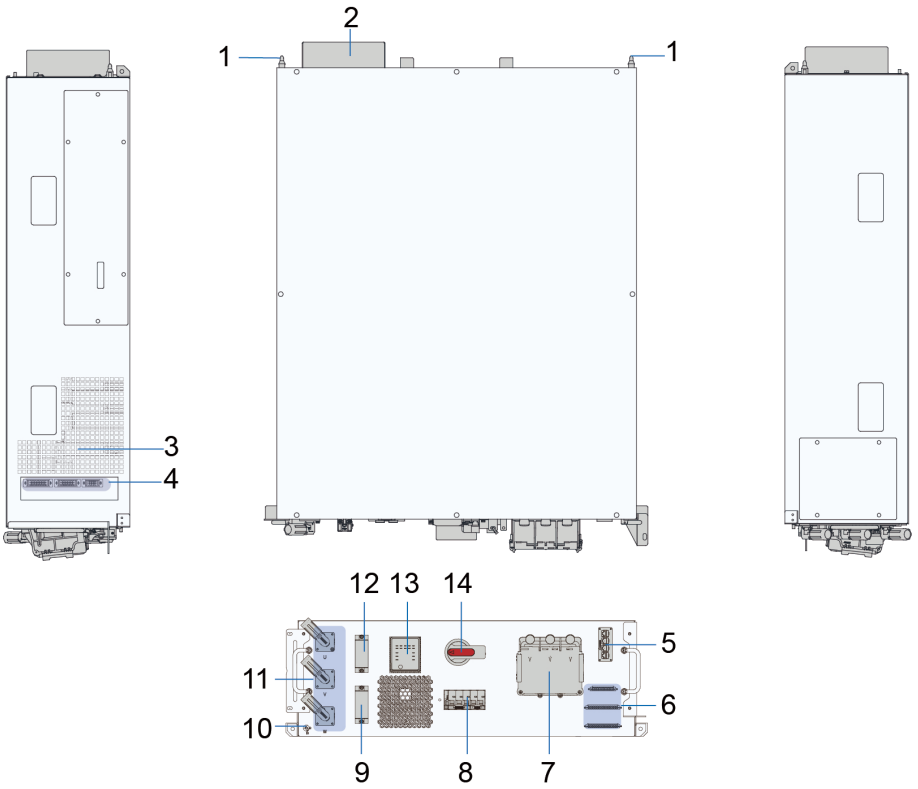


Figure 2-8 External Design

*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 power distribution box.
2	Air outlet	Used to exhaust the circulating hot air from the power distribution box.
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	Communication wiring area.
6	CONN1–3	Ports for FSS, LC, and EMS.
7	AC output port	AC output wiring area.

No.	Name	Description
8	Miniature circuit breaker (MCB)	AC auxiliary power supply and UPS control switch.
9	*AUX POWER	Used for external auxiliary power supply wiring.
10	Additional protective grounding terminal	Terminal used for additional protective grounding, as specified by EN 50178.
11	AC wiring area	Connected to DC/AC power converter unit AC side.
12	LCS POWER	Used for power supply wiring of the liquid cooling unit.
13	UPS	Uninterruptible power supply.
14	AC MAIN SWITCH	Used to disconnect the equipment from the loads safely.

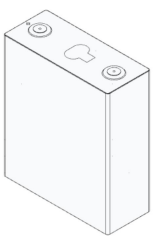
*The system is equipped with an internal auxiliary power supply as standard.

2.3.4 Battery

Cell and PACK

The PACK (battery module) is mainly composed of cells connected in series. It is equipped with functions such as battery voltage and temperature sampling and balancing control. Designed with chips dedicated to battery management, it receives control commands and uploads the collected data over daisy chain communication.

Table 2-3 Cell and PACK Data - CATL

Cell	Parameter	Value
	Type	CB310
	Dimensions (thickness * height * width)	(71.7±0.8) mm * (207.2±0.8) mm * (173.9±0.8) mm
	Weight	(5.34±0.20) kg
	Rated capacity	280Ah
	Rated energy	896Wh
	Rated voltage	3.2V
	Voltage range	2.5V–3.65V (cell temperature 0℃< T ≤55℃)

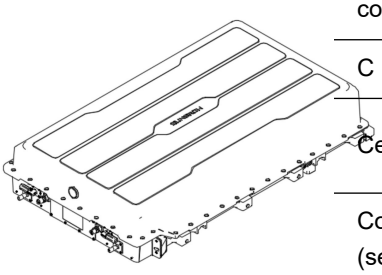
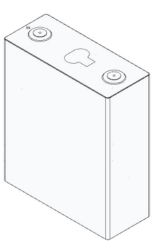
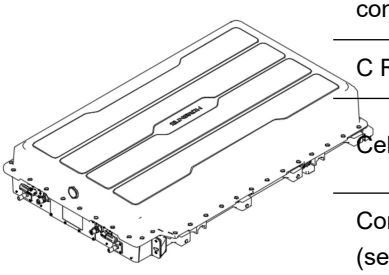
Cell	Parameter	Value
		2.0V–3.65V (cell temperature –30℃≤ T ≤0℃)
PACK	**Parameter**	**Value**
	Model	P573-111/P573B-111
	Dimensions (W*H*D) (wiring terminals and faucets not considered)	(868±5) mm * (247±5) mm * (1415±5) mm
	C Rate	≤0.5C
	Cell type	Prismatic cell with aluminum shell, LFP
	Configuration (series and parallel)	1P64S
	Key components	64 cells, 1 BMU, 1 fuse
	Weight	(400±12.0) kg
	IP rating	IP65

Table 2-4 Cell and PACK Data - CALB

Cell	Parameter	Value
	Type	L173F280A
	Dimensions (thickness * height * width)	(71.57±0.5) mm * (207.2±0.8) mm * (174.7±0.8) mm (with terminal) (71.57±0.5) mm * (204.57±0.8) mm * (174.7±0.8) mm (without terminal)
	Weight	(5.35±0.16) kg
	Rated capacity	280Ah
	Rated energy	896Wh
	Rated voltage	3.2V
	Voltage range	2.5V–3.65V (cell temperature 0℃ < T ≤55℃)

Cell	Parameter	Value
		2.0V–3.65V (cell temperature –30℃≤ T ≤0℃)
PACK	**Parameter**	**Value**
	Model	P573AL-181/P573BL-181
	Dimensions (W*H*D) (wiring terminals and faucets not considered)	(868±5) mm * (247±5) mm * (1415±5) mm
	C Rate	≤0.5C
	Cell type	Prismatic cell with aluminum shell, LFP
	Configuration (series and parallel)	1P64S
	Key components	64 cells, 1 BMU, 1 fuse
	Weight	(400±12.0) kg
	IP rating	IP65

RACK

RACK is mainly composed of several PACKs and fuse.

RACK data is shown in the table below.

Table 2-5 RACK Data - CATL

RACK Model	DC output voltage range	Rated power	Rated voltage	Short-circuit current
R0229BL-ACAA	691.2–934.4V	114.7 kW	819.2V	≤20kA
R0458BL-ACCA	691.2–934.4V	114.7 kW	819.2V	≤20kA

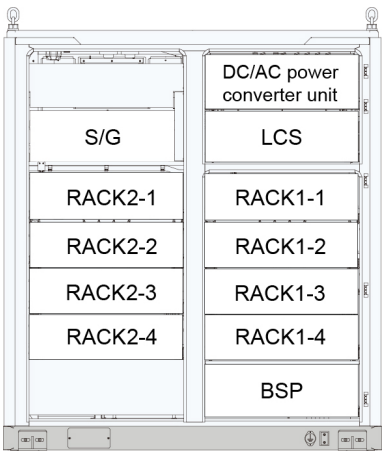
Table 2-6 RACK Data - CALB

RACK Model	DC output voltage range	Rated power	Rated voltage	Short-circuit current
R0229BL-AHAA	691.2~934.4 V	114.7 kW	819.2V	≤20kA

RACK Model	DC output voltage range	Rated power	Rated voltage	Short-circuit current
R0458BL-AHCA	691.2~934.4 V	114.7 kW	819.2V	≤20kA

RACK Structure

Table 2-7 RACK Structure

Model	Arrangement
ST455kWh-110kW-4h	

Note: RACK x-x indicates an 1P64S PACK (battery module). DC/AC power converter unit stands for power conversion system, S/G stands for switch gear, LCS for liquid cooling unit, and BSP for battery power supply panel.

2.3.5 EMS Controller (Optional)

The EMS300CP energy management system controller can collect the operation data of the ESS and upload it to the iSolarCloud so that users can monitor and control the system operation remotely.

The EMS300CP controller is optional. It is built into the ESS power distribution box. Users can read the label on the power distribution box to understand whether the product has an EMS300CP controller or not.

Auxiliary Meter

In addition to the ESS operation data, the EMS300CP also needs to collect the meter data, as required by some particular functions. Therefore, please install the following two meters first before installing the ESS.

- Gateway meter: Zero export, demand control.
- Electricity meter: Overload protection.

Local Monitoring on Web

The internal communication wiring between the EMS300CP and the ESS has been completed in the factory. Connect the PC to the communication port on the ESS at the site. Then, you can access the EMS300CP Web system on the PC.

The homepage of the EMS300CP Web system is shown below:

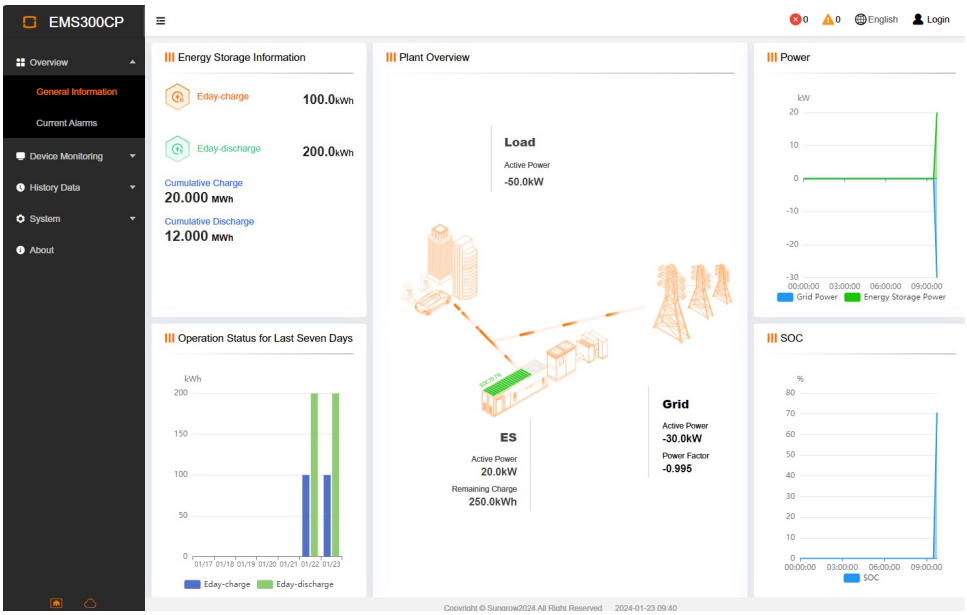


Figure 2-9 EMS300CP Web Homepage

You can scan the QR code on the nameplate at the rear of the ESS cabinet to get the EMS300CP user manual, or scan this QR code directly:

Remote Monitoring on iSolarCloud

You can also monitor the ESS remotely via iSolarCloud. You can log in to the iSolarCloud Web system on the PC, or download the iSolarCloud App from an application store on your phone:

The EMS300CP can only be configured locally by connecting it to a PC via Ethernet. It accesses the Internet through a router with network access. After the plant is registered on iSolarCloud, users can monitor the system remotely using the App.

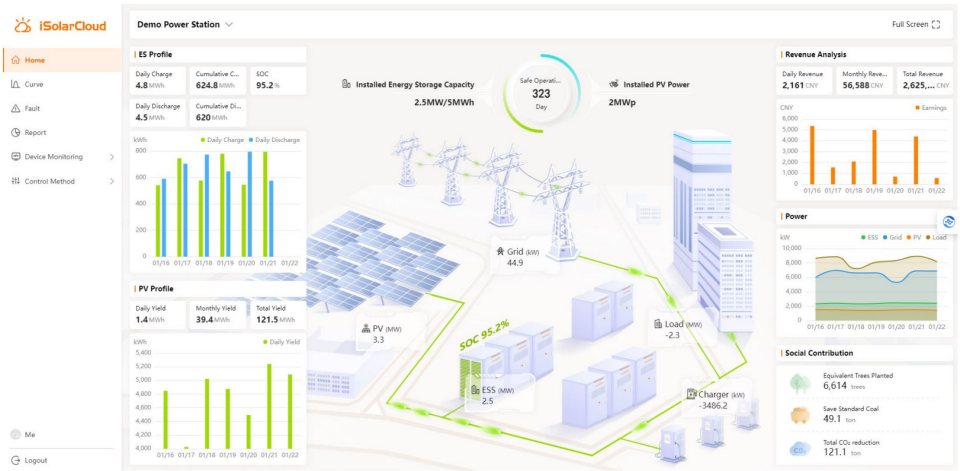


Figure 2-10 EMS300CP iSolarCloud Homepage

2.4 Transformer Cabinet

Transformer cabinet is optional.

2.4.1 Cabinet Appearance

The appearance of LVS250UD is shown in the following figure.

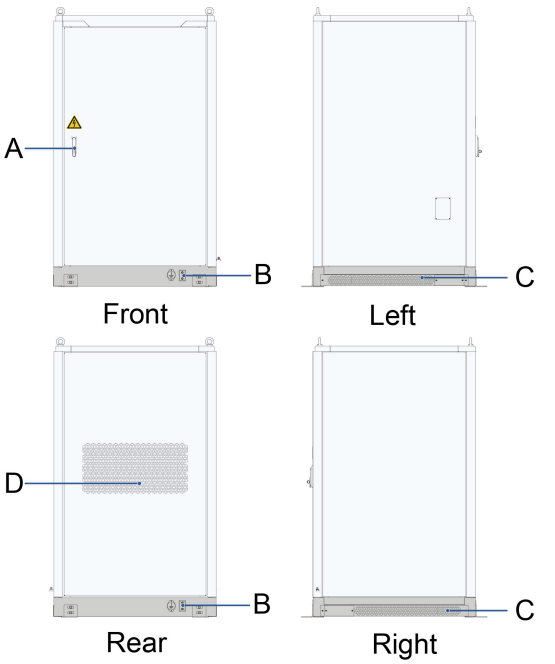


Figure 2-11 Appearance of LVS250UD

No.	Name
A	Door lock
B	Grounding point
C	Air inlet
D	Air outlet

* The figure is for reference only. The product received may differ.

2.4.2 Mechanical Parameters

The external dimensions of LVS250UD are shown in the figure.

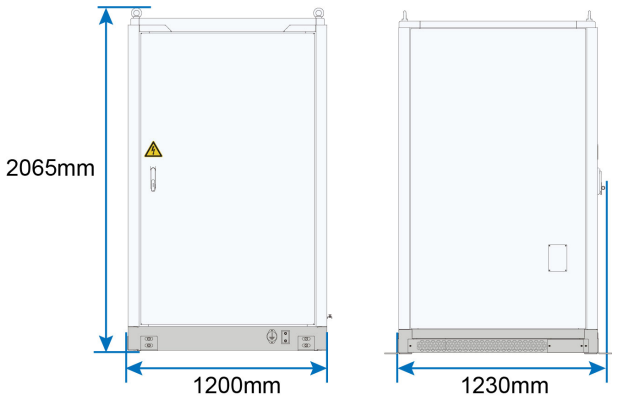


Figure 2-12 Dimensions of LVS250UD

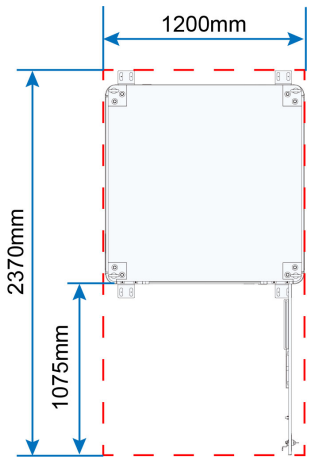


Figure 2-13 LVS250UD dimensions diagram (door open)

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

2.4.3 Internal Equipment

The main electrical equipment in the LVS250UD is shown in the figure below.

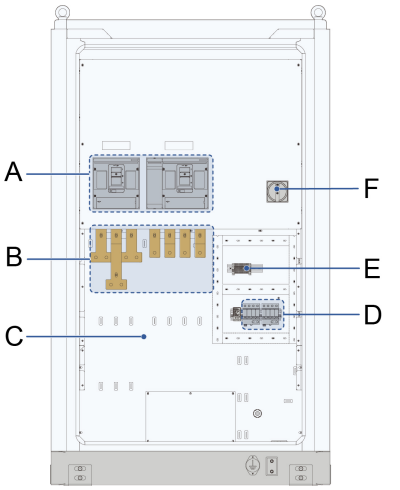


Figure 2-14 Internal layout of the LVS250UD

* The figure is for reference only. The product received may differ.

No.	Name
A	Moulded case circuit breakers
B	Wiring copper bars
C	Transformer
D	Surge protection device (SPD)
E	Wiring terminals
F	AC load switch

3 Transport and Storage

3.1 Precautions

⚠ CAUTION

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

3.2 Transport Methods

The ESS can be transported by land and sea. It adopts an integrated and easy-to-lift design that facilitates transport. Currently, permission has not been granted to transport the ESS by air, and no relevant guide for rail transport is available.

The ESS can be transported by truck within the country.

NOTICE

In most cases, the total weight of the truck that carries the ESS will exceed the general weight limit on the road. Therefore, you may need to acquire an overweight permit from the relevant local agency in that area.

3.3 Transport Requirements

The ESS leaves the factory with most of its internal components secured inside its body. You may lift or move the ESS as a whole directly during transport.

⚠ WARNING

In the whole process of loading, unloading, and transport, follow strictly the applicable safe operation procedure for ESS in the country/region where the project is located.

- **All the tools used on the ESS, or during operation, must have undergone proper maintenance.**
- **All personnel engaged in loading, unloading, and anchoring operations must have received relevant training, especially in safety.**
- **Do not transport the ESS when the temperature is below -30 ℃.**

During the whole process of loading, unloading, and transport, always keep in mind the mechanical parameters (overall dimensions and weight) of the ESS.

