

User Manual

EMANET ESS



Important hint:

Please read this manual carefully before installing or operating the BESS. Be sure to save this manual for future reference.

Foreword

Dear user,

We sincerely hope that our BESS can meet your needs, and at the same time, you can also make suggestions on the performance, function, appearance, etc. of BESS, and we will continue to improve it according to your suggestions.

Purpose

The purpose of this manual is to ensure safe operation during the installation process, ensure the installation quality of the equipment, ensure the construction progress and promote the installation technology.

Application scope of manual

This manual is suitable for transportation, assembly, installation and commissioning. The product models of EMANET ESS outdoor energy storage system are shown in the table.

EMANET ESS-P60E215

Target audience

This manual is for the use of designated operators only.

Preservation instruction

This manual contains important information about the installation of outdoor energy storage cabinets. Please read this manual carefully before operation. Please strictly follow the operation methods described in the manual. Otherwise, equipment damage, casualties and property loss may be caused. This manual shall be kept properly so that the operator can read it at any time.

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1 Safety Precautions

1.1 Qualifications and responsibilities of operators

A qualified operator is someone who has the necessary knowledge, professional training and experience:

- Operators are required to obtain certificates that comply with local regulations.
- Protect and maintain the equipment according to relevant safety standards.
- Operators shall have the ability of safety first aid.
- Comply with local regulations, standards and management.

The operator must ensure that:

- Before commissioning and switching off the isolating circuit breaker, all basic information and step instructions must be known, especially the safety instructions for assembly and installation, which must be strictly followed.
- Do not change the size and rating of the fuse.
- Appropriate measuring devices must be used and appropriate standards and instructions must be followed. Before taking any measurements, the operating manual of the measuring device must be read.
- Do not open the device during operation.
- If required on site, construction machinery such as forklifts and cranes must be operated by qualified operators.
- When the device is connected to a location with a power supply, a safety officer must be appointed to ensure that switch that are disconnected during maintenance are not turned on.
- Operators should wear work clothes and protective gear, and be equipped with special tools in accordance with local laws and regulations.
- The installation work must be carried out by full-time operators.
- During the wiring process, two or more operators are not allowed to connect one wire at the same time.
- During the installation process, each completed item must be checked once and cross-check is required.
- Devices must be installed in order, no steps can be skipped.
- Isolation belt must be set up during installation to prevent irrelevant personnel from entering the site.
- Do not delete or change the nameplate.
- Do not open the cabinet door on rainy days.

- The software, shell and components of the device may not be replaced without authorization from the manufacturer. Responsibility and quality assurance will be void if the software, shell and components of the device are changed.
- All operations of the energy storage system should follow the instructions in the User Manual. Damage to the equipment caused by violation of this instruction will void the relevant responsibility and quality assurance.




1. 2 BESS label description

The operator must read and understand the labels attached on the BESS cabinet before performing any operations.



Figure 1-1 Safety stickers

1. 3 Safety warning

	<p>Dangerous: Refers to an extremely dangerous situation</p> <p>This warning sign indicates that there is an immediate danger, which may lead to serious personal injury or death.</p>
	<p>Warning: Indicates a very dangerous situation</p> <p>It indicates that there is a potentially dangerous situation, which may lead to serious personal injury or death.</p>
	<p>Warning: Indicates a dangerous situation</p> <p>It indicates that there is a potentially dangerous situation, which may lead to slight personal injury.</p>

2 BESS overview

2.1 Introduction

Energy storage technology has been recognized as an important part of the six links of power system operation: generation, transformation, transmission and distribution, application and energy storage. Incorporating energy storage into the power grid system can effectively manage the demand side, eliminate the peak value of the power grid, smooth the load curve, and adjust the frequency and voltage. Promote the application of renewable energy by improving the stability of power generation of renewable energy system. Energy storage has important strategic application value in the future energy structure.

BESS includes battery, BMS, DCDC, PCS, MPPT, STS, auxiliary power system, fire fighting system, air conditioning system, grounding system.

- Battery and BMS systems are used to store electrical energy.
- PCS is used for AC/DC conversion.
- DCDC is used for DC voltage conversion.
- MPPT is used for photovoltaic charging.
- STS is used for on-grid and off-grid switching.
- The auxiliary power system provides power to all equipment inside the BESS.
- Fire fighting system is the protection for the operators and the BESS in the event of a fire.
- Air conditioner is used to regulate the temperature inside the BESS.
- Grounding system is the safety guarantee of BESS.

2.2 BESS components and dimensions

Bess overall dimensions

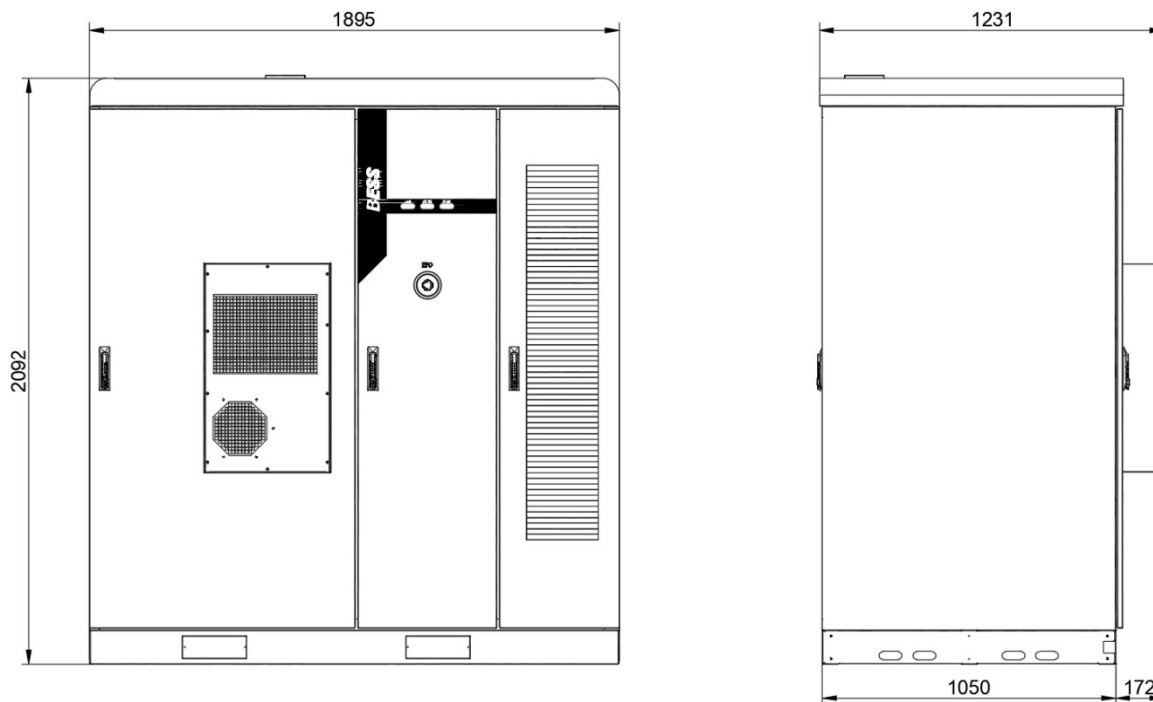


Figure 2-1 Cabinet size drawing

BESS size				
Name	W(mm)	D(mm)	H(mm)	Weight(kg)
Outdoor energy storage cabinet	1895	1231	2092	About 2500

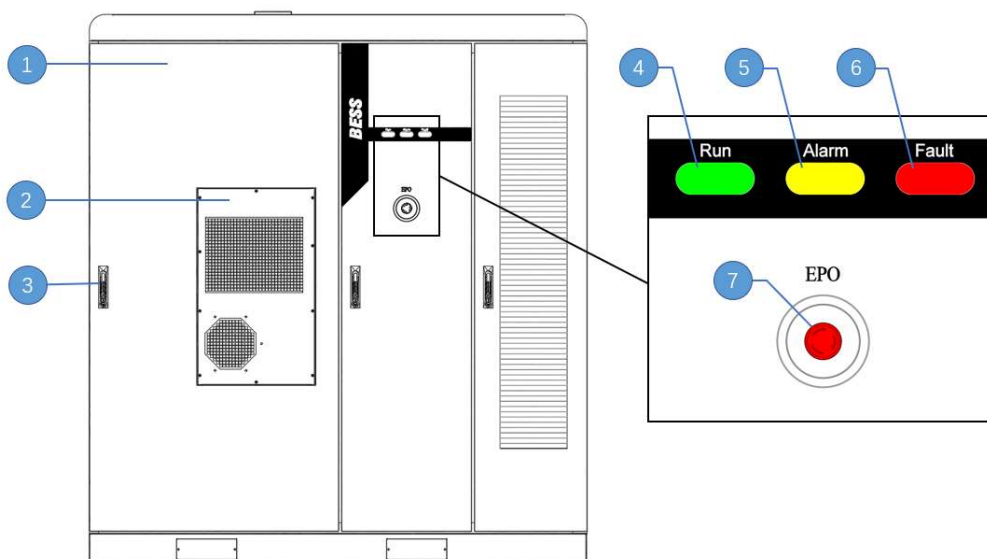


Figure 2-2 Front view of BESS

Item	Name	Function	Remark
1	Cabinet	Shell	
2	Air conditioner	Adjust the temperature inside the outdoor cabinet	
3	Door lock	Lock the cabinet door, requires a specific key to open	
4	Running indicator	Green constant light indicates operation, flashing indicates standby	
5	Alarm indicator	Yellow constant light indicates that there is an alarm in the system, but it does not affect the operation of the system.	
6	Fault indicator	Red constant light indicates that there is a fault in the system and the system stops running.	
7	Emergency stop	The system stops working when the button is pressed	

※Note: Do not operate the emergency stop button in non-emergency situations.

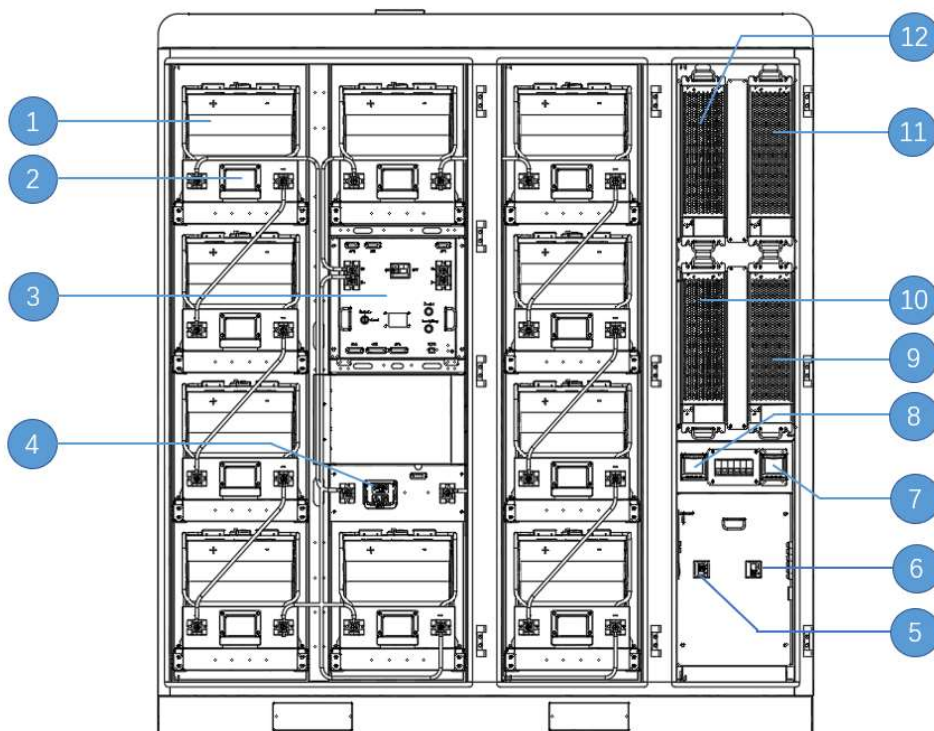


Figure 2-3 Front interior illustration

Item	Name	Function	Remark
1	Battery module	For electrical energy storage	The number of batteries is subject to the actual product
2	BMM	Battery module acquisition module	
3	High voltage control box	BMS , real-time monitoring of battery status	
4	Service switch	Intermediate splitting of battery clusters	
5	Load breaker	Break and protect the load side	
6	AC circuit breaker	Break and protect the grid side	
7	Meter 1	Collect AC side current data	Optional
8	Meter 2	Collect load side current data	
9	STS	For on-grid and off-grid switching	Optional
10	MPPT	For photovoltaic charging	Optional
11	PCS	For AC/DC conversion	
12	DCDC	For voltage conversion	Optional

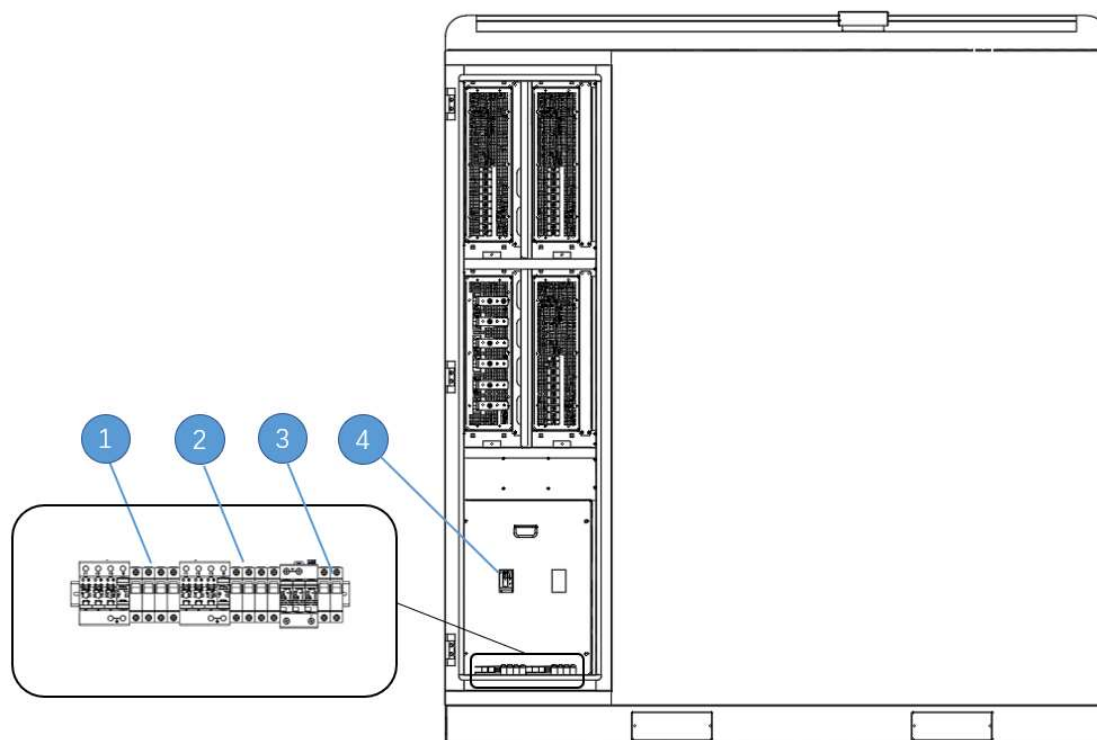


Figure 2-4 Internal illustration of BESS back

Item	Name	Function	Remark
①	AC side lightning protection	Protect the AC side line	
②	Load side lightning protection	Protect customer load side line	
③	Photovoltaic side lightning protection	Protect the photovoltaic side line	Optional
④	Photovoltaic circuit breaker	Break the PV side	Optional

