PRODUCT SPECIFICATION SHEET

Rechargeable Lithium Ion Battery system

Model: 314Ah prismatic cell series

PACK design	PACK process	PACK approval	Cell approval	QA. approval	Sales approval

Client Approval	Signature:	Date:
	Company Code:	
	Company Stamp:	

Confidential ： （） Level 3（） Level 2（√） Level 1

Zhuhai OTE Electronic Technology Co.,Ltd.

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1. Summary

1.1. Scope of application

This specification describes in detail the performance indicators, parameter thresholds, product use conditions and risk warnings for the 314Ah rechargeable lithium iron phosphate aluminium cells, battery modules, battery clusters, battery system, liquid cooling units, BMS etc. produced by Orient Power for application inlarge energy storage container systems.

Note: The specification shall be in both Chinese and English, and the Chinese definition shall prevail.

1.2. Design criteria

The design standards of Orient Power conform to the International Electrotechnical Commission Standards (IEC). The main referenced standards are as follows：

IEC 62619 Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for secondary lithium-ion cells and batteries for use in industrial applications

IEC 63056 Safety requirements for secondary lithium-ion cells and batteries for electrical energy storage systems

IEC 61000 Electromagnetic compatibility (EMC)

IEC 62477- 1 Safety requirements for power electronic converter systems and equipment – Part 1: General requirements

2. System scheme

2.1. Design scheme

The 3.2V/314Ah lithium iron phosphate square aluminum shell battery cells manufactured by Orient Power Battery Technology Co, Ltd. are used in this scheme. The battery system consists of 1P416S * 12 clusters, each containing 4*1P104S battery modules, and each module containing 8*1P13S modules. The battery management system inside the box uses high-precision BMS to collect and monitor data from the battery pack. The BMS has external communication function and is compatible with the supporting PCS, HMI, EMS, and water cooler Firefighting and other equipment can transmit data and operate safely and stably for a long time.

2.2. Configuration scheme

Based on standard battery modules, Orient Power has designed a standard 20-foot container energy storage system with dimensions of 6058*2438*2896mm, with a power distribution capacity of 5.01MWh. Each pair of 5.01MWh battery prefabricated cabins is equipped with a 5MW step-up inverter integrated cabin, and the system operating rate is 0.5P.

Table 2.2-1 20 foot container system configuration

Type	Model	Voltage min	Voltage max	Voltage rated	Energy	Quantity
Cell	314Ah	2.8	3.55	3.2	1004.8	4992
Pack	1P104S	291.2	369.2	332.8	104499.2	48
Cluster	1P416S	1164.8	1476.8	1331.2	417996.8	12
System	12P416S	1164.8	1476.8	1331.2	5015961.6	1

3. System parameter

3.1. Cell

The following chart shows the main parameters of the cell:

Table 3.1 314Ah cell parameters

NO.	Item		Product specification	Condition
1	Cell capacity		≥314Ah	2.5 ~ 3.65V, 25±2℃ 0.5P discharge current, new battery state
2	Working voltage		2.8~3.55V	N.A.
3	Operating temperature (charging)		0~55℃	Refer to the specification of cell for details
4	Operating temperature (Discharging)		-20~55℃	Refer to the specification of cell for details
5	Net Weight		5.55±0.15kg	N.A.
6	Standard operating current		157.0A	25 ± 2 ℃ ambient temperature
7	Max. sustainable operating current		314.0A	25 ± 2 ℃ ambient temperature
8	Storage temperature	1 Months	-30℃-45℃	SOC: 25% -40% Storage environment, humidity ≤ 85% RH, no condensation
		6 Months	-20℃-35℃	

3.2. Battery Pack

The battery module consists of 8 standard modules connected in series

The following chart shows the main parameters of the battery module:

Table 3.2 314Ah battery box parameter list

NO.	Name		Product specification	Condition
1	Combination mode		1P104S	N.A
2	Nominal voltage		332.8V	N.A
3	Voltage range		291.2~369.2V	Monomer protection 2.8 to 3.55V
4	Nominal energy		104.499kWh	25℃±2,0.5P
5	Standard operating current		157.0A	N.A
6	MAX. operating current		173.0A	N.A
7	Installation mode		Plug in pack type	N.A
8	Safety		MSD Includes fuse and MSD	N.A
9	Charging temperature		0~55℃	N.A
10	Discharging temperature		-20~55℃	N.A
11	Storage temperature	1 Months	-30℃-45℃	SOC: 25% -40% Storage environment humidity ≤ 85% RH, no condensation
12		6 Months	-20℃-35℃	
13	Cooling mode		liquid-cooled	N.A
14	Battery pack size		See below	Please refer to the actual product for details

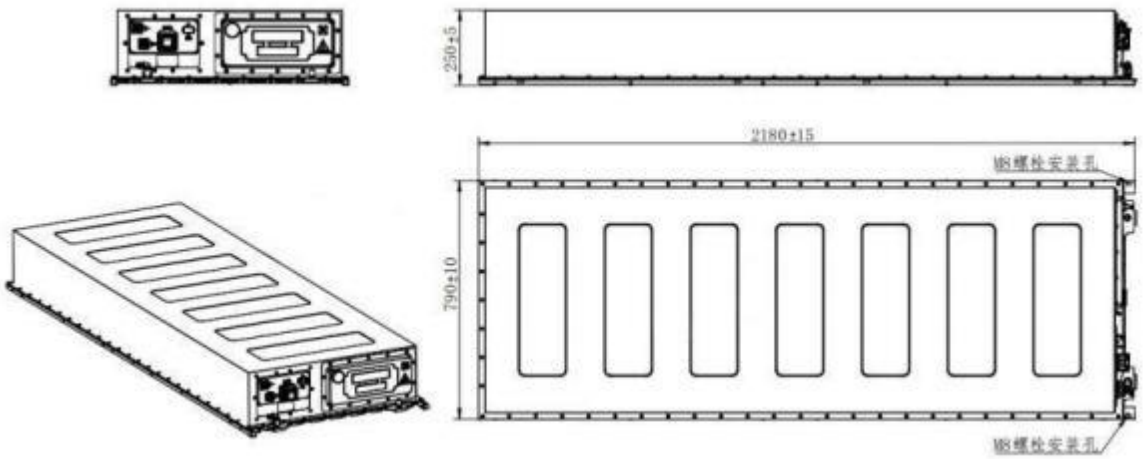


Fig. 3.2-1 Schematic diagram of battery box (for reference only)

3.3. Battery cluster

The battery cluster consists of 4 battery modules connected in series, a high-voltage box, and other wiring harness accessories.

The following chart shows the main parameters of a standard battery cluster:

Table 3.3 Standard battery cluster parameter

NO.	Name	Product specification	条件 Condition
1	Combination mode	1P416S	N.A
2	Nominal voltage	1331.2V	N.A
3	Voltage range	1164.8~1476.8V	Monomer protection 2.8to 3.55V
4	Nominal energy	417.99kWh	25℃±2,0.5P
5	Standard operating current	157.0A	N.A
6	MAX. operating current	173.0A	N.A
7	Charging temperature	0~55℃	N.A

8	Discharging temperature	-20~55℃	N.A
9	Cooling mode	liquid-cooled	N.A
10	Battery rack size	See below	Please refer to the actual product for details

