



High Voltage Residential Lithium Battery

Preliminary User manual

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Shandong Sacred Sun Power Sources Co., Ltd.

This manual introduces the High Voltage Residential Lithium battery system from Shandong Sacred Sun Power Sources Co., Ltd. Please read this manual carefully before installing the batteries and follow the instructions carefully during the installation process. If you have any questions, please do not hesitate to contact Sacred Sun.

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1. Safety

The Residential Lithium battery system is a high voltage DC system with certification CE\CB\UN38.3 and should only be operated by skilled or trained qualified personnel. Read all safety instructions carefully before doing any work and always follow these instructions when using the system.






Skills required of qualified personnel


- Training in the installation and commissioning of electrical systems and the handling of hazards
- Knowledge of this manual and other relevant documents
- Knowledge of local regulations and directives

Possible consequences of incorrect operation:

- Improper operation may cause injury or death to humans
- Damage to the system hardware and the operator's property

1.1 Safety Warning Symbols

	Danger	Lethal voltage: The battery pack will generate high voltage DC power and can cause lethal voltage and electric shock; only qualified personnel should connect the batteries
	Warning	Risk of damage to the battery system or personal injury; do not disconnect the connector while the system is operating
	Caution	Risk of battery system failure or reduced life cycle.
	Description	Please read this user manual before operating the battery system.
	Symbolic label	Warning about electric shock

	<p>Fire and heat protection</p>	<p>Do not approach flammable materials</p>
	<p>Symbolic label</p>	<p>Do not reverse the positive and negative connections.</p>
	<p>Symbolic label</p>	<p>Do not place near an open flame</p>
	<p>Symbolic label</p>	<p>Keep out of the reach of children and pets.</p>
	<p>Symbolic label</p>	<p>Waste Electrical and Electronic Equipment (WEEE) Labelling Directive (2012/19/EU)</p>
	<p>Symbolic label</p>	<p>EMC certification label</p>
<p>UN38.3 锂电池认证</p>	<p>Symbolic label</p>	<p>UN38.3 Certification Label</p>

1.2 Instructions for use

- 1) It is very important and necessary to read the user manual carefully before installing or using the battery. Failure or disregarding any instructions or warnings in this document may result in electric shock, serious injury or death, or damage to the battery or possibly resulting in the battery becoming unusable.
- 2) After unpacking, check the product and packing list first and contact your local retailer if you find damage or missing parts.
- 3) The battery system must be installed, moved, or maintained with the grid disconnected and the battery switched off.
- 4) The battery must be wired correctly and must not be connected to the positive or negative cable by mistake or short-circuited to external equipment.
- 5) It is forbidden to connect the battery directly to the AC power supply; it is forbidden to connect the battery to a different type of battery.
- 6) It is forbidden to interchange High-voltage boxes with different voltage levels (different number of batteries).
- 7) The battery system must be well grounded.
- 8) Ensure that the electrical parameters of the battery system are compatible with the relevant equipment; it is forbidden to connect the battery to faulty or incompatible equipment such as incompatible inverters.
- 9) Do not disassemble the battery.
- 10) Keep the battery away from water and fire.
- 11) In case of fire, only dry powder fire extinguishers should be used, not liquid fire extinguishers.
- 12) Do not swallow any parts of lithium batteries or substances contained in lithium batteries.
- 13) When the electrolyte of lithium battery leaks, skin and eyes should be prevented from contacting the electrolyte. In case of contact, wash the contact area with plenty of clean water and seek medical help.

1.3 Human Safety Protection

Wear suitable personal protective equipment such as rubber gloves, safety shoes, goggles etc. for your own protection when installing and maintaining the battery system.



Insulating gloves



Protective glasses



Safety shoes

2. System Description

2.1 Products

This residential battery system is a high-voltage energy storage system based on lithium iron phosphate batteries. It can be used to support a reliable power supply for various types of equipment and systems. The residential battery system is particularly suitable for applications with high power output requirements, limited installation space, restricted weight load capabilities and long cycle life .