To transport and move the ESS, make sure the below requirements are met:

- All the doors of the ESS are locked.
- Select an appropriate crane or lifting tool according to the on-site conditions. The tool used must have a sufficient load capacity, boom length, and swing radius.
- It is recommended to use one crane to lift the ESS.
- Extra traction may be required to move the ESS along a slope.
- Remove all obstacles that exist or may exist along the route, such as tree branches and cables.
- Transport or move the ESS in good weather, whenever possible.
- Be sure to set up warning signs or fence off warning zones to prevent irrelevant personnel from entering the operating area, thus avoiding accidents.
- The ESS must stand upright during transport.
- Ensure the base of the ESS remains level throughout the whole transport process, with a maximum allowable tilt of 15°.
- Avoid collision or strong shock during transport.
- If the ESS is transported by land, use ropes to secure the lifting rings at the top of the ESS to the transport vehicle, to prevent it from getting overly tilted during transport.

  After the ESS arrives at the project site, remove the diagonal fixing pieces at the top four corners, and store them properly.

- Transport vehicles must comply with local traffic regulations.
- During transportation, the vehicle shall maintain a constant speed whenever possible. Sudden braking is not allowed.
- The logistics carrier shall monitor abnormal driving behavior through the logistics tracking platform or the vehicle's on-board GPS system and issue early warnings or manual intervention alerts. If any visible damage is found during on-site unpacking, the carrier shall provide driving records as evidence for responsibility determination.

3.4 Storage Requirements

NOTICE

Store the product according to the storage requirements. Damage resulting from failure to meet the storage requirements will not be covered by the warranty

- During storage, properly archive all documentation demonstrating compliance with product storage requirements, including ambient temperature and humidity logs, photos, and inspection reports.

- The base of the ESS must be elevated off the ground to a certain height, to avoid internal condensation and also to prevent the ESS bottom from getting soaked by rain water in rainy seasons. The height shall be decided according to the on-site geological and meteorological conditions, etc.
- Store the ESS on a dry, flat, solid, and hard ground surface that is not covered by any vegetation. Requirements for the surface are as follows:
  - The surface must have sufficient load-bearing capacity to support the equipment.
  - The surface must be level, with a levelness deviation of 0–10 mm, and the slope must be less than 5°.
  - The surface must provide good drainage to prevent water accumulation or submersion of the ESS.
- Before storage, ensure that the doors of the ESS and all internal equipment are locked. During storage, avoid opening the doors, unless it is necessary.
- Maintain a clearance of 200 cm in front and 60 cm behind the ESS during storage.
- The ambient temperature range for system storage is -30°C to +50°C. Since battery degradation (SOC and SOH) is related to temperature, the optimal storage temperature is -30°C to +25°C.

  Long-term storage of the battery is not recommended as it may lead to battery capacity degradation. Even if the battery is stored at the recommended optimal storage temperature, irreversible capacity degradation will still happen during the period of rest, and such degradation will become more severe as the storage time lengthens. Please refer to the technical agreement for the specific amount of degradation.

- The UPS that is not put into operation needs to be charged every six months.
- The relative humidity for storage is 0%–95%, non-condensing.
- Use effective protections for the air inlets and outlets of the ESS. During storage, make sure the protective films on the air inlets and outlets are intact. Meanwhile, take effective measures to prevent the ingress of rainwater, dust, and sand.
- It is recommended to replace the desiccant every six months. Use montmorillonite desiccant, 200 g per bag. Place eight bags of desiccant at the collection tray area under each cabinet. Remove all desiccant from the cabinet before operation.
- Perform regular inspections at least every half a month. Check for signs of damage caused by pests or animals, and inspect the ESS and its packaging, wiring terminals, cables, and internal components for damage or aging. Promptly address any issues found or replace parts as necessary.
- Before installing an ESS that has been stored for more than six months, open its doors and perform a visual inspection. Ensure that the ESS and all internal components are intact and free of damage. Additionally, conduct inspections after powering on and startup. If necessary, request qualified personnel to test it before installation.
- Avoid storing the ESS in areas containing flammable or explosive materials. Ensure there is no fire hazard.

- Avoid storing the ESS in dusty environments with a large amount of dust, smoke, or floc. These particles may cling to the air inlets and outlets or heat sink of the equipment, thus impairing its heat dissipation performance or even getting it damaged.
- Avoid storing the ESS in places where corrosive gas or dust may be produced or accumulated, or in places within 30 km of saline-alkaline land or pollution-generating industrial complex such as chemical plants and power plants (chemical gas class: 1C1, solid particle level: 1S2).
- Do not store the ESS in environments contaminated with halogen or sulfur pollutants.
- Do not store the ESS in places with vibration or a magnetic field strength of over 30 A/m.
- When storing PACKs separately, in addition to the ESS storage requirements, observe the following:
  - Store PACKs indoors in a clean and dry place, avoiding direct sunlight or rain.
  - Keep the storage area free of hazardous gases, flammable or explosive materials, and corrosive chemicals. Avoid mechanical shock, heavy pressure, and strong magnetic fields.
  - Protect PACKs from harsh environmental conditions, such as sudden temperature changes or collisions, to avoid damage.
  - Do not tilt the packing case or turn it upside down.

If the ESS has been stored for over six months (from the date it is delivered from SUNGROW) under the required conditions mentioned above, perform charging-discharging once until the system SOC reaches 30%–40%. Make sure the SOC values are consistent after recharging.

4 Mechanical Installation

⚠ WARNING

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

4.1 Inspection Before Installation

4.1.1 Deliverables Inspection

Check whether deliverables are complete against the attached packing list.

4.1.2 Equipment Inspection

- Check whether the product you have received matches the order you have placed.
- Inspect the product and its internal components, and make sure there is no damage.
- If the product is equipped with an EMS300CP controller, ensure the gateway meter and electricity meter used with the EMS300CP have been installed before commissioning.

In case of any problem or doubt, contact your transport service provider or SUNGROW in time.

⚠ WARNING

- **Proceed with installation only if the equipment is intact without any signs of damage!**

Before installation, ensure that:

- **The product is in good condition, without any damage.**
- **All the components inside the product are intact without any signs of damage.**

4.2 Installation Environment Requirements

4.2.1 Installation Site Requirement

- The climate environment and geological conditions, such as stress wave emission and underground water level, should be fully considered when selecting the installation site.
- The environment around the installation site should be dry and well ventilated.
- There should be no trees around the installation site to prevent branches or leaves blown off by heavy winds from blocking the door or air inlet of the Battery Energy Storage System Container.

- The installation site should be away from areas where toxic and harmful gases are concentrated, and free from inflammable, explosive and corrosive materials.
- It is suggested the product be installed in a place away from the residential area. Ensure the distance and noise requirements specified by the local laws and regulations are met. If the requirements cannot be met due to geographical restrictions, use noise mitigation measures. For detailed solutions, consult with the designer or SUNGROW.
- Avoid installing the Battery Energy Storage System Container in dusty environments with a large amount of dust, smoke, or floc. These particles may cling to the air inlets/ outlets or heat sink of the Battery Energy Storage System Container, thus impairing its heat dissipation performance or even getting it damaged.
- Avoid installing the Battery Energy Storage System Container in places where corrosive gas or dust may be produced or accumulated, or in places within 30km (20 miles) of saline-alkaline land or pollution-generating industrial complex such as chemical plants and power plants (chemical gas class: 1C1, solid particle level: 1S2).
- Do not install the Battery Energy Storage System Container in environments contaminated with halogen or sulfur pollutants.
- There are no underground facilities at the site.

NOTICE

Do not install the device in an environment with vibration and strong electromagnetic field. Strong-magnetic-field environments refer to places where magnetic field strength measures over 30 A/m.

4.2.2 Foundation Requirements

⚠ WARNING

Considering the equipment's heavy weight, before foundation building, perform a thorough inspection on the installation site first (from the aspects of geology, environment, and climate, etc.). Foundation design and construction can be carried out only after confirming that the installation site meets all relevant requirements.

An improperly built foundation may lead to difficulties or troubles in equipment mounting, opening and closing of cabinet doors, and future operation of the equipment. Therefore, the foundation must be designed and constructed in compliance with certain standards, to meet the requirements of mechanical support, cable laying, and future maintenance.

Make sure at least the below requirements are met during foundation building:

- The bottom of the foundation pit must be compacted, filled and made even.
- The foundation should be built in compliance with the foundation drawing provided, or approved, by SUNGROW. The tolerance for the upper surface of the foundation is ±5mm.
- The foundation should provide sufficient and effective support for the equipment.

- The equipment should be positioned in a higher place, to protect its base and interior from rain erosion. It is recommended to build a foundation about 300mm higher than the horizontal ground on site.
- Set up a proper drainage system based on the local geological conditions.
- Build a cement foundation with sufficient cross-sectional area and height. The foundation height should be determined by the constructor based on the on-site geological conditions.
- Take cable laying into consideration when building the foundation.

  In the process of foundation building, remove the muck immediately after excavation, to avoid affecting the hoist and transport of the equipment.

- Build a platform around the foundation to facilitate future maintenance.
- During the foundation building, reserve sufficient space for the AC side cable trench according to the position and size of the cable inlet and outlet on the equipment, and embed the cable conduit in advance.
- Determine the specifications and quantity of the perforating gun according to the model and quantity of cables used.
- Both ends of each embedded conduit should be temporarily sealed off to prevent the ingress of foreign objects. Otherwise, it may lead to difficulties in wiring.
- After all the cables are connected, seal off the cable inlet and outlet and the connectors with fireproof mud or other suitable materials, to prevent rodents from entering the equipment.

  Pre-bury the grounding unit according to the applicable standards of the country/region where the project is located.

4.2.3 Installation Space Requirements

For effective heat dissipation and ease of maintenance, it is recommended to reserve sufficient space around the ESS during installation.

NOTICE

The clearance here refers to the clearance between cabinets, not foundations.

Single ESS

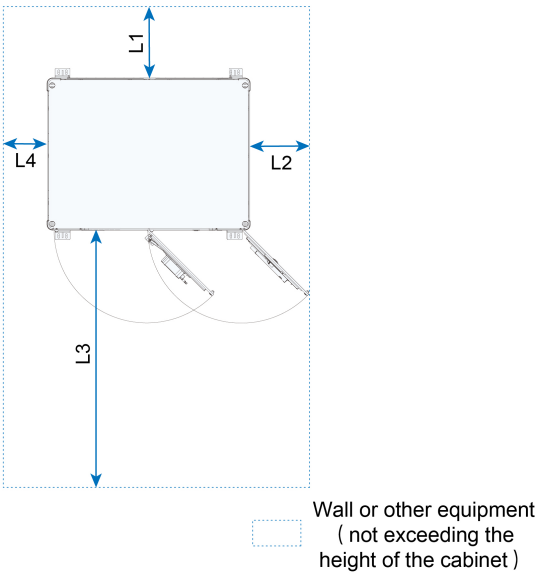


Figure 4-1 Clearance Requirements for One ESS

Maintenance Item	Clearance Requirements
Automatic liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2500 mm, L4 ≥ 430 mm
Manual liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2000 mm, L4 ≥ 430 mm

Multiple ESSs

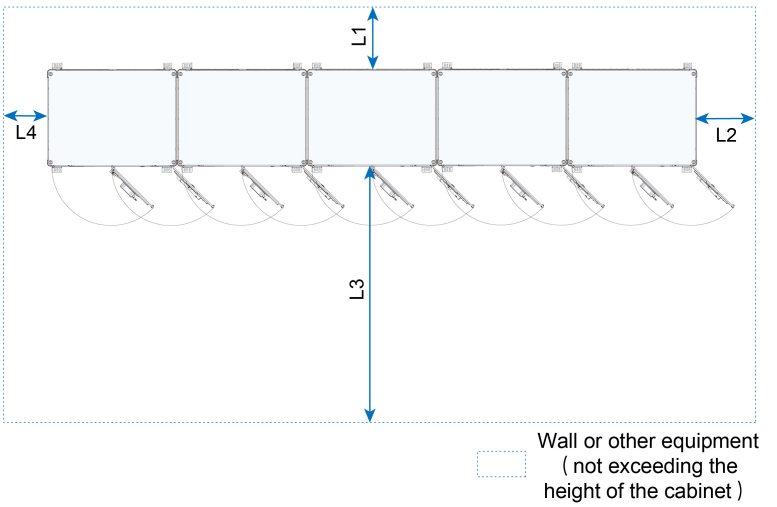


Figure 4-2 Clearance Requirements for ESSs in One Row

Maintenance Item	Clearance Requirements
Automatic liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2500 mm, L4 ≥ 430 mm
Manual liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2000 mm, L4 ≥ 430 mm

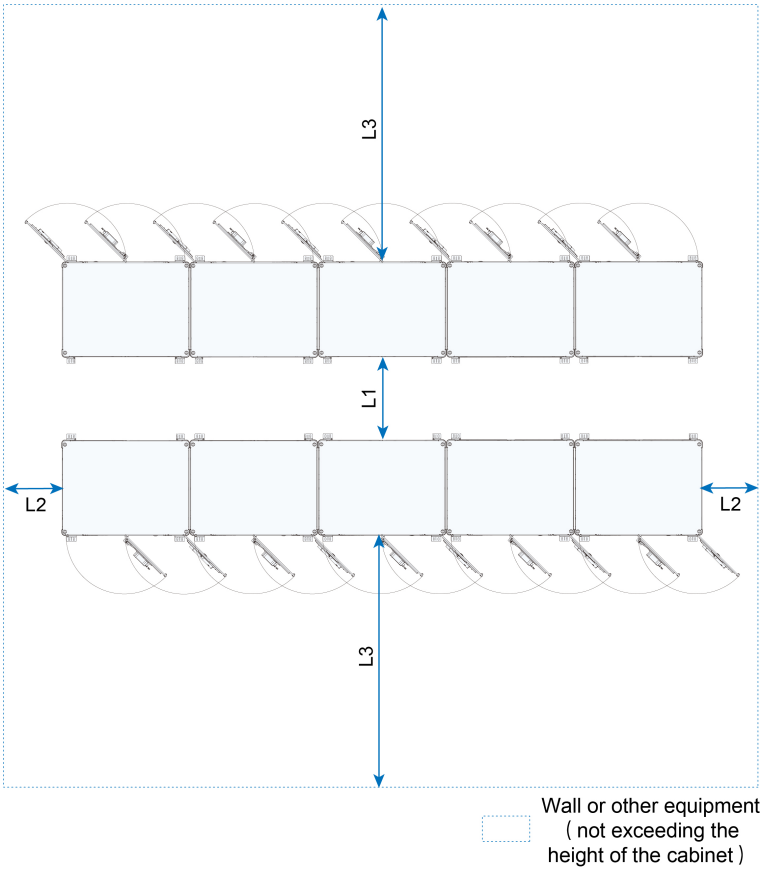


Figure 4-3 Clearance Requirements for ESSs in Two Rows (Back-to-Back)

Maintenance Item	Clearance Requirements
Automatic liquid cooling maintenance tooling	L1 ≥ 600 mm, L2 ≥ 630 mm, L3 ≥ 2500 mm
Manual liquid cooling maintenance tooling	L1 ≥ 600 mm, L2 ≥ 630 mm, L3 ≥ 2000 mm

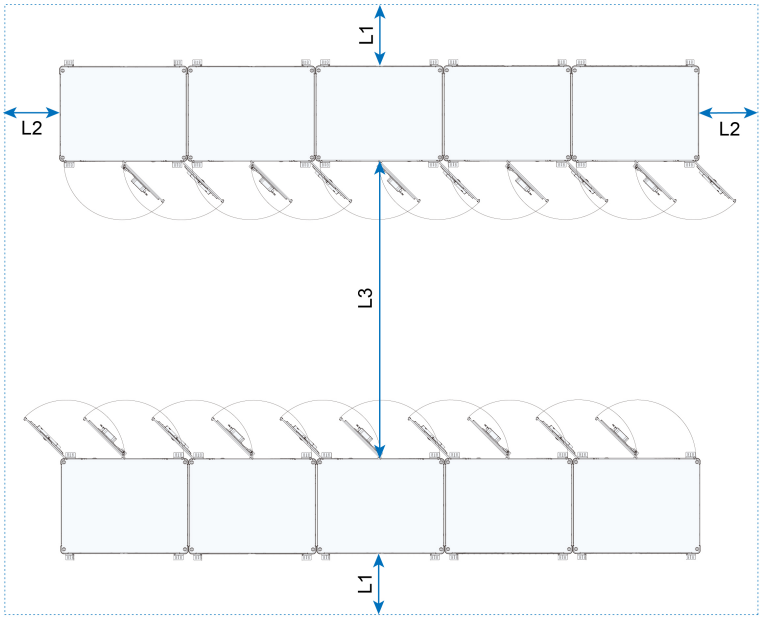


Figure 4-4 Clearance Requirements for ESSs in Two Rows (Face-to-Face)

Maintenance Item	Clearance Requirements
Automatic liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2500 mm
Manual liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 630 mm, L3 ≥ 2000 mm

*The figure is for reference only. The actual product may differ.

When arranging the ESSs in two rows, ensure that the two rows are aligned on both sides. Avoid misaligned arrangements to minimize the risk of hindered heat dissipation.