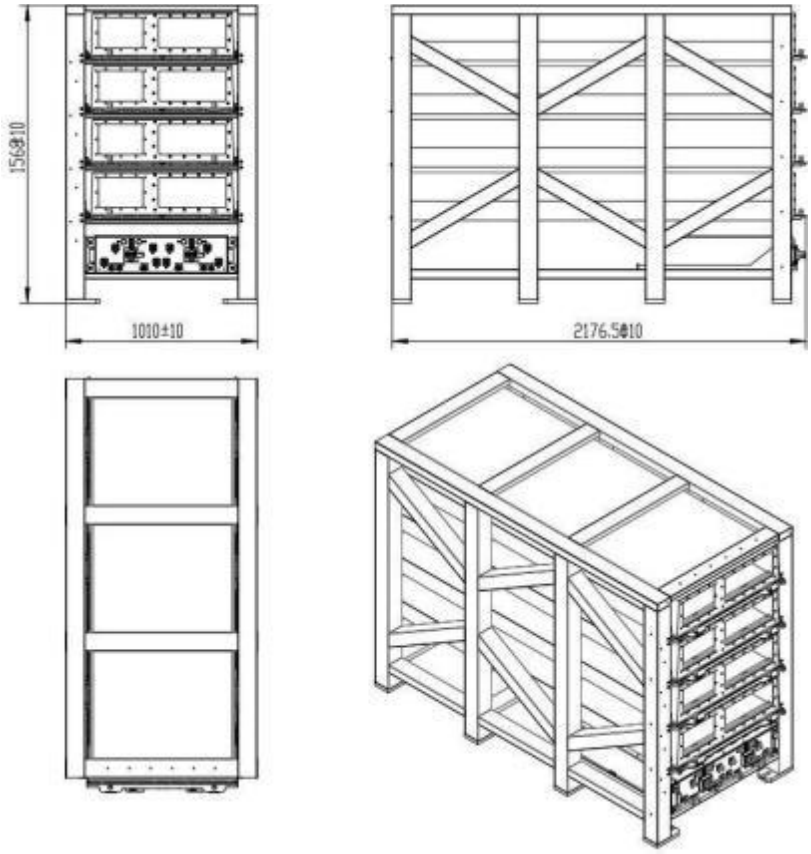


Fig. 3.3-1 Schematic diagram of battery cluster (for reference only)

3.4. Battery System

The following is the system layout of the 20-foot container: built-in 12*1P416S battery clusters, 1 high-voltage zone, 1 set of dehumidifiers, 1 set of water cooler, 1 set of fire-fighting system, 1 set of temperature and humidity, 1 set of exhaust system, high- and low-voltage wiring harnesses, and liquid-cooling pipelines.

