

Rechargeable Li-ion Battery System SP-HEHV27 Series Operation Manual

Version: A0

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Catalogue

1. Safety

SP-HEHV27 series is a high voltage DC system and is to be operated by skilled/qualified personnel only. Read all safety instructions carefully before doing any work and always follow them when using the system.

Improper operation or work can cause

- Injury or death of the operator or a third party;
- Other property of the operator or the third party is damaged;
- The system hardware is damaged.

Qualified Person's Skills

Qualified individuals must possess the following skills:

- Training in electrical system installation and commissioning and hazard handling;
- Learn about this manual and other related documents;
- Understand local regulations and directives.

1.1 Symbol Description

Symbol	Description
	 DANGER ! Connecting batteries in series will generate high-voltage direct current with risk of electric shock and fatality. Only qualified personnel should wire the battery.
	 WARNING ! Do not unplug the connector while the system is working ! When shutting down the system, cut off multiple power supplies and confirm that there is no voltage.
	ATTENTION ! Battery system failure or reduced service life.
	There is a potential risk when the device is in operation. Take precautions when operating the equipment.
	High voltage is present when the device is operating. When working on the device, confirm that the device is powered off.
	Before operating the equipment, please read the product manual carefully.

	At the end of the life of the device, do not dispose of it with household waste.
CE	CE certification mark.
	Grounding symbol.
	Keep the device away from open flames or sources of ignition.
	Equipment should be kept out of reach of children.
	Non-professionals are prohibited from disassembling the equipment.
	It is forbidden to short-circuit the positive and negative poles of the battery.
	Do not pour water on a runaway battery.
	Equipment should be recycled in accordance with local environmental regulations.
SUD SUD	Safety certification label from TÜV SÜD.



Danger

- Danger: Short circuit or incorrect installation of battery may cause burn or fire hazard.
- Danger: Lethal voltage in battery terminals and cables. Serious injury or death may result if cables and terminals are touched.



Warning!

- Do not open or deform the battery module, otherwise the product will be out of warranty
- WARNING: Appropriate personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles should be worn when working with batteries.
- Warning: System operating temperature range: $0^{\circ}C \sim 45^{\circ}C$, exceeding the operating temperature range may cause the battery system temperature to be too high/low, which will further shorten the cycle life.
- For battery installation, the installer should strictly abide by the installation operation standards.
- Improper maintenance can permanently damage the battery.
- Incorrect inverter parameters will further lead to battery failure/damage.



Attention!

- Before installing or using the battery, it is very important and necessary to read the user manual (included in the attachment) carefully. Failure to do so or to follow any instructions or warnings in this document may result in electric shock, serious injury or death, or damage to the battery, possibly rendering it inoperable.
- If the battery is stored for a long time, it is required to be charged every six months, and the SOC should not be lower than 90%;
- The battery needs to be charged within 12 hours after being fully discharged;
- Do not expose cables to the outside;

1.2 In use

- If the battery system needs to be moved or serviced, the power must be disconnected and the battery turned off completely;
- It is forbidden to connect the battery with a different type of battery;
- Do not use the battery with a faulty or incompatible inverter;
- Do not remove the battery modules;
- In the event of a fire, only dry powder fire extinguishers can be used, liquid fire extinguishers are prohibited;

1.3 Before wiring

- After unpacking, please check the product and packing list first, if the product is damaged or missing parts, please contact your local retailer;
- Before installation, make sure to cut off mains power and make sure the

battery is in off mode;

- The wiring must be correct, the positive and negative cables must not be wrongly connected, and there is no short circuit with external equipment;
- Do not connect the battery directly to AC power;
- The battery system must be well grounded and the resistance must be less than 4Ω;
- Please ensure that the electrical parameters of the battery system are compatible with the related equipment;
- Keep batteries away from water and fire.

2.System introduction

2.1 Product description

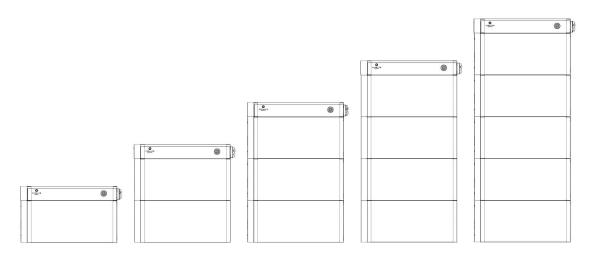
- SP-HEHV27 series energy storage battery system is mainly composed of battery module (SP-HE10227) and control box (SP-HVC600).
- The battery system can be used with single-phase high-voltage energy storage inverter and three-phase energy storage inverter.