Installation Scenario with Firewalls

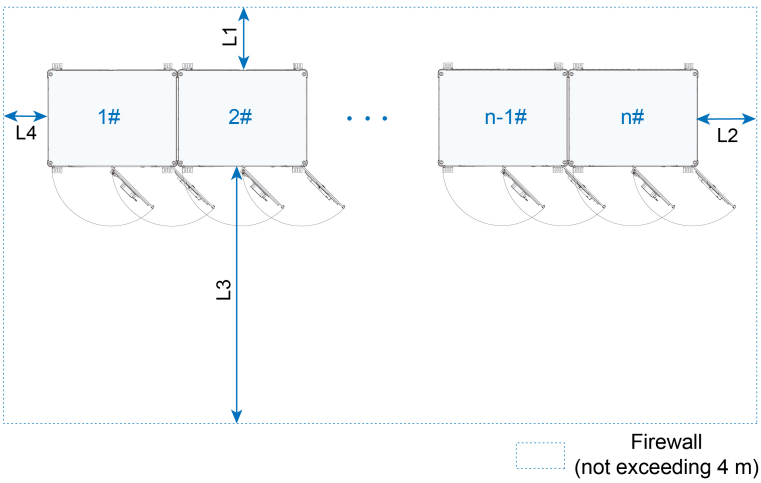


Figure 4-5 Clearance Requirements for ESSs in One Row

Number of ESSs	Clearance Requirements
n = 5	• With walls on all four sides: L1 ≥ 500 mm, L2 ≥ 630 mm, L3 ≥ 3000 mm, L4 ≥ 600 mm • With walls on the back only: L1 ≥ 300 mm • With walls on the left and right sides: L2 ≥ 630 mm, L4 ≥ 430 mm • With walls on the front and back: L1 ≥ 500 mm, L3 ≥ 2800 mm
n = 10	• With walls on all four sides: L1 ≥ 800 mm, L2 ≥ 630 mm, L3 ≥ 3000 mm, L4 ≥ 600 mm • With walls on the back only: L1 ≥ 600 mm • With walls on the left and right sides: L2 ≥ 630 mm, L4 ≥ 430 mm • With walls on the front and back: L1 ≥ 600 mm, L3 ≥ 3000 mm
n = 15	• With walls on all four sides: L1 ≥ 1200 mm, L2 ≥ 630 mm, L3 ≥ 3500 mm, L4 ≥ 600 mm • With walls on the back only: L1 ≥ 1000 mm • With walls on the left and right sides: L2 ≥ 630 mm, L4 ≥ 430 mm • With walls on the front and back:

Number of ESSs	Clearance Requirements
	L1 ≥ 1200 mm, L3 ≥ 3500 mm

Single Transformer Cabinet

For the arrangement of a single transformer cabinet, the clearances required on its front, back, left, and right sides are shown below, where: L1 ≥ 600 mm, L2 ≥ 450 mm, L3 ≥ 1200 mm, L4 ≥ 400 mm.

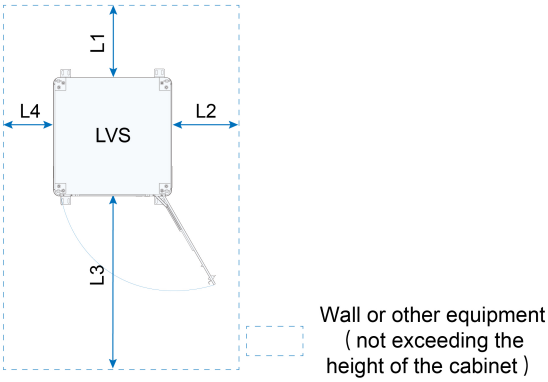


Figure 4-6 Clearance Requirements for One Transformer Cabinet

ESS-Plus-Transformer Cabinet Arrangement

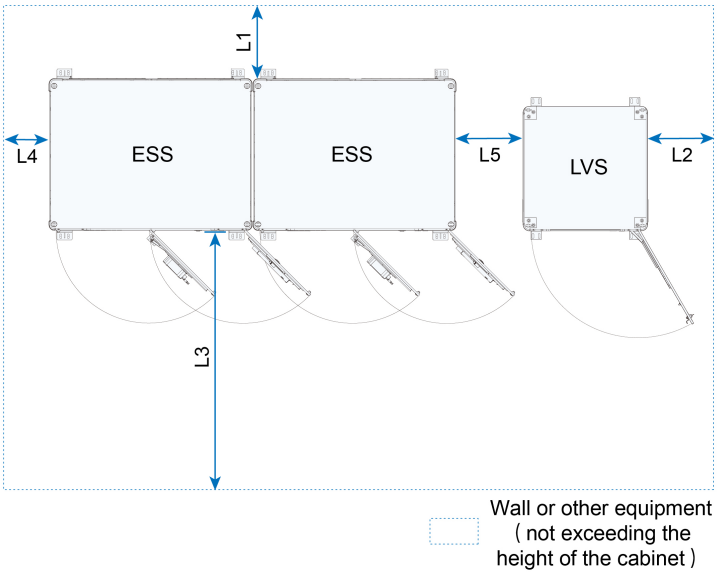


Figure 4-7 Clearance Requirements for ESS-Plus-Transformer Cabinet Arrangement

Maintenance Item	Clearance Requirements
Automatic liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 450 mm, L3 ≥ 2500 mm, L4 ≥ 430 mm, L5 ≥ 400 mm
Manual liquid cooling maintenance tooling	L1 ≥ 300 mm, L2 ≥ 450 mm, L3 ≥ 2000 mm, L4 ≥ 430 mm, L5 ≥ 400 mm

- When firewalls taller than the ESS are present on the front, back, left, and right sides of the ESS or transformer cabinet, the space above the cabinet must remain open and free of obstructions. The height of the surrounding walls (especially the front and back ones) must not exceed 4 meters.
- If pile foundations or other open foundations are used on-site and there are no obstructions at the air inlets at the bottom of the transformer cabinet, the bases of the transformer cabinet and the ESS can be placed tightly against each other, shoulder-to-shoulder (i.e., L5 ≥ 0 mm). All other clearance requirements remain unchanged.

Top Heat Dissipation Requirements for Indoor Installations

To install the ESS indoors, exhaust equipment with sufficient air flow rate is required. For good heat dissipation on top, reserve sufficient space above the ESS.

If the ESS is installed indoors, the temperature at the air inlet must not exceed 45°C to ensure long-term stable operation. The recommended clearances above the ESS are as follows:

- ESS with one side against the wall: Clearance ≥ 800 mm.
- ESS with two sides against the wall: Clearance ≥ 1200 mm.
- If the clearance above the ESS is 400 mm, the clearance between two ESSs shall be ≥ 200 mm, and the distance from one side of the ESS to the wall shall be ≥ 600 mm.
- If the clearance above the ESS is 0, the clearance between two ESSs shall be ≥ 400 mm, and the ESS back shall be ≥ 600 mm away from the wall.

NOTICE

Ensure a ventilation rate of 2500 m^3/h and a cooling capacity of 7 kW at the air outlet on the rear of each ESS.

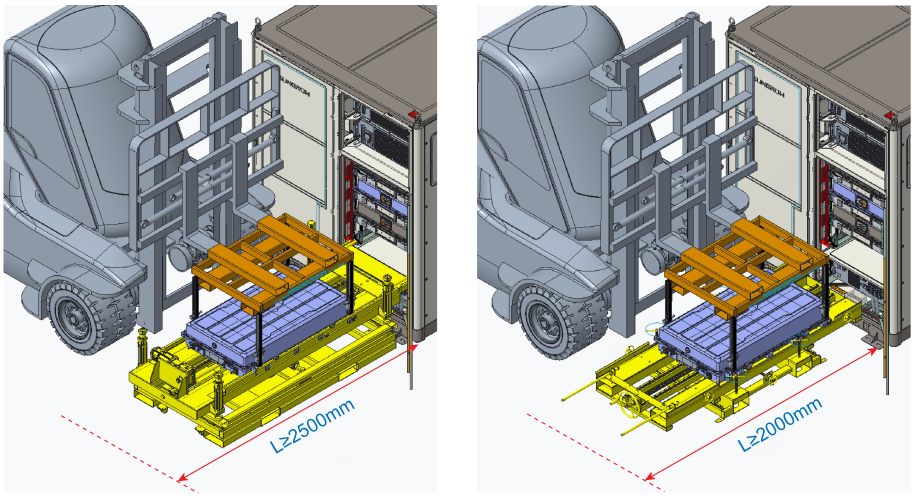
NOTICE

For outdoor installations, if nearby wall structures are present above or on the sides of the ESS, or if the ESS is placed under a canopy, it shall be regarded as an indoor installation.

- Installing the ESS outdoors is recommended, as per the general plant design standards.
- If indoor installations are selected due to layout constraints: SUNGROW specifies indoor arrangement requirements from the perspective of product design and maintenance only. The owner/EPC shall consider plant-level requirements in these cases.

Instructions for PACK Maintenance Tooling

Two types of PACK maintenance tooling are available for the ESS: automatic and manual. The required clearance for maintenance during installation must be determined based on the dimensions of the selected tooling. For details, please refer to the illustration below.



Automatic PACK tooling maintenance Manual PACK tooling maintenance

Figure 4-8 The Required Clearance for Maintenance

4.3 Handle with Forklift

The ESS can be moved using a forklift if the ground on the installation site is flat. Forklift pockets are provided at the bottom of the ESS for the insertion of forklift forks.

To move the ESS using a forklift, make sure the below requirements are met:

- The forklift has sufficient load capacity.
- The forks are long enough for moving the equipment.

The forks should be inserted into the forklift pockets at the bottom of the equipment (see the figure below for the positions of the pockets). The depth of the forks inserted into the pockets should be the depth of the pockets.

- Handle, move, and place the ESS slowly and steadily. It is suggested to try a little first before handling, to make sure all requirements are met.
- Position the ESS on a stable surface only, and this place should be free of obstacles or protrusions, with good drainage.

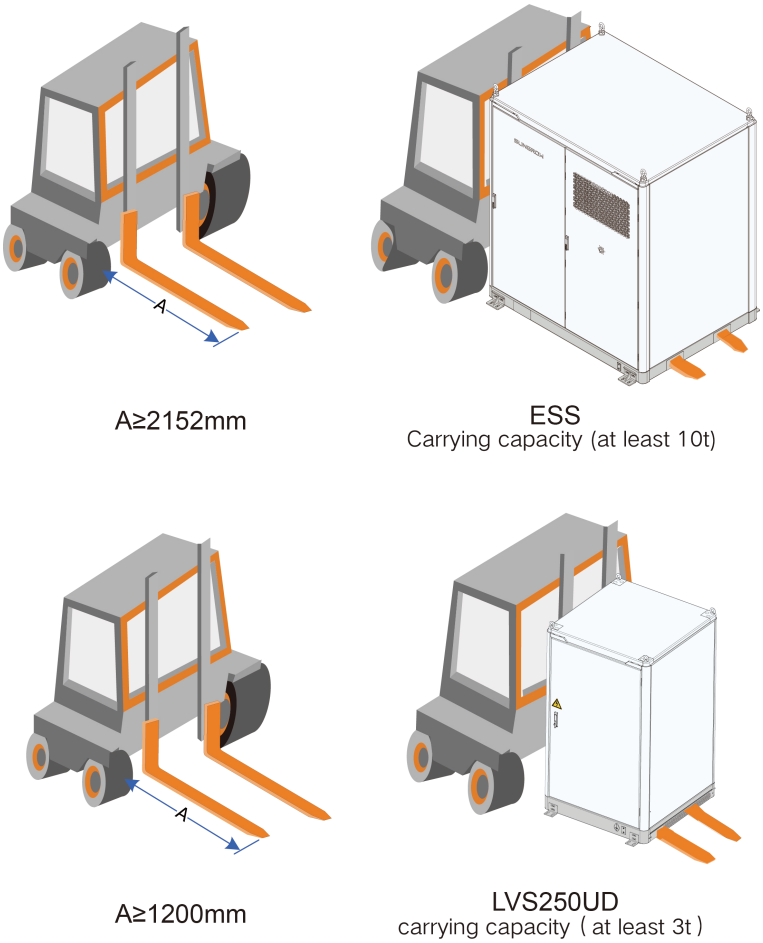


Figure 4-9 Handle with Forklift

⚠ WARNING

- **Move the ESS using a forklift by the bottom forklift pockets.**
- **Never insert the forklift forks into any position on the equipment else than the bottom pockets.**

The ESS will be delivered with forklift pockets exposed to air. It is suggested to cover the pockets with sealing plates after the installation is completed. The sealing plates are included in the accessories.

4.4 Hoisting

4.4.1 Precautions

Strictly adhere to safe operating procedures throughout the hoisting process to ensure the safety of operators, equipment, and the surrounding environment.

Requirements for Hoisting

- Qualifications:
  - Engage a qualified specialized hoisting service provider to perform the hoisting.
- Foundation:
  - Ensure sufficient space is reserved in the cable trench, and the cable conduit is embedded in advance.
  - Clearly mark the designated area for the equipment on the foundation with lines.
  - Prior to hoisting, recheck the flatness of the foundation. The flatness deviation must not exceed 10 mm, and the slope must not exceed 5°.
  - Correct any excessive deviations in flatness or slope, or prepare in advance an adequate number of metal washers that match the sizes of the load-bearing points.
  - If the system includes a SUNGROW battery cabinet and a firewall is present on site, ensure that the designated area for the battery cabinet is ≥ 150 mm away from the firewall.
- Familiarity with Equipment Arrangement
  - Properly determine the order of trailer arrivals at the site based on the project's equipment layout. Vehicles carrying lifting devices have priority for entry.
  - Determine the positions and orientations of all equipment.
  - If the system includes SUNGROW battery cabinets, ensure that all battery cabinets within the same block are of the same grade.
- Equipment Status:
  - Verify that all equipment and lifting devices have undergone inspections, and that cabinet doors are securely closed and locked.

Selection of Cranes

The load capacity of the crane should be determined based on the weight of the load to be lifted, the crane's operating zone (operating radius and range of motion) and design parameters, the foundation conditions, and the specific hoisting requirements.

⚠ WARNING

Before hoisting, select an appropriate crane with sufficient load capacity based on an evaluation by a qualified hoisting service provider to ensure operation safety. SUNGROW shall not be held liable for any damages resulting from the use of inappropriate cranes.

Lifting Device Requirements

- Please use the lifting devices provided by SUNGROW (slings, shackles, and lifting beams).
- If it is necessary to use slings and shackles that are not provided by SUNGROW due to special circumstances, ensure that the selected lifting devices meet the requirements specified in 4.4.2 Hoisting System.

Safety Instructions

⚠ WARNING

Perform operations in strict accordance with the local safe operating procedures relevant to the country or region, including but not limited to:

- **Stop hoisting immediately in severe weather conditions, such as heavy rain, fog, or strong winds.**
- **Set up warning signages or fence off a warning zone to prevent irrelevant personnel from entering the operating area, thus avoiding personal injury or death.**
- **Ensure that all personnel engaged in hoisting, loading, unloading, and anchoring operations have received relevant training, especially in safety.**
- **Do not stand directly beneath or within 10 meters of any moving equipment to avoid personal injuries or fatalities.**
- **Conduct all work under the guidance of qualified technical personnel on site.**
- **Ensure that all tools and equipment used during the operation have undergone proper maintenance.**
- **Lift and lower the equipment gently, avoiding any dragging or collisions.**
- **Do not proceed with hoisting in low light conditions or when vision is not clear.**
- **Do not proceed with hoisting if there is any person or moving or movable objects on top of the equipment.**

4.4.2 Hoisting System

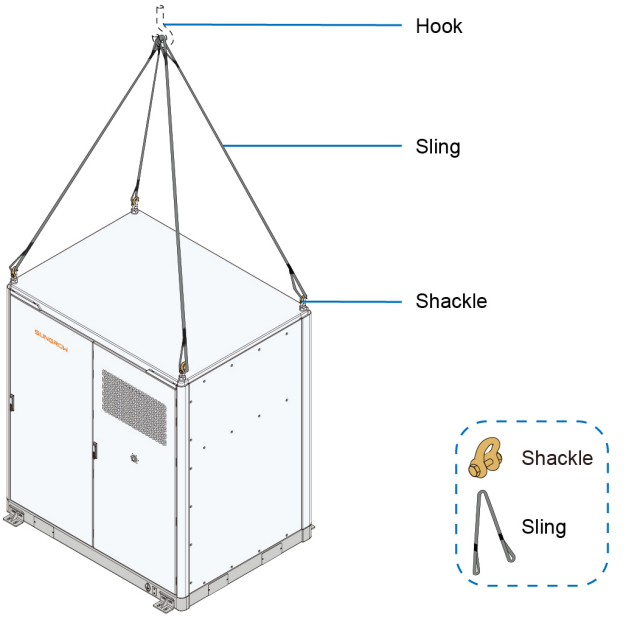


Figure 4-10 Hoisting System of ESS

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

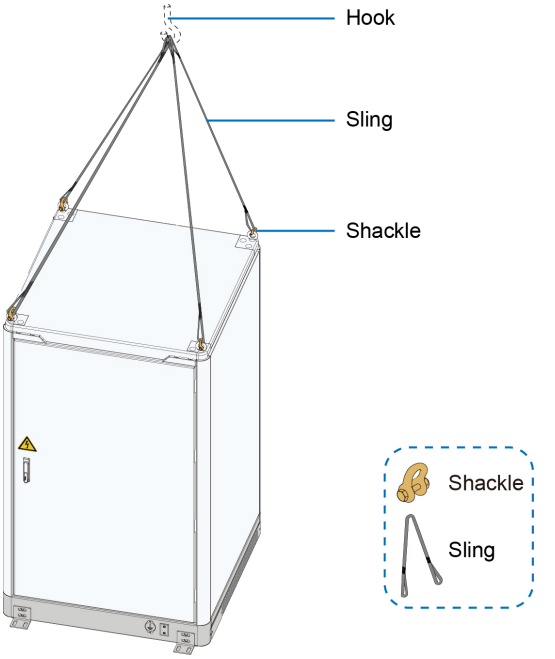


Figure 4-11 Hoisting System of LVS250UD

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

- If using slings or shackles not provided by SUNGROW, ensure that their specifications meet the requirements listed above. Request the hoisting service provider to conduct a thorough evaluation before proceeding with the hoisting.
- The short slings above the lifting beam each have a length of 4 m and are folded for use. If using the slings unfolded, ensure that each sling has a rated load capacity of 30 t.
- After hoisting, store the lifting devices properly for future use.

4.4.3 Hoisting Procedure

Step 1 Secure the lifting devices.

a. Attach four shackles to the four loops at both ends of the two slings.

b. Connect the four shackles on the two slings to the top lifting rings of the equipment.

c. Hang the two slings directly onto the lifting hook. Ensure the hook is positioned in the middle of the sling.

Step 2 Lift the equipment smoothly and stably.

a. Suspend lifting when the equipment is lifted 300 mm off the supporting surface. Then, check the connections between the slings and the equipment.

b. Ensure that the connections between the slings and the equipment are all secure and that the angle of the equipment relative to the horizontal plane is less than 5° after it settles naturally. Once confirmed, continue with the lifting.

Step 3 Lay the equipment down steadily in the designated area marked by lines on the foundation.