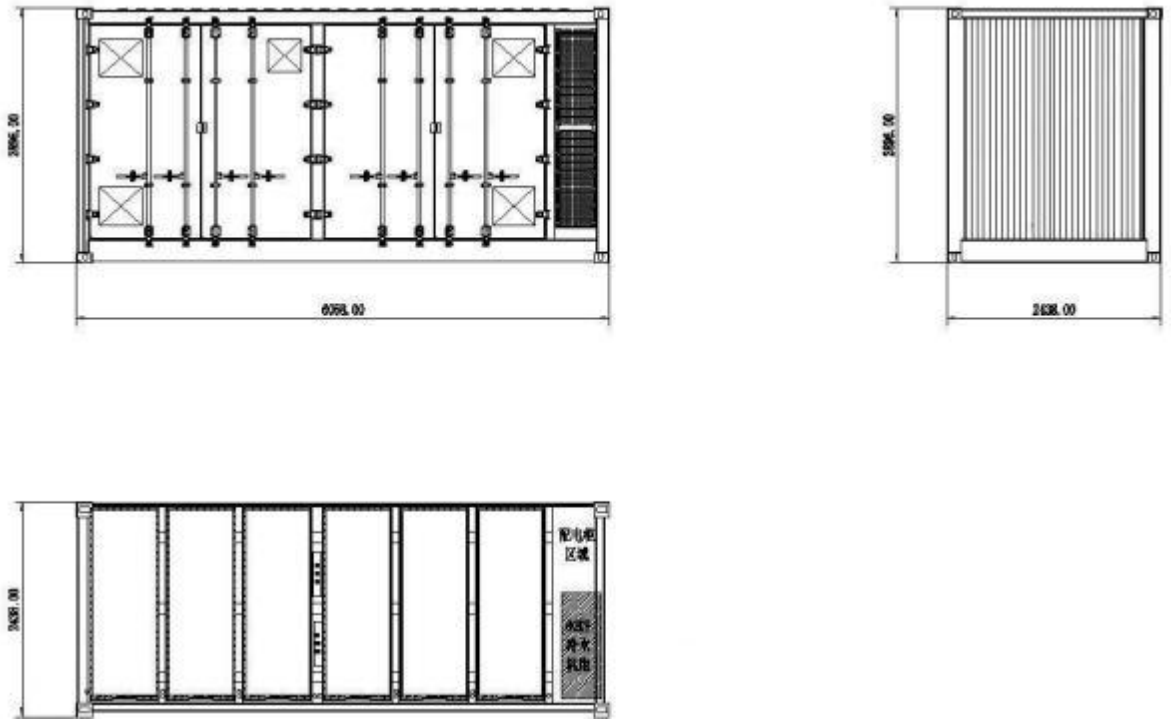


Fig. 3.4-1 20 ft container layout diagram (for reference only)

3.5. High voltage box

There is one high-voltage box for every two battery clusters. The high-voltage box is mainly responsible for collecting voltage and current of the battery cluster, summarizing the voltage and temperature information of individual batteries within the cluster, calculating the SOC/SOH status of the battery cluster, executing balancing strategy judgment and battery fault diagnosis functions, and implementing on-site protection and relay control of the battery cluster based on battery fault information. The high-voltage box has a communication interface, which can achieve data communication with the battery management unit (BAU) and battery array management unit (EMS). BMS has functions such as insulation collection and individual SOC/SOH state calculation.

3.5.1. Parameter table of high voltage box

The parameters of high voltage box are as follows：

Table 3.5 1 Parameter table of high voltage box

NO.	Item	Description
1	Main components	BCU, relay, fuse, shunt, etc.
2	Panel device	Air switch, circuit breaker, 220 VAC interface, etc.
3	Protection function	System protection, insulation / total voltage detection, communication etc.
4	Installation mode	Plug in box

3.5.2. External interface

The definition of external interface of high voltage box is as follows：

Table 3.5 2 external interface of high voltage box

NO.	Name	Describe	Remarks
1	High voltage input positive	BAT1+	N.A
2	High voltage input negative	BAT1-	N.A
3	High voltage input positive	BAT2+	N.A
4	High voltage input negative	BAT2-	N.A
5	AC input	220Vac	N.A
6	Inter box communication	BCU-BMU	N.A
7	External communication	BCU-BAU	N.A
8	High voltage output positive	PCS1+	N.A
9	High voltage output negative	PCS1-	N.A
10	High voltage output positive	PCS2+	N.A

11	High voltage output negative	PCS2-	N.A
12	Ground point	M6 screw	N.A

3.6. HMI

Each BAU master control (located in the combiner cabinet) inside the container contains a display screen to display the operation status, alarm information and other main parameters of all battery clusters under the master control.

The main parameters of the display are as follows：

Table 3-6 Display parameters

NO.	Name	Describe	Remarks
1	Dimensions and specifications	Color touch screen	N.A
2	Power supply mode	DC24V	N.A
3	Communication mode	RS485	N.A
4	Running state	Stop, standby, charging, discharging, fault, emergency stop, etc	N.A
5	Alarm information	Overcharge, over discharge, over current, over temperature, insulation fault, communication fault, self check fault, etc	N.A
6	Main parameter	SOC, total voltage, total current, maximum and minimum cell voltage, maximum and minimum temperature, etc	N.A

7	Display parameters	With the battery cluster details button, click to open the corresponding details page. The battery cluster details display the operation status, alarm information, SOC, total voltage, total current, insulation resistance value, maximum cell voltage difference, maximum temperature, all cell voltages, all temperature measurement values, and make special marks for the maximum cell voltage, minimum cell voltage, maximum temperature and other parameters.	N.A
8	Settings window	Display window, setting window, history record, etc.	N.A
9	Storage function	Historical data can be stored and read by SD card.	N.A
10	Installation	Combiner cabinet panel	N.A