e comparation of ca	e comparation of each battery system model is as follows.			
System model	Number of battery modules	Number of control boxes		
SP-HE10227-H	1	1		
SP-HE20427-H	2	1		
SP-HE30727-H	3	1		
SP-HE40927-H	4	1		
SP-HE51227-H	5	1		

The configuration of each battery system model is as follows:

2.2 Technical parameters

2.2.1 System parameters

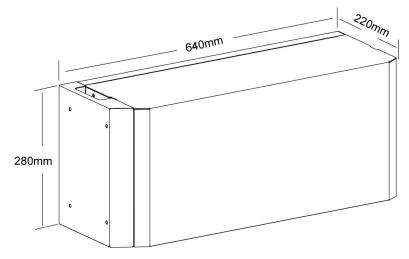


Product model	SP-HEHV27				
Number of battery modules	1	2	3	4	5
System models	SP-HE10227-H	SP-HE20427-H	SP-HE30727-H	SP-HE40927-H	SP-HE51227-H

Battery module model		SP-HE10227				
Battery type		LFP				
Capacity(kWh)		2.76	5.53	8.29	11.05	13.82
Nominal voltage	(Vdc)	102.4	204.8	307.2	409.6	512
Voltage range (Vd	c)	80~115.2	160~230.4	240~345.6	320~460.8	400~576
	L			640±5		
Dimension (mm)	W			220±5		
	Н	380±5	660±5	940±5	1220±10	1500±10
weight(kg)		30.5±1	57.5±1	84.5±1	111.5±1	138.5±1
Depth of discharge	2			95%		
Working	Rated	27				
current(A)	MAX	30				
current(A)	Peak@15s	33				
Rated DC power(W)		2160	4320	6480	8640	10800
Prospective DC fau	ult current (A)	1440				
Communication m	ethod	RS485/CAN				
Protection class		IP65				
Operating temperating	ature	0℃~45℃				
Storage temperature		Recommend: -10℃~30℃				
Humidity		5~95%				
Design life		10Years (25°C)				
Cycle life		>6000 (25℃)				
Certification		IEC62619/CE/UN38.3				
		· ·				

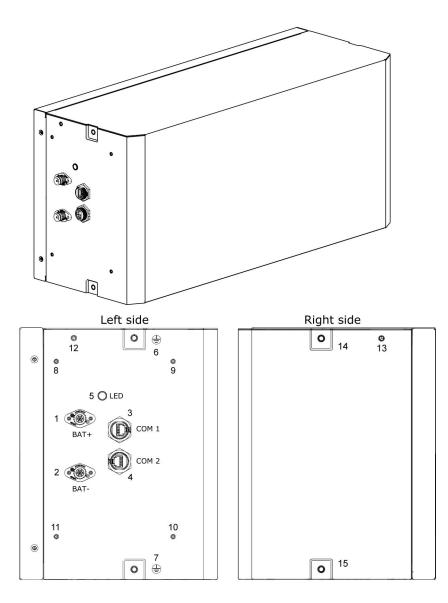
*Unpacked products can be stored at an ambient temperature of - 20 $^{\circ}C$ ~60 $^{\circ}C$, but high temperature storage will lead to capacity degradation.

2.2.2 Battery modules (SP-HE10227)



Battery model	SP-HE10227
Battery type	LFP

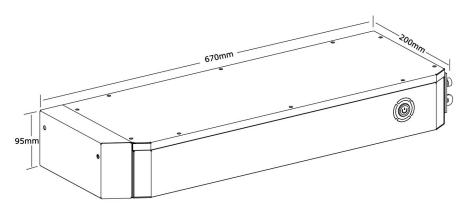
Energy (kWh)	2.76
Rated voltage (Vdc)	102.4
Capacity (Ah)	27
Number of cells in series	32
Nominal voltage of cell (Vdc)	3.2
Operating temperature $(^{\circ}C)$	0~45
Storage temperature $(^{\circ}C)$	-10~30
Dimension (W*D*H, mm)	640*220*280
Weight (kg)	30
Protection class	IP65