2.3 BESS parameters

The detailed BESS parameters are shown in the following figure:

Model	EnerBlock-60P	EnerBlock-100P
Battery Parameters		
Cell Type	LFP-280Ah	LFP-280Ah
Module Model	IP20S	IP20S
System Configuration	1P240S	1P240S
Battery Capacity (BOL)	215kWh	215kWh
Battery Voltage Range	672V-864V	672V-864V
AC On-Grid Parameters		
Grid Type	3P4W	3P4W
Rated Charge/Discharge Power	60kW	100kW
Rated Grid Voltage	AC400V	AC400V
Grid Voltage Range	-15%~+15%	-15%~+15%
Rated Grid Frequency	50Hz	50Hz
Frequency Range	±5Hz	±5Hz
Rated Current	86A	172A
Power Factor	0.8 (Leading) ~0.8 (Lagging)	0.8 (Leading) ~0.8 (Lagging)
Output Harmonics (Rated power)	≤3%	≤3%
General Parameters		
Dimension (W*H*D)	1900*2100*1230mm	1900*2100*1230mm
Max Weight	2500kg	2500kg
IP Protection Rating	IP54 (Battery room) IP54 (Electrical room)	IP54 (Battery room) IP54 (Electrical room)
Seismic Intensity Rating	8 degree (IEC60980)	8 degree (IEC60980)
Anti-Corrosion Grade	C3	C3
Operating Temperature	-20°C~50°C	-20°C~50°C
Relative Humidity	0-95% (Non-condensing)	0-95% (Non-condensing)
Altitude	<2000m	<2000m
Cooling Method	Battery room: air conditioning; Electrical room: forced air cooling	Battery room: air conditioning; Electrical room: forced air cooling
Noise	≤75dB	≤75dB
System Efficiency	≥85%	≥85%
Cycle Life	10years or >	10years or >
Design Standard	System (BS7671, GB/T 36558, IEC 62933); Cell (GB/T 36276, IEC 62619, UL1973, UL9540A); PCS (GB/T 34120, G99, EN 50549, VDE4105)	
Sales Territory	UK/China/Germany (More countries will follow)	

2.4 BESS system application

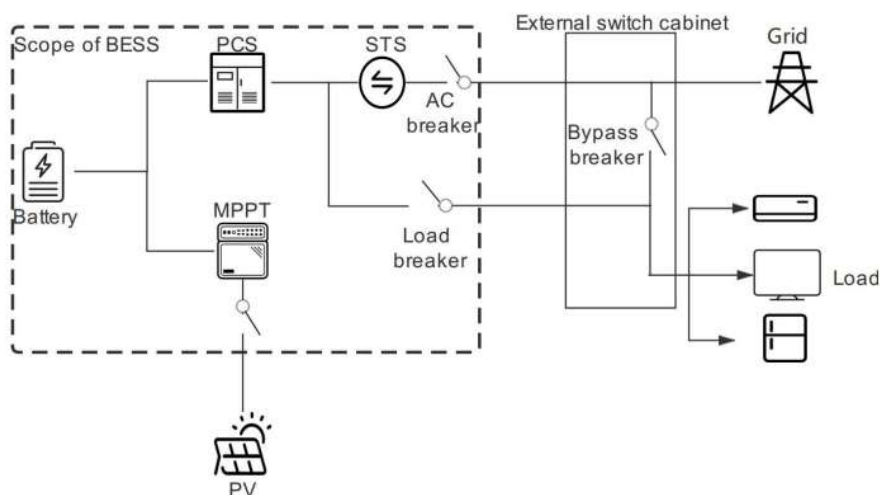


Figure 2-5 BESS on-grid and off-grid seamless switching topology

Note: DC , STS, MPPT are optional.

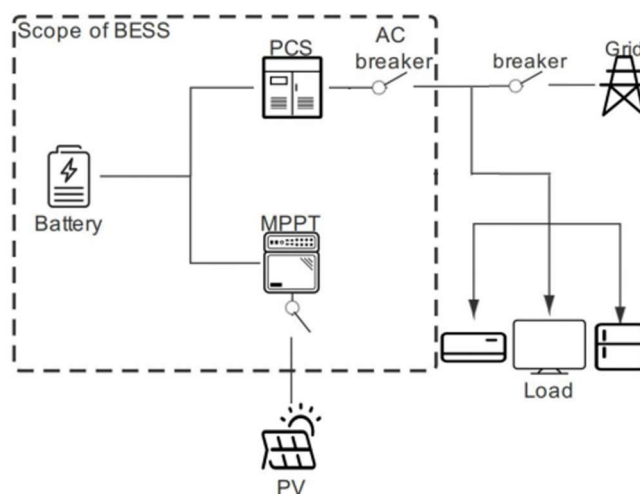


Figure 2-6 BESS On-grid and off-grid switching (second level) topology

Note: MPPT is optional.

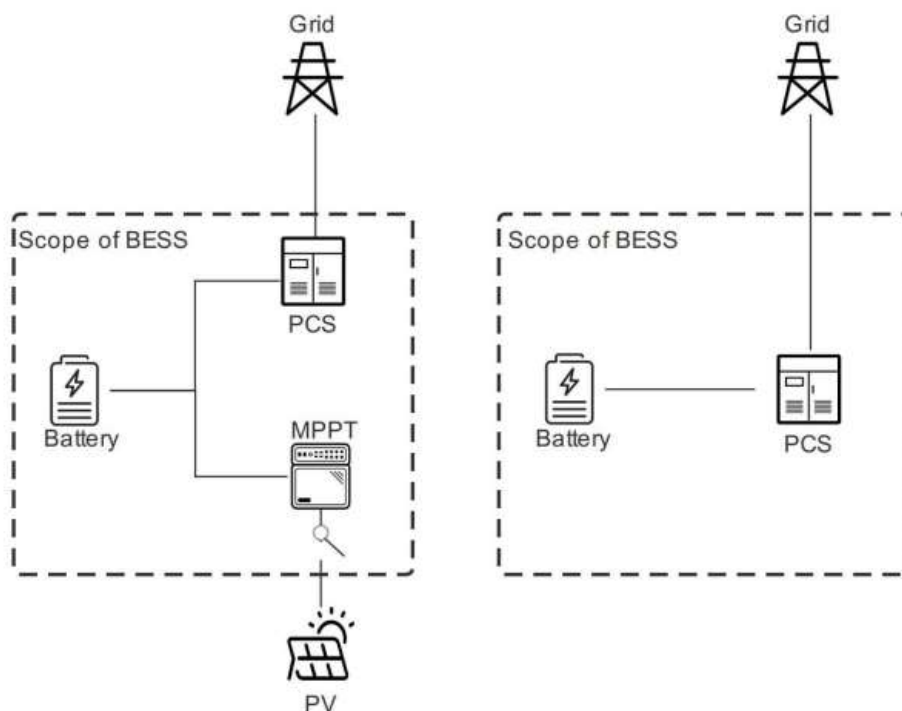


Figure 2-7 BESS on-grid topology

Note: MPPT is optional.

2.5 Delivery list


The delivery includes outdoor BESS, documents (electronic version) , accessories, keys.

The detailed list is as follows:

Number	Category	Name	Quantity	Remark
1	BESS	Outdoor energy storage cabinet	1	
2	Documentation (Electronic version)	User Manual	1	
3		Air Conditioning Manual	1	
4	Accessories	Door lock key	3	
5	Spare parts			Subject to the actual

3 Subsystem

3.1 Battery

	Danger:
	<ul style="list-style-type: none"> ◆ Do not touch any batteries when BESS is running. ◆ Only authorized operators can operate the battery. ◆ End of life (decommissioning, dismantling and disposal in accordance with the provided recycling program).

Using lithium iron phosphate battery module (LiFePO₄), excellent safety, long service time, good temperature performance, high energy density, low cost, pollution-free modular assembly, high strength, high structural reliability, low maintenance cost.

Note : BESS output will be limited when any battery temperature exceeds 40°C.

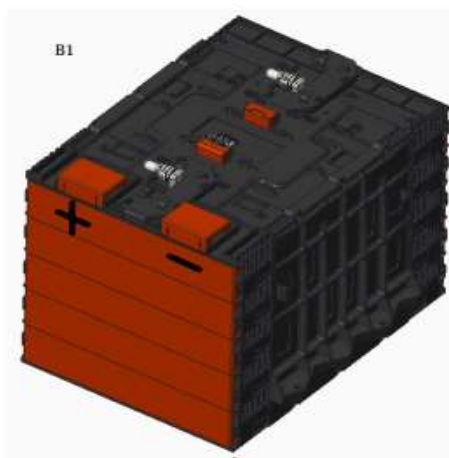


Figure 3-1 Battery module diagram

When the battery is found to be leaking electrolyte

- When the battery leaks, please stop using it immediately.
- Electrolyte is non-toxic and has little odor. If it contacts the skin, it has certain pathogenicity. Please stay away from the skin.
- When handling battery leakage, please ensure that the power supply connected to the battery is turned off to prevent fire and sparks, and handle it in a well-ventilated handling area, during which rubber gloves should be worn.
- Disposal: Use gauze (ordinary medical gauze) or other liquid absorbent solids to clean battery leakage.

- The disposed batteries should be placed in isolation and should not be used again.
- Please do not directly contact electrolytes, if accidental contact with skin, please rinse with plenty of water.
- When the battery has an irritating abnormal smell and it is impossible to judge whether there is electrolyte leakage, please stop using it immediately and isolate the battery.

3.2 High voltage control box

The high-voltage control box makes the battery function stable and safe by monitoring the battery status in real time. Extend the battery life by monitoring the battery consistency.

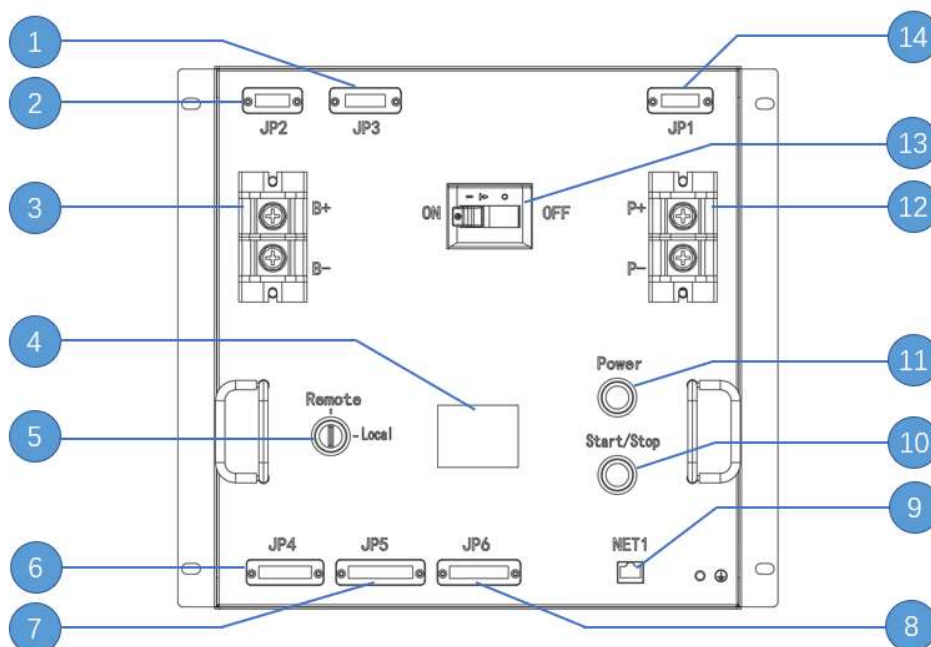


Figure 3-2 Control box panel

	Name	Effect	Remark
1	JP3	Power supply recheck of the intermediate contactor and recheck of the DC circuit maintenance switch	
2	JP2	CAN/12V power supply of BCM	
3	B terminal		
4	Display		
5	Mode switch		
6	JP4	Power supply for indicator lights	
7	JP5	RS485 communication	

8	JP6	CAN communication, fire battery valve control	
9	NET1	Industrial personal computer communication	
10	Start/stop button		
11	Power switch		
12	P terminal		
13	DC circuit breaker		
14	JP1	DC, battery powered	

3.3 PCS

PCS can control the charging and discharging process of the battery, perform AC-DC conversion, and can directly supply power to the AC load when there is no power grid. PCS consists of DC/AC bidirectional converter, control unit, etc. PCS controller receives the background control command through communication, and controls the converter to charge or discharge the battery according to the sign and size of the power command, so as to adjust the active power and reactive power of the grid.

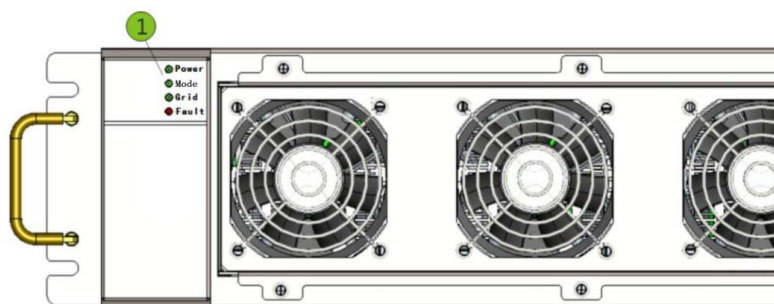


Figure 3-3 PCS working status indicator










Indicator Description			
Indicator	Indicator Status		Status Description
Power		Always on	System standby
		Flash	Start up
Mode		Always on	Standby
		Flash	Charging
		Rapid flash	Discharging
Grid		Always on	Off-gird
		Flash	On-gird
Fault		Always on	System fault
		Off	No fault

Figure 3-4 Description of PCS working status indicator

3.4 DCDC (optional)

The role of DC/DC is to convert the voltage of the battery into a fixed voltage output.

3.5 MPPT (optional)

MPPT is used for photovoltaic charging.