4. Liquid cooling system

4.1. Description

Containerized battery pack water cooler is air-cooled chiller. External unit releases heat into the air by the fan, the internal refrigerating compressor system makes heat exchange with the refrigerant glycol solution through the heat exchanger, computer control system output temperature through the upper computer and the unit of water temperature and pressure of the feedback signal logic control system, the water system configures circulating water pump based on the main line and the battery module resistance configuration of the circulating water pump, the liquid cooling system controls module refrigerant flow (glycol solution) in and out of the module .

4.2. Parameter table

This project is equipped with 1 set of water cooler with the following parameters:

Table 4-1 Parameter table

NO.	Name	Unit	Remarks
1	Working voltage	-	380Vac
2	Refrigerant carrier	-	50% pure water+50% glycol
3	Communication protocol	-	RS485
4	Operating ambient temperature	℃	-20~55℃

5. BMS

5.1. Topological graph

The battery management of the system adopts a three-level BMS architecture, which enables control management to achieve corresponding functions and ensure system stability and reliability.

BMU battery cell management unit: responsible for collecting information on each cell of the battery (voltage, temperature), providing calculation and analysis of the battery's SOC and SOH parameters, achieving balance of individual cells, and uploading abnormal information of individual cells to the battery cluster unit BCU.

BCU battery cluster management unit: responsible for collecting various individual battery information uploaded by BMU, and collecting various information of battery pack (group voltage, group temperature). Calculate and analyze the SOC and SOH of the battery pack, including charging and discharging currents, and

upload the information to the battery array management unit (BAU).

BAU Battery Array Management Unit: mainly responsible for collecting various battery information

uploaded by BCU, controlling the charging and discharging of the system based on the current working conditions and battery pack status, and uploading all information to PCS and EMS for battery status management. It can communicate with peripheral devices.