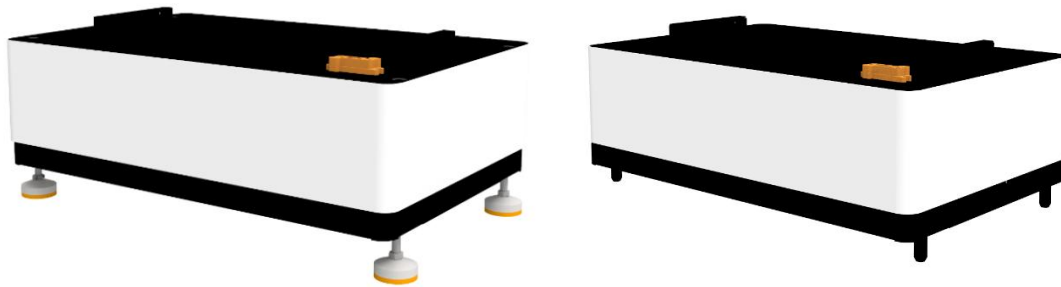


2.2 System parameters

Item	Parameter values				
Battery cathode material	LiFePO ₄				
Modules	2	3	4	5	6
System voltage (V)	204.8	307.2	409.6	512.0	614.4
System low voltage protection (V)	179.2	268.8	358.4	448.0	537.6
System high voltage protection (V)	230.4	345.6	460.8	576.0	691.2
Single module capacity (Ah)	50Ah				
Recommended charge and discharge current	25A				

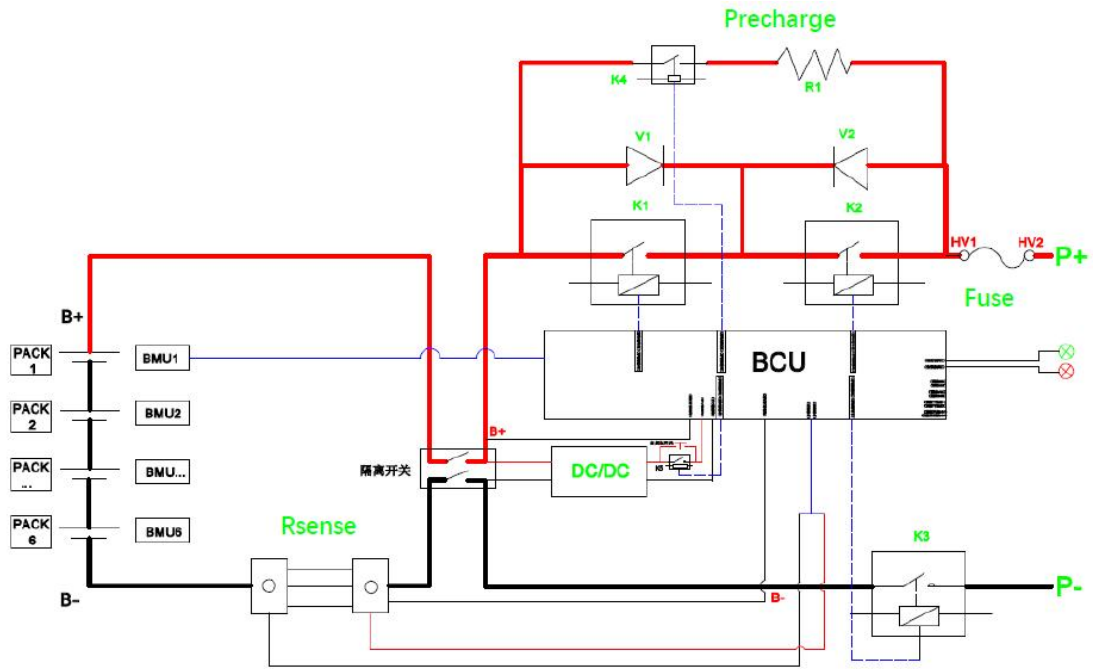
(A)	
Maximum charging current (A)	≤55A
System discharge current (A)	≤55A
Maximum discharge current (A)	60A (Time allowed) <10min)
Charging and discharging efficiency	≥98%
Discharge temperature	-20°C~50°C, Recommend Best 5°C~40°C
Charging temperature	0°C~45°C, Recommend Best 15°C~30°C
Protection class	IP51
Communication	CAN/RS485 (System can operate autonomously without communication, protection)
Certification	IEC 62619* CE CB UN38.3

2.3 Introduction to the battery module



Product type	Lithium Iron Phosphate 102.4V50Ah Battery
Battery module voltage (V)	102.4V
Battery module capacity (Ah)	50Ah
Number of battery strings (S)	32S
Battery unit voltage (V)	3.2V
Battery unit capacity (Ah)	50Ah
Battery size (mm)	740*480*185
Bottom module size (with support feet) mm	740*480*240
Battery weight (kg)	64kg
Battery weight (kg) (including support feet)	65.5kg

2.4 System diagram for control module



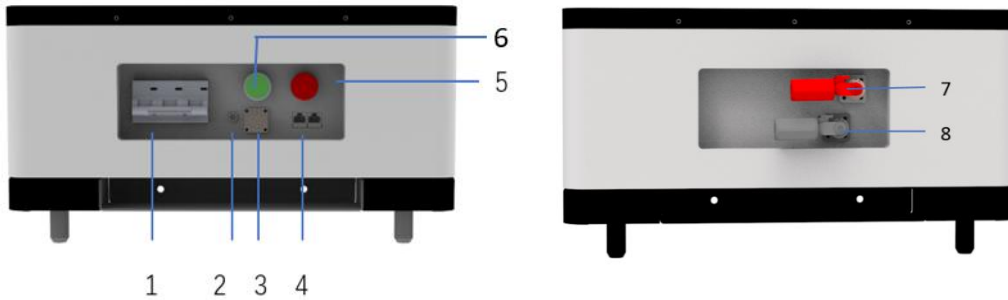
2.5 Introduction to the control module



Picture of control module

Product type	Communication
Recommended charging and discharging current (A)	25A
Maximum charge current (A)	≤55
System discharge current	≤55
Maximum discharge current (A)	60A (Allowed time <10min)
Battery unit voltage (V)	3.2V
Control module voltage range	160 ~ 700
Discharge temperature	-20°C~50°C, recommended optimal 5°C~40°C
Charging temperature	0°C~45°C, recommended optimal 15°C~30°C
Control module dimensions (mm)	740*480*213.5
Control module weight (kg)	28Kg
Communication	CAN/RS485

2.5.1 Control Module Features

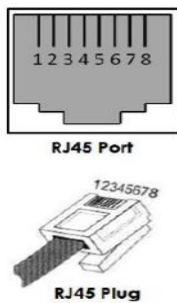


Control module panel picture

No.	Item	Description
1	Power main switch	ON: The main switch is ON, and the battery system can be started by pressing the start button OFF: main switch OFF state system completely shut down, no power output
2	24V power supply connector	External power supply for BMS
3	CAN Connector	CAN connector for manufacturer or professional engineer for commissioning or service
4	RJ45 interface (RS485/CAN)	Battery and inverter communication

5	Alarm light	Used to display battery system alarm status
6	Operation light/self-reset switch	The green light is always on when the self-resetting switch is pressed, the system is successfully powered up
7	Battery system output positive terminal	For connecting the positive inverter input terminal
8	Battery system output negative terminal	For connecting the negative inverter input terminal

2.5.2 RJ45 interface pin definition



No	CAN	RS485
1	/	/
2	/	/
3	CAN ground	/
4	CANH	/
5	CANL	/
6	/	RS 485 Ground
7	/	RS485A
8	/	RS485B

3 System installation

3.1 Tools for installation and use

Following tools are required to install the battery system:

 <p>Wire Cutter</p>	 <p>Nylon ties</p>	
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Caution:

Use insulated tools during installation to prevent accidental electric shock or short circuit. If insulating tools are not available, cover the entire exposed metal surface with an insulating substitute.

3.2 System installation environment requirements

3.2.1 Ambient installation temperature

The High Voltage Residential Lithium battery system allows a discharge temperature of minus 20°C~plus 50°C, the recommended best temperature is 5°C~40 °C ; charging temperature 0°C~45°C, the recommended best charging temperature is 15°C~30°C. Installation should be avoided in the frost or direct sunlight environment. If you operate the system outside the battery working temperature range, it will cause battery system over temperature- / low temperature alarm or protection, resulting in battery cycle life reduction. Choose to install a cooling- or heating system according to the installation environment requirements.

3.2.2 Firefighting systems

For safety reasons, the battery system installation environment must be equipped with a fire protection system; regular inspection of the fire protection system is required to keep the fire protection system in normal working condition.

3.2.3 Grounding system

The reliability of the grounding point of the installation environment must be confirmed before battery installation. When the battery system is installed in a separate equipment compartment (such as a container), it must ensure that the equipment compartment grounding is stable and reliable. Grounding system resistance should be $\leq 100\text{m}\Omega$.

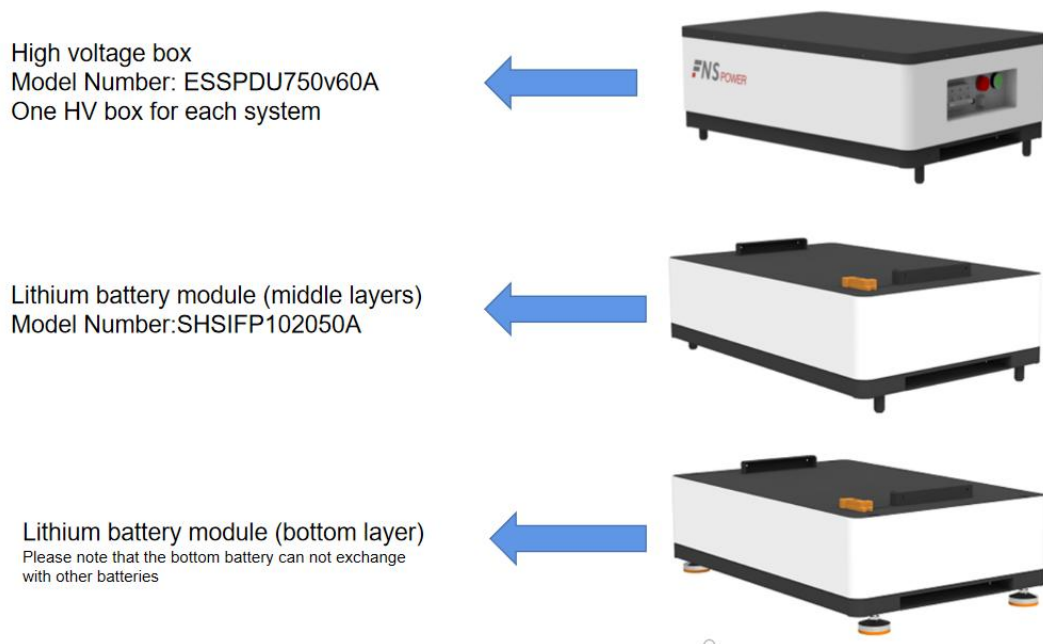
3.2.4 Clean environment

Before installing and powering on the system, dust and iron filings on the equipment must be removed to keep the environment clean.

3.3 Battery system components and installation methods

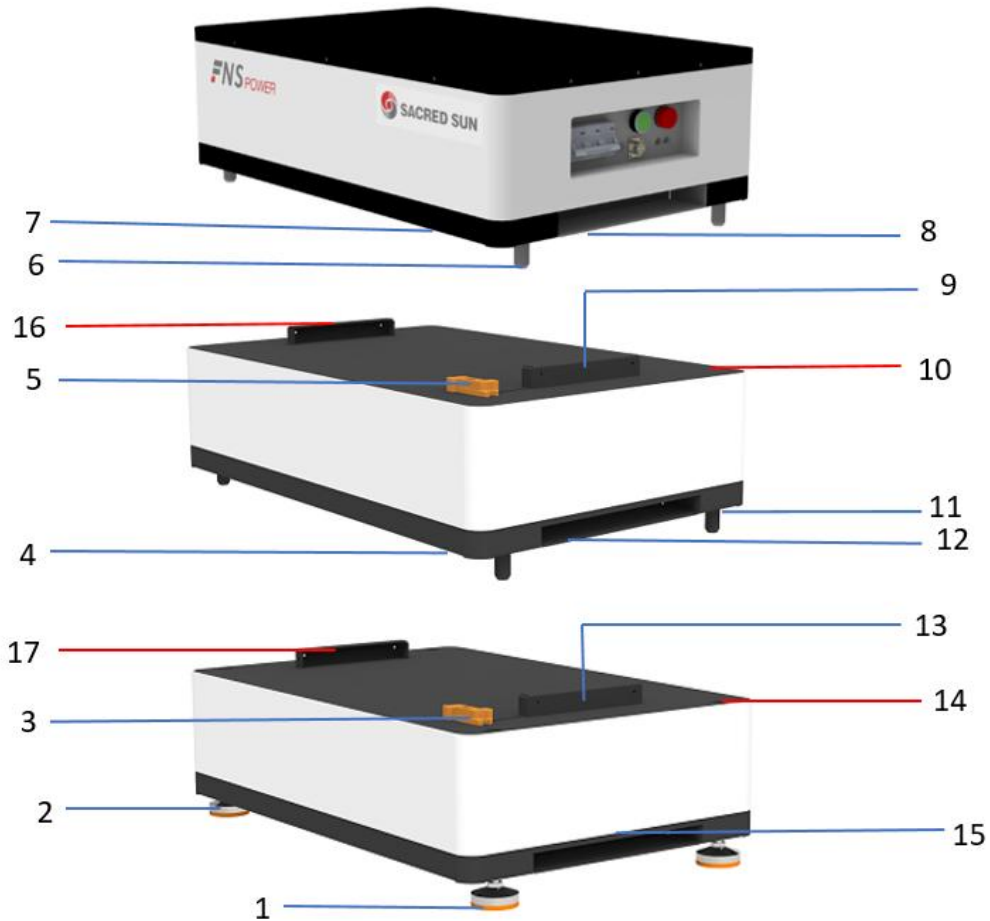
3.3.1 Battery system components

Each battery system consists of a bottom battery module, N middle layer battery modules and one control module (high voltage box). The bottom battery module is equipped with bottom support feet, the other upper modules do not have bottom support feet, please pay attention to the distinction when installing; depending on the system voltage, the middle layer battery modules consist of 1 to 5 battery modules.



Picture of battery system composition

3.32 Introduction to the components of the battery- and control module



No	Item	Description
1、 2	Bottom support feet	Supports the entire battery system, in contact with the ground, ensuring that the entire installation is balanced and free from skewing
3、 4、 5、 7	Output connector	For series connection of the upper and lower layers of the battery and connection of the battery to the high voltage control module (HV Box)
6、 11	Guide pillar	4 guide pillars correspond with 4 positioning holes for easy placement of upper and lower base layers
10、 14	Positioning hole	4 guide pillars correspond with 4 positioning holes for easy placement of upper and lower base layers

8、12、15	Handle	For battery or high voltage box handling
9、13、16、17	Upper and lower fixtures	For fixing the upper- and lower-layer modules

3.3.3 Battery system assembly procedure

1、Handling of battery modules or control modules

The weight of a single battery module or control module is heavy and must be carried by two or more people if no handling tools are available, and protective equipment must be worn during handling.

2、Battery module and control module base release

- 1) First determine the voltage level of the system. The voltage level of different battery modules depends on the number of modules in the system installed to complete the base-layer assembly.
- 2) First find the bottom battery module with bottom support feet, each system is equipped with only one battery module with bottom support feet, other middle layer battery module without bottom support feet, middle layer battery module without bottom support feet is equipped with guideposts.
- 3) Place the bottom battery: In a flat installation site, place the battery module with bottom support feet on the bottom layer, and the bottom four support feet should be completely in contact with the ground reliably.
- 4) Place the middle layer battery: When placing the middle layer battery, connect the output terminal at the bottom of the upper layer battery module with the output terminal at the top of the lower layer battery module, and connect the four guide pillars of the upper layer battery module with the four positioning holes of the lower layer battery module. The other intermediate battery layers are connected in turn.
- 5) After the battery module is connected, measure the voltage at the output terminal of the uppermost battery module with a multimeter to confirm whether the output voltage meets the required voltage level; make sure the battery is connected reliably.
- 6) Placement of the control module (High Voltage Box): After the battery modules are completely stacked, the control module is placed on the uppermost layer, the output terminal at the bottom of the control module is connected with the output terminal on the upper side of the battery module, and the guidepost of the control module

corresponds to the positioning hole of the battery module after being stacked.

- 7) After all the battery- and the control modules are placed, the upper and lower layers are fixed with M6*12 bolts at each upper- and lower-layer fixing device.



Final Battery Mounting



Additional cable connections:

- 1) Connect the yellow ground wire reserved for the bottom battery module to the grounding system.
- 2) Connect the system positive and negative output terminals reserved on the control module (high voltage box) to the positive and negative terminals of the inverter with 16 square connection wire, please make sure the hybrid inverter voltage level is within the battery system voltage level before wiring.

3) Connect the RJ45 communication port to the inverter communication port (CAN or 485 communication).

3.4 Commissioning the System

3.4.1 System start-up and debugging steps

- 1) Check that all cables are properly connected and securely attached.
- 2) If necessary, turn on the switch on the battery side of the inverter or between the inverter and the battery. If possible, turn on the AC power or PV power to wake up the inverter.
- 3) Close the main power switch of the battery system.
- 4) Press the green self-resetting switch button. The green operation light is normally on, the red alarm light is not on, and the battery is powered on successfully.
- 5) If the battery system has other problems, contact the sales engineer, technical support engineer or Shandong Sacred Sun Power Sources Co., Ltd.

3.4.2 System shutdown procedure

- 1) Turn off the DC side inverter or power supply.
- 2) Turn off the switch between PCS and the battery system.
- 3) Turn off the main power switch of the battery system

4. System maintenance

4.1 Operating Indicators

This residential energy storage systems is a high-voltage DC system, it should be operated only by qualified and authorized personnel!

No	Green light status	Red light status	Status Definition	Remarks
1	Off	Off	BMS power down, system shutdown state	
2	Blinking	Blinking	System is operating normally and can be charged or discharged	
3	Blinking	Off	System charging in progress	
4	On	Blinking	Discharge secondary alarm; other secondary fault alarms (except full secondary alarm)	Can be connected to the host computer to view alarms

				information
5	On	On	System discharge level 3 alarm	Can be connected to the host computer to view alarm information
6	Off	On	Other three-stage fault alarms (except discharging and charging three-stage alarms)	Can be connected to the host computer to view alarm information

When the system detects a fault that needs to be handled, the control module should be shut down before operation to ensure safety and avoid further battery discharge due to battery self-consumption.

4.2 Battery maintenance



DANGER: Battery maintenance must be performed by qualified and authorized personnel.

DANGER: The power switch must be turned off before maintenances.

DANGER: Do not disassemble or replace any battery and components in the battery system without permission, and dissecting the battery is strictly prohibited.

- Voltage inspection
(Regular maintenance) It is recommended to check the total battery voltage once a month, etc., to find problems and timely maintenance treatment, and to check whether there are voltage abnormalities in the system. For example: Abnormally high or low voltage of individual batteries.
- SOC inspection
(Regular Maintenance) Check the battery system SOC through the monitoring system. Check if there is any abnormality in the battery pack SOC.
- Cable Inspection
(Regular Maintenance) Visually inspect all cables of the battery system. Check the cables for breakage, aging, looseness.
- Balance
(Regular Maintenance) The battery pack will be unbalanced if it is not fully charged for a long time, when the battery pack is not used for a long time, please turn the power switch off
- Output relay check
(Cycle Maintenance) In the low load (low current) state, control the output relay OFF and ON, and hear a click sound from the relay, which means the relay can be OFF and ON normally.
- History Check
These certifications are not available, delete. Now contains the most complete for future preparation

- Shutdown and Maintenance
 [Regular Maintenance] BCU reboot process requires maintenance of some system functions, it is recommended that the system be maintained once every six months.

5.1 Storage recommendations



Improper storage poses the risk of battery system failure or reduced life cycle!

- 1) When storing the battery pack, it should be placed correctly according to the box identification, not upside down or on its side.
- 2) When stacked, the battery pack should conform to the placement requirements on the outer packaging.
- 3) The battery pack should be stored in a dry and cool environment. The storage environment requirements are as follows.
 Ambient temperature 0~50°C; recommended storage temperature 20~30°C.
 Relative humidity \leq 95%.
 Dry, ventilated, dust free and clean place.
 Avoid contact with corrosive substances or organic solvents.
 Avoid direct sunlight.
 Distance from heat sources (heating equipment, etc.) should not be less than 2m.
 The packing box should be padded at least 20cm high from the ground and at least 50cm from walls and windows.
- 4) Store the battery system in a dry environment without exposure to the sun or rain.
- 5) When the battery pack is to be stored for a long period of time, please charge the battery pack to about 50% of its capacity.

5.2 Warranty provisions

- 1) FNS POWER shall not be responsible for the damage to the battery pack provided by FNS POWER caused by force majeure events (such as earthquakes, volcanic eruptions, mudslides, fires, lightning strikes, wars, etc.).
- 2) FNS POWER is not responsible for the damage to the battery pack provided by FNS POWER due to the following reasons.
 - a. The battery pack is damaged, broken or leaked due to improper operation or failure to connect the battery pack as required.
 - b. Due to the customer's failure to charge in time, the battery pack has been stored for more than 6 months, resulting in capacity loss or irreversible damage to the battery pack.
 - c. The battery pack was damaged due to the customer's failure to accept in time.
 - d. Direct damage to the battery system caused by the on-site equipment operating environment failing to meet the environmental requirements for normal operation. This includes the fact that the operating temperature of the battery system is bad, the power grid is bad and the power outage is frequent, and the battery system is frequently over-discharged due to improper customer maintenance, or the battery system cannot be fully charged for a

long time.

- e. The customer changed the usage scenario of the battery system without notifying.
- f. Damage to the battery system caused by customers or third parties, including relocation and installation of the battery pack without authorization according to the requirements of FNS POWER.
- g. The customer did not properly maintain the battery system according to the operation manual, including but not limited to: did not regularly check whether the battery terminal screws were tightened
- h. The customer connects additional load to the battery pack
- i . The customer mixed the battery pack of FNS POWER with other battery packs, resulting in accelerated capacity degradation, including but not limited to: mixing with other brand battery packs, mixing with battery packs with different rated capacity, and mixing with old battery packs.
- J. The battery was stolen.
- k. Battery pack beyond the warranty period.

1 Transportation

Transport requirements: Suitable for transport by car, boat, or plane. The batteries should be protected from the sun and the sun. During loading and unloading, the batteries should be handled gently and prevented from being thrown, tumbled, or pressed. Transport should avoid direct rain, snow, and mechanical impact.