Step 4 Check and adjust the load-bearing points.

a. Verify that the equipment doors open and close normally, that the equipment frame shows no signs of deformation, and that the equipment rests securely and evenly on the supporting surface.

b. If any deformation is detected, lift the equipment slowly and add washers at the load-bearing points. Then, lower the equipment again gradually, until it is fully seated with each load-bearing point completely bearing the weight.

Step 5 Remove the lifting devices.

--End

Ensure the equipment is securely and fully seated on the foundation within the designated area and neatly positioned. Verify that the equipment is free from deformation and that its doors open and close smoothly.

NOTICE

After hoisting, properly store the lifting devices provided by SUNGROW for future use.

4.5 Cabinets Fixing

After moving the cabinets to the target position, fix it in place. You can fix the equipment by welding or using L-shaped angle steels.

Fixed by welding

Fix the cabinets bottom to the foundation by welding. Apply anti-corrosion treatment to the welding points after welding is completed.

Fixed with L-shaped angle steels

As shown in the figure below, mounting holes for L-shaped angle steels are provided at the bottom of the cabinets .

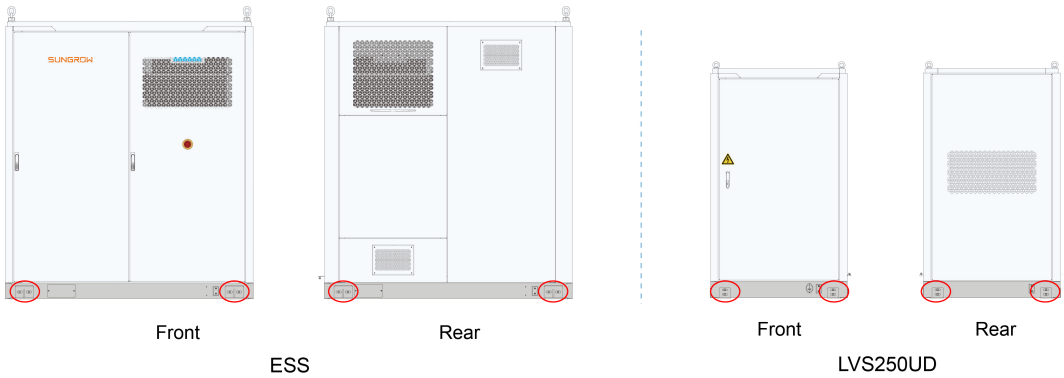


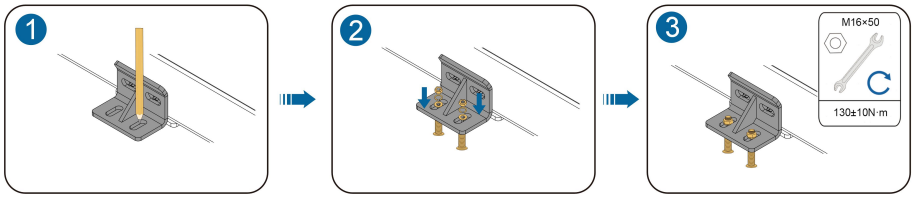
Figure 4-12 L-shaped Angle Steels

Installation Tools

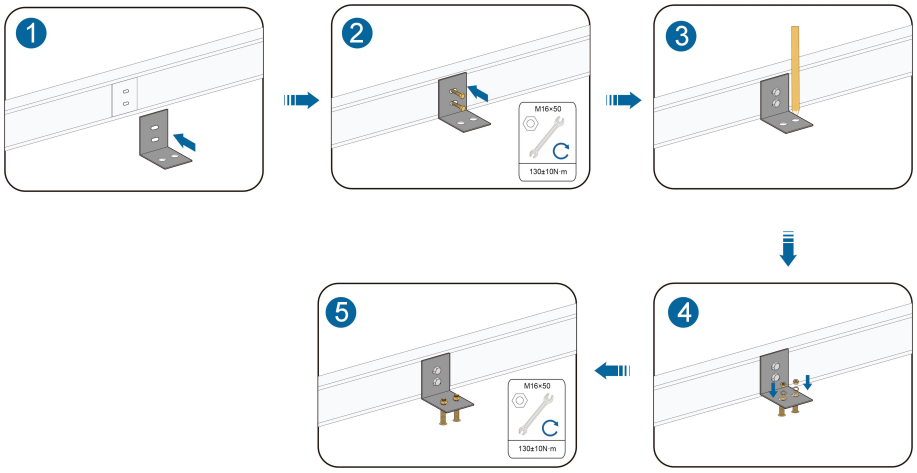
Tools that may be used when installing the L-shaped angle steels are as follows:

No.	Name	Source
1	Marker	Not included in the scope of supply
2	Hammer drill	Not included in the scope of supply
3	Angle steel	Included in the scope of delivery
4	M16 expansion bolt	Not included in the scope of supply
5	M16 screw	Included in the scope of delivery

Installation Method 1



Installation Method 2



Please choose the installation method according to the actual situation.

5 Electrical Connection

5.1 Precautions

⚠ DANGER

High voltage! Electric shock!

- **It is strictly forbidden to directly touch the live parts in the unprotected state!**
- **Before installation, ensure that the all switches are off.**

⚠ WARNING

Sand and moisture penetration may damage the electrical equipment in the system, or affect their operating performance!

- **Avoid electrical connections during sandstorms or when the relative humidity in the surrounding environment is greater than 95%.**
- **Perform electrical connection when there is no sandstorm and the weather is fair and dry.**

⚠ WARNING

- **Before wiring, check and ensure that the polarity of all input cables is correct.**
- **During electrical installation, do not forcibly pull any wires or cables, as this may compromise the insulation performance.**
- **Ensure that all cables and wires have sufficient space for any bends.**
- **Adopt the necessary auxiliary measures to reduce the stress applied to cables and wires.**
- **After completing each connection, carefully check and ensure that the connection is correct and secure.**

⚠ WARNING

When an external short circuit occurs in the RACK circuit and the switch box fuse produces a protective action, the fuse and the two DC contactors must be replaced at the same time.

5.2 Electrical Connection Overview

The wiring diagram of the ESS is shown below:

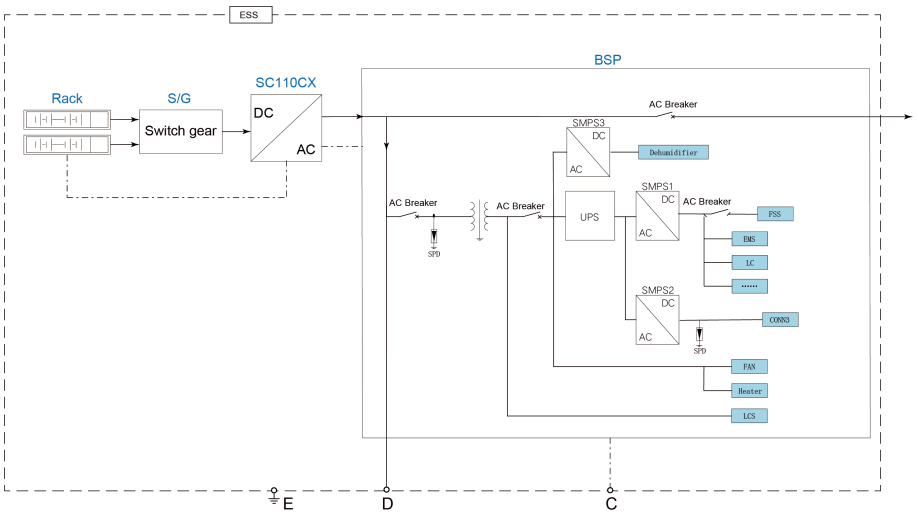


Figure 5-1 ESS Wiring Diagram (On-grid)

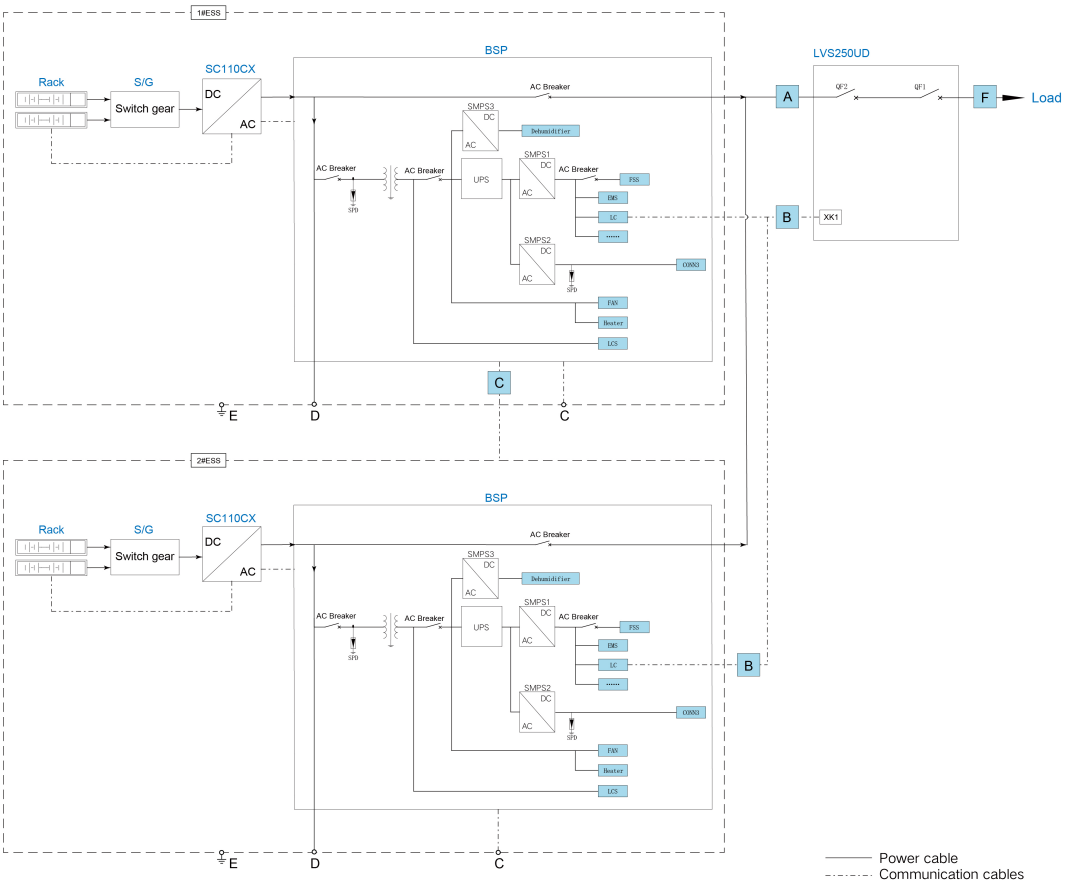


Figure 5-2 ESS-LVS Wiring Diagram (Off-grid)

Table 5-1 Interface Description

No.	Name	*Recommended cable specifications
A	AC output port	3×95mm^2/copper wire
		3×150mm^2/aluminum wire
B	LC communication port (connection port 1)	2×1.5mm^2 shielded twisted-pair cable
C	Ethernet communication port	CAT6A S/FTP network cable
D	External power supply	3×4mm^2/copper wire
E	Grounding point	70mm^2–95mm^2 yellow-green cable or grounding flat steel
F	LVS250UD AC side to load	240 mm^2/copper wire

*The above cables are not included in the scope of delivery and should be prepared separately.

⚠ WARNING

- **Electrical connections must all be performed in strict accordance with the wiring diagram.**
- **Electrical connections must all be performed when the equipment is completely voltage-free.**

⚠ WARNING

Operations related to the electrical connection must only be performed by qualified electrical engineers, all in compliance with the "Safety Precautions" specified in this manual. SUNGROW shall not be held liable for any personal injury or property damage arising from failure to follow the safety instructions.

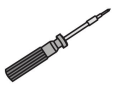
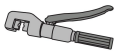
NOTICE

- **Installation and wiring of the ESS must conform to the applicable standards or regulations in the country/region where the project is located.**
- **Wiring or installation not in accordance with the relevant instructions provided in this manual may result in equipment or system failure, which will not be covered by the warranty.**

- The EMS is optional.
- The dehumidifier is optional. The CONN3 interface reserveds for dehumidifier power supply input.
- The system is equipped with an internal auxiliary power supply as standard.
- Each transformer cabinet can be adapted to one or two ESS cabinets.

5.3 Preparation Before Wiring

5.3.1 Prepare Installation Tools

Item	Name and Graphics		
Installation tool			
	Torque screwdriver	Wire stripper	Hydraulic pliers
			
	Heat gun	Multimeter	Screwdriver
			
	Torque wrench		
Protective tools			
	Safety gloves	Goggles	Safety shoes
			
	Protective clothing		

5.3.2 Open Cabinet Door

Open the cabinet door before wiring.

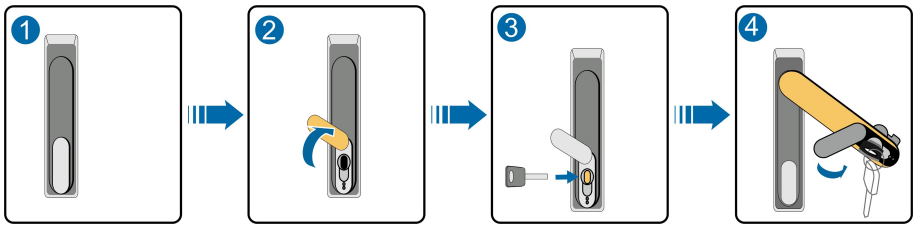


Figure 5-3 Open the Front Door

Step	Description
1	Door locked
2	Move the cover above the lock hole
3	Insert the door key and turn it clockwise
4	Rotate the handle counterclockwise to the position shown in the figure to open the front door

5.3.3 Prepare Cables

⚠ DANGER

Before electrical connection, check and ensure that the cables are all intact and well-insulated. Poor insulation or cable damage may result in safety hazards. If necessary, replace the cable immediately.

The cables must meet the following requirements:

- The current carrying capacity of the cable meets requirements. Factors affecting the current carrying capacity of a conductor include but are not limited to:
  - Environmental conditions;
  - Type of the insulation material of the conductor;
  - Cabling method;
  - Material and cross-sectional area of the cable.
- Select cables with a proper diameter according to the maximum load, and the cables should be long enough.
- Ensure that all cables and wires have sufficient space for any bends.
- During electrical connection, do not forcibly pull any wires or cables, as this may diminish their insulation performance.
- All DC input cables must be of the same specifications and materials.
- AC output cables of three phases must be of the same specifications and materials.
- Only flame retardant cables can be used.

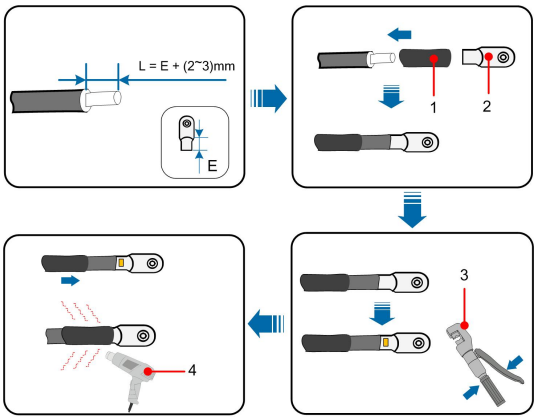
- Keep a sufficient distance between the cables and the heat-generating components, to prevent the cable insulation layer from aging or getting damaged due to high temperature.
- After completing each connection, carefully check that the connection is correct and secure.
- Adopt necessary auxiliary measures to reduce the stress applied to cables and wires.
- Select cables with appropriate cross-sectional areas, according to the actual environmental conditions for heat dissipation of the cables laid on-site.
- Select communication cables equipped with corresponding shielding protection features according to the requirements of SUNGROW.
- Secure the power cables and the communication cables separately. Ensure a minimum space of 10cm between the lines of strong and weak electricity to avoid electromagnetic interference.
- Inspect the connection between the wiring terminal and the copper bar. If any part of the heat-shirk tubing is caught between them, remove it immediately. Otherwise, it may lead to poor contact or even damage due to heat.

NOTICE

- **The cables used should comply with requirements of local laws and regulations.**
- **The cable color in figures in this manual is for reference only. Please select cables according to local standards.**

Crimp OT/DT terminals

Follow the steps shown below to crimp terminal.

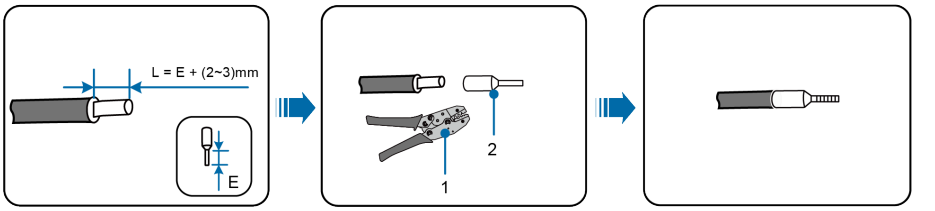


No.	Name	No.	Name
1	Heat shrink tubing	2	OT/DT terminal
3	Hydraulic pliers	4	Heat gun

NOTICE

- **Strip the cables with caution. Avoid scratching the core wires.**
- **After crimping, the conductor crimp barrel of the OT/DT terminal must fully enclose the core wire, forming a closed cavity that ensures a tight and secure connection between the wire and the terminal.**
- **Take appropriate protective measures when using a heat gun to prevent heat damage to the equipment.**

Crimp the Ferrule



No.	Name
1	Crimping tool
2	Ferrule

5.3.4 Copper Wire Connection

When copper cables are selected, the connection sequence of wiring parts is shown in the following figure.

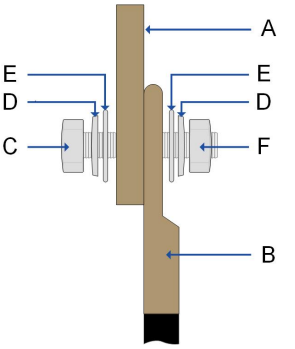


Figure 5-4 Copper cable terminal connection sequence

No.	Name	No.	Name
A	Copper bus bar	D	Spring washer
B	Copper connection terminal	E	Flat washer

No.	Name	No.	Name
C	Bolt	F	Nut

NOTICE

Bolt fastening should be firm and reliable, and the exposed wire buckle should not be less than 2 buckles.