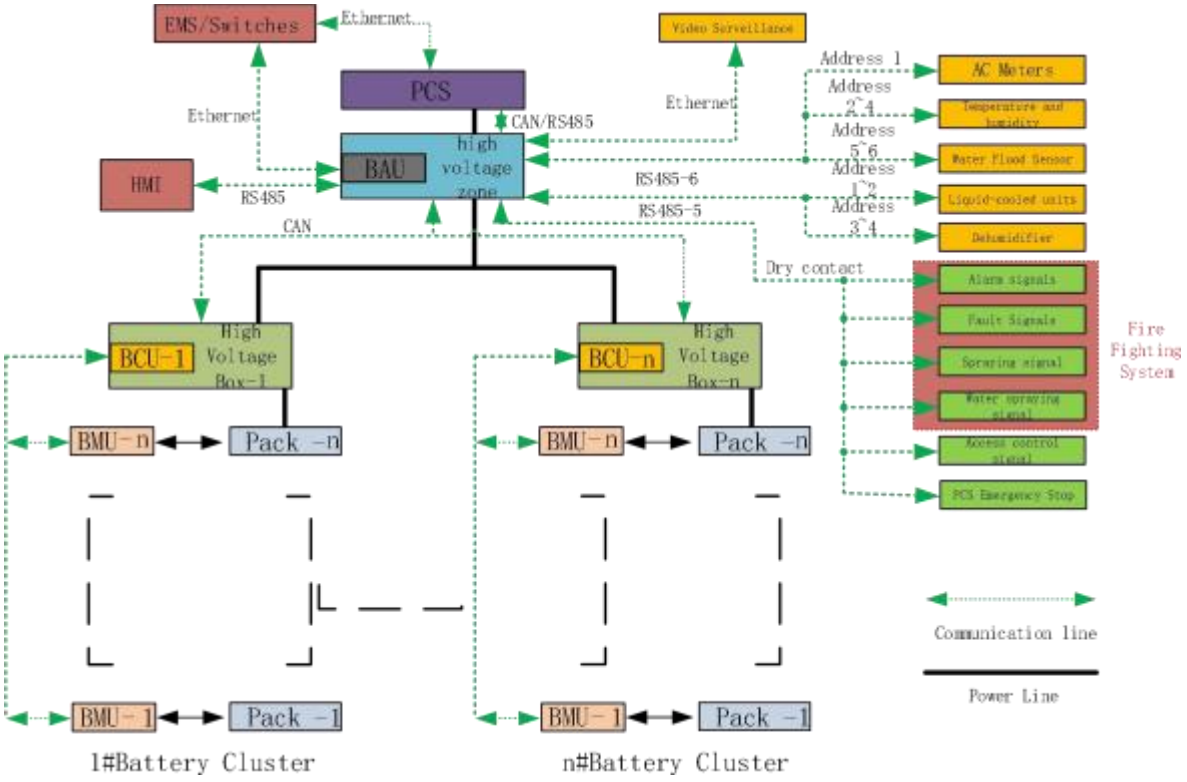


Fig. 5.1 topological diagram of BMS system

5.2. BMS Function description

The battery management system is a real-time monitoring system composed of electronic circuit devices, which can effectively monitor battery voltage, battery current, battery cluster insulation status, battery SOC, manage system charging and discharging safety, alarm and emergency protection for possible faults, optimize control of the battery system, and ensure safe, reliable, and stable operation of the battery.

5.3. BMS parameters and configuration values

The battery management system consists of a battery cell management unit (BMU), a battery cluster management unit (BCU), a battery array management unit (BAU), and its current, voltage, and temperature detection units. The BMS system has functions such as high-precision detection and reporting of analog signals, fault alarms, uploading and storage, battery protection, parameter settings, active balance, battery pack SOC calibration, and information exchange with other devices.

BMS parameters are as follows：

Table 5.3-1 BMS parameters

NO.	Name	Describe	Remarks
1	Supply voltage	24Vdc	External power supply
2	Balance mode	Active balance	N.A
3	Alarm protection	Overcharge, over discharge, over temperature and short circuit	N.A
4	Communication mode	CAN/RS485/ Ethernet	
5	Communication protocol	CAN2.0B/Modbus-RTU/IP	

Table 5.3-2 System Control Strategy

Alarm level 1 (power reduction requested)	Alarm level 2 (PCS standby)	Protection level 3(relay cut off)
Single cell overcharge/over discharge alarm; single cell voltage difference alarm; single cell charge / discharge high temperature / low temperature	Single cell overcharge / over discharge; large voltage difference of single cell; high / low temperature of single cell charge / discharge; large temperature	Overcharge / over discharge of single cell, large voltage difference of single cell, high / low temperature of single cell charging / discharging, large
alarm; temperature difference alarm; total voltage high / low alarm; charge / discharge current high alarm; insulation low alarm, etc	difference; high / low total voltage; high charge / discharge current; insulation low	temperature difference of total voltage, overvoltage / undervoltage charging / discharging overcurrent protection. Insulation low, communication timeout, cell failure, NTC failure, etc

6. High voltage area

The container houses AC power distribution, communication, and busbar functions, equipped with auxiliary power switches, HMI, UPS & batteries, switches, BMS, switching power supplies, etc. Twelve battery clusters converge to the input DC busbar, which connects to the PCS after passing through load switches and fuses (specific configuration designed according to project requirements).

Power distribution function

The battery compartment power distribution requires the use of three-phase five wire power supply, which can provide independent control power and 220V single-phase AC power supply for AC electrical equipment such as UPS, switch power supply, fire protection, temperature and humidity sensors, sockets, etc. inside the battery

compartment.