NO. Name	Description
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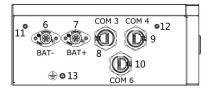
1	BAT+	Positive pole of battery module
2	BAT-	Negative pole of battery module
3	COM1	Communication input
4	COM2	Communication output
5	LED	Battery module status indicator. Green light
5		flashing: normal; red light on: fault.
6~7	GND/Connector	Grounding/Fixing the connecting piece between
0 /	fixing hole	the battery boxes.
8-11	Screw hole	Used to fix the module side cover
		Used to fix L-shaped structural parts. (The L-shaped structure can fix the battery system to
12~13	Screw hole	the wall and prevent the battery system from
		tipping over.)
14~15	Connecting piece	The connecting piece between the fixed boxes
14 15	fixing hole	

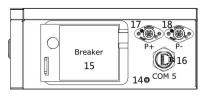
2.2.3 High Voltage Battery Controller (SP-HVC600)



Model	SP-HVC600
Supply voltage (V)	32~600
Static power consumption(W)	<2
control loop	2
Insulation detection range ($M\Omega)$	≤10
Operating temperature $(^{\circ}\mathbb{C})$	-40~85
Storage temperature $(^{\circ}C)$	-40~125
Dimension (W*D*H, mm)	670*200*95
Weight (kg)	4.5
Protection class	IP65
Fault alarm	Buzzer







NO.	Name	Description
1	SOC indicator light	0~25%Capacity.
2	SOC indicator light	25%~50%Capacity.
3	SOC indicator light	50%~75%Capacity.
4	SOC indicator light	75%~100%Capacity.
5	Start switch	System startup.
6	BAT-	Battery module negative input.
7	BAT+	Battery module positive input.
8	СОМЗ	Communication between control box and battery module.
9	COM4	Battery system parallel communication.
10	COM6	Main control board program update.
11~12	Screw hole	Controller side cover fixing hole.
13~14	Screw hole	Used to fix L-shaped structural parts. (The L-shaped structure can fix the battery system to the wall and prevent the battery system from tipping over.) #13 is also the system grounding location.
15	Breaker	Used to cut the connection between the battery and the inverter.
16	COM5	Battery system and inverter communication
17	P+	Positive output port of battery system, connected to inverter.
18	P-	The negative output port of the battery system is connected to the inverter.

Start switch

- When starting, press the button, the green light flashes and the SOC light is on;
- After startup, the system can only enter the standby mode and cannot output directly. It needs to wait for the inverter to send the contactor pull in command.
- When shutting down, press the button again, release the button, and the button light and SOC light will go out.

Light status

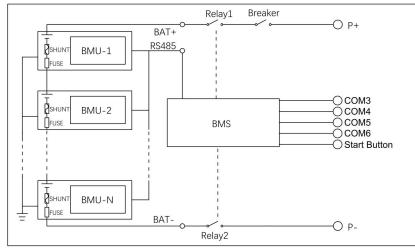
- When startup, the green button light flashes; the SOC blue light does not flash.At this time, the system is in standby mode.
- When charging, the green button light flashes; the SOC blue light flashes clockwise from 25% one by one.
- When discharging, the button flashes green; the SOC blue light starts flashing anti-clockwise from 100% one by one.
- When a fault occurs, the button flashes green; the SOC indicator changes from blue to red.

Communication port definition

RJ45 Port definition

	Pin	COM4	COM5	COM6
	1	GND	CAN_UP	VCC
12345678	2	CAN_DOWN	GND	GND
	3	GND	GND	485B
	4	CAN_H	CAN_H	
	5	CAN_L	CAN_L	
	6	CAN_5VIN	CAN_5V	485A
	7			
	8			

2.3 System schematic



Notice: For the AU market, over current and protection devices that isolate the positive and negative conductors simultaneously will need to be installed between the battery and the inverter.

3.Installation Notes

3.1 Tools

The following tools are required to install the battery pack:

	Con the	
Wire Cutter	Crimping	Sleeve Piece
	Modular Plier	
Screw Driver	Electric Screw Driver	600VDC Multimeter

Notice !

Use properly insulated tools to prevent accidental electric shock or short circuit.

3.2 Safety equipment

The following safety equipment is recommended when handling the battery pack:



3.3 System operating environment check

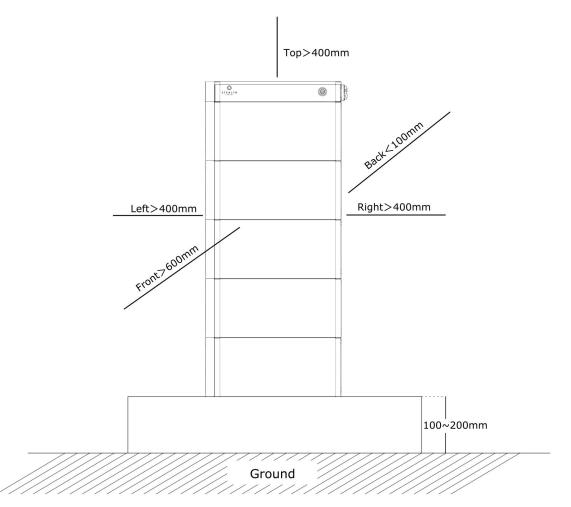
3.3.1 Cleaning up of the environment

• Before installation, the surrounding area should be made clean of dust and iron filings.