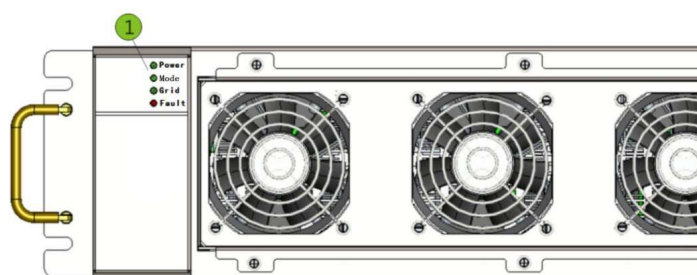


Figure 3-5 DCDC, MPPT working indicator








Indicator Description			
Indicator	Indicator Status		Status Description
Power		Always on	System standby
		Flash	Start up
Mode		Always on	Standby
		Flash	Charging
		Rapid flash	Discharging
Grid	/	/	/
	/	/	/
Fault		Always on	System fault
		Off	No fault

Figure 3-6 Description of DCDC, MPPT working status indicator

3.6 STS (optional)

STS static transfer switch is mainly used for power supply switching of two-way power supplies, and it is an automatic switching system for two-way power supplies. In the on-grid working state, the power grid supplies power to BESS and customer loads at the same time. When the power grid fails, the customer load automatically switches to BESS for power supply. After the power grid returns to normal, the customer load and PCS automatically switch to the power grid for power supply.

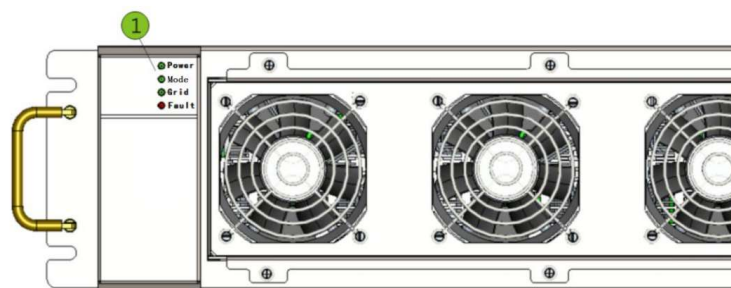


Figure 3-7 STS working indicator






Indicator Description			
Indicator	Indicator Status		Status Description
Power		Always on	System standby
		Flash	Start up
Mode	/	/	/
	/	/	/
	/	/	/
Grid	/	/	/
	/	/	/
Fault		Always on	System fault
		Off	No fault

Figure 3-8 Description of STS working indicator

3.7 Fire fighting system



Figure 3-9 Fire fighting system Fire extinguishing pipe

	Note:
	It is forbidden to use the BESS when the smoke detector is alarming or the battery temperature is too high.

The battery cabinet of BESS is equipped with a fire fighting system. In the event of a fire hazard inside the battery cabinet, the fire fighting system will start and extinguish the fire. It includes solenoid valve, fire extinguishing pipe and smoke detector.



Figure 3-10 Smoke sensation

	Working status	Description	Remark
1	Monitoring status	The red indicator flashes approximately every 6 seconds	
2	Alarm status	The red indicator is always on	
3	Fault status	The red indicator flashes 2 times continuously about every 6 seconds	

The fire fighting system will be activated and release gas in two situations:

Item	Trigger component	Description
1	Fire extinguishing pipe	When the surface of the fire extinguishing pipe meets a fire, it will burst into a natural discharge outlet to release the fire extinguishing agent, so as to achieve the effect of fire suppression.
2	Solenoid valve	<p>A set of detection circuit is installed in the battery cabinet, and the detection circuit includes two smoke detectors:</p> <ul style="list-style-type: none"> ➤ BESS will now stop running when only one smoke detector is activated . ➤ When both smoke detectors are activated together, the BESS system will immediately stop running, and the solenoid valve will be activated to release the extinguishing agent, thus achieving the effect of suppressing the fire.

3. 8 Air conditioning system

Install an air conditioner with a default cooling temperature of 26°C and automatically adjust the temperature inside the battery cabinet. The air conditioning settings have already been set up and no user settings are required. For detailed air conditioning information, please refer to the air conditioning manual.

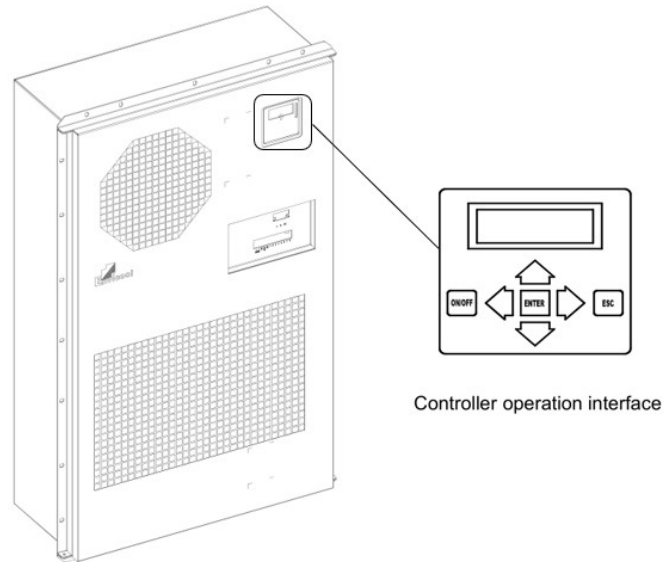


Figure 3-11 Air conditioning operation interface

4 Installation process

4.1 Installation preparation

4.1.1 Installation process

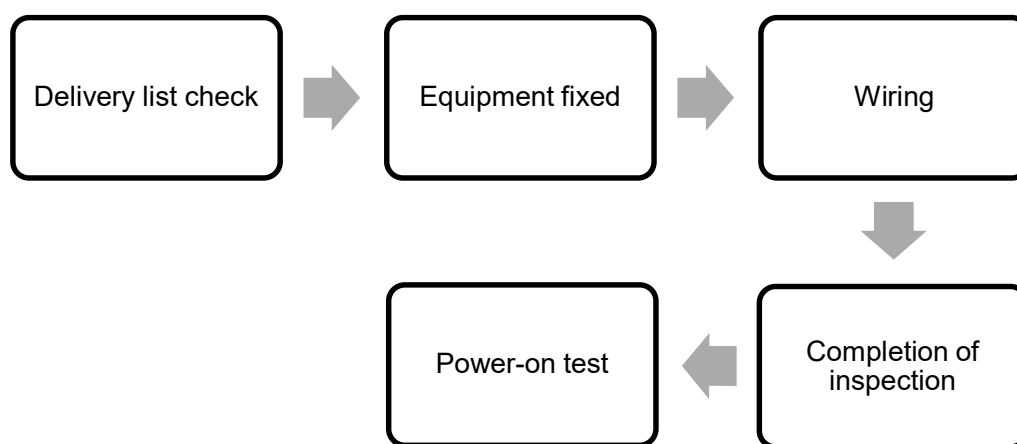


Figure 4-1 Installation process

4.1.2 Installation tool

When performing on-site installations at the engineering site, the installation tools need to be prepared in advance.

Wear protection:



Figure 4-2 Protective tool

Tool list:

Number	Recommended tools	Quantity	Use
1	Electric forklifts	1 unit	Rated load $\geq 3.5T$. For unloading and handling.
2	Impact drills and M12 drills	1 group	Drilling in the ground. Place the expansion screws (M12*150).
3	Hammer	1PCS	Knock the expansion bolt into the fixed position.
4	Sleeve tool	1 group	M12 sleeve: For tightening expansion bolts M8 sleeve: Terminal block fixed.
5	Insulated torque wrench	1PCS	Check and mark the torque value.
6	Adjustable wrench	1PCS	Tighten the bolts to which the cable is connected.
7	Diagonal jaws	1PCS	Cut off the nylon tie from the bag
8	Slotted screwdriver/crowbar	1PCS	Unpacking operation

4. 1. 3 Installation site environmental requirements

The environmental requirements of the installation site are shown in the following table:

Number	Project	Demand
1	Ambient temperature range	-20°C ~ 55°C (When the battery temperature exceeds 40°C, the output power decreases)
2	Allowable altitude _	< 2000m (Derating above 2000m)
3	Allowable humidity	5% ~ 100% (Non-condensing)
4	Installation base requirements	For specific requirements, see Chapter 4.4
5	Installation space requirements	For specific requirements, see Chapter 4.4

Other: Do not install or debug BESS under the condition of rain.

4. 1. 4 Site installation foundation

This outdoor energy storage cabinet should be fixed on a concrete foundation. Please follow the diagram below to build the installation foundation in advance.

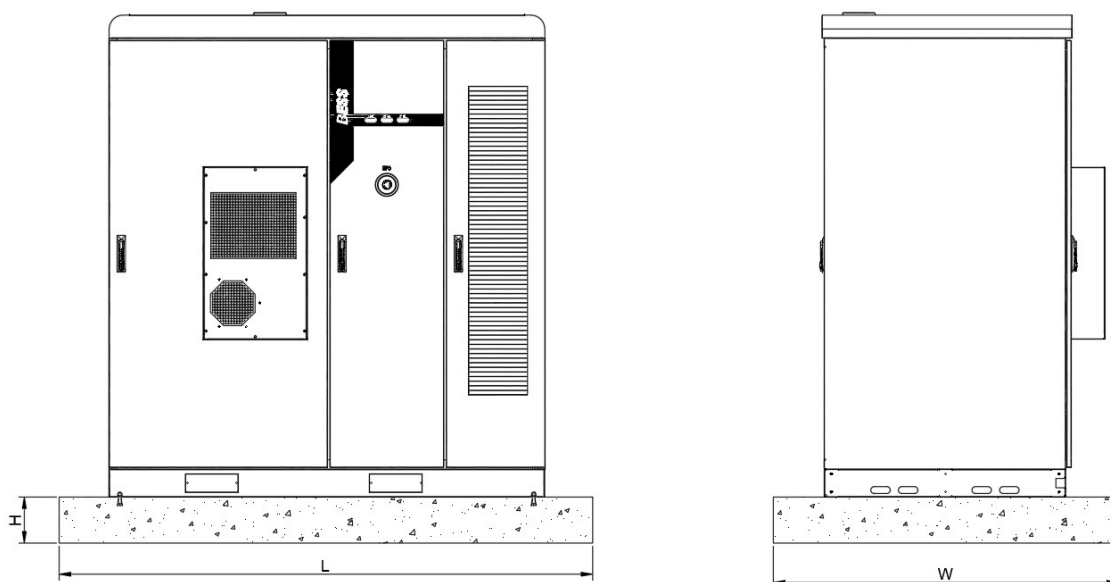


Figure 4-3 Site installation foundation

Installation foundation requirements		
Number	Category	Parameter
1	Minimum hardened area	$L \geq 2000\text{mm}$, $W \geq 1200\text{mm}$
2	The height of the installation foundation	$H \geq 100\text{ mm}$ (higher than the historically high flood level)
3	Mounting foundation load carrying capacity	Bearing capacity $> 2.5\text{ t / m}^2$
4	Foundation service life	≥ 20 years
5	Foundation level	3mm / m^2

※**Note:** W indicates the width of the mounting surface of a single cabinet, D indicates the depth of the mounting surface of a single cabinet, and the steel gasket can be prepared in advance on the spot to level the installation foundation of the cabinet.