5.3.5 Aluminum Wire Connection

When the aluminum wires are selected, a copper-to-aluminum adapter terminal is needed as shown below:

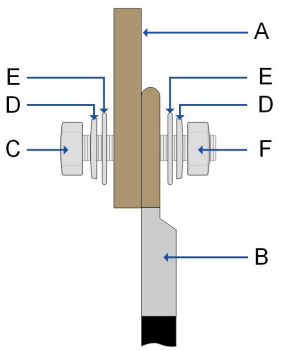


Figure 5-5 Copper-to-aluminum adapter terminal connection

No.	Name	No.	Name
A	Copper bus	D	Spring washer
B	copper-toaluminum adapter terminal	E	Flat washer
C	Bolt	F	Nut

NOTICE

Bolt fastening should be firm and reliable, and the exposed wire buckle should not be less than 2 buckles.

5.3.6 Cable Inlet Design

Cables connecting the external devices to the ESS can be led through the cable inlet at the bottom of the ESS.

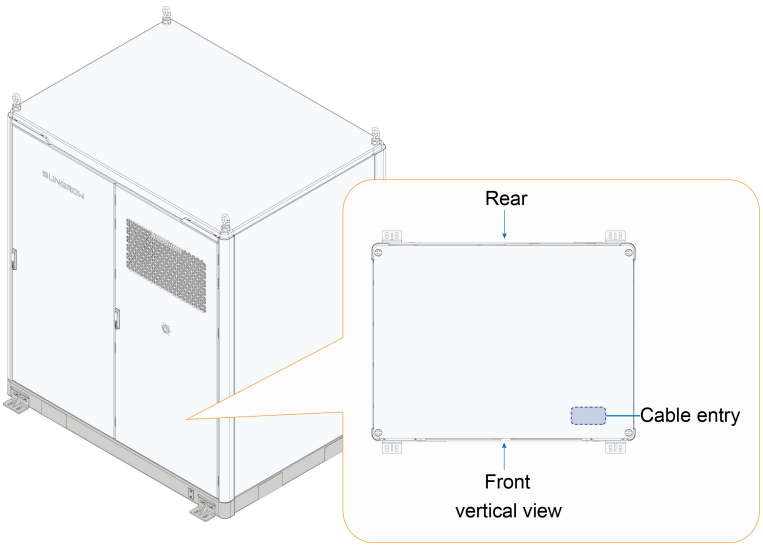


Figure 5-6 Schematic diagram of BESS inlet and outlet

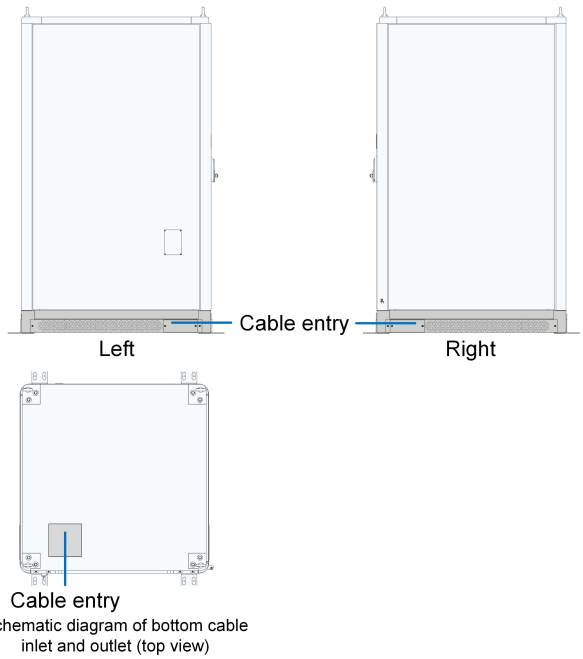


Figure 5-7 Schematic diagram of LVS250UD inlet and outlet

5.4 Ground Connection

NOTICE

Grounding must be completed by strictly following the applicable local standards and regulations.

NOTICE

- **Before grounding, clean the periphery of the threaded port of the grounding point and the surface of the grounding point, to ensure reliable grounding.**
- **After grounding, apply anti-corrosion treatment for the entire grounding area.**

Overview

Grounding can be made in the following two ways: welding a grounding flat steel, or connecting a grounding cable. For the location of the grounding point, see "**ESS External Design**".

Devices installed on-site by users (such as wireless routers) should be properly grounded by connecting to a nearby grounding point.

Grounding Flat Steel (Recommended)

Remove the protective tape from the grounding point and weld the hot-dip galvanized flat steel to the grounding point (the area where the flat steel and the ESS are joined together should be 40mm x 70mm). Spray paint the whole fixing area after completing welding.

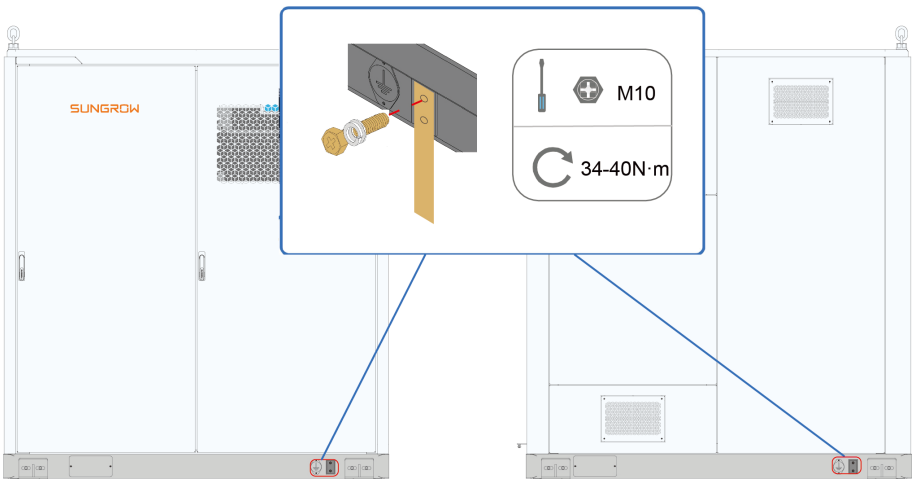


Figure 5-8 BESS grounding diagram

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

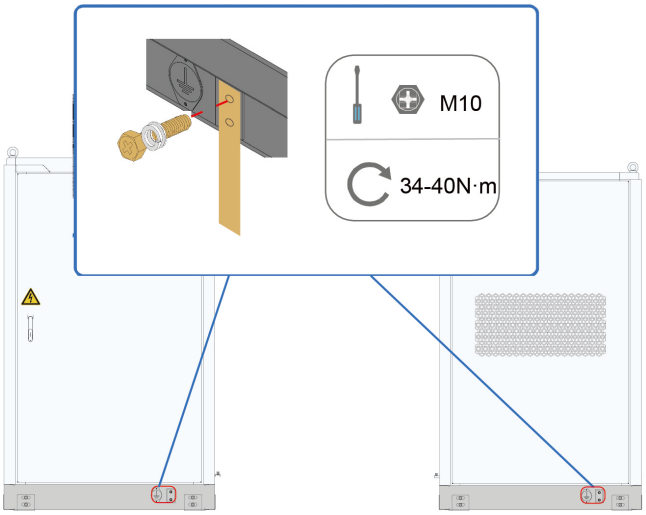


Figure 5-9 LVS250UD grounding diagram

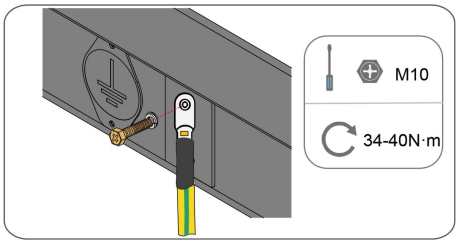
*The figure is for reference only and the actual product shall prevail.

Transformer cabinet is optional.

Grounding Cable

Use a 70 mm^2–95 mm^2 copper grounding cable to connect the target grounding point to the grounding point on the ESS properly and reliably (the grounding point is covered with protective tape upon delivery, which should be removed before wiring).

Crimp the DT terminal. For details, see 5.3.3 Prepare Cables. Secure the DT terminal to the wiring hole with an M10 bolt at a tightening torque of 34–40N.m.



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

Carry out external ground connection in compliance with the actual on-site conditions and the instructions by the plant staff.

Measure the ground resistance after completing the grounding. Make sure the resistance does not exceed 4Ω.

The specific ground resistance should comply with the applicable national/local standards and regulations.

5.5 AC Connection

5.5.1 Safety Precautions

WARNING

Accidental touching of live terminals can cause fatal electric shock!

- **Ensure that the AC/DC switches of the DC/AC power converter cabinet are open, and that the wiring terminals are dead.**
- **Connecting to the power grid must be approved by the relevant department and comply with all power-related safety instructions and specifications.**

WARNING

- **When connecting to the AC grid, disconnect the upstream AC side circuit breaker to ensure that there is no voltage at the contact terminals.**
- **Connect to the grid only if approved by the utility grid and all relevant safety instructions are followed.**
- **The AC output is not grounded inside the device.**
- **The DC and AC circuits are isolated from the enclosure. If required by the relevant national electrical codes, the installer is required to connect the system.**

5.5.2 Overview of the Wiring Area

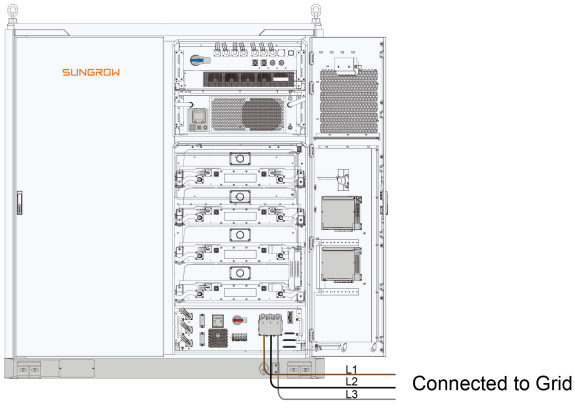


Figure 5-10 ESS Wiring Overview (On-grid)

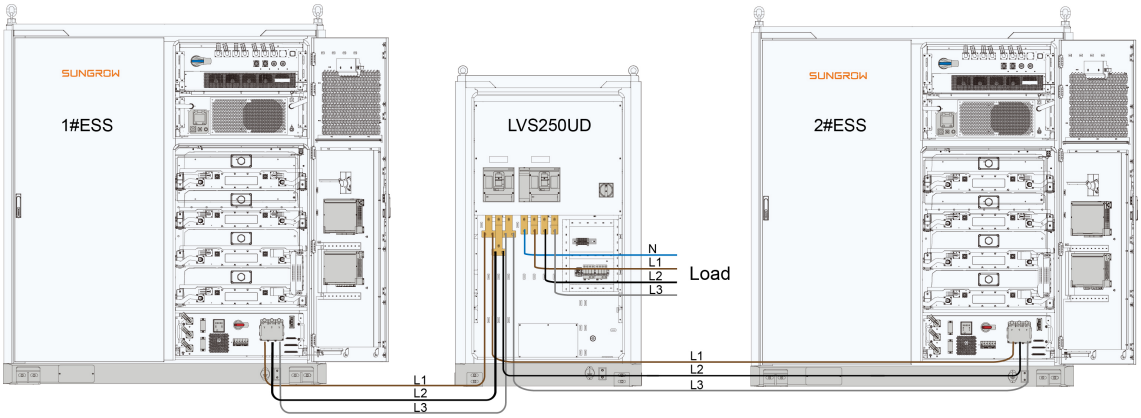


Figure 5-11 ESS+LVS Wiring Overview (Off-grid)

- Transformer cabinet is optional.
- A transformer cabinet can be matched with one ESS cabinet or two ESS cabinets.

5.5.3 ESS AC Output Wiring

Step 1 Turn off the upstream AC circuit breaker and measure with a multimeter to ensure no voltage is present at the terminals.

Step 2 Lead the cable to the AC wiring area inside the cabinet through the cable inlet.

Step 3 Make sure the AC cables are connected properly in the correct positions.

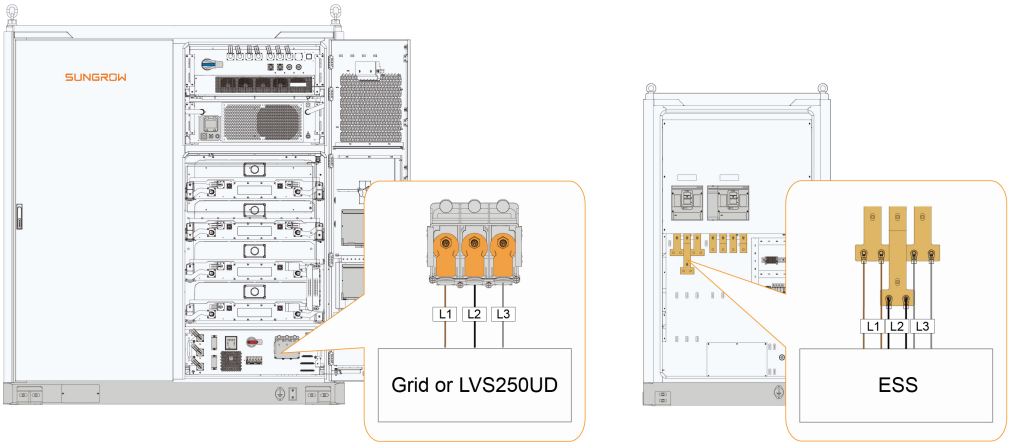


Figure 5-12 AC Wiring Area

Step 4 Strip the protective layer of the cables using wire strippers to expose the copper cores.

Step 5 Crimp the OT terminals. For details, see 5.3.3 Prepare Cables.

Step 6 Secure the terminals to the wiring holes of ESS or LVS250UD with bolts.

- ESS: Secure the OT terminals to the wiring holes with M12 bolts at a tightening torque of 40 N·m (for detailed wiring instructions, please refer to #unique_61).
- LVS250UD: Secure the OT terminals to the wiring holes with M10 bolts at a tightening torque of 34~40 N·m (for detailed wiring instructions, please refer to #unique_61).

Step 7 Pull gently the cables backward after wiring to ensure the cables are long enough.

Step 8 Close the protective cover for terminals, fasten the protective buckles on both sides, and tighten the four screws.

NOTICE

- **Perform wiring in strict accordance with the correct phase sequence.**

--End

5.5.4 LVS250UD-Load Connection Steps

Transformer cabinet is optional.

Step 1 Make sure the upstream and downstream switches are disconnected.

Step 2 Pass the cables into the LVS250UD cabinets from the inlet holes.

Step 3 Make sure that the AC cable connection sequence is correct.

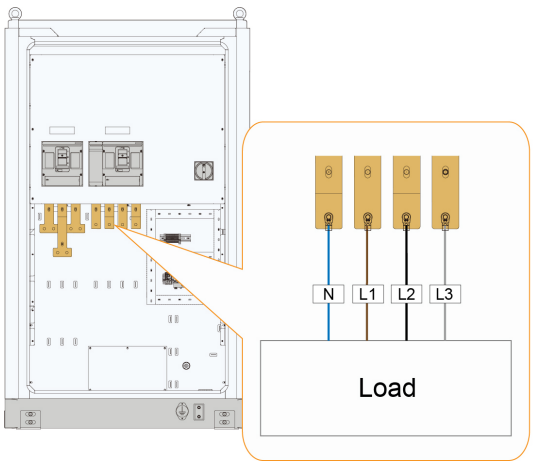


Figure 5-13 LVS250UD-Load wiring area

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

Step 4 Strip the protective layer of the cable to expose the copper core of the wire with strippers.

Step 5 Crimp with OT terminal, refer to5.3.3 Prepare Cables.

Step 6 Secure the OT terminal to the wiring hole by M10 bolt with a tightening torque of 34~40 N·m. Refer to the #unique_61 connection sequence for installation.

Step 7 Pull the cable back slightly after wiring to ensure that the cable is long enough.

NOTICE

- **Strictly follow the phase sequence to connect cables.**

--End

5.6 Auxiliary Power Supply Wiring

Devices of the system, such as the internal liquid cooling unit, 24Vdc device, and fans, are powered by an external or internal auxiliary power supply. Internal auxiliary power supply is used for this system by default.

Prerequisite

Power Supply Mode

The auxiliary power supply of the system includes the internal auxiliary power supply and the external auxiliary power supply:

- If the external auxiliary power supply is adopted, use the auxiliary power supply port inside the ESS power distribution box for wiring.
- If the internal auxiliary power supply is adopted, use the internal auxiliary power supply terminal inside the BSP for wiring before delivery.

Steps for External Auxiliary Power Supply Wiring

Step 1 Make sure the circuit breakers of the upstream and downstream equipment are all in the open state.

Step 2 Pass the cable through the cable inlet/outlet into the ESS.

Step 3 Make sure the AC cables are connected properly in the correct positions.

Table 5-2 Port Definition

Mode	Port	Description	*Recommended cable specifications
400Vac external power supply	Auxiliary power supply L1	Phase L1	4mm^2
	Auxiliary power supply L2	Phase L2	
	Auxiliary power supply L3	Phase L3	

*These are recommended cable specifications. You may make adjustments based on your actual needs.

Step 4 Complete the wiring by referring to the port marks on the cabinet and the above port definitions. After completing the wiring, secure the terminals at a tightening torque of 5 N·m.

--End

This product comes with internal auxiliary power supply as standard. If an external auxiliary power supply is needed, contact SUNGROW for wiring solutions.

5.7 EMS/LC/FSS External Power Supply Wiring

CONN1/2/3 on the power distribution box are used for the wiring of the EMS, the LC, and the external power supply of the FSS.

The positions of CONN1, CONN2, and CONN3 are shown below.

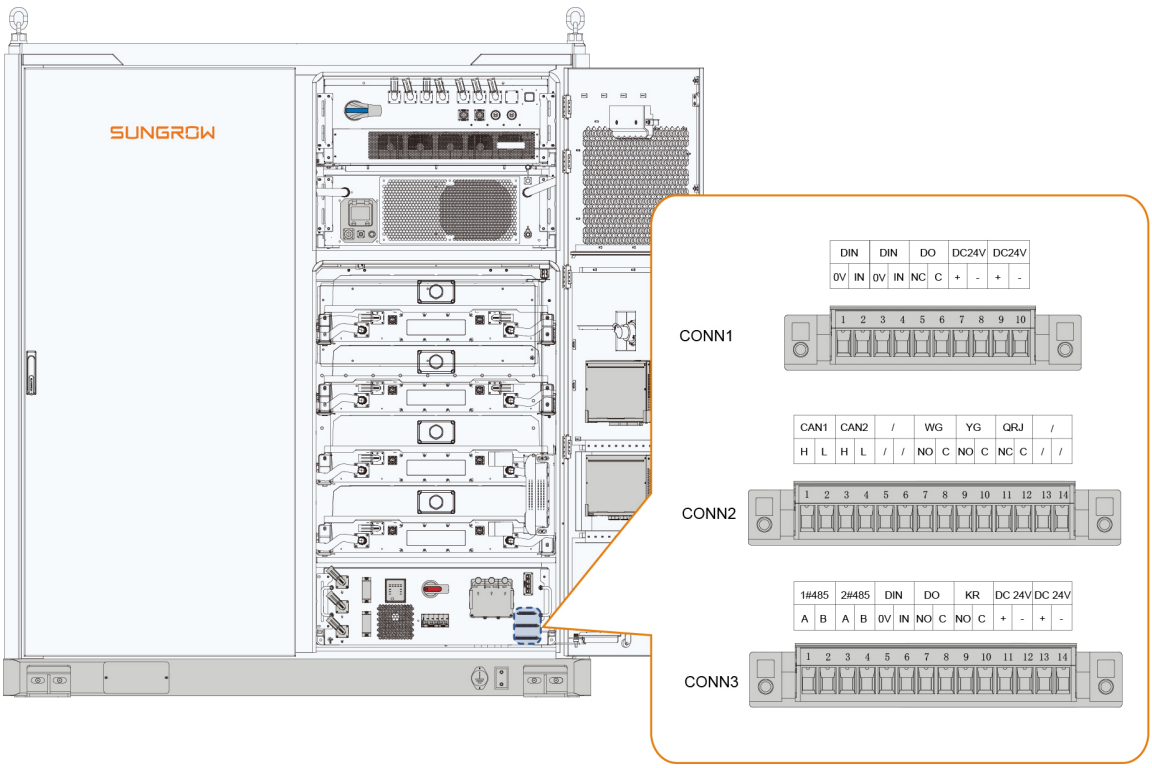


Figure 5-14 Communication Ports

Port	Position	Definition
CONN1	CONN1-1/2	Reserved for DIN dry contact input
	CONN1-3/4	Reserved for LC “transformer cabinet fault” dry contact input (DIN10)
	CONN1-5/6	Reserved for LC “transformer cabinet fault linkage control” digital output (DO1)
	CONN1-7/8	Reserved for dehumidifier power supply input

Port	Position	Definition
	CONN1-9/10	Reserved for 24Vdc power supply interface
CONN2	CONN2-1/2	CMU communication, reserved for maintenance
	CONN2-3/4	DC/AC power converter unit parallel communication
	CONN2-5/6	Reserved
	CONN2-7/8	FSS "heat detector triggered" dry contact output
	CONN2-9/10	FSS "smoke detector triggered" dry contact output
	CONN2-11/12	FSS "aerosol extinguishant spraying" dry contact output
	CONN2-13/14	Reserved
CONN3	CONN3-1/2	Reserved for EMS RS485 communication
	CONN3-3/4	
	CONN3-5/6	Reserved for EMS dry contact input (DI1)
	CONN3-7/8	Reserved for EMS digital output (DO1)
	CONN3-9/10	“Flammable gas detecter” dry contact input
	CONN3-11/12	Reserved for 24Vdc power supply interface of ATS
	CONN3-13/14	Reserved for fire ventilation input

Transformer cabinet is optional.

- If there is no transformer cabinet, positions 3–6 of CONN1 do not need to be wired.
- If there is no EMS, positions 1–8 of CONN3 are invalid.
- If there is no ATS, positions 1–2 of CONN1 and 11–12 of CONN3 are invalid.
- If there is no fire ventilation, positions 13–14 of CONN3 are invalid.

5.8 Fault Dry Contact Signal Connection (Off-grid)

Prerequisite

The cable from the transformer cabinet is connected to the ESS cabinet for the transmission of dry contact signals such as transformer cabinet fault signal and fault linkage signal between ESS cabinets. The output port is located on the XK1 terminal block of the

transformer cabinet and the input port is located on the CONN1 terminal block of the ESS cabinet.

Step 1 Confirm that the circuit breakers of the front and rear equipment are all off.

Step 2 Pass the cables out of the transformer cabinet and into the ESS cabinet through the inlet and outlet holes.

Step 3 Make sure that the cables are connected in the correct order.

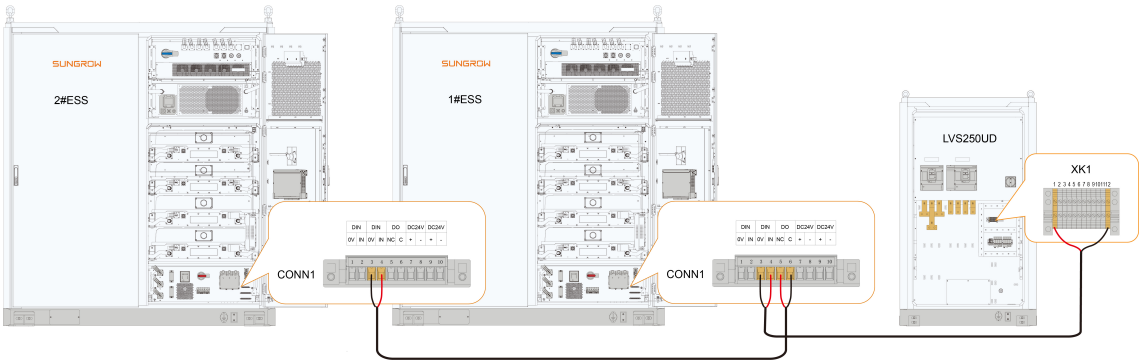


Table 5-3 Port description

Cabinet	Mark	Description	*Recommended specification
Transformer cabinet	XK1-1	Connected to CONN1-3 of 1#ESS	1.5 mm^2
	XK1-12	Connected to CONN1-4 of 1#ESS	
ESS cabinet	1#ESS-CONN1–5	Connected to CONN1-3 of 2#ESS	1.5 mm^2
	1#ESS-CONN1–6	Connected to CONN1-4 of 2#ESS	

*The noted cable specifications are recommended values. It can be adjusted according to actual needs.

Transformer cabinet is optional.

Step 4 Wiring according to the port identification and definition. Tighten with a screwdriver with a torque of 0.7±0.1 N·m.

--End

5.9 Ethernet Communication

Positions of the Ethernet communication ports are shown in the figure below.

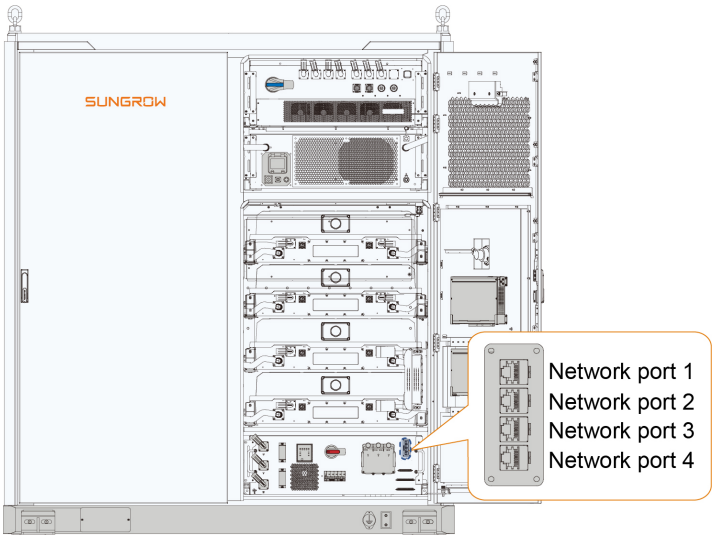
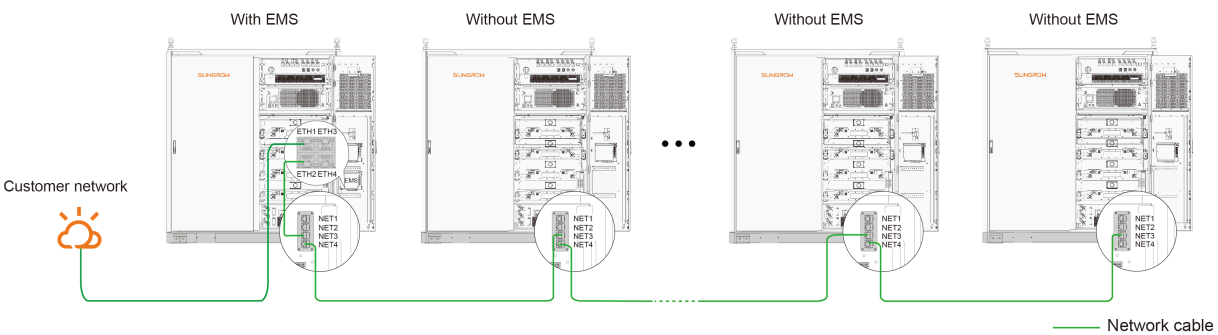


Figure 5-15 Communication Ports

Table 5-4 Port Description

Name	Description
NET1	Connected to LC (the internal wiring has been completed)
NET2	Connected to EMS (the internal wiring has been completed) or reserved
NET3	Used for inter-cabinet networking
NET4	Used for inter-cabinet networking



- The system supports up to 10 ESS cabinets in parallel. The cabinet with an EMS is accessed to the customer network and connected hand-in-hand with other cabinets that do not have EMS.
- Users can check the label on the power distribution box to understand whether the product is equipped with an EMS controller.
- NET3 and NET4 are used for inter-cabinet networking and no distinction is made between them.

Figure 5-16 Inter-cabinet Networking

5.10 Post-wiring Work

Prerequisite

Inspect the wirings thoroughly and carefully after all electrical connections have been completed. In addition, perform the following operations:

- Check that there is no obstruction or blockage by foreign objects at the air inlet and outlet.
- Seal off the cable inlet and outlet of the ESS cabinet, by filling the gap around them with fire-/water-stop materials.

⚠ WARNING

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

Lock the cabinet door

Step 1 Mount back the protective cover for the wiring area, by completing the steps for removal (see "Open Cabinet Door") in reverse.

Step 2 Lock the cabinet door and pull out the key.

--End

NOTICE

After closing the cabinet door, make sure the sealing strip around the door does not curl.

6 Battery Connection

6.1 Precautions

Always follow the safety instructions in this manual. In order to avoid personal injury and property damage that may occur during installation or operation, and extend the service life of this product, please carefully read all safety instructions.

Improper or incorrect use may result in:

- A threat to the life and personal safety of the operator or third parties;
- Damage to the Battery Energy Storage System Container or other property of the operator or third party.

- The safety precautions in this manual do not cover all specifications to be followed, and all operations should be performed based on the site conditions.
- SUNGROW shall not be liable for any loss arising from failure to follow the safety precautions in the manual.

⚠ WARNING

- **While installing the device with hazardous voltage, follow relevant regulations and local installation safety guidelines.**
- **Please observe the regulations on the correct use of tools and personal protective equipment.**
- **All connections must be carried out with distinctive guidance. Any guess and ambiguous attempts must be prohibited.**
- **Tools with an insulating protective coating must be used.**

- Connecting cables should meet the voltage and current requirements.
- All connectors must be safe and reliable to avoid loosening or virtual contact. They must be corrosion-resistant, wear-resistant and shock-proof.
- All connections must comply with the requirements of relevant national standards to prevent arc discharge in any form.
- The connections of internal batteries must be equipped with anti-vibration and antiloosening devices. Temperature, voltage and current sensors must be connected safely and reliably, to prevent loosening, ageing and extrusion. All sensor cables must be free of metal exposure.
- Any type of short circuit should be prevented in the connection process.
- Operators must use this product with personal protective equipment.

- All connections must be carried out with distinctive guidance. Any guess and ambiguous attempts must be prohibited.
- Key connections must be correct, reliable (without loosening) and in good contact, without short-circuits.
- All the finished connections must be measured and confirmed one by one.
- All connections must not be in contact with the casing or other components or shortcircuited.
- If there are other uncertain factors, please consult the after-sales technicians of SUNGROW before any operation.

6.2 Battery Wiring

Tools

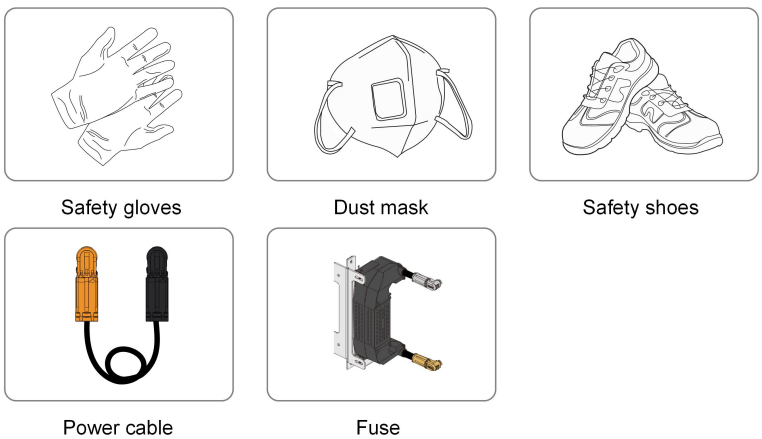


Figure 6-1 Installation Tools

Step 1 Before connecting the power cable, put on insulated shoes and safety gloves. Before connecting the power cable between PACKs, disconnect the wiring between the PACK and the S/G first.

Step 2 Install the fuse. Open the cabinet door, and remove the sponge separators that hold the fuse plugs.

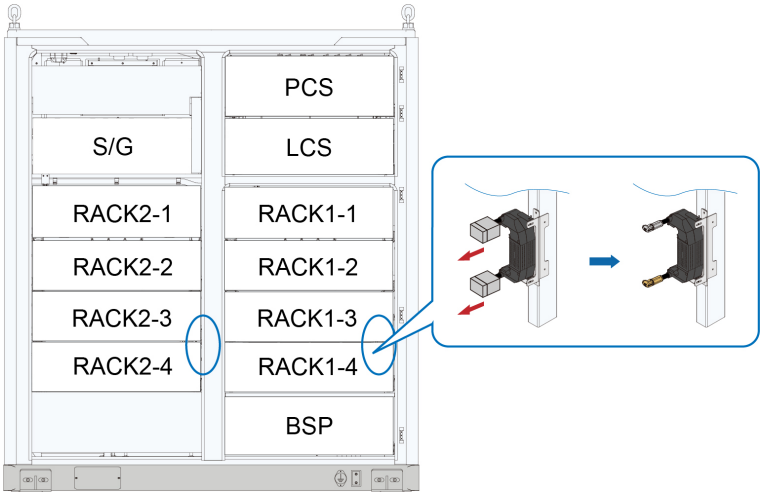


Figure 6-2 Position of Fuse

Step 3 Insert the plugs that come with the fuse into the PACK bases properly.

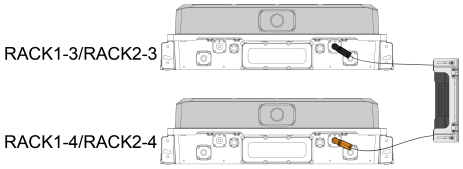


Figure 6-3 Insert Fuse Plugs into PACK Bases

⚠ 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 cables, you can adjust the position of the fuse properly.

Step 4 Connect the power cables between the PCAKs. The positive connector of the power cable between the PACKs has been secured on the RACK, and the negative connector is secured on the side bracket with the quick-connect clip and cable tie.

⚠ WARNING

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

NOTICE

When connecting the power cable between the PACKs, take down the negative connector of the power cable from the quick-connect clip on the side bracket, and then insert it into the negative on the base.

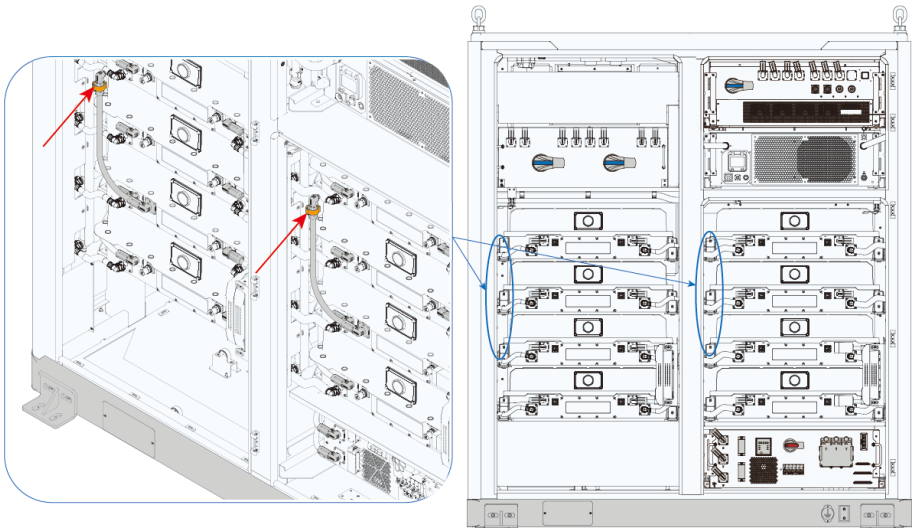


Figure 6-4 Quick-connect Clip

a. Connect the BAT- of Rack1–1 to the BAT+ of Rack1–2;
b. Connect the BAT- of Rack1–2 to the BAT+ of Rack1–3.
c. Connect the BAT- of Rack2–1 to the BAT+ of Rack2–2;
d. Connect the BAT- of Rack2–2 to the BAT+ of Rack2–3.

Step 5 Connect the power cable between the PACK and the DC/AC power converter unit:

a. Connect the BAT+ of Rack1–1 to the BAT1+ of S/G;
b. Connect the BAT- of Rack1–4 to the BAT1- of S/G.
c. Connect the BAT+ of Rack2–1 to the BAT2+ of S/G;
d. Connect the BAT- of Rack2–4 to the BAT2- of S/G.

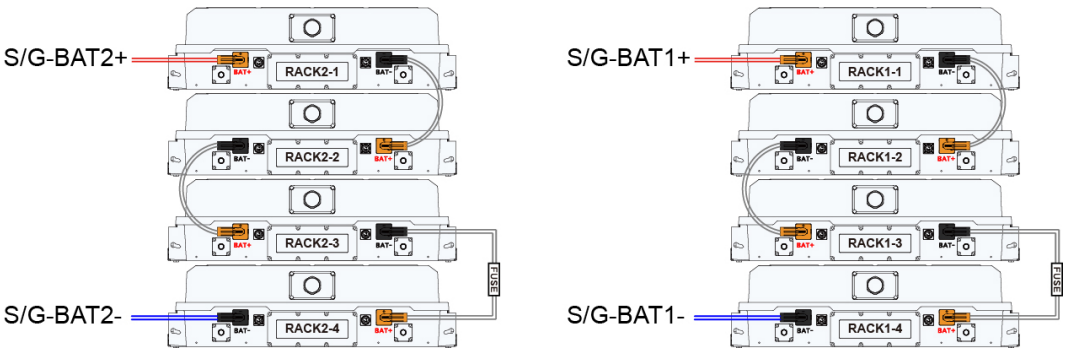


Figure 6-5 PACK Wiring Diagram

⚠ WARNING

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

--End

7 Powering up and Shutdown

7.1 Powering up

⚠ WARNING

- **The equipment can only be put into operation after confirmation by a professional and approval of the local energy department.**

⚠ WARNING

- **For equipment that has a long shutdown time, inspect it thoroughly and carefully and make sure all the indicators meet the relevant requirements before powering up.**

7.1.1 Inspection Before Powering up

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

- Check whether the wiring is correct.
- Check whether the protective covers inside the equipment are installed firmly.
- Check whether the emergency stop button is released.
- Check and ensure that there is no grounding fault.
- Check whether the AC and DC voltages meet startup conditions and ensure that there is no over-voltage with a multimeter.
- Check and ensure that no tools or components are left inside the equipment.
- Check all air inlets and outlets for blockage.
- If the equipment has been stored for more than six months, the top radiator fan should be checked for proper rotation, noise or stalling before powering up.

7.1.2 Powering on Steps

Inspect the equipment thoroughly before powering it on. The equipment can only be powered on after all the inspection items are confirmed to meet the requirements.

Prerequisite

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

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 Power up the transformer cabinet.(Not configured please skip this step.)

a. Close the moulded case circuit breaker QF2 (AC MAIN SWITCH 1#) and completion of the closure of the ESS side switch.

b. Close the moulded case circuit breaker QF1 (AC MAIN SWITCH 2#) and completion of the closure of the load/grid side switch.

c. Close the switch QS1 (AC FAN), completion of AC supply to the fan.

Transformer cabinet is optional.

Step 2 Power up the ESS cabinet.

a. Turn on the power switch of the S/G (DC SWITCH1~2).

b. DC/AC power converter unit: Set the DC switch of the DC/AC power converter unit to "ON". Make sure the emergency stop button on the cabinet is in the reset state.

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

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

e. 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 (the switch, LC, fans, and other devices have all been powered on).

f. Start up the system through the control software.

NOTICE

If the cabinet is equipped with a liquid cooling unit, check the status of the circuit breakers inside the liquid cooling unit. Close the circuit breaker that has not been closed.

--End

7.2 Shutdown

7.2.1 Planned Shutdown

Planned shutdown refers to an interruption to the equipment operation that is scheduled in advance for overhaul, test, or maintenance.

Prerequisite

Shut the system down via the control software, and switch off the battery relay (in case of an emergency, you can press the emergency stop button on the cabinet).

Step 1 Preparation for powering off: Shut down the system via the control software (in case of an emergency, you can press the emergency stop button on the cabinet).

Step 2 Power down the ESS cabinet.

a. Turn off the UPS. Turn off the Q2 (UPS SWITCH) on the panel.

b. Turn off the Q1 (AC AUX SWITCH) on the panel.

c. Turn off the QF1 (AC MAIN SWITCH) on the panel.

d. Rotate the DC/AC power converter unit DC switch to "OFF".

⚠ DANGER

Before working on the AC wiring terminals, be sure to turn off the upstream switches of the ESS first.

e. Turn off the power switch of the S/G (DC SWITCH1~2).

Step 3 Power down the transformer cabinet.(Not configured please skip this step.)

a. Disconnect the fan switch QS1 (AC FAN).

b. Disconnect the moulded case circuit breaker QF1 (AC MAIN SWITCH 2#).

c. Disconnect the moulded case circuit breaker QF2 (AC MAIN SWITCH 1#).

--End

Test the voltage after the system self-discharge is completed.

7.2.2 Emergency Shutdown

Contact the local fire department in case of an emergency.

8 Fire Suppression

8.1 General Rules

Please comply with the fire laws and regulations of the country/region where the project is located.

Perform regular inspection and maintenance on the fire suppression system regularly to ensure it can function properly.

8.2 Fire Suppression System

The FSS scheme for the energy storage system mainly revolves around fire detection and alarm, as well as fire extinguishing. It includes three subsystems: the detection and alarm system, the fire extinguishing system, and the backup system.

FSS Devices

The specific components and configuration of the FSS are illustrated in the figure and table below.

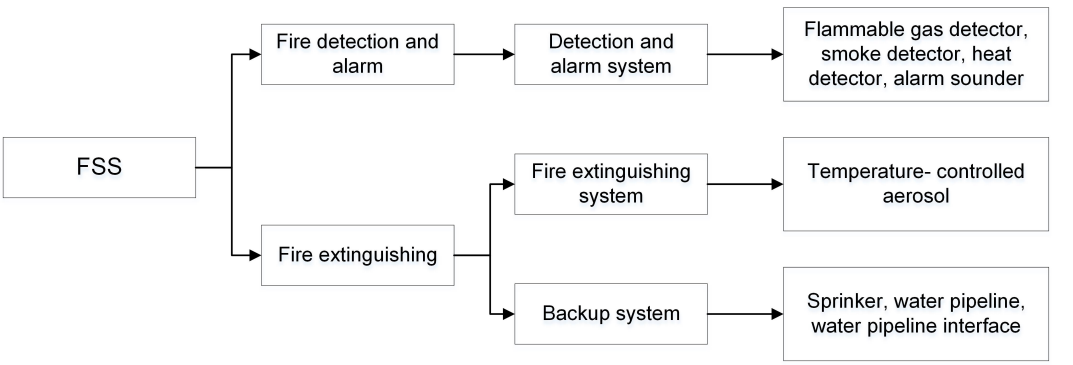


Figure 8-1 FSS Composition

Layout of FSS

The flammable gas detector, the smoke detector, the heat detector, and the alarm sounder are positioned in the top on the left side of the outdoor cabinet. The temperature-controlled aerosol is located on the inside of the left door panel of the outdoor cabinet. The water pipeline is installed at the middle of the battery compartment, the sprinkler is installed at the top of the water pipeline, and the water pipeline interface is located at the front bottom on the left side of the outdoor cabinet. Please refer to the following figure for further details.

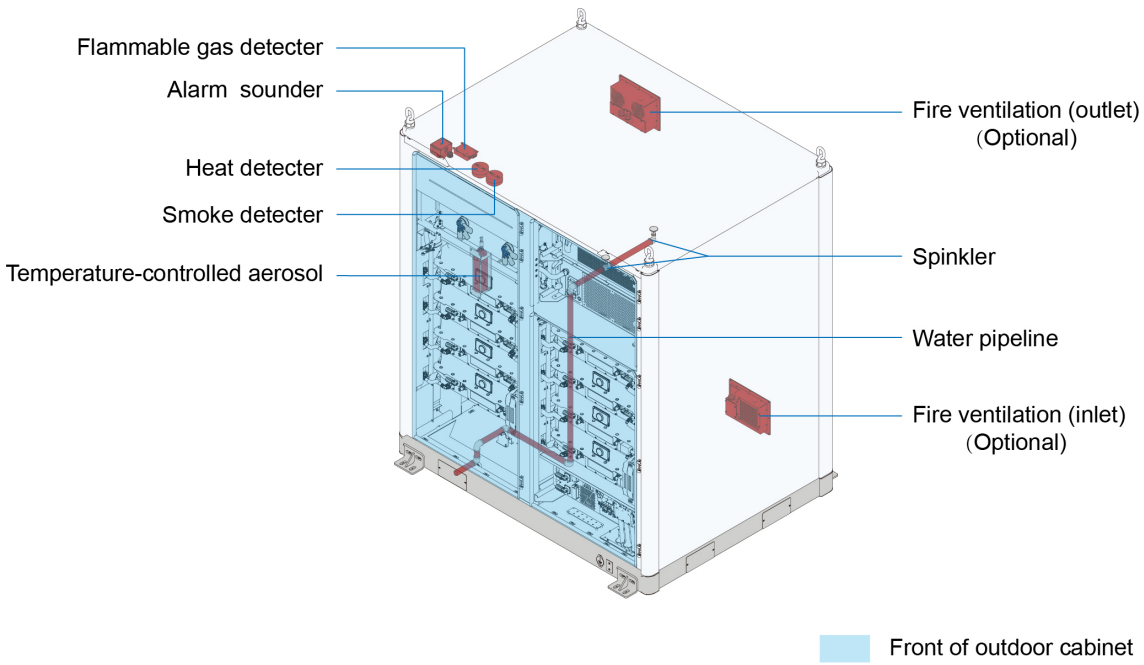


Figure 8-2 Layout of FSS

Combustible Gas Detectors Test Requirements

To ensure the detection accuracy of the combustible gas detectors, perform a bump test at least twice a year. If the detector fails the bump test, check and if necessary, calibrate the detector.

Bump Test Requirements:

- Personal protective equipment: Safety goggles (recommended).
- Test gas: 4000 ppm hydrogen with nitrogen as the balance gas.
- Gas flow: Use a pressure-reducing valve to maintain a gas flow rate of ≥ 0.5 L/min.
- Gas pipe: Vinyl (recommended); maximum outer diameter of 5/16 inches (approximately 8 mm).

8.3 Device Introduction

8.3.1 Fire Detection and Alarm System

The fire detection and alarm system is able to discover fires early in their development and thus helps to reduce the risk of fires to the minimum.

Each ESS cabinet is equipped with a flammable gas detector, a smoke detector, a heat detector, and an alarm sounder, which together constitute the detection and alarm system.

- The flammable gas detector can detect the concentration of flammable gases such as hydrogen. When the flammable gas detector detects that hydrogen concentration in the

battery compartment reaches the set threshold (10% LEL), it will send an alarm signal to LC.

- The smoke detector can judge the smoke concentration by measuring the scattering effect of smoke on light. When the smoke detector detects that the smoke concentration in the battery compartment reaches the set threshold (0.15 dB/m), it will send an alarm signal to LC.
- The heat detector can detect temperature changes in the battery compartment. When the heat detector detects that the temperature in the battery compartment reaches the set threshold (54°C), it will send an alarm signal to LC.
- In addition, if the LC receives any alarm signal from the flammable gas detector, the smoke detector, or the heat detector, and also receives the over-temperature fault signal of the cell, it will start the alarm sounder, triggering an acoustic alarm to remind the personnel on field about equipment anomaly.

NOTICE

When the product leaves the factory, the alarm sounder is off by default. If required, it can be turned on manually on site.

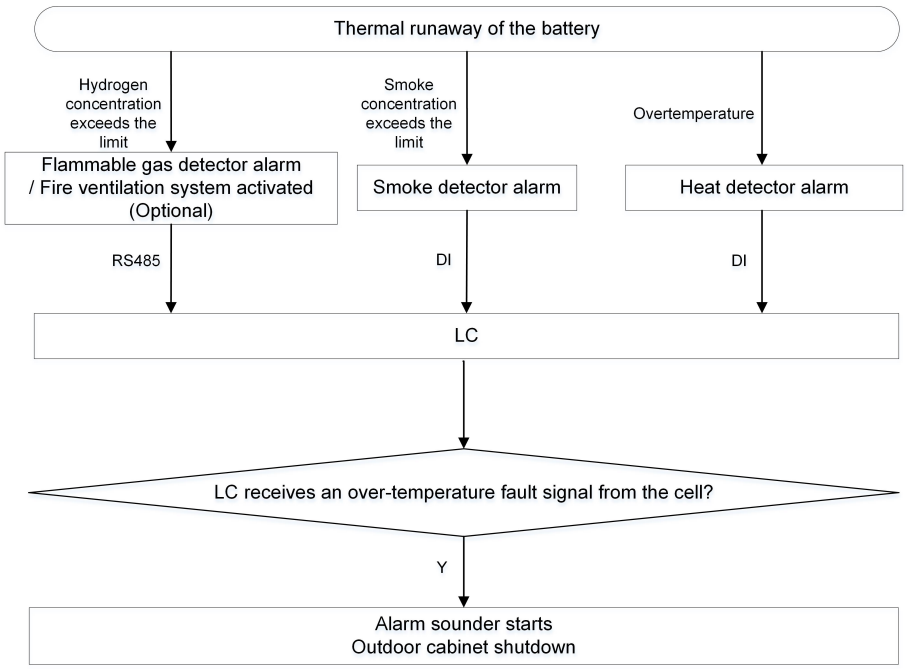


Figure 8-3 Control logic of Detection and Alarm System

8.3.2 Fire Extinguishing System

The ESS is equipped with an aerosol fire extinguishing system.

The fire extinguishing system is an aerosol fire extinguishing system, which includes fire extinguishing agent (temperature-controlled aerosol), a fire extinguishing agent tank, a temperature sensor and a signal feedback device. Each outdoor cabinet is provided with

a fire extinguishing agent tank containing aerosol, a temperature sensor, and a signal feedback device.

When the temperature sensor detects that the temperature in the battery compartment reaches 93°C, the aerosol will be automatically released into the battery compartment to extinguish the fire. After the aerosol is released, the signal feedback device sends the fire extinguishing agent release signal to LC.

NOTICE

In addition, if LC also receives an over-temperature fault signal from the cell, it will shut down the corresponding outdoor cabinet.

The effective space volume for the outdoor cabinet is 3.72 m^3, while the aerosol fire extinguishing system contains 500 g aerosol extinguishing agent, which covers an effective space volume of 6.3m^3 , meeting the fire extinguishing requirements.

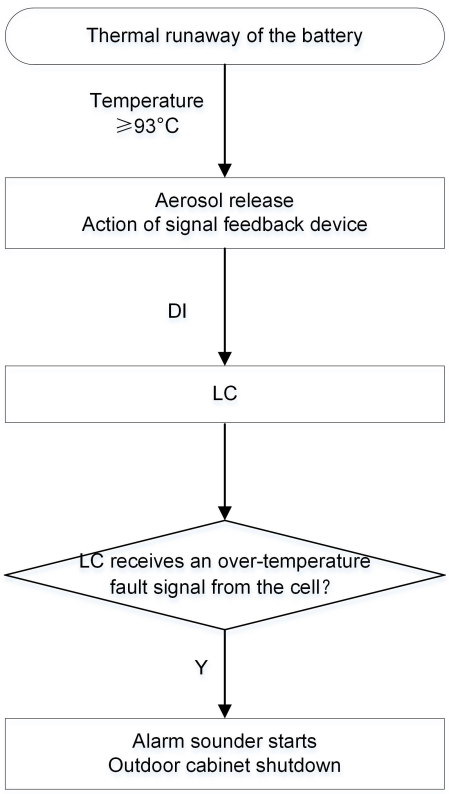


Figure 8-4 Control logic of Fire Extinguishing System

8.3.3 Backup Protection System

In addition to the fire extinguishing system, the ESS also has a backup protection system, in case the fire keeps spreading even after the fire extinguishing system has acted.

After the fire extinguishing system acts, if the fire continues to spread, the customer can use the backup system to extinguish the fire after the ESS is powered off. The backup system mainly includes sprinklers, water pipelines and water pipeline interfaces.

- Each ESS cabinet is equipped with two sprinklers, a water pipeline, and a water pipeline interface.
- The sprinkler is an upright and closed type. When the temperature around the sprinkler reaches 93°C, the glass ball of the sprinkler automatically breaks and the sprinkler acts. Water flows into the battery compartment through pipelines inside and outside the ESS cabinet, and submerges the battery Pack in the battery compartment, thus cooling the cabinet and extinguishing the fire.
- The water pipeline and pipeline interface are galvanized steel pipes with a diameter of DN25. The water pipeline and pipeline interface have been installed before they leave the factory. The pipelines outside of the ESS cabinets need to be designed and installed by customers and connected with the pipeline interfaces in ESS cabinets.

NOTICE

The water pressure at the inlet of the water pipeline interface shall not be less than 0.101 MPa, and the total flow rate shall not be less than 114.73 L/min.

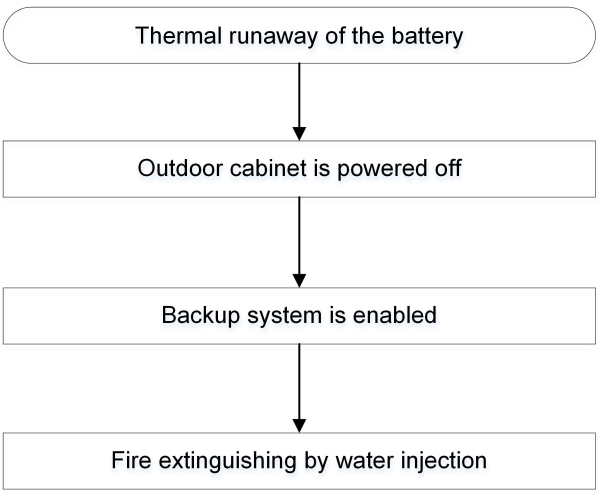


Figure 8-5 Control logic of Backup System

9 Troubleshooting

In case of anything abnormal with the ESS, it is suggested to perform troubleshooting by referring to the troubleshooting methods mentioned in the LC300 user manual first.

For more information, please refer to the below documents:

Document	QR Code
LC300 User Manual	

If the problem persists or there are any other questions, please contact SUNGROW. It would be helpful if you could provide the below information:

- Model and S/N of the ESS and its internal device;
- Fault information and a brief description of the fault;
- A photo of the fault, if possible.

10 Routine Maintenance

10.1 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.

10.2 Maintenance Item and Interval

- This section is the recommended maintenance cycle. The actual maintenance cycle should be adjusted according to the specific installation environment of this product.
- The power station scale, installation location and on-site environment affect the maintenance cycle of this product. In sandy or dusty environments, it is necessary to shorten the maintenance cycle and increase the frequency of maintenance.

10.2.1 First Grid Connection

Inspection Item	Inspection Method
Electrical connection	Check the following items. If any item does not meet the requirements, take corrective measures immediately: • Check the materials and specifications of the input and output cables. • Check the materials, specifications, and orientations of the wiring terminals. • Check the sizes of bolts and the orientation of their washers.

10.2.2 Once a Month

Inspection Item	Inspection Method
ESS cabinet	• Check the cabinet for oxidation and rust. • Check the cabinet and its internal components for deformation and damage. • Check whether there are flammables on the top of the cabinet. • Check whether the welding points between the cabinet and the foundation steel plate are firm and secure, and whether there is rust or corrosion. • Check whether the lock of the cabinet door can operate smoothly and properly, • Check whether the sealing strip is fixed properly. • Check whether there are foreign matters, fallen screws, dust, dirt, or condensation inside the cabinet.
Air inlet and outlet	Check whether the air inlet and outlet of the ESS cabinet are blocked.
Cables	Check the cables for damages.
System status	• Check whether the internal devices make abnormal noises during operation. • Check whether the temperature inside the ESS cabinet is too high. • Check whether the humidity inside the ESS cabinet is within the normal range.

10.2.3 Once Every Six Months

Inspection Item	Inspection Method
Safety function	• Check whether the emergency stop button can function properly.

Inspection Item	Inspection Method
	• Simulate a shutdown. • Check whether the warning signs and other marks on the ESS are all legible and free from dirt. Replace them in time if the signs or marks are indistinct or damaged.
Internal components	• Check the cleanliness of the circuit board and other elements and components. • Check whether the fans can operate normally and whether there is abnormal noise during operation. • Check the temperature of the heat sink and the amount of dust accumulated. Clean heat-dissipation modules with a vacuum cleaner if necessary. • Replace the air filter screen at the air inlets/outlets if necessary.
Component maintenance	• Inspect all metal components for rust and corrosion regularly (once every six months). • Perform annual inspection on contactors (auxiliary switches and miniature circuit breakers) to ensure they can operate properly. • Check the operation parameters (especially voltage and insulation). • Check whether there is a UPS that is not running. A UPS in rest needs to be charged once every six months.*

NOTICE

UPS recharge plan:
When the grid is restored, the ATS cabinet adopts the bypass mode. Close the QF3, QF4, and QF6 switches manually to charge the ESS cabinet. The UPS will charge too when the ESS cabinet is powered.

10.2.4 Once a Year

Inspection Item	Inspection Method
Grounding of the cable shielding layer	Check whether the cable shielding layer is in good contact with the insulating bushing, and whether the grounding copper bar is firmly fixed.
SPD and fuse	Check whether the SPD and fuse are firmly secured.
Wiring and cable arrangement	• Check whether the cables are laid and arranged properly, and whether there is a short circuit or other abnormal symptoms.

Inspection Item	Inspection Method
	In case of anything abnormal, take corrective measures immediately. • Check whether the cable inlet and outlet holes of the ESS cabinet are all sealed off properly. • Check if the power cables are loose. If so, fasten the cable at the specified torque. • Check the power cables and control cables for damage. In particular, check the area where the cable comes in contact with the metal surface for signs of cuts. • Check whether the insulating tapes wrapped around the power cable wiring terminals have peeled off.
Grounding and equipotential bonding	• Check whether the ground connection has been completed properly. Make sure the ground resistance does not exceed 4Ω. • Check whether the equipotential bonding inside the ESS has been properly completed.

10.3 Liquid Cooling System Maintenance

The recommended maintenance intervals are listed below, which however may need to be adjusted based on the installation environments of the product.

The maintenance interval of the product is subject to factors like plant size, installation position, and on-site environment. For the equipment working in sandy or dusty environments, it is necessary to shorten the interval and increase the frequency of maintenance.

Item	Content	Inspection Method	Maintenance tools
Fans	Check whether the fan blades can rotate properly and are free of damage. If not, replace the fan.	1. The fan blade rotates smoothly without making abnormal noise; 2. There is no damage to the fan blade. Note: This inspection should be performed at least once every six months. Damage inspection is not mandatory.	Screwdriver with long handle

Item	Content	Inspection Method	Maintenance tools
Water pump	1. Check whether an area of over 5% of the air intake hole for heat dissipation on the water pump is blocked. If so, clear the blockage with a brush; 2. Inspect the pump body (not the pipe joining points) visually, and see if there is visible dripping (except condensation). If so, replace the sealing ring of the pump.	1. The water pump operates smoothly without making abnormal noise; 2. There is no visible dripping on the pump body (except condensation).	Brush
Water system	Check whether the HMI of the liquid cooling unit reports an alarm.	Check if the unit reports a "water level too low" alarm. Refill coolant into the water tank if the alarm is reported.	Slotted screwdriver, Phillips screwdriver, water pump, water pipe, clamp

10.4 Container Maintenance

10.4.1 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	10.4.1.1 Detergent Cleaning
Finish paint falls off, and the primer is intact	10.4.1.2 Finish Paint Repair
Primer is damaged, and the base material is exposed	10.4.1.3 Double-Layer Paint Repair

10.4.1.1 Detergent Cleaning

Prerequisite

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

Prepared by Users

Table 10-1 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

10.4.1.2 Finish Paint Repair

Prerequisite

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 10-2 Finish Paint Selection and Mixing

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

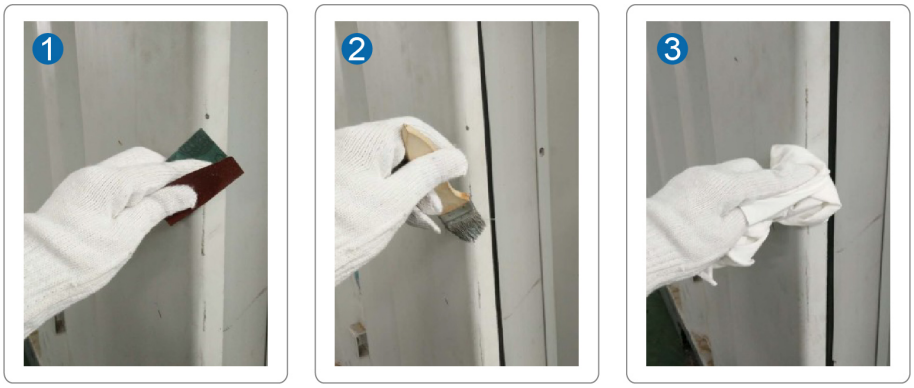
- Ambient temperature: 5℃–40℃
- Base material temperature: 5℃–60℃
- Relative humidity: 10%–85%RH

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.

a. Prepare the finish paint with the same color as the appearance.

Common finish paint colors

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

b. Mix the finish paint according to the paint model and the requirements of Table 10-2 Finish Paint Selection and Mixing.

c. 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.

d. 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

10.4.1.3 Double-Layer Paint Repair

Prerequisite

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 10-4 Primer and Finish Paint Selection and Mixing

Brand and model	Chemical Component	Mixing Ratio	Thinner	Drying Time (Minimum)
Jotun Primer Jotamastic 90	Two-component epoxy paint	Main component : Hardener= 3.5:1 (Volume Ratio)	Jotun Thinner No.17	5℃ 30h 10℃ 10h 23℃ 3h 40℃ 1.5h
AkzoNobel Primer Interseal 670HS	Two-component epoxy paint	Main component : Hardener= 5.67:1 (Volume Ratio)	International GTA220	5℃ 36h 10℃ 16h 25℃ 10h 40℃ 4h
Jotun Finish Coat Hardtop XP or Hardtop XPL	Two-component chemically cured aliphatic	Main component : Hardener= 10:1 (Volume Ratio)	Jotun Thinner No.10	5℃ 24h 10℃ 12h 23℃ 5h 40℃ 3h
AkzoNobel Finish Paint Interthane 990	Two-component acrylic polyurethane paint	Main component : Hardener= 6:1 (Volume Ratio)	International GTA056	5℃ 24h 25℃ 6h 35℃ 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 10-5 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℃–40℃
- Base material temperature: 5℃–60℃
- 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.

a. Prepare the primer with the same color as the appearance.

Common finish paint colors

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

b. Mix the primer according to the paint model and the requirements of Table 10-4 Primer and Finish Paint Selection and Mixing.

c. 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.

d. 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 10.4.1.2 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.

10.4.2 Checking Door Locks and Hinges

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

10.4.3 Checking Sealing Strips

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

10.5 Battery Maintenance

10.5.1 Maintenance Precautions

⚠ WARNING

Do not allow the product to remain in a low voltage or low SOC condition for a long time. Capacity loss resulting from any of the following conditions is not covered by warranty:

- **The discharging cell voltage remains below 2.7 V for 120 consecutive hours.**
- **The SOC of any RACK remains at 0% for 120 consecutive hours.**
- **The discharging cell voltage is below 2 V.**

⚠ WARNING

Cell overvoltage and undervoltage fault/alarm (For details, see Communication Protocol > LC300 Info-3x table > CMU fault word/CMU alarm word).

- **Fault: “Cell overvoltage fault”, “Cell undervoltage fault”, “Total voltage overvoltage fault”, “Total voltage undervoltage fault”.**
- **Alarm: “Cell overvoltage alarm”, “Cell undervoltage alarm”, “Total voltage overvoltage alarm”, “Total voltage undervoltage alarm”.**

End users must prioritize resolving the above faults and alarms reported by the SUNGROW local controller. The relevant fault or alarm information will be shown on the user interface. In addition, users shall contact SUNGROW to resolve the problems promptly to prevent the battery from overdischarging or overcharging, which may void the warranty.

NOTICE

- **To avoid voiding the warranty, if a cell undervoltage or overvoltage fault occurs, users must contact SUNGROW's local team within 24 hours and follow their instructions.**
- **The active recharge function is enabled by default at the factory (if the system supports this function). If the SOC is too low, the system will automatically charge the batteries at a low current, until the SOC reaches the safe threshold (configurable). SUNGROW recommends keeping this function enabled to minimize the risk of voiding the warranty due to battery undervoltage.**

NOTICE

- **If the system remains inactive for 7 days or longer, it is suggested to raise the SOC lower limit protection value to above 10%. Besides, regularly monitor the system's SOC to prevent overdischarge, which may void the warranty.**
- **During maintenance or shutdown, if any RACK's SOC falls to 0%, charge it to at least 15% within 120 hours.**
- **During operation, if any RACK's SOC falls to 0%, charge it to at least 5% within 2 hours. Alternatively, when the SOC reaches 0%, switch the system to recharging mode via the upper computer EMS.**
- **If the system is stored without operation for six months or more, it must undergo at least one full charge to activate the batteries before being used for the first time.**

The user needs to calibrate the SOC when the battery system is in one of the following conditions during operation.

- During operation, if the SOC does not reach 1%–5% when discharging, and does not reach 97%–100% when charging, it is recommended that a SOC calibration be performed once every 1 month.
- During operation, when the SOC reaches 1%–5% when discharging, or the SOC reaches 97%–100% when charging, and the resting time is < 1h, it is recommended that a SOC calibration be performed once every 1 month.

  During operation, no additional calibration is required when the SOC reaches 1%–5% when discharging or 97%–100% when charging, and the resting time is ≥ 1h.

- A calibration is recommended for major changes in operating conditions, such as from energy shifting to frequency regulation application.

Steps to manually perform SOC calibration

1. Set SOC protection lower limit to 1%–5% and upper limit to 97%–100%.
2. Discharge the system until the SOC reaches the lower limit, and then let the system rest for 1 h without changing the power command.

3. Charge the system until the SOC reaches the upper limit, and then let the system rest for 1 h without changing the power command.
4. SOC calibration is complete. The system can be put back into operation.

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

1. Maintenance personnel must hold an electrician's license issued by the local safety supervision authority and successfully complete professional training before operation.
2. Observe related safety precautions, use necessary tools, and wear personal protective equipment.
3. Do not wear jewelry or metal accessories such as watches.
4. Do not touch the positive and negative high-voltage terminals of the ESS with hands at the same time.
5. Turn off all HV and LV switches before maintaining the ESS.
6. Do not clean the ESS with water directly. Use a vacuum cleaner if necessary.
7. Connect and disconnect cables by following the standard operation procedure. Do not connect or disconnect any cables forcefully or brutally.
8. Put away the tools and materials in time after maintenance. Check that no metal objects are left inside or on top of the equipment.
9. If there is any question about the operation and maintenance of the equipment, please contact SUNGROW Customer Service. Unauthorized operation is prohibited.

10.5.2 Maintenance

1. PACK operating temperature: The working temperature should be kept between -30℃–50℃. The temperature charging and discharging should be 15℃–30℃ and typically 25℃.
2. The RACK should not be charged or discharged with high magnifying power. The continuous charging and discharging current of a single rack should not exceed the rated current.
3. When the Battery Energy Storage System Container is not used in a long time, it should be charged once every 18 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 Battery Energy Storage System Container 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 Energy Storage System 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 Battery Energy Storage System Container are in good conditions and whether they work properly.
12. Regularly check whether the emergency stop button of the Battery Energy Storage System Container 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.**

10.6 Coolant Replacement

Object	Standard	Period	Tools
Coolant	1. There are obvious impurities in antifreeze; 2. Antifreeze is significantly darker in color.	5–6 years	Water pump, hose, hose clamp, slotted screwdriver Note: Please contact Sungrow Customer Service to replace hardware facilities

⚠ WARNING

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

NOTICE

- **The coolant in the refill tank must not exceed the "H" line.**
- **The brand of coolant to be replaced is limited to Great Wall and Acwell, and it is recommended to use the same brand of coolant. If you choose to mix Great Wall and Acwell coolants, the mixing ratio of different coolants is limited to 9:1.**

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 ℃ (149 ℉)].
Hands protection	Use oil-resistant, chemical-resistant protective gloves.
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

Waste types	Disposal measures
	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.
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.

11 Appendix

11.1 Abbreviations

Abbreviation	Definition
B	
BM	Battery Module (or PACK)
BC	Battery Cluster (or RACK)
BMU	Battery Management Unit
BCMU (CMU)	Battery Cluster Management Unit (CMU for short)
BSMU (SMU)	Battery System Management Unit (SMU for short)
BMS	Battery Management System
BSC	Battery System Controller
BCP	Battery Collection Panel. Battery DC inputs are combined into the BCP DC copper bar, and connected to the DC/AC power converter unit DC side through the copper bar on the other side of the BCP.
BSP	Battery Power Supply Panel. It is used as an auxiliary power supply for the components inside the battery, such as lighting, FSS, etc.
D	
DC/DC	DC/DC Converter
L	
LC	Local Controller
S	
SCADA	Supervisory Control and Data Acquisition System
S/G	Switch Gear
SOC	State Of Charge
SOH	State Of Health

11.2 Technical Data

Product Model	ST455kWH–110kW–4h
DC Side	
Cell type	LFP 3.2 V / 280 Ah
System battery configuration	256S2P
Nominal capacity	458 kWh
Nominal voltage range	691.2V–934.4V
AC side (on-grid)	
Nominal power	110kW
Nominal voltage	400 V
Voltage range	340 V ~ 440 V
Nominal frequency	50 Hz / 60 Hz
Frequency range	45 Hz ~ 55 Hz / 55 Hz ~ 65 Hz
Max.THD of current	< 3 % (Nominal power)
DC component	< 0.5 % (Nominal power)
Power factor range	1.0 leading ~ 1.0 lagging
AC side (off-grid) *	
Nominal voltage	400 V
Nominal frequency	50 Hz / 60 Hz
Max.THD of voltage	< 3 % (Linear load)
Unbalance load capacity	100 %
System Parameters	
*Dimensions (Width * Height * Depth)	2152 mm * 2470 mm * 1610 mm
*Weight	Approx. 5300 kg
Degree of protection	IP55
Auxiliary power supply	Internal power supply (Default) External power supply (Optional)

Product Model	ST455kWH–110kW–4h
Anti-corrosion degree	C5 (Default) C3 (Optional)
Operation humidity range	0 % ~ 100 %
Operation temperature range	-30 ℃ ~ 50 ℃ (> 45 ℃ derating)
Max. operating altitude	3000 m
Temperature control method	Intelligent liquid cooling
Noise	≤ 70 dB(A) @ 1 m
Fire suppression system	Default : Flammable gas detector, Smoke detector, Heat detector, Alarm sounder, Aerosol, Sprinkler Optional : Ventilation system
Communication interface	Ethernet
Communication protocol	Modbus TCP
Standard	IEC 62619, IEC 63056, IEC 62040, IEC 62477, IEC 61000, UN 38.3, AS/NZS 4777.2, AS/NZS 3000
Max.Parallel quantity (off-grid)	10
Transformer cabinet parameter **	
Transformer capacity	250 kVA
Primary side voltage / Secondary side voltage	400 V / 400 V (Dyn11)
Nominal frequency	50 Hz / 60 Hz
Dimensions (W * H * D)	1200 mm * 2000 mm * 1200 mm
Weight	1500 kg
Degree of protection	IP55
Anti-corrosion degree	C5 (Default) C3 (Optional)
Operation humidity range	0 % ~ 100 %
Operation temperature range	-30 ℃ ~ 50 ℃ (> 45 ℃ derating)

Product Model	ST455kWH–110kW–4h
Max. operating altitude	3000 m
Temperature control method	Air cooling

*The technical data is for reference only, please refer to the information on the nameplate of the product.

**The transformer cabinet is needed additionally when the system is in off-grid mode.

11.3 Tightening Torques

To avoid poor contact caused by the loosening of copper cable lugs due to stress, and to prevent heat or even fire due to increased contact resistance, make sure to tighten the screws on the cable lugs at the recommended torques:

Bolt	Torque(N·m)	Bolt	Torque(N·m)
M3	0.7–1	M8	18–23
M4	1.8–2.4	M10	34–40
M5	4–4.8	M12	60–70
M6	7–8	M16	119–140

*Torque values listed in the table are intended for the bolt and nut assembly, and do not apply to riveted nuts or riveted screws, etc. The torque to be adopted should depend on the actual situation.

**Secure the cable at a proper point to reduce the stress on the cable lug.

11.4 Quality Assurance

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

Evidence

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

Conditions

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

Exclusion of Liability

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

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

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

11.5 Contact Information

In case of questions about this product, please contact us. We need the following information to provide you the best assistance:

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

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

SUNGROW

Sungrow Power Supply Co., Ltd.

www.sungrowpower.com

MODOOOOO