• Before the system is powered on, make sure that there are no flammable and explosive objects around.

3.3.2 Installation Environment Requirements

- System operating temperature range: $0\,{\rm ^\circ C} \sim 45\,{\rm ^\circ C}$; optimum temperature: $15\,{\rm ^\circ C} \sim 35\,{\rm ^\circ C}\,{\rm _\circ}$
- Although there are no forced ventilation requirements for battery systems, please avoid installation in restricted areas.
- High salinity, high humidity or high temperature should be avoided in ventilated areas.
- The battery system needs to be installed indoors. In cold areas, it is necessary to place the battery in an indoor environment not lower than 0 $^{\circ}C$.
- The minimum clearance between the system and the heat source is greater than 2m.
- The system shall not be immersed in water. When installing the battery system, we suggest that the bottom of the battery system should be 100mm~200mm higher than the ground.
- The ground where the battery system is installed must be able to support the weight of the whole battery system (35~175kg).
- Recommendations for the minimum clearance around the battery system: more than 400mm at the top, more than 400mm at the left and right sides, more than 600mm at the front and less than 100mm at the back against the wall.



3.3.3 Fire extinguisher system

- For safety, fire extinguishers must be equipped. Regularly check whether the fire extinguisher is in normal condition.
- It is recommended to choose carbon dioxide, ABC dry powder fire extinguisher or Helen fire extinguisher.
- The fire caused by over temperature of general cables and connectors is controllable, but there is high voltage, so it is necessary to shut down the system and then use the fire extinguisher to extinguish the fire.
- If the fire is caused by batteries, you must leave the site and call the local fire department for treatment.

3.3.4 Grounding system

- Before installing the battery, make sure that the grounding point in the base is stable and reliable. If the battery system is installed in a separate equipment compartment (such as a container), it must be ensured that the grounding of the compartment is stable and reliable.
- The resistance of the grounding system must be measured $<4\Omega$.

3.4 Handling and placement

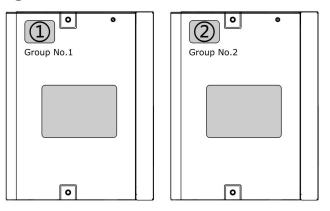
• The power terminal of the battery pack is high-voltage DC, which must be handled and placed by special personnel.

3.5 System installation

Note: Batteries exist in groups, and the same group number must be selected during installation. Mixing batteries with different group numbers will affect the battery performance.

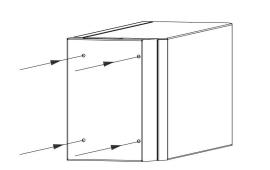
3.5.1 Grouping

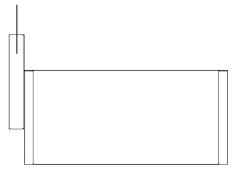
The battery module will be divided into different gears according to the battery capacity. The capacity of different gears is slightly different, but they are within the normal range of the rated capacity. The battery module composition system of the same gear can improve the use efficiency of the battery. The gear identification is shown in the figure below, on the right side of the battery box. The gears are not limited to (1) and (2), and the pictures are for reference only.



3.5.2 Side cover removal

There are 4 holes on the side cover. Insert a screwdriver along the holes to loosen the screws that fix the side cover. After loosening the 4 screws, lift the side cover straight.