Electrical interfaces include but are not limited to the following interfaces(tentative):

1) Main circuit breaker for control power (3P5W),;

2) Three-phase power supply of the water cooler is 400VAC, one circuit of 3L+PE;

3) 220V power supply for lighting and socket;

4) UPS input power supply 220V power supply;

5) BMS auxiliary 220V power supply (provided by UPS);

6) Auxiliary 220V power supply for fire protection (provided by UPS);

7) Switch power supply input power supply 220V power supply (provided by UPS);

8) 220V power supply of explosion-proof fan (provided by UPS);

9) Touch screen power supply (provided by switching power supply);

10) Electric shutter, temperature and humidity, smoke sensing, temperature sensing, combustible gas, water immersion 24V power supply;

11) The auxiliary switch is required to be controlled by BAU with shunt;

12) The cabinet shall be equipped with lighting, which can be turned on when the door is opened.

7. Container

1. Container protection level meets IP54

2. Corrosion resistance: meets C5 corrosion resistance requirements.

3. The container is equipped with an access control alarm function. When someone attempts to forcibly open the door, the access control system will generate a threatening alarm signal. This alarm function can be disabled by the user..

8. Fire control

8.1. Overall requirements

The overall fire protection design is based on the policy of 'prevention first, combining prevention and elimination' to prevent and reduce fire disasters and protect the safety of people and property. The energy storage system is equipped with a complete fire protection system, in order to adapt to the special needs of the energy storage battery for fire protection, the battery prefabricated compartment is equipped with an automatic fire extinguishing system, the fire extinguishing medium is aerosol, which is used in the PACK and the compartment, and each prefabricated compartment fire protection system is independent of each other, and is equipped with a fire alarm system for CO and H2 gas detection.

PACK

PACK level fire protection design

Judgment of the battery PACK box thermal runaway, will lead to rapid start of aerosol fire extinguishing equipment, which execute fire extinguishing directly to the root cause, with rapid inerting inhibition, so as to prevent the expansion of the thermal runaway, and prevent the secondary re-ignition. It has the advantages of precise positioning detection, precise cooling and fire extinguishing, early warning and early processing, so as to prevent the fire as far as possible and minimize the loss and impact.

Water fire fighting

Reserved fire pipeline interface is arranged for prefabricated cabin, in which piping is allocated to the top of the battery racks with a stop valve, so that when a fire occurs, fire-fighting water can be accessed to reduce the temperature in the prefabricated cabin, effectively suppressing the fire and preventing re-combustion.

9. Packaging, storage, transportation and maintenance

9.1. Packaging

The packaging box of parts and components is marked with the product name, model, quantity, gross weight, manufacturer and contact address, date of production, as well as necessary signs such as "handle with care", " keep dry ", "upward", etc., and the signs of packaging, storage and transportation comply with the

provisions of International logistics and transportation standard.

9.2. Storage requirements

(1) When the battery pack needs long-term storage, please charge the battery pack to about 50% of the power. The standard charge and discharge current shall be cycled at least once a month, and activate with small current(0.1C) every three months. Environmental requirements: temperature 25 ± 5 ℃, relative humidity 45% ~ 85%, atmospheric pressure 70kpa ~ 106kpa. Place it in a dry and ventilated place to avoid contact with corrosive substances and away from fire and heat sources.

(2) The battery pack is packed in avoid to severe vibration, impact or extrusion during transportation, and – exposure to the sun and rain.

9.3. Transportation requirements

The battery pack is packed in avoid to severe vibration, impact or extrusion, It can be transported by car, train, ship, etc.

Exporting containers mostly adopts the top lifting method, use the special lifting gear for containers (e.g. four-corner hanger), hooks and container top corners are completely locked, slowly lifting to 10cm from the ground, pause to check the balance; if tilted, adjust the lifting point position. Keep moving at an even speed,

avoid stopping sharply or swinging; make sure the ground is level when placing down.



Figure 9 Lifting Schematic (for reference only)

9.4. Maintenance requirements

During maintenance, do not dissect, reassemble or replace the battery in the battery pack by yourself.

9.5. Product identification

Clear high-voltage, positive and negative poles, interface definition symbols, and traceable QR codes of the battery module, battery module, and battery system can be seen on the surface of the battery module, and high-voltage box.