1) Site requirements for installation of a single outdoor energy storage cabinet

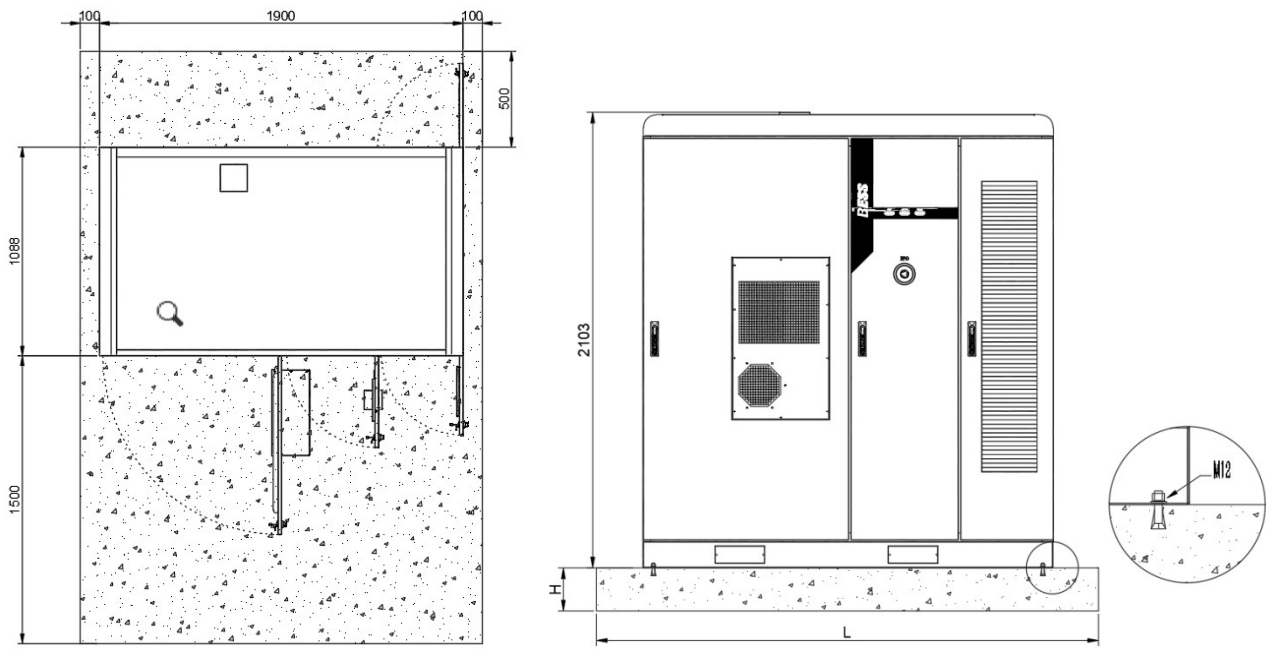


Figure 4-4 Installation diagram of single outdoor energy storage cabinet

2) Site requirements for installation of two outdoor energy storage cabinets

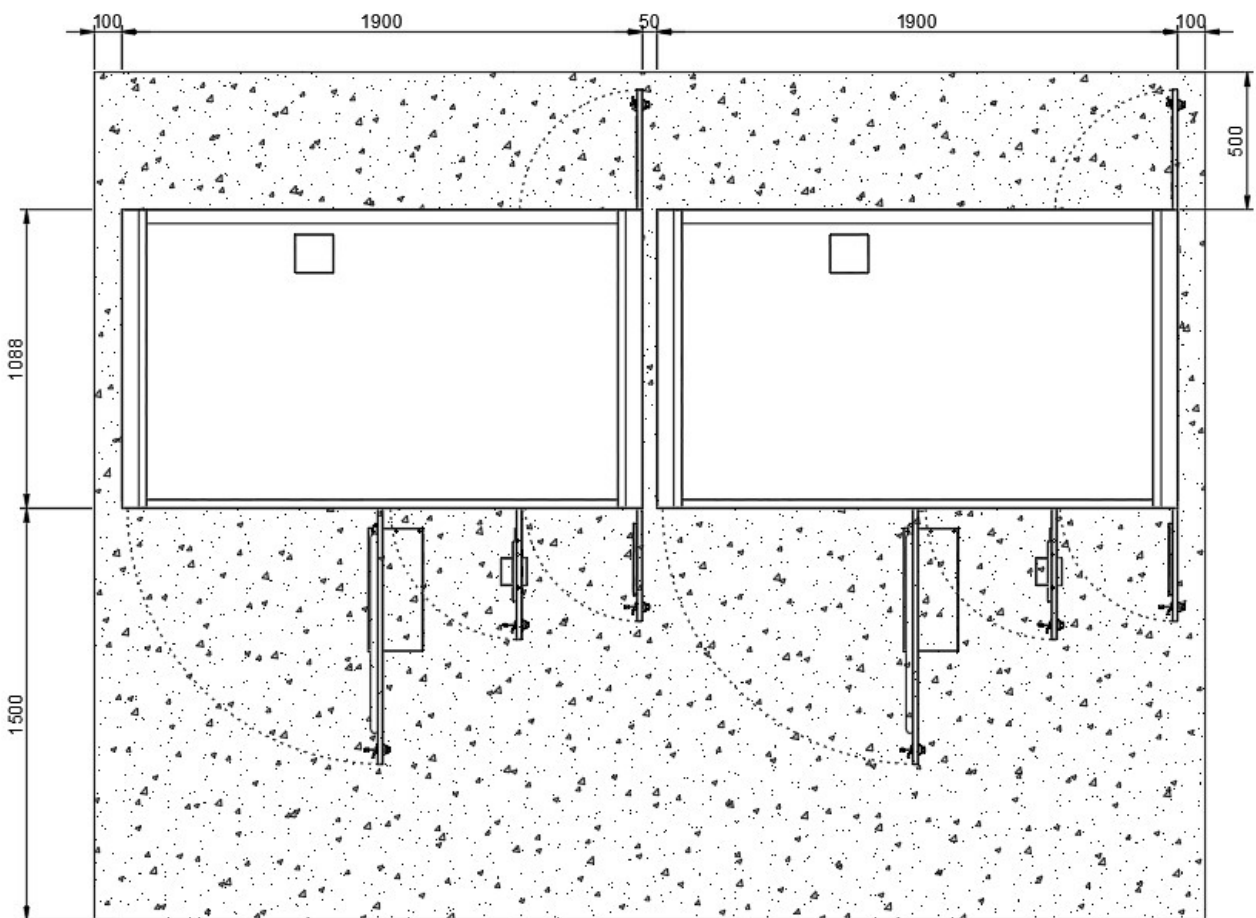


Figure 4-5 Installation diagram of two outdoor energy storage cabinets

Notice:

W indicates the total mounting surface width of the two cabinets, and D indicates the total mounting surface depth of the two cabinets.

3) Site requirements for installation of multiple outdoor energy storage cabinets

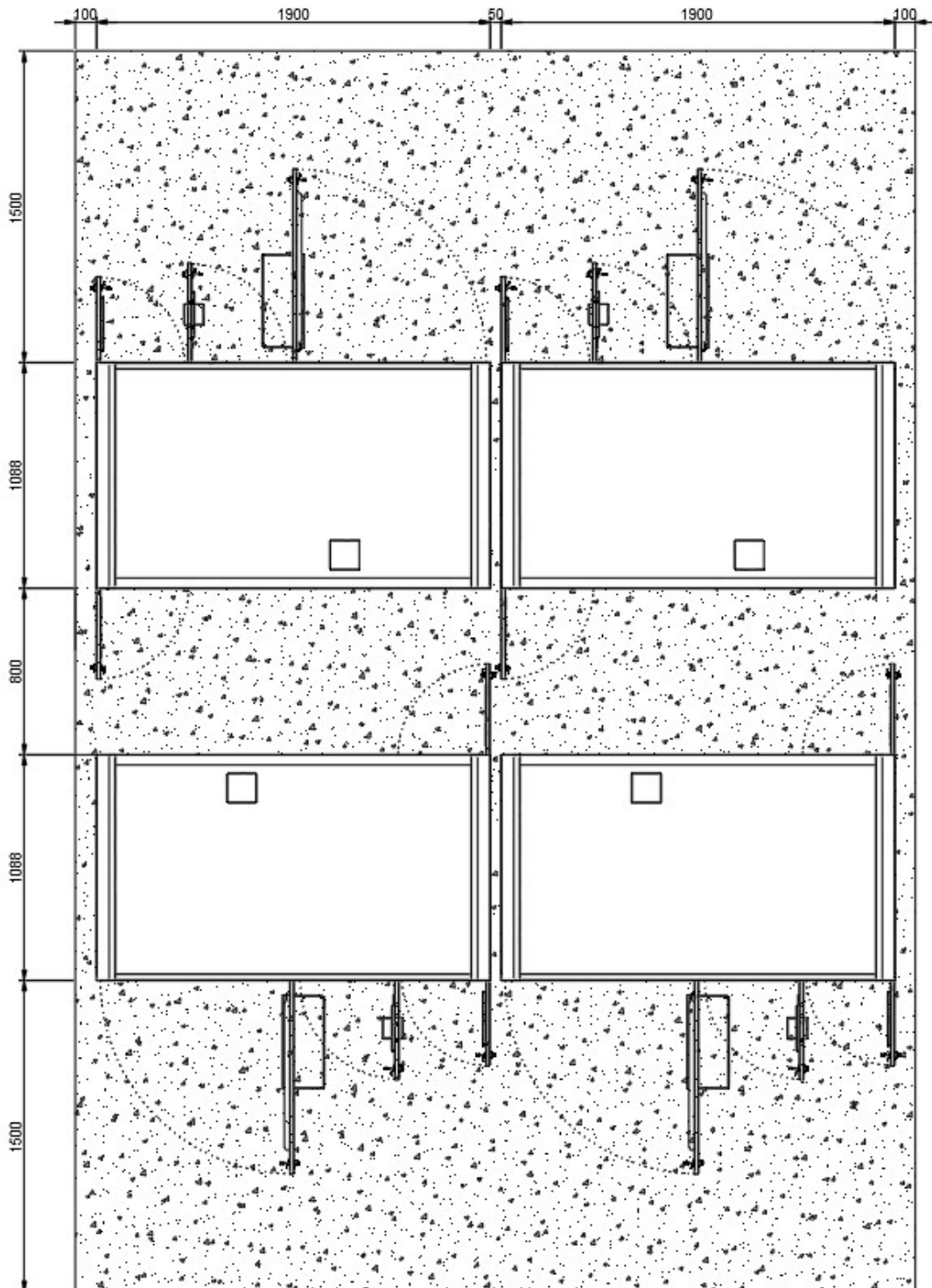



Figure 4-6 Installation diagram of multiple outdoor energy storage cabinets


4. 1. 5 Transportation of outdoor energy storage cabinet

	Danger:
	<ul style="list-style-type: none"> ◆ During transportation, the surrounding sites must be inspected, and an obvious safety cordon must be set up for safety protection. ◆ During transportation, any irrelevant persons are not allowed to enter the transportation danger zone.

The forklift is required to meet one of the following requirements.

Forklift Requirements: 1	
Forklift specifications	Outdoor energy storage cabinet weighs about 2.5 tons and needs to be equipped with an electric forklift with a rated load of ≥ 3.5 tons.
Fork length	Since the width of the outdoor energy storage cabinet is about 1.1 m, it is recommended to use a fork with a length of > 1.1 m .
Fork handle hole width	The fork handle hole of this product is 190mm wide, and the center-to-center distance between the two holes is 800mm. Therefore, a wide-spaced fork is recommended.
Fork position	Adjust the position of the fork so that the distance between the fork and the back of the cabinet is < 50 mm, and the distance of the far fork protruding to the right side of the cabinet is > 50 mm. Slowly lift the fork, and when the product reaches the desired position, put down the fork and remove the base. The entry position of the fork is the back of the cabinet without air conditioner.
Forklift Requirements: 2	
Forklift specifications	Outdoor energy storage cabinet weighs about 2.5 tons and needs to be equipped with an electric forklift with a rated load of ≥ 3.5 tons.
Fork length	Since the length of the outdoor energy storage cabinet is about 1.9m, it is recommended to use a fork with a length of > 2 m.
Fork handle hole width	Wide and narrow forks are available.
Fork position	Adjust the position of the fork so that the distance between the fork and the side of the cabinet close to the air conditioner is < 50 mm, and the distance between the far fork protruding to the right side of the cabinet is > 50 mm. Slowly lift the fork, and when the product

	reaches the desired position, put down the fork and remove the base. The entry position of the fork is the side of the cabinet close to the air conditioner.
--	--

	<p>Warning:</p> <ul style="list-style-type: none"> ◆ When transporting the outdoor energy storage cabinet, only forklifts can be used. ◆ Do not insert the fork from where the air conditioner is located. ◆ When handling this product, please use an electric forklift with movable forks. A manual forklift is not recommended. ◆ Protection should be provided to avoid damage to the surface of the equipment when handling with a forklift. ◆ When transporting with a forklift, use a belt/safety rope to secure the cabinet to the forklift.
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Transportation scheme 1: Front insertion

1. Confirm forklift fork

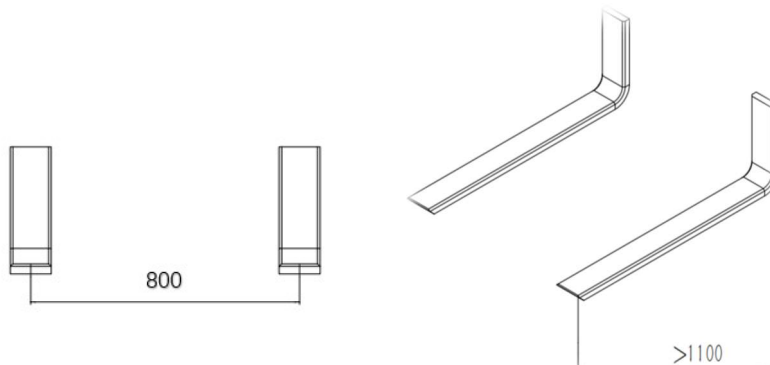


图4-7 Forklift forks show 1 Transportation scheme 1 Front insertion

2. Remove the fork hole cover and confirm the fork hole

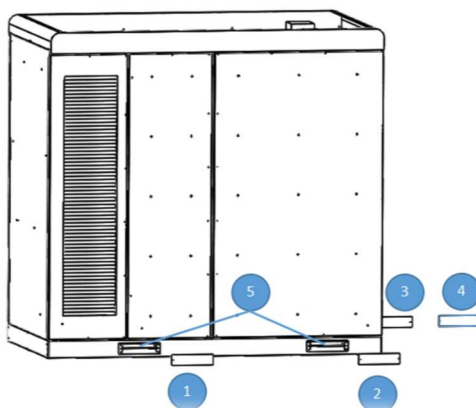


Figure 4-8 Front jack position diagram

Number	Name
1, 2, 3, 4	Forklift hole baffle
5	Forklift hole

3. Fork entrance

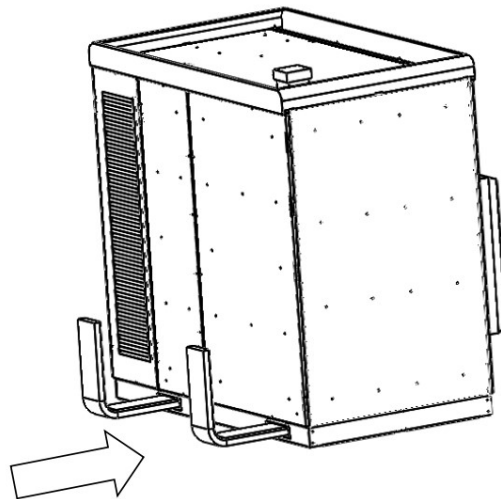


Figure 4-9 Front fork transport direction diagram

4. Transportation

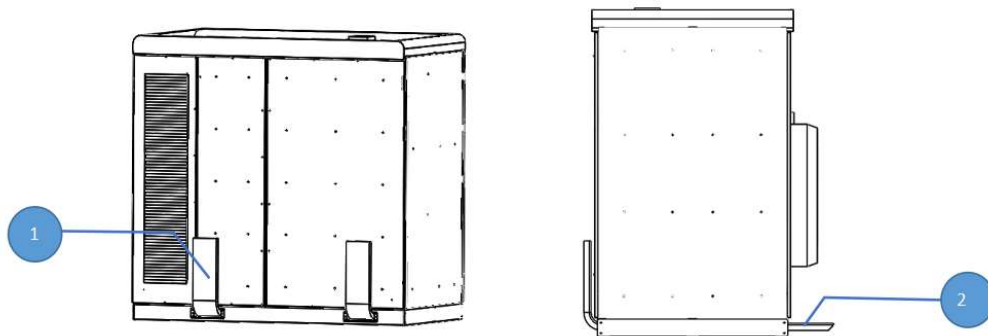


Figure 4-10 Front fork transport direction diagram

Number	Request
1	The forklift should be forked in from the side away from the air conditioner, so that the distance between the fork and the rear side of the cabinet is < 50mm
2	To extend at least 50mm

5. Put down the fork and exit

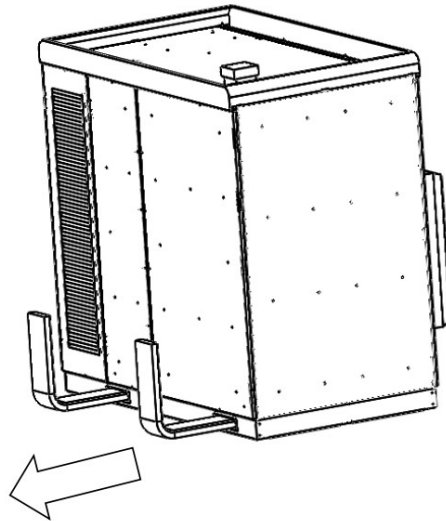


Figure 4-11 Front fork transport direction diagram

Transportation scheme 2: Side insertion

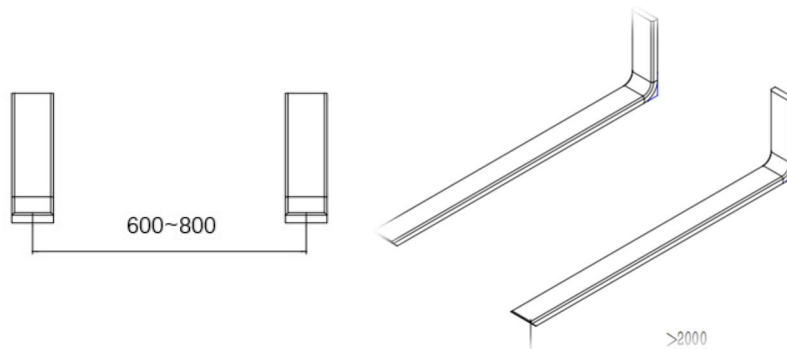


Figure 4-12 Forklift forks show 2 Transportation scheme 2 Front insertion

1. Remove the fork hole cover and confirm the fork hole

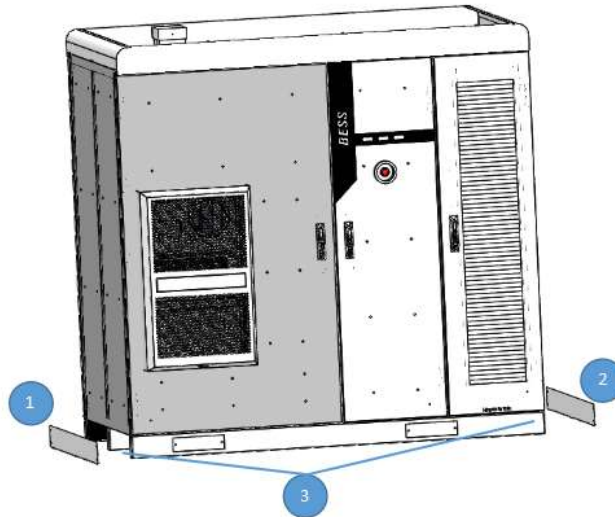


Figure 4-13 Schematic diagram of side cover removal

Number	Request
1, 2	Forklift hole baffle
3	Forklift hole

2. Fork entrance

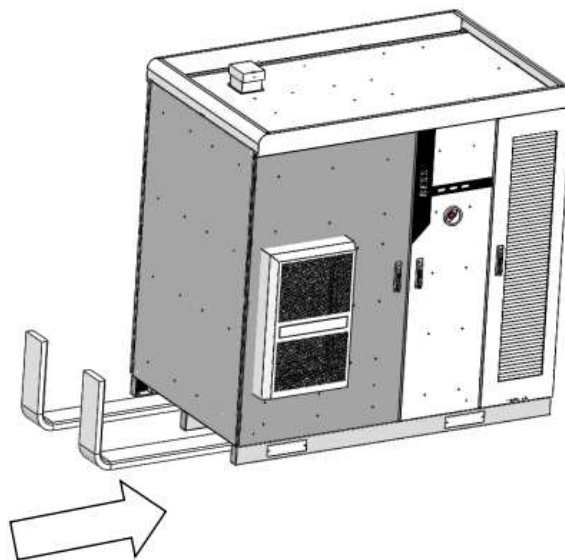


Figure 4-14 Fork transport direction of fork arm side

3. Transportation

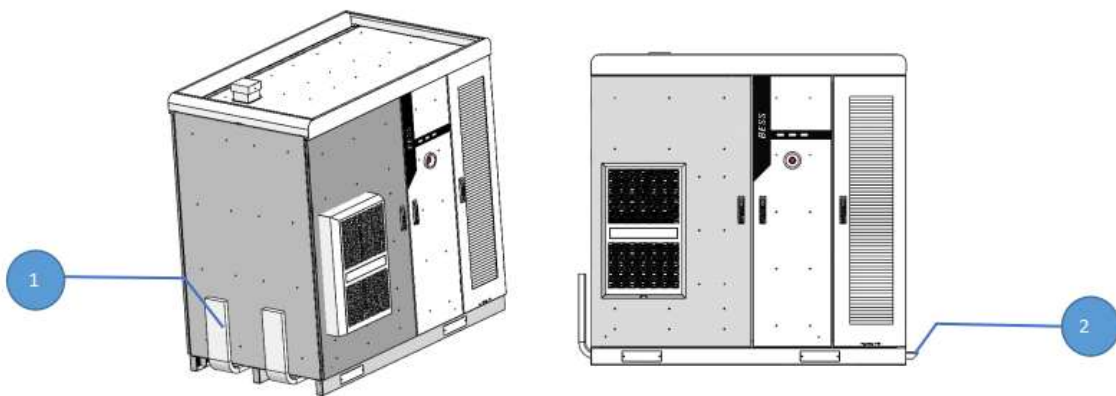


Figure 4-15 Side handling diagram of fork arm

Number	Request
1	The forklift should be forked in from the side adjacent to the air conditioner, so that the distance between the fork and the rear side of the cabinet is $< 50\text{mm}$
2	The rear end of the forklift needs to protrude out of the cabinet at least 50mm

4. Put down the fork and exit

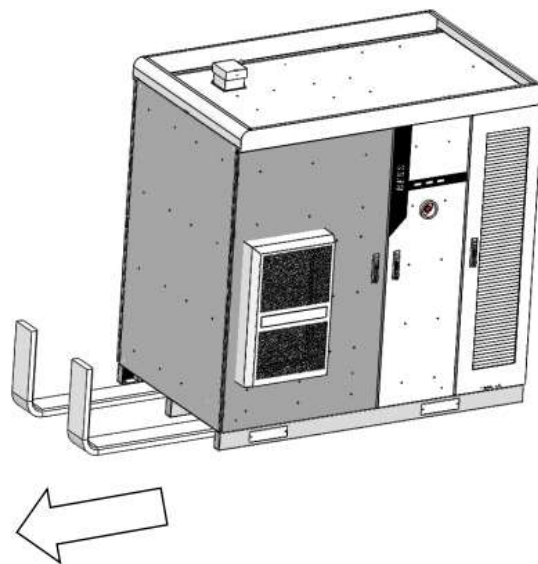


Figure 4-16 Side exit diagram of fork arm

4.2 Cabinet fixed

Before the outdoor energy storage cabinet is fixed, please check again according to the requirements of Section 4.4 whether the outdoor energy storage cabinet is placed in a qualified position.

- Prepare the impact drill with the M12 drill bit, check the specifications and quantity of expansion screws;
- Ground drilling: Align the impact drill with the center of the fixed installation foundation hole, and drill according to the following fixed hole position (4 holes on both sides of the equipment), with a depth of 120mm;

Note: Holes need to be drilled before the outdoor energy storage cabinet is placed, as the external trunk will block the impact drilling holes.

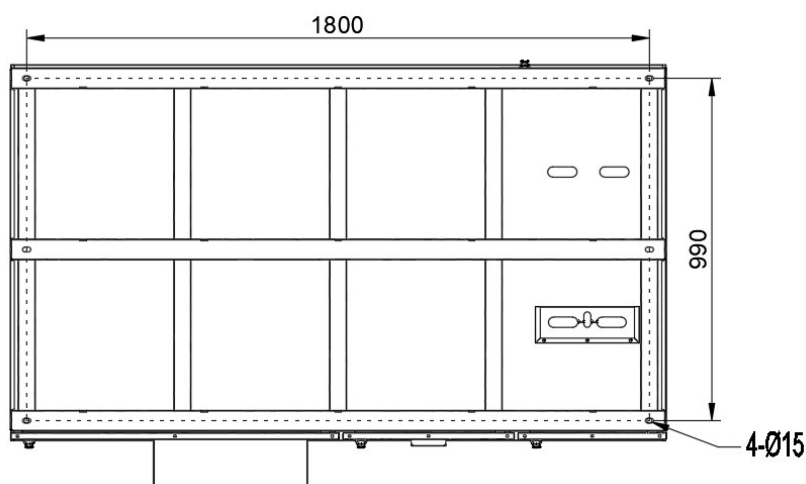



Figure 4-17 ESS bottom fixing hole (top view)

- Bolt installation: After removing the hole slag, put the expansion bolts (4 pieces) into the corresponding holes, hammer to the bottom with a hammer, install the nut and gasket and tighten with sleeve, confirm the torque with a torque wrench (96 NM);



Figure 4-18 Expansion bolt illustration

4.3 ESS access grid and load type declaration

	Warning:
	<p>When the ESS is used on-grid, please confirm whether the on-grid parameters of the equipment are applicable to the local power grid. The circuit breaker where the ESS is connected to the power grid must have the leakage protection function.</p> <p>When the ESS is connected to the load off-grid, please confirm the load type and power.</p> <p>If the equipment is not connected according to the recommended method, it may cause the equipment to fail to work normally, or even cause the equipment to malfunction.</p>

4. 3. 1 Introduction of load types

Common types of loads are inductive, capacitive and resistive.

1. Inductive load:

Inductive loads are loads with inductive parameters. To be precise, it should be that the load current lags the load voltage with a phase difference characteristic is the inductive load, such as transformers, motors, etc. Lamps that rely on gas conduction to emit light are also inductive loads, such as fluorescent lamps, high pressure sodium lamps, mercury lamps, metal halide lamps, etc.

The other is that some devices also consume reactive power when consuming active power, and a circuit with coil load is called an inductive load.

When the inductive load starts, the magnetic field has not yet been established, and the input resistance of the motor is equal to the DC resistance DCR, which is the wire resistance of the coil, and the starting current is the input voltage U/DCR . Such products require a much larger starting current (about 3-7 times, or even 10 times) than the current required to maintain normal operation when starting. For example, a refrigerator that consumes about 150 watts during normal operation can have a starting power of more than 1000 watts.

2. Capacitive load:

Capacitive loads generally refer to loads with capacitive parameters, that is, loads that conform to the current leading voltage characteristics. When the capacitive load is charged and discharged, the voltage cannot change abruptly, and the corresponding power factor is negative.

For capacitive loads, before startup, the voltage at both ends of the capacitor is generally discharged to 0V. At the moment of startup, the input voltage U charges the capacitor through the wire resistance R connecting the capacitor and the equivalent series resistance ESR of the capacitor itself.

The starting instantaneous current is $U/(ESR+R)$. Since the wire resistance and ESR are very small, which may be only milliohm, the starting current may be as high as several tens of times the normal

operating current.

3. Resistive load:

Resistive loads refer to purely resistive loads that work through resistive elements.

The resistance of a resistive load is generally a constant value, assuming that the resistance is R. The starting current of the resistive load is the same as the normal working current, both are U/R .

4. 3. 2 ESS access grid type

The wiring mode of outdoor cabinet access to the power grid can only be 3-phase 4-wire connection method.

Grid voltage: $AC400V \pm 15\%$, grid frequency: $50Hz \pm 5Hz$.

4. 3. 3 Off-grid load type of ESS

ESS is a three-phase four-wire system. Taking a 60KW ESS as an example, the three-phase load capacity is 60kW, and the corresponding single-phase load capacity is 20kW. The rated phase voltage is 230V, so the off-grid on-load rated current per phase is 86A. PCS has 100% three-phase unbalanced load, which can be three-phase load or single-phase independent load.


Load type	P60(60kW)	
	Single-phase load capacity	Three-phase load capacity
Resistive load	20kW	60kW
Inductive load	5kW	15kW
Capacitive load	4kW	12kW
Three-phase three-wire balanced load	Not applicable	Applicable, load capacity refer to the first three items
Three-phase three-wire unbalanced load	Not applicable	Not applicable

The load situation at the installation site is generally complex, and there will be mixed use of various types of loads. Please investigate the load situation before applying this ESS. If the load exceeds the load


in the above table or is not applicable, please contact this ESS supplier for consultation.

4. 4 External wiring

Regarding the wiring of this BESS system, follow the instructions in this chapter to properly connect all wiring.

	Danger:
	<ul style="list-style-type: none"> ◆ Wiring should be done by a qualified electrician. An electrician should confirm that all cables are properly connected. ◆ Wiring operations require at least two operators. One operator conducts wire operation, and the other operator monitors and reminds to avoid misoperation. ◆ Before wiring, make sure all switches are turned off. ◆ For any damage or accident caused by improper operation, the operator shall bear all the consequences arising therefrom.

4. 4. 1 Outdoor energy storage cabinet wiring position

	Danger:
	<ul style="list-style-type: none"> ◆ Before wiring, make sure all switches are turned off. ◆ Protective equipment must be worn when connecting. Must wear goggles, insulating gloves, and safety shoes.

All BESS switches are listed below

Number	Switch name and type	On/off judgment	Application
1	LOAD circuit breaker	OFF	Customer load circuit
2	AC circuit breaker	OFF	AC circuit
3	Secondary distribution circuit breaker	OFF	Auxiliary circuit
4	Air conditioner power supply circuit breaker	OFF	Air conditioner power supply
5	Control power	OFF	Control board power supply

6	PV circuit breaker	OFF	Photovoltaic circuit
7	DC circuit breaker	OFF	DC circuit
8	Control box button switch	Recover	Control box power supply
9	Start-stop button switch	Recover	Start-stop signal
10	Manual service switch	Pull	DC segmentation switch

All the switches of BESS are shown in the following figure:

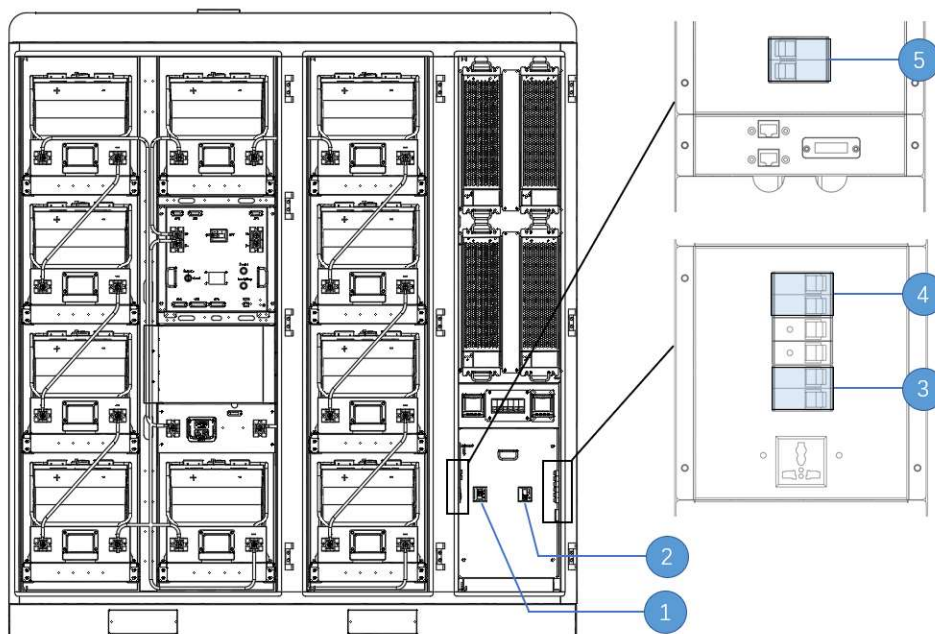


Figure 4-19 Outdoor energy storage cabinet front circuit breaker

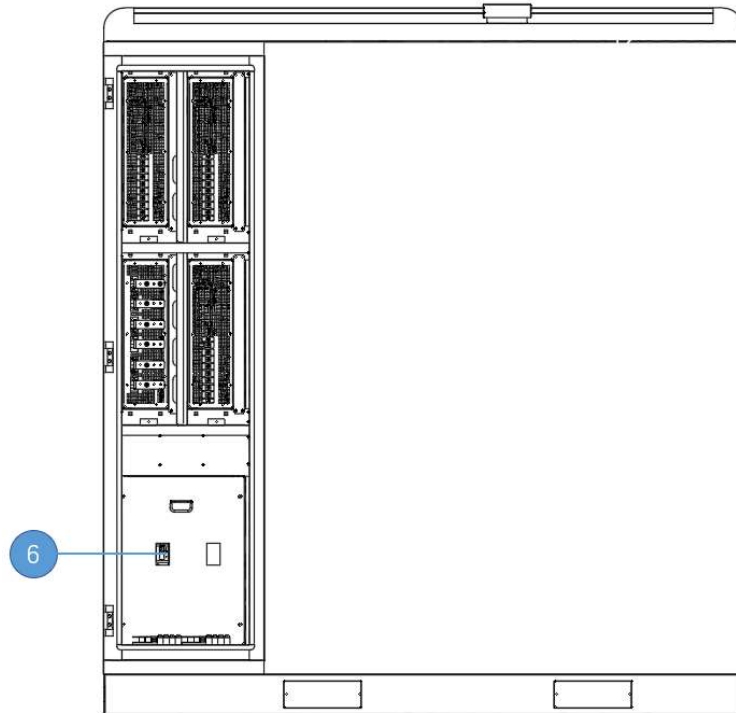


Figure 4-20 PV circuit breaker position diagram

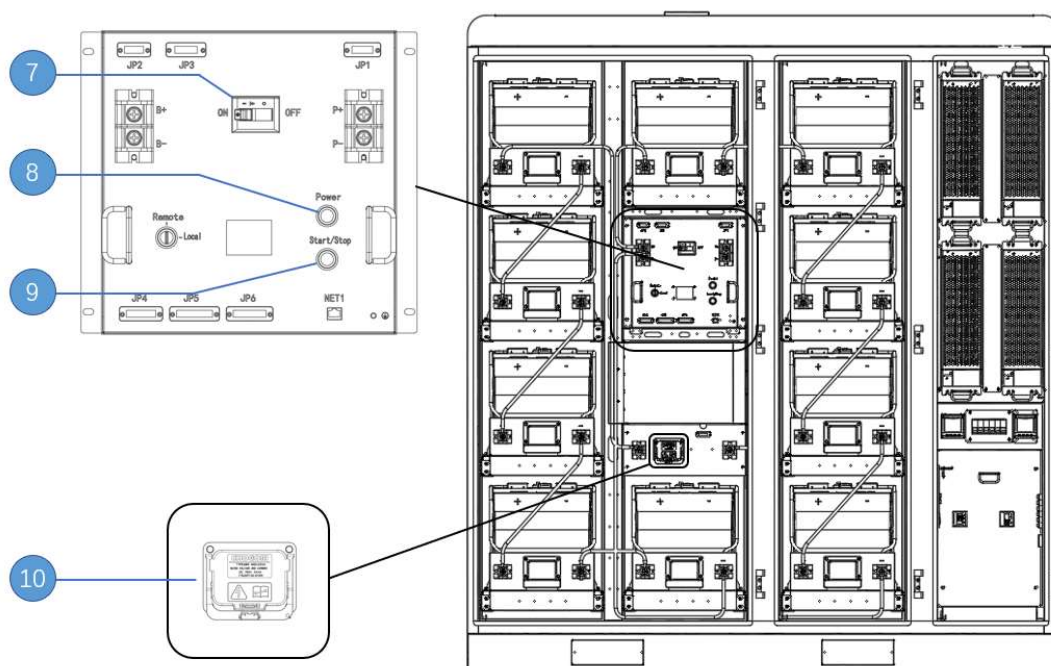


Figure 4-21 DC circuit switch position diagram

4. 4. 2 Main circuit wiring

All external interfaces are arranged in the electrical compartment. The details are as follows:

Remove the circuit breaker cover as shown below.

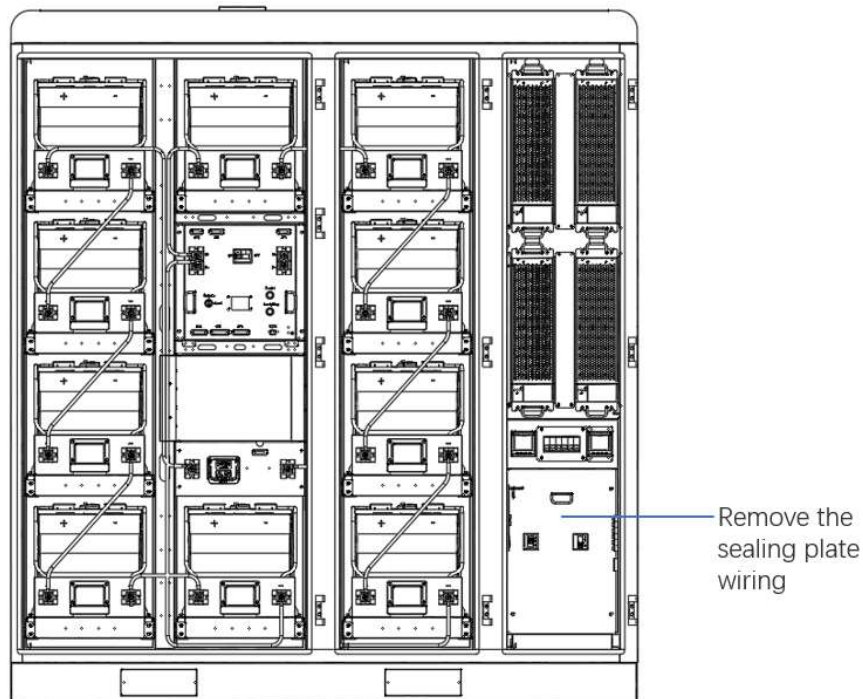


Figure 4-22 Front wiring position

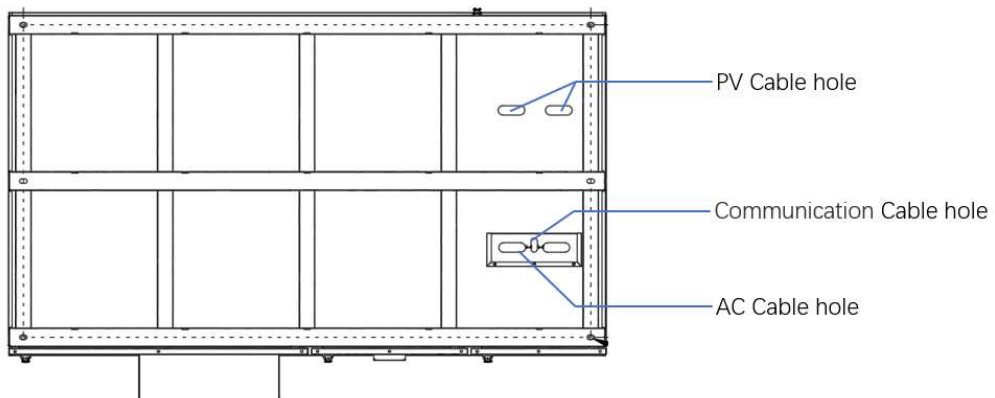


Figure 4-23 Bottom wiring hole diagram

Insert the cables from the holes at the bottom of the cabinet , and connect and tighten them in the order shown in the figure below. The bolts are M 8 *1 6 bolt sets, the torque requirement is 10 ± 1 N.M.

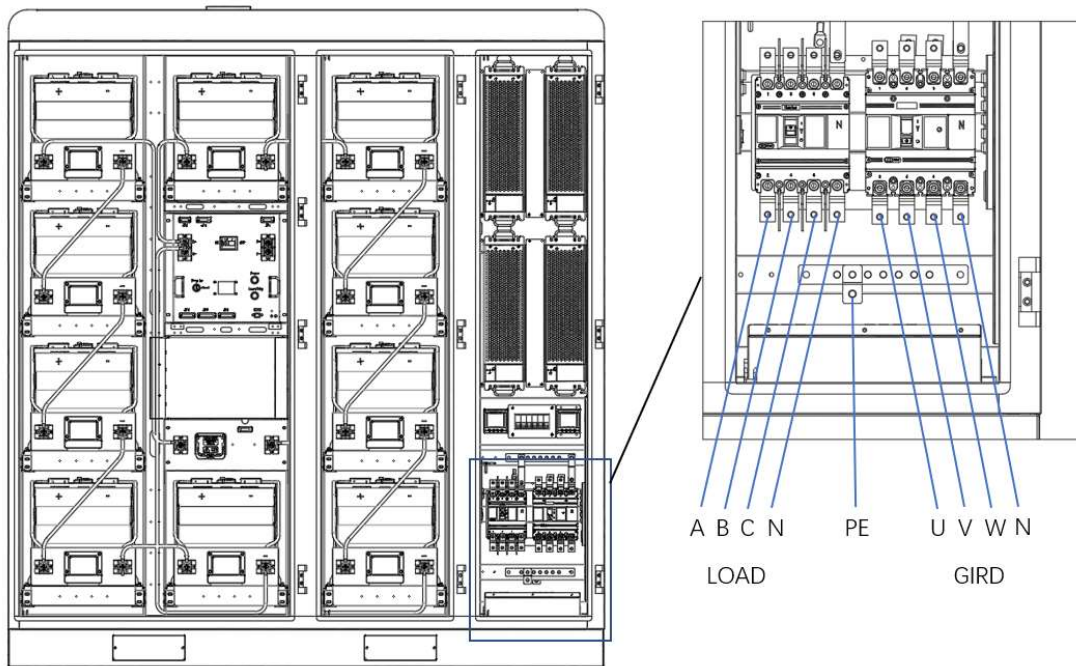


Figure 4-24 Front position wiring diagram

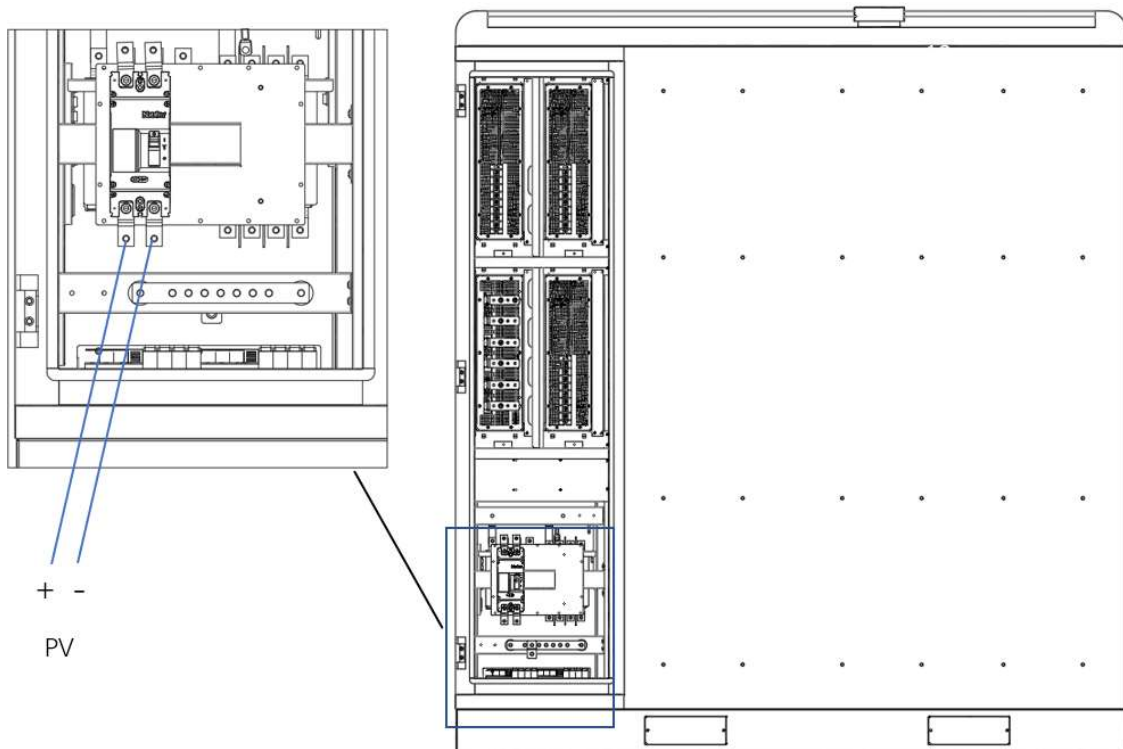


Figure 4-25 Back position wiring diagram

Location		Terminals	Cable recommendation	Remark
AC	U	SC50-8	50 mm ²	10 ± 1N·m
	V	SC50-8	50 mm ²	10 ± 1N·m
	W	SC50-8	50 mm ²	10 ± 1N·m

	N	SC25-8	25 mm ²	10 ± 1N·m
LOAD	A	SC25-8	25 mm ²	10 ± 1N·m
	B	SC25-8	25 mm ²	10 ± 1N·m
	C	SC25-8	25 mm ²	10 ± 1N·m
	N	SC16-8	16 mm ²	10 ± 1N·m
	PE	SC16-8	16 mm ²	10 ± 1N·m
	PV	SC25-8	25 mm ²	10 ± 1N·m

4. 4. 3 Communication cable wiring

Use the network cable to connect to the network port shown in the following figure

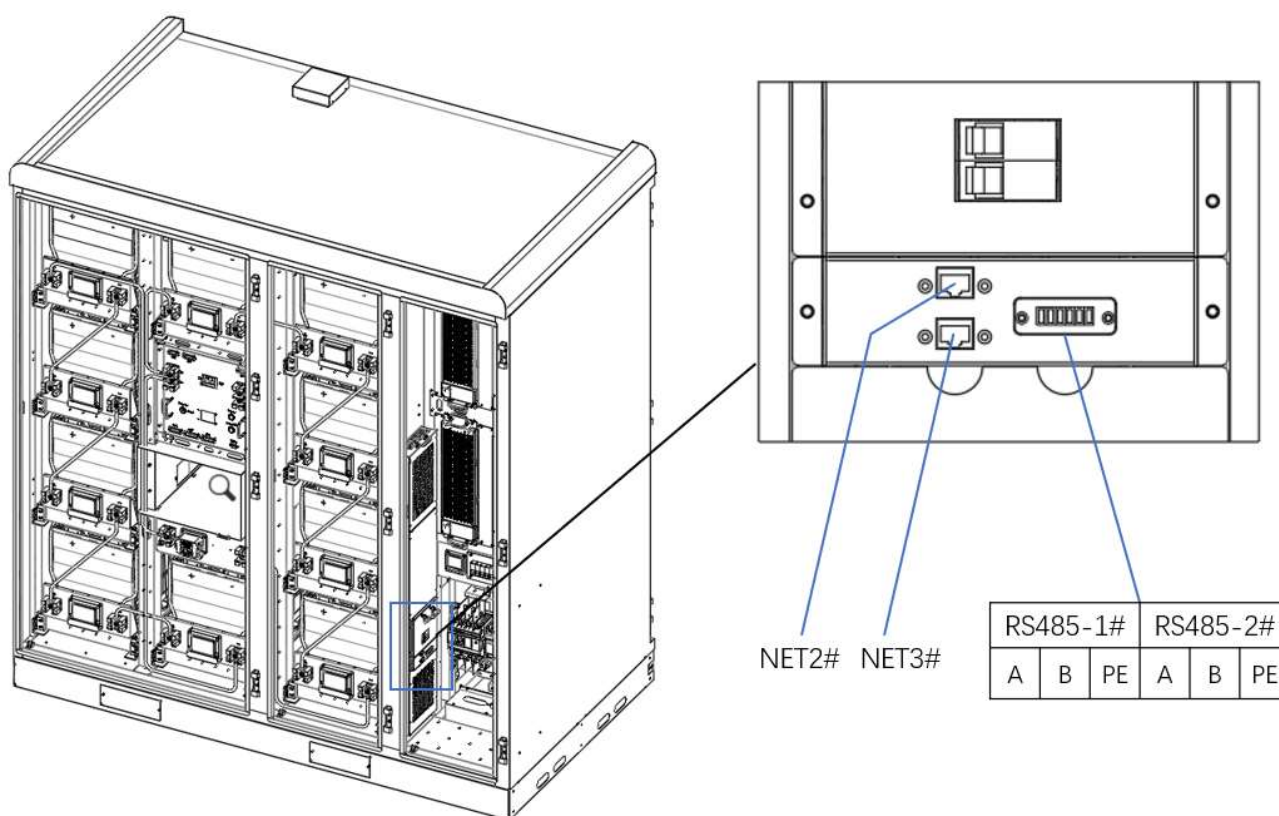


Figure 4-26 Communication cable connection interface

Location	Terminals	Cable recommendation	Remark
NET1#	RJ45	Cable	
NET2#	RJ45	Cable	
RS485-1#	E0510	Shielded twisted pair 2x0.5mm	

RS485-2#	E0510	Shielded twisted pair 2x0.5mm	
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4. 4. 4 Grounding

The grounding point of the ESS shell needs to be connected to the site ground network, and the interface is an M6 nut.

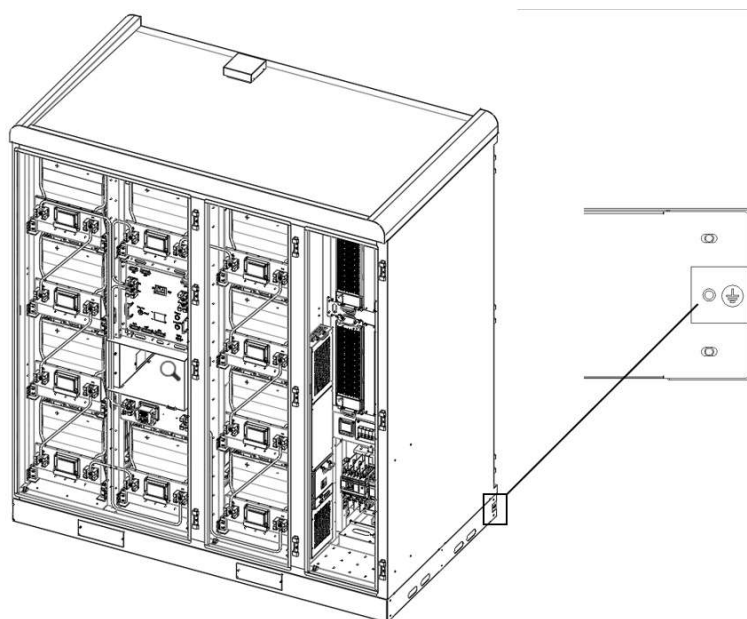



Figure 4-27 Shell grounding point diagram

4. 5 Completion of inspection

	Warning:
	Another operator needs to check the wiring again to confirm that all cables are connected correctly

4. 5. 1 Line inspection

Please make sure all cables are connected correctly according to Chapter 6.

Number	Location
1	Service switch
2	AC, load, PV wiring
3	Grounding cable routing
4	Communication cable routing

4. 5. 2 Bolt torque inspection

Make sure all bolts are tightened as required below. After confirming the torque, make a red mark on the bolt as a marker.

Number	Category	Location	Fastener	Specified value
1	Outdoor energy storage cabinet	Outdoor energy storage cabinet and ground fixed	M12*150	96±5 N·m
2	storage	AC, load, PV cable	M 8 * 1 6	10 ± 1N·m
3	cabinet	Grounding cable	M 8 * 1 6	10 ± 1N·m

Check that the SPD micro-break is in the "ON" state

5 Power-on steps


5.1.1 Check before power-on

Make sure to complete the wiring check in Section 4.4

Check whether the SPD micro-break is turned on and check whether the SPD is damaged

Check that the intermediate service switch is turned on

5.1.2 BESS power-on process

	Danger:
	<ul style="list-style-type: none"> ◆ Make sure to complete the pre-power-on inspection before power on. ◆ Power-on operation requires at least two operators. One operator performs power-on operation, and the other operator monitors and reminds to avoid misoperation. ◆ For any damage or accident caused by improper operation, the operator shall bear all the consequences arising therefrom.

➤ BESS main circuit power-on is divided into 4 steps:

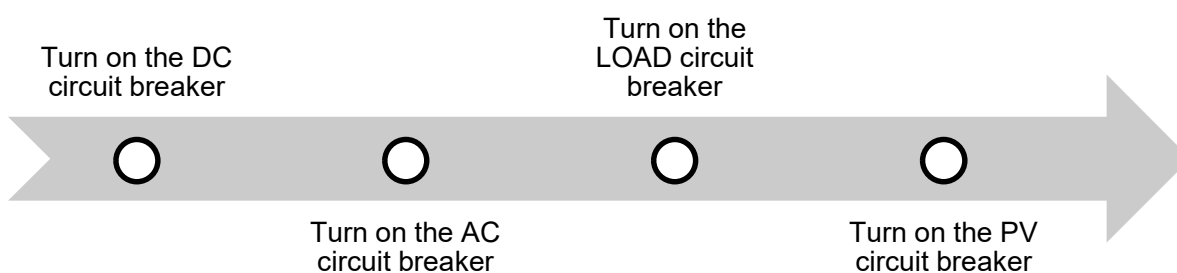


Figure 5-1 BESS main circuit power-on process

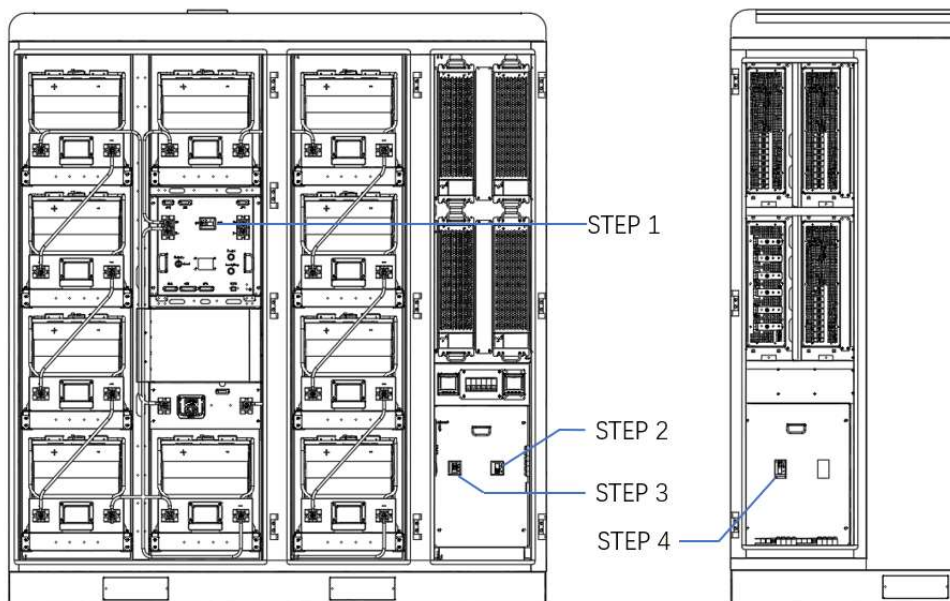


Figure 5-2 Main circuit switch position diagram

※Note: Depending on the actual configuration, the circuit breaker step without an option can be skipped.

- The secondary circuit power-on is divided into 4 steps:

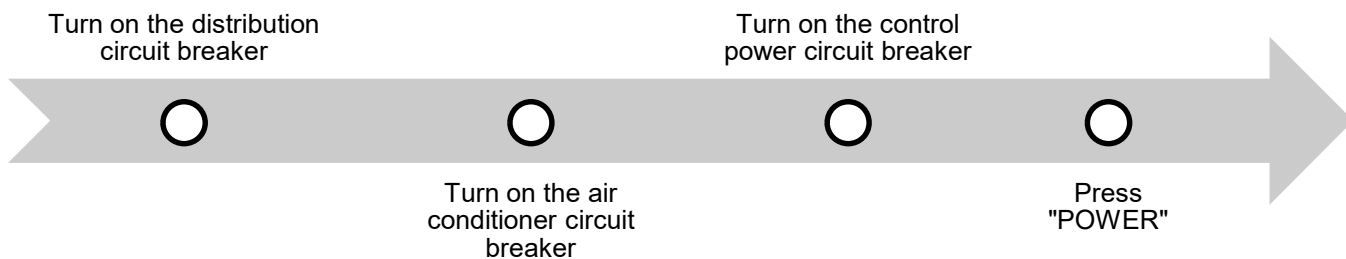


Figure 5-3 BESS secondary power supply power-on process

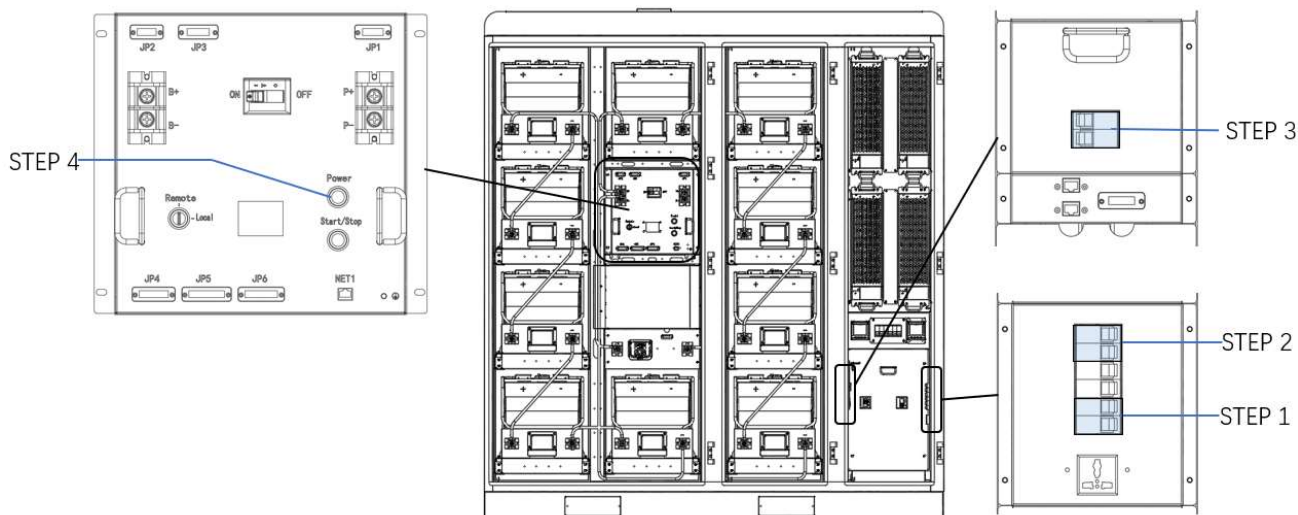


Figure 5-4 Secondary circuit switch position diagram

After the steps are performed in sequence, the power grid is powered on, the AC circuit is started, check whether the indicator light of the BESS high-voltage control box is on, and whether the screen of the high-voltage control box is displayed. If the BESS status is normal, the running indicator is on, the fault indicator and the alarm indicator are off. Then enter standby mode, please wait for an external command to be received.

5. 1. 3 BESS power-off process

There are two power-off procedures for BESS power-off according to the application scope:

- Secondary power supply is divided into 4 steps:

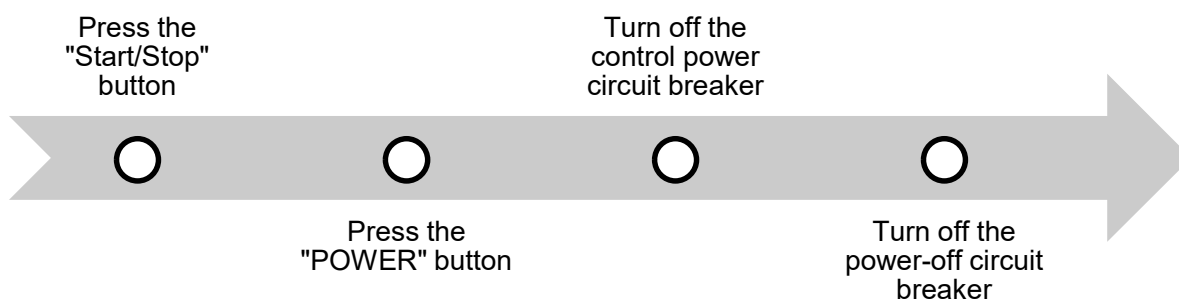


Figure 5-5 BESS secondary power supply circuit power-off process

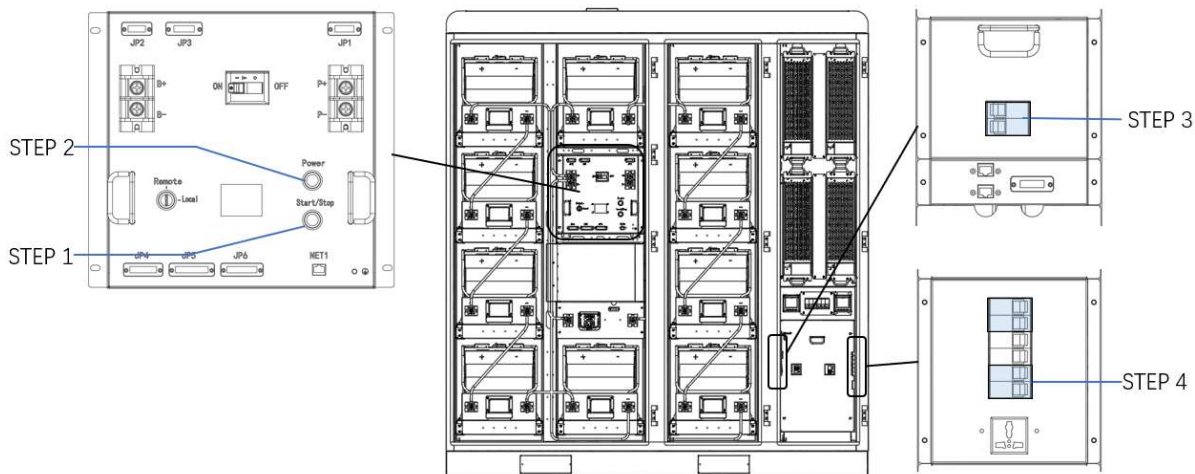


Figure 5-6 BESS secondary power supply circuit power-off switch position

➤ When the main circuit is powered off for a long time, it is divided into 4 steps:

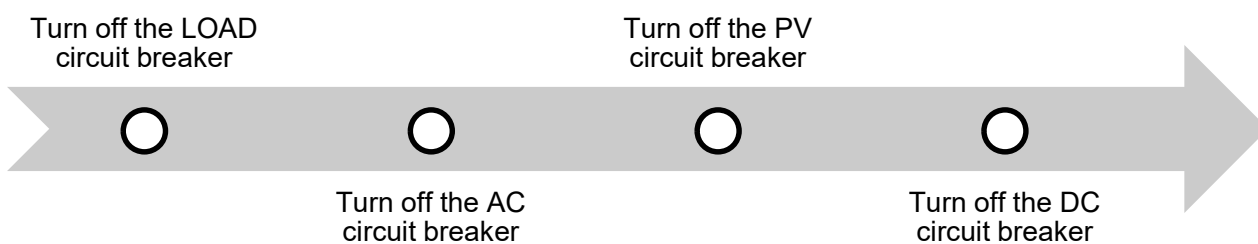


Figure 5-7 BESS main loop circuit power-off process

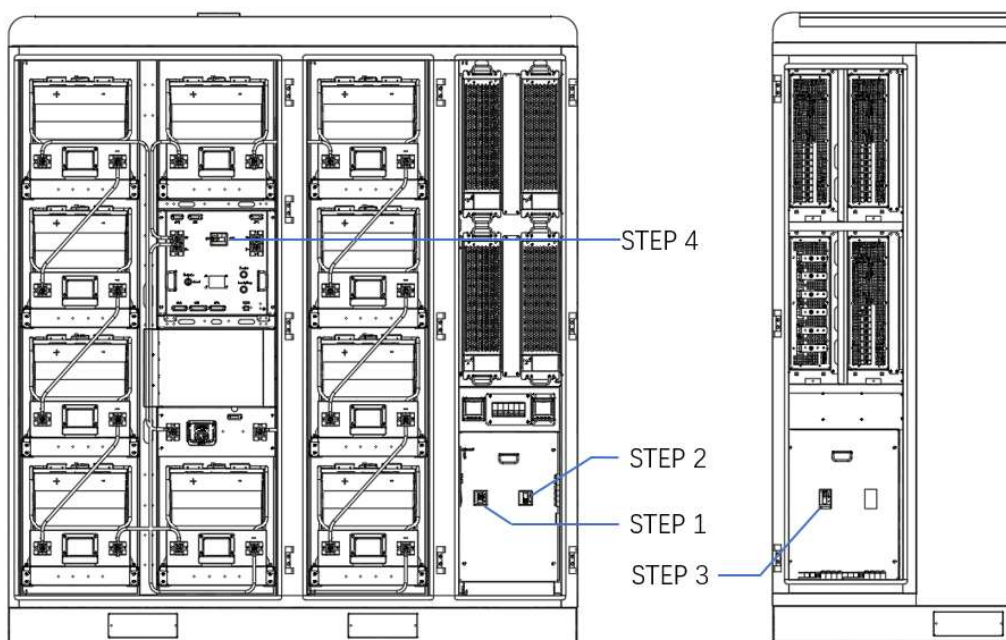


Figure 5-8 BESS main loop circuit power-off switch position

After the steps are followed in sequence, the air conditioner and high-voltage control box will stop running, and the indicator light and screen of the BESS high-voltage control box will go out.

When the equipment is overhauled, the maintenance switch needs to be disconnected, and the maintenance and inspection of the equipment can be carried out after the equipment has been shut down for five minutes.

5. 1. 4 Off-grid power-on

First, make sure that the selected model has the off-grid startup function.

The BESS off-grid main circuit is divided into 8 steps:

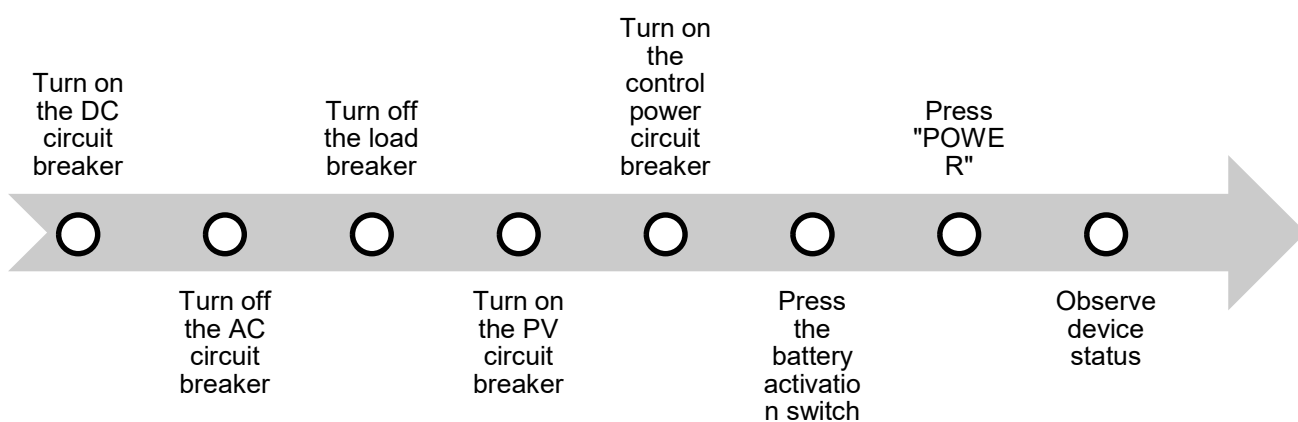
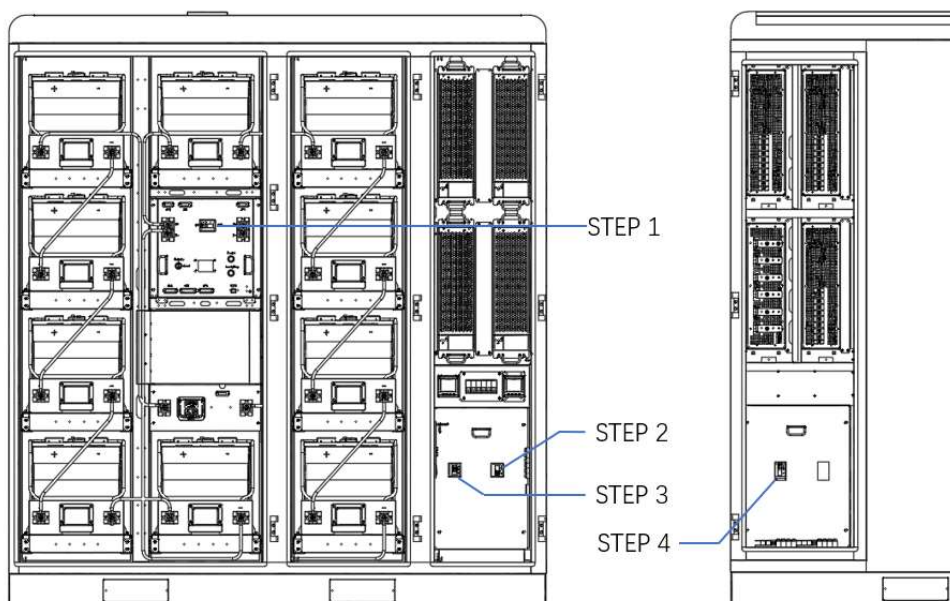


Figure 5-9 BESS off-grid main circuit power-on process



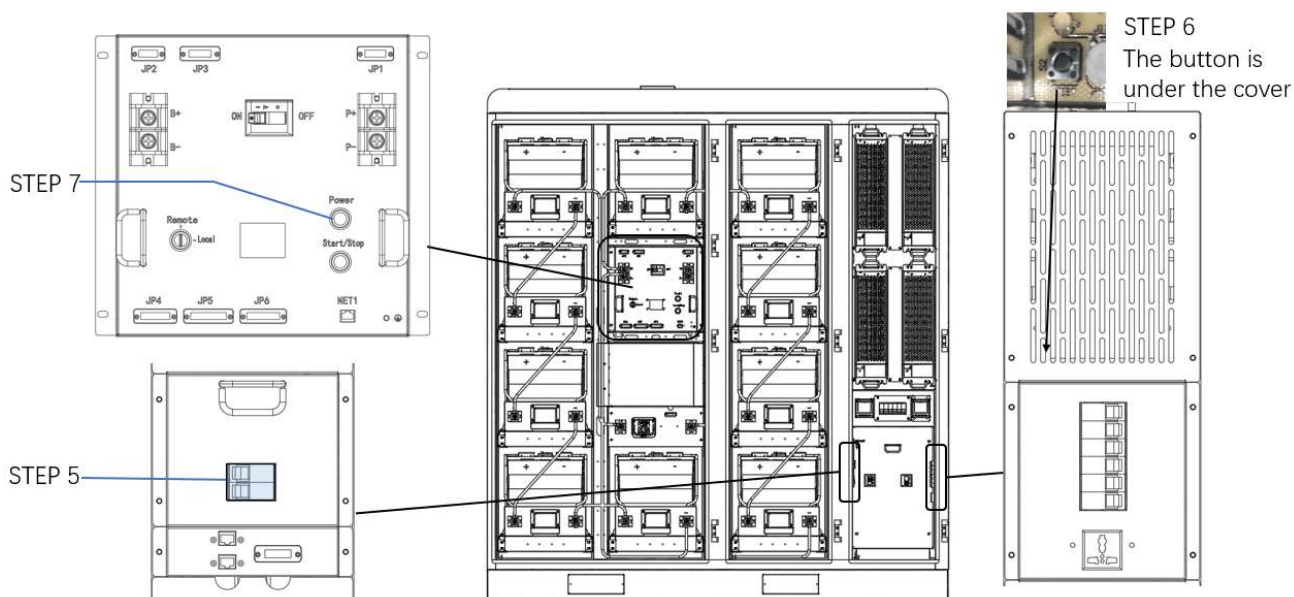


Figure 5-10 BESS off-grid main circuit power-on process

Check whether the BESS high voltage control box indicator light is on, and whether the control box screen is displayed. If the BESS status is normal, the operation indicator flashes, the fault indicator and alarm indicator are not on; then enter the standby mode, please wait for the external command.

6 Debugging

6.1 BESS debugging

6.1.1 Native start

The device is powered on, check whether the device status and other indicators are flashing, and if so, continue with the following operations; if the product has an alarm or fault, please take a picture of the fault code on the display. For fault data query, please refer to chapter 7.3, and contact the product dealer to apply for after-sales service.

Put the mode switching switch of the control box in the "Local" state, press the "Start / Stop" button, and the system will complete the self-starting within 2 minutes.

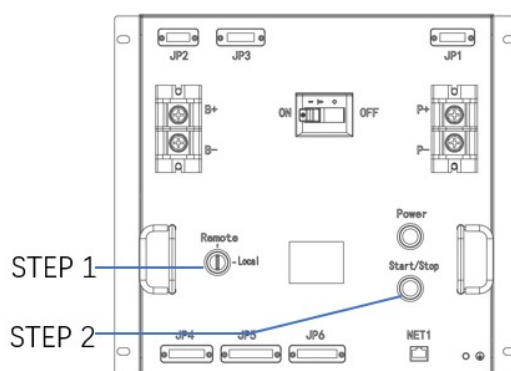


Figure 6-1 Native start operation position

6.1.2 Communication configuration

The device is powered on, set the mode switch of the control box to the "Remote" state, and connect the network cable to the computer

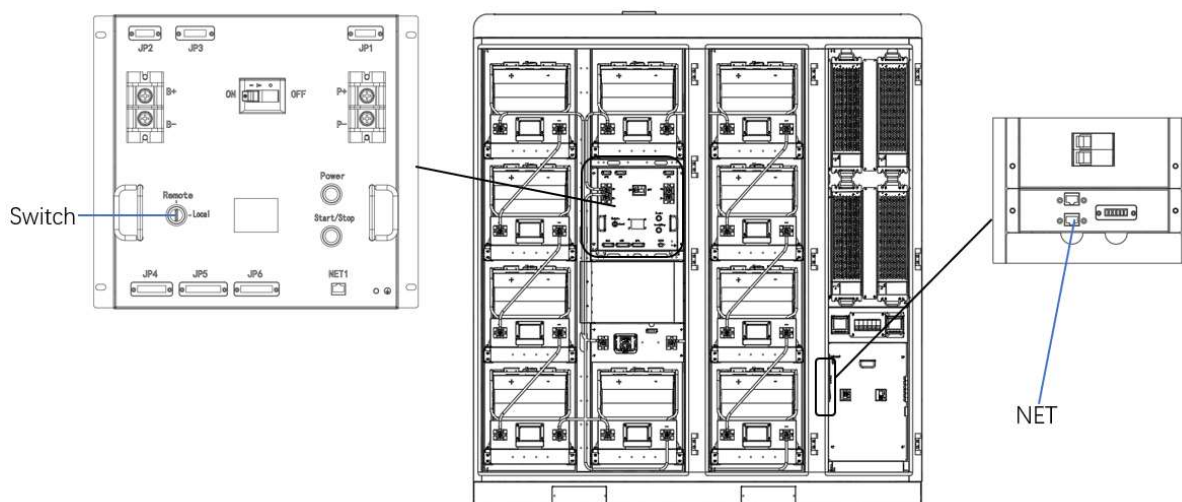


Figure 6-2 Debug interface position

BESS supports the power scheduling function and is connected through a remote interface. The remote interface is divided into two types: TCP/IP and RS485. The relevant configurations are as follows:

TCP / IP_IP : 192.168.1.199 or 192.168.1.200

Device address: 1

Port number: 502

RS485: Baud rate 38400

Device address: 1

Data bits: 8

Check digit: No check

Stop bit: 1

6. 1. 3 Scheduling instructions

- Data reading and scheduling are carried out according to the product agreement, the main functions are start, stop, charge, discharge, etc. The detailed scheduling agreement is provided separately.
- After the input of the system start-stop command exceeds the limit, the system will not perform any action, nor will it modify the wrong command.
- After the system power input exceeds the limit, the system will actively modify the command to the maximum charge and discharge power.
- The system is fully charged and the emptying stop is determined according to the voltage of a

single cell. When the highest voltage is 3.55V, it is determined to be fully charged, and when the lowest voltage is 2.8V, it is determined to be empty. When the system is fully charged, the continuous delivery of charging power will not be executed, only the discharge power will be executed. When the system is empty, the continued power will not be executed, only the charging power will be executed. After filling and emptying, the limit will be automatically restored after the SOC changes due to the reverse power.

- If the system-level full and empty protection fails, the BMS-level full and empty protection will act, and manual recovery is required after the action.
- The system SOC is the reference value, which is calculated according to the battery configuration and current value, but the battery capacity and current value have errors, which are not accurate. Therefore, it is not recommended to use SOC as the judgment condition for full and empty for system scheduling.