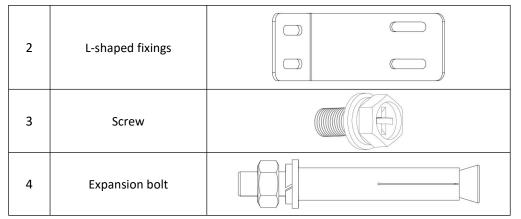




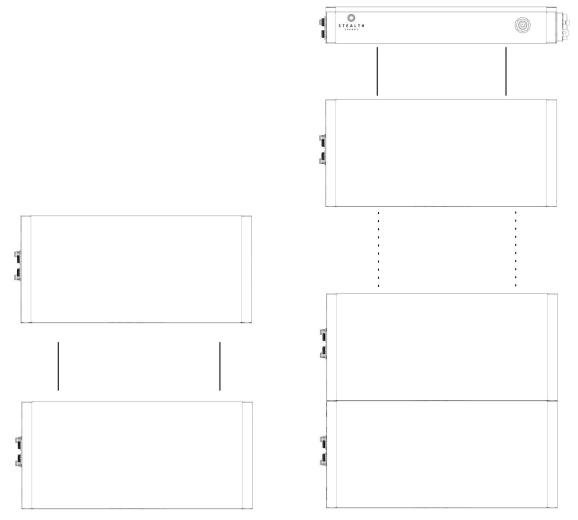
3.5.3 Stacking and fixing of battery modules

- Accessories required for battery module fixing.
- Note: Accessories are supplied with the battery pack and do not need to be purchased separately.

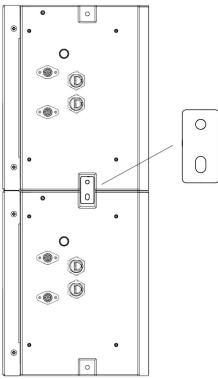
NO.	Name	Figure
1	Fixtures between boxes	



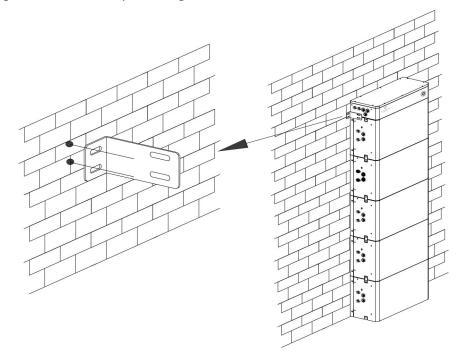
• The high voltage batteries of the SP-HEHV27 series can be formed into 5 different systems. The way they are stacked and fixed is the same.



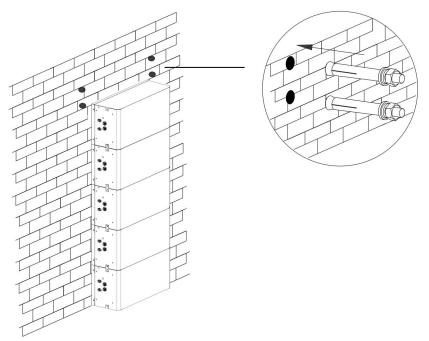
• The battery box fixing parts are installed, and the left and right sides are installed symmetrically to ensure a stable installation of the system.



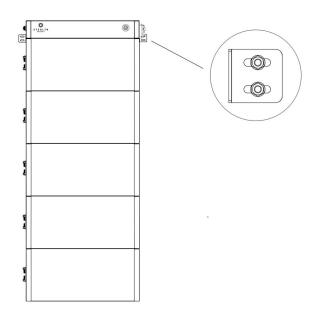
- Install the L-shaped fixing between the control box and the battery box. The opening of the L-shaped fixing is a rectangular hole, which can be adjusted from 0 to 20mm according to the distance between the battery system and the wall. The L-shaped fixings are also installed symmetrically from left to right.
- After adjusting the position of the battery system, mark the position of the fixing hole of the L-shaped fixing on the wall.



 Remove the L-shaped fixing, remove the control box, and make a hole in the wall. When drilling holes, cover the battery well.
 Drill size: hole diameter 10mm, depth 60mm.



Fix the two L-shaped fixings on both sides of the battery box and the control box, and then fix them on the expansion bolts on the wall .



3.6 Wiring



DANGER: The battery system is a high-voltage DC system. It must be ensured that the grounding is secure.

DANGER: All power cable plugs and sockets must not be reversed. Otherwise it will cause personal injury.

WARNING: Incorrect communication cable connection will cause battery system failure.



3.6.1 Wiring harness

NO.	Name	Figure	Provided or not
1	Battery positive input cable		V
2	Battery negative input cable	150mm(1moduel) 440mm(2moduels) 710mm(3moduels) 990mm(4moduels) 1270mm(5moduels)	V
3	Battery positive	Customization	Purchase separately
5	output cable		P/N:201-04029-00
4	Battery negative		Purchase separately
-	output cable		P/N:201-04030-00
5	Battery series cable		V
6	Master-slave communication cable		~
	Communication	270mm	
7	cable between		✓
	battery modules		
8	External communication cable		Purchase separately P/N:201-04034-00
9	Ground cable	2000mm	Purchase separately P/N:201-04041-00

Notice:

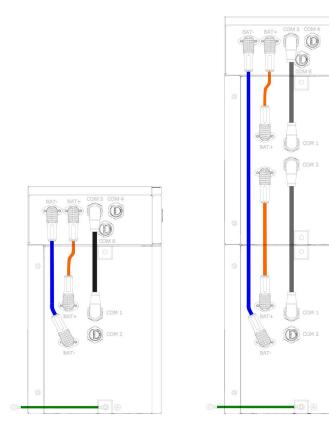
1. Positive and negative battery output cables are only used for battery to circuit breaker, circuit breaker to inverter cables are not provided.

2. Cables that can be purchased separately can be purchased from authorized dealer.

3.6.2 Battery system wiring diagram

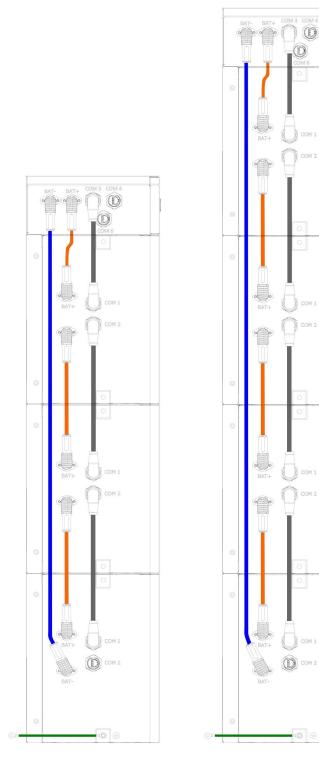
Danger: It is forbidden to connect the positive and negative poles of the battery series cable to the same battery module, otherwise it will damage the battery and even cause personal injury.

• Wiring Diagram for System (SP-HE10227-H) and System (SP-HE20427-H)

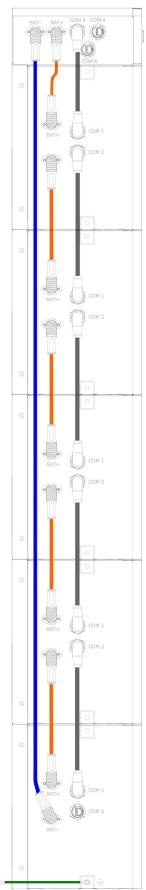


Wiring diagram of system (SP-HE30727-H) and system (SP-HE40927-H) •

D



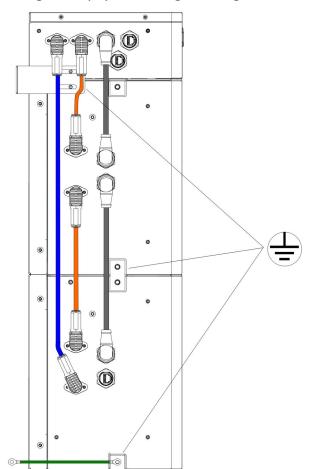
• Wiring diagram of the system (SP-HE51227-H)



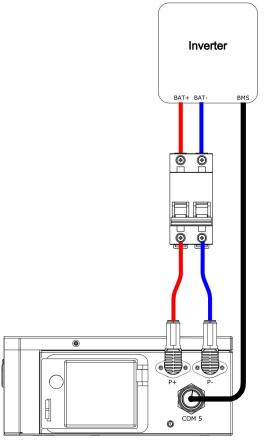
- 20 -

3.6.3 Battery system grounding wiring

Note: L-shaped fastener and connecting piece between boxes must be installed. It has the function of fixing battery system and grounding.



3.6.4 Inverter terminal wiring



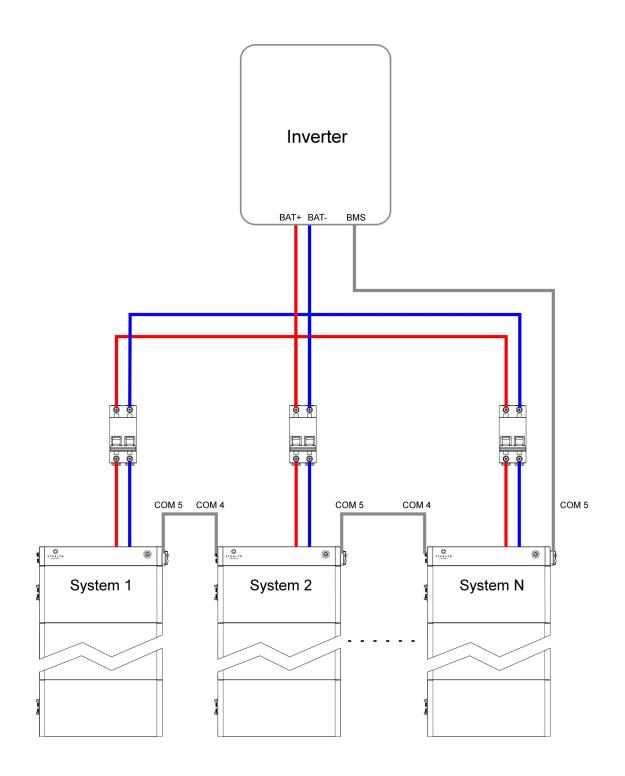
3.6.5 Parallel wiring diagram between battery systems



Danger: When the system is connected in parallel, it must be confirmed that the system is closed and the circuit breaker is disconnected. Live line operation is easy to cause safety accidents, even casualties

Note: When the battery system is paralleled, it must be confirmed that the voltage and SOC between the systems are consistent. Otherwise, the working efficiency of the system is low and the system is prone to failure.

Note: When the power lines are connected, use the bus bar wiring. It is recommended to consult the supplier for the number of parallel machines.



3.7 Battery system power on



WARNING: Carefully inspect all power and communication cables. Before connecting, make sure that the voltage of the inverter is the same as the voltage of the battery system. Check that all power switches are off. System startup steps:

- 1) Check that all cables are properly connected. Check if ground is connected.
- 2) Open the switch on the battery side or between the inverter and the battery.
- 3) Press the start button on the high-voltage control box, the SOC indicator light is

always on (not flashing), the system is in standby state, waiting to establish communication with the inverter $_{\circ}$

4) After the inverter is powered on, the communication between the battery system and the inverter is established, and the external port of the battery system starts to output.



Note: Before the communication between the battery system and the inverter is established, press the button, the contactor of the battery system will not pull in, and there is no voltage at the output port.

Note: When the circuit breaker trips due to overcurrent or short circuit, it must be connected again after 10 minutes, otherwise the circuit breaker may be damaged.



WARNING: If a fault occurs during the self-test, the fault must be corrected before starting the next step.

WARNING: During the first power-up, the system will need to be fully charged for SOC calibration.

3.8 Battery system shutdown

- The battery system must be shut down before malfunction or repair:
 (1) Turn off the inverter or power supply on the DC side.
 - (2)Turn off the start button on the high voltage control box $_{\circ}$

(3) Close the circuit breaker between the PCS and the battery system.

Note: After shutting down, the battery module indicator will not turn off immediately. After waiting for 30 minutes, the battery module will go to sleep.

4. System debugging

• The system debugging is aimed at the SP-HEHV27 high voltage battery energy storage system, which must run together with the supporting inverter.

Steps	Details
Preparation	 Turn on the battery system, see Chapter 3. The load is not allowed to be turned on until the entire energy storage system is turned on! In addition to the battery system, if other devices have their own system startup steps, the operation manual must be followed.
Working with inverter	 Check whether the parameters on the inverter and battery control box match. Check the communication cable connections and make sure the cables on the battery and inverter side match in sequence. It is recommended that all undefined pins be empty. Check whether the baud rate of the inverter matches the baud rate of the battery.

5.Maintenance

5.1 Troubleshooting



DANGER: The SP-HEHV27 is a high voltage DC system and should only be operated by qualified and authorized personnel.

DANGER: Before checking for faults, all cable connections must be checked and the battery system can be turned on normally.

NO.	Fault	Reason	Solutions
1.	After power on,	communication	1.Check if the green indicator
	buzzer sounds.	failure.	of the battery module is
			flashing.
			2.Reconnect the
			communication line to
			eliminate poor contact.
			3. Use a single battery module
			to communicate with the
			control box to check the
			defective battery module and
			communication cable.
2.	The battery	1.Communication	Replace the communication
	module indicator is	cable failure.	cable.
	off.	2.Battery module	Replacing the battery module.
		failure.	
3.	The battery	1.Battery module	Replacing the battery module.
	module indicator	failure。	
	lights up red.	2.Abnormal	If the voltage and current are
		temperature,	abnormal, replace the battery
		voltage and current.	module. When the

			temperature is abnormal, evaluate whether it is a battery problem or the on-site ambient temperature is too high based on the on-site ambient temperature .
4.	Controller SOC light is on red.	Controller failure.	Replace the controller
5.	The green light of the main control box button is not on	 Controller failure Battery module failure. 	Replace the controller Replace the battery modules whose indicator light is off.
6.	The system suddenly shuts down within minutes after power on	1.Controller failure 2.key switch failure	Replace the controller Replace the controller



DANGER: The SP-HEHV27 is a high voltage DC system and should only be operated by qualified and authorized personnel.

DANGER: Before replacing major components, power to the maintenance battery system must be turned off. All power cables must be unplugged from the battery module and high voltage control box.

5.2 Replacement of main spare parts

5.2.1 Replacement of battery modules

- Remove the battery module to be replaced.
- Charge or discharge the existing battery module to the voltage and soc close to the new battery module.
- Reinstall the fixing parts, wiring and start the machine.

5.2.2 Replacement of battery controller

- System shutdown: close the key and disconnect the circuit breaker.
- Unplug the power cable and communication cable connected to the controller.
- Remove the screws connecting the controller with the L-shaped fixing piece.
- Replace with a new controller, and fix the new controller on the L-shaped fastener.
- Connect the power cable and communication cable, and then restart the system.

5.3 Battery maintenance

Items	Cycle
If the battery is not in use, fully charge the battery	Every 3
and discharge it to 25%~50%。	months
Check the L-shaped fasteners and re-tighten if	Every 6
loose 。	months
Check whether the shell is damaged. If yes, please	Every 6
contact after-sales service.	months
Check whether the external cables is damaged. If	Every 6
yes, please contact after-sales service	months
Check whether there is debris around the battery,	Every 6
and clean it up if so, so as not to affect the heat	months
dissipation of the battery.	
Check whether there is water around the battery	Every 6
system to prevent the battery from being in a humid	months
environment for a long time.	

5.4 Recycling

Note: Damaged batteries may leak electrolyte or generate flammable gases. Note: If damaged batteries need to be recycled, they should be disposed of in accordance with local recycling regulations and using the best available technology to achieve the relevant recycling efficiency.

6.Storage advice

- NOTE: The cycle life of the battery will be severely shortened if the battery is stored for extended periods of time without following the instructions below.
- For long-term storage (more than 3 months), the battery should be stored in an environment with a temperature range of 5~45°C, relative humidity below 65%, and no corrosive gas.
- The environment around the battery module is dry, clean and well ventilated.
- The battery should be charged to 50%~60% SOC before storage;
- It is recommended to activate the battery chemistry (discharge and charge) every 3 months, with a maximum discharge and charge interval of no more than 6 months.

7.Shipment

- Battery modules will be pre-charged to 100% SOC before shipment or as per customer requirements. The remaining capacity of battery cells after shipment and before charging is determined by storage time and conditions.
- The battery module meets the UN38.3 certification standard.
- In particular, the special local regulations on the transport of goods by road and the current dangerous goods laws must be observed.

Tick after completion	Step	Item	Remark
	1	Installation environment check	Reference
			chapter3.3
	2	Installation location selection	Reference
			chapter3.3
	3	Battery system stacking and fixing	Reference
			chapter3.5
	4	Battery System Wiring: Ground Wire	Reference
	4	Battery System Winng. Ground Wire	chapter3.6
	5	Battery system wiring: power cables	Reference
	5	and communication cables	chapter3.6
	6	Energy storage system wiring: P+/P-output cables and BMS communication cable are connected to the inverter.	Reference chapter3.6
	7	Check the wiring again before turning it	Reference
	/	on.	chapter3.7
	8	Start the inverter to make sure it is functioning properly.	Reference inverter manual
	9	Start the battery system. When starting for the first time, you need to set the inverter to force the battery system to charge.	Reference inverter manual

Attachment 1: Installation and System Startup Schedule

Tick after	Step	Item	Remark
completion			
	1	Inverter off	Reference inverter
			manual
	2	Press the start button, the indicator	Reference chapter
		light is off.	3.8
	3	Open the circuit breaker on the high	Reference chapter
		voltage control box	3.8

Attachment 2: System Shutdown Schedule



STEALTH

ENERGY

Suzhou Stealth Energy Technology Co.,Ltd

ADDR:8F, NO.198, Jinfeng Road, Huqiu District,

Suzhou, Jiangsu Province, China

TEL: +86 0512-66720026

E-mail: Sales@stealthenergy.cn

www.stealthenergy.cn