10. Precaution

10.1 It is forbidden to expose the battery to high temperature environment exceeding that specified in this specification for a long time, otherwise it may cause fire; Under any normal use and storage conditions, the temperature of the battery module shall not exceed 55 ℃. If the temperature exceeds 55 ℃, the battery management system shall protect and turn off the battery, and prohibit the charging and discharging of the battery module.

10.2 It is forbidden to short circuit the positive and negative poles of the battery pack, Please do connect the positive and negative poles of the battery pack in strict accordance with the marking instructions.

10.3 It is forbidden to immerse the battery pack in water, fire, microwave oven or pressure vessel.

10.4 When an electrolyte leak is detected in the battery pack, avoid skin and eye contact with the electrolyte. If contact occurs, rinse the affected area thoroughly with copious amounts of water and seek medical assistance at the nearest hospital. Do not allow humans or animals to ingest any components of the battery. If a leak occurs during use or transportation due to unforeseeable circumstances, professionals should establish protective barriers to isolate the leak site. Use materials such as sand or absorbent cotton to contain the leaked liquid, preventing further spread, and perform solidification and stabilization treatment on contaminated soil. The primary component of the leaked liquid is electrolyte, which is corrosive, flammable, and toxic. When handling leakage incidents, maintain a minimum distance of 5 meters from any heat sources. Wear protective gear, including a gas mask, acid-resistant gloves, and protective clothing. Place the treated leaked liquid into a sealed container, label it with the name of the leaked substance, hazard level, treatment time, and responsible party, and hand it over to a qualified hazardous waste disposal facility for proper disposal.

10.5 in case of liquid leakage, peculiar smell and abnormal noise during the use of the battery pack, please stop charging and discharging immediately and contact the manufacturer. Do not disassemble and decompose the battery module without permission, otherwise Orient Power will not undertake any product quality assurance.

10.6 Do not wilfully dispose the scrapped battery pack at will, for it will pollute the local environment. Please contact an eligible and qualified recycling organization or manufacturer for special treatment.

11. Technical services and warranty after-sales service

11.1 During the installation, commissioning, and warranty periods, any damage to equipment components caused by quality issues shall be addressed by Orient Power . Damage caused by human error is not covered under the warranty. During the warranty period, if the product experiences malfunctions caused by factors other

than improper use, disasters, wars, or other unforeseeable and unavoidable circumstances, and such malfunctions are confirmed by both parties' technical personnel to be due to product quality issues, Orient Power will be responsible for free repair or replacement. During the warranty period, ownership of faulty parts replaced free of charge shall belong to Orient Power .

11.2 For products that are past their warranty period, Orient Power will provide paid repair or replacement services.

11.3 If both parties confirm that the fault was caused by improper use by the customer, Orient Power will assist the customer in handling the matter based on the actual situation and provide paid services when necessary. If the parties cannot reach an agreement on the cause of the fault, a third party may be invited to conduct an appraisal and confirmation.

11.4 The quality warranty services provided under this manual and any related expenses incurred for overseas after-sales service shall be governed by the commercial contract or warranty agreement separately agreed upon by both parties.

11.5 If a customer discovers a quality issue with a product and notifies Orient Power , maintenance personnel shall provide domestic technical support and solutions within 48 hours.

11.6 If product abnormalities are caused by customer responsibility, Orient Power will not assume responsibility for product quality assurance, and the customer shall bear the costs of handling the abnormalities.

11.7 If this product involves relevant third-party certification, other certification fees incurred shall be separately negotiated by both parties.

12. Risk warning

WARNING

CELLS ARE POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE OBSERVED IN HANDLING AND MAINTENANCE.

RUNNING TESTS ON THE CELLS IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES.

WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED.

CELL MAINTENANCE MUST BE CARRIED OUT BY PERSONNEL KNOWLEDGEABLE OF CELLS AND TRAINED IN THE SAFETY PRECAUTIONS INVOLVED.

FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS.