

动力锂离子电池

POWER LITHIUM-ION BATTERY

使用与维护保养手册

USE AND MAINTENANCE MANUAL

以人为本 以精品回报社会

People oriented Reward the society with fine works

动力锂离子电池使用与维护保养手册

power lithium-ion battery use and maintenance manual

安全指导

安全标记说明： Safety Marking Description:

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危险: 由于没有按要求操作造成的危险, 可能会导致火灾、人身严重伤害, 甚至死亡;
Danger: Danger caused by failure to operate as required, may result in fire, serious personal injury, or even death.
- 

注意: 由于没有按要求操作造成的危险, 可能会导致人身中等程度的伤害或轻伤, 以及发生系统损坏。
Caution: Moderate or minor personal injury and system damage may occur due to the risk of failure to operate as required.

用途 application	 危险 danger
	本系列电池系统主要为锂电叉车提供动力源, 请按操作规范使用, 以防触电。 The battery system of this series mainly provides power source for lithium electric forklift truck. Please use it according to the operation specification to avoid electric shock.
安装 install	 注意 attention
	本系统要远离易燃物体, 远离热源。 安装本系统时切勿将杂物落入其内部, 否则可能引起系统的故障。 The system should be away from flammable objects and heat sources. When installing this system, do not drop sundries into its interior, otherwise it may cause system failure.
安装 install	 危险 danger
	所有模块和显示屏正确连接后方可通电, 通电状态下严禁拔插线, 否则有触电的危险。 设置页面的参数不可轻易更改, 否则可能对电池造成损坏。 All modules and displays can be energized after correctly connected. It is strictly prohibited to unplug the plug cord in energized state, otherwise there is a risk of electric shock. The parameters of the setting page should not be changed easily, otherwise it may damage the battery.
	 注意 attention
	运行前, 请确认本系统是否在允许使用的范围内, 否则可能引起系统的损坏。 运行前, 请确认系统控制策略是否正确, 否则可能导致电池损坏 Before operation, please confirm whether the system is within the allowable range, otherwise it may cause damage to the system. Before operation, please confirm whether the system control strategy is correct, otherwise it may cause battery damage.
维护、检查 Maintenance and inspection	 危险 danger
	如果要拆卸外壳, 请务必断电, 否则有触电的危险。电池系统内部存在大置的电气部件和电池模组, 切勿将金属物体调入箱体内部, 以防短路。请指定合格的电气工程师人员进行维护、检查或更换部件。 If the housing is to be removed, please be sure to power off, otherwise there is a risk of electric shock. There are a large number of electrical components and battery modules in the battery system. Do not transfer metal objects into the box to prevent short circuit. Please designate qualified electrical engineers to perform maintenance, inspection or replacement of components.
安全 Safety	 注意 attention
	禁止自行改造本系统, 以免造成严重事故。 It is prohibited to transform the system by oneself to avoid causing serious accidents.
	保证电池远离危险物品或危险材料, 如具有腐蚀性的化学物品、危险的机械设备、高温环境等。 Keep the battery away from dangerous materials, such as corrosive chemicals, dangerous machinery and equipment, high temperature environment, etc.
	不合理的使用该系列产品可能导致冒烟, 如电池外部短路、过充电、过高的环境温度等。若发生冒烟的情况, 请及时切断电源, 使用黄沙及干粉灭火器进行处理。整个过程中必须及时疏散人群并及时报警 (如有必要)。 Unreasonable use of this series of products may lead to smoke, such as battery external short circuit, overcharging, too high ambient temperature, etc. In case of smoke, please cut off the power supply in time, use yellow sand and dry powder fire extinguisher for treatment. Evacuate the crowd and call the police (if necessary).

安全 Safety	 注意 attention
	不合理的使用该系列产品可能导致单体电池铝壳膨胀, 严重时可能导致电池铝壳破裂或产生裂纹, 此时应立即停止使用该电池, 请及时联系我公司相关技术部门或售后服务部门以获得处理方法。 Unreasonable use of this series of products may lead to battery cell bulge, and in severe cases may cause the battery aluminum shell to rupture or crack, at this time should immediately stop using the battery, please contact the relevant technical department or after-sales service department of our company for treatment.
	禁止拆卸、挤压、穿刺、高温搁置或烘烤电池及电池箱体, 避免电池受到过高幅度的震动、外力冲击、高处跌落等, 此操作可能导致人身伤害或财产损失。 Do not disassemble, squeeze, puncture, store or bake the battery and battery case at high temperature, to avoid the battery from excessive range of vibration, external force impact, and high drop, this operation may result in personal injury or property damage.
	禁止直接把电池的正负极短路, 避免有电池极柱压紧螺栓和导电之外的任何金属或其他导电物体接触电池的正极和负极, 此操作可能导致人身伤害或财产损失。 Do not directly short-circuit the positive and negative poles of the battery, and avoid any metal or other conductive objects other than the battery pole press bolt to contact the positive and negative pole of the battery, this operation may result in personal injury or property damage.
	禁止将电池暴露或长期搁置在55℃以上的环境中, 禁止将电池投入火中, 此操作可能导致人身伤害或财产损失。 Do not expose the battery or keep it in an environment above 55℃ for a long time. Do not put the battery into a fire. This operation may cause personal injury or property loss.
	禁止在没有安装合理的充电保护装置 (锂离子电池保护线路板、电池管理系统等) 或使用非电池制造商认可的充电设备 (充电机、直流电源等) 的情况下对电池进行充电, 此操作可能导致人身伤害或财产损失。 It is prohibited to charge the battery without proper charging protection device (lithium-ion battery protection circuit board, battery management system, etc.) or using a charging device (charger, DC power supply, etc.) that is not approved by the battery manufacturer. This operation may result in personal injury or property damage.
	禁止非厂家指定技术人员私自拆装电池, 此操作可能导致人身伤害或财产损失。 It is forbidden for non-manufacturer designated technicians to disassemble or install the battery privately. Such operation may cause personal injury or property loss.
	禁止将电池浸入到水或其他导电的液体中, 此操作可能导致人身伤害或财产损失。 Do not immerse batteries in water or other conductive liquids, which may result in personal injury or property damage.
	禁止儿童和其他缺乏锂离子电池安全使用知识的人使用本系类产品, 此操作可能导致人身伤害或财产损失。 Children and other persons without knowledge of safe use of lithium-ion batteries are prohibited from using these products. Such operation may result in personal injury or property damage.
	禁止将本系列产品与其他型号或类型的电池进行串联或并联使用, 此操作可能导致人身伤害或财产损失。 It is forbidden to use this series of products in series or parallel with other types of batteries, such operation may cause personal injury or property loss.
	禁止将含有锂离子电池保护线路板或电池管理系统的整套电源系统再进行串联或并联操作, 此操作可能导致人身伤害或财产损失, 若有需要请联系系本公司相关技术部门以获得正确的技术支持。 It is prohibited to operate the entire power supply system containing the lithium-ion battery protection circuit board or battery management system in series or in parallel. Such operation may cause personal injury or property damage, if necessary, please contact the relevant technical department of our company to obtain the correct technical support.

请用户在安装、使用和维修本系统时仔细阅读本章, 务必按照本章内容所要求的安全注意事项进行操作, 如出现因违规操作而造成的任何伤害和损失均与本公司无关。

Please read this chapter carefully when installing, using and maintaining the system, and be sure to operate in accordance with the safety precautions required in this chapter. The company has nothing to do with any injury or loss caused by illegal operation.

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一、产品特点 Product feature

- 目前我司可自主研发设计与PACK生产电动叉车动力锂离子电池。我司所选用的电芯为锂电行业排名前列的磷酸铁锂电芯，电芯具有安全性好、内阻小、能量密度高、高温特性好，循环寿命长等优点。

At present, our company can independently design and produce lithium ion batteries for electric forklift trucks. The batteries selected by our company are lithium iron phosphate batteries, which are in the forefront of the lithium industry. The batteries have the advantages of good safety, low internal resistance, high energy density, good high and low temperature characteristics, long cycle life and so on.

- 我司的电池系统标配以下功能：低温电加热、全时均衡、故障远程预警、远程报警、远程监控与诊断、远程定位、网络程序烧录等。

Our battery system comes standard with the following functions: low-temperature electric heating, full time equalization, remote fault early warning, remote alarm, remote monitoring and diagnosis, remote positioning, network program burning, etc.

- 磷酸铁锂电池是指用磷酸铁锂作为正极材料的锂离子电池，主要应用方向为动力电池，该类型电池相对铅酸电池而言具有体积小、重量轻、循环寿命长、安全性高和绿色环保等优点。

Lithium iron phosphate battery refers to the lithium ion battery using lithium iron phosphate as the cathode material, the main application direction is power battery. Compared with lead-acid battery, this type of battery has the advantages of small volume, light weight, long cycle life, high safety and green pollution-free.

- 磷酸铁锂电池完全解决了镍钴锰三元锂电池的安全隐患，在许多恶劣的条件下也不会产生起火和爆炸；我司所选用的电池电芯通过了以下验证：穿刺、挤压、振动、短路、过充电、过放电等安全性能指标完全符合国家标准，不起火、不爆炸；我司部分电芯拥有UN38.3认证证书。

Lithium-iron phosphate battery completely solved the safety hidden danger of nickel-cobalt-manganese ternary lithium battery, it will not cause fire and explosion under many harsh conditions; The battery cells selected by our company have passed the following verification: puncture, extrusion, vibration, short circuit, overcharge, over discharge and other safety performance indicators are fully in line with national standards, no fire, no explosion; Part of our cell has UN38.3 certification.

- 磷酸铁锂电池不含任何重金属与稀有金属，在制造和使用过程中完全不使用任何对人体和环境有害材料，是当今全球最环保的绿色电池之一。

Lithium-iron phosphate battery does not contain any heavy metals and rare metals, and does not use any harmful materials to human body and the environment in the process of manufacture and use. It is one of the most environmentally friendly green batteries in the world today.

二、术语和定义 Terms and definitions

标称电压 nominal voltage

用来表示电池电压的一个适当的近似数值。

An appropriate approximate value for the battery voltage.

过放电 over-discharge

电池电压低于放电截止电压时的状态。

A state in which the battery voltage is below the discharge cutoff voltage.

标称容量 nominal capacity

在规定条件下，电池处于完全充电态所能提供的由制造商标明的容量值。

The manufacturer's stated capacity of a fully charged battery under specified conditions;

实际容量 actual capacity

在规定条件下，充满电的单体电池以规定的放电电流所实际放出的容量值。

The actual discharge capacity of a fully charged single cell at a specified discharge current under specified conditions.

最高充电电压

maximum charging voltage

由电芯制造商推荐的在充电过程中不应超过的充电电压。

The charging voltage recommended by the cell manufacturer that should not be exceed.

过电流 excess current

电池的充、放电电流值高于电芯制造商允许的最大充、放电电流的状态，通常可视为电池进入过电流状态。

A state in which the charge and discharge current value of the battery is higher than the maximum charge and discharge current allowed by the cell manufacturer, which can usually be regarded as an over-current state of the battery.

功率型蓄电池

high power density battery

以高功率密度为特点，主要用于瞬间高功率输出、输入的蓄电池，俗称倍率型电池。

Characterized by high power density, it is mainly used for instantaneous high power output and input batteries, commonly known as multiplier batteries.

充电终止电流

end-of-charge current

在指定的恒压充电模式下，蓄电池终止充电的电流值

In the specified constant voltage charging mode, the current value of the battery to stop charging.

过充电 overcharge

电池电压高于最高充电电压时的状态，通常可视为电池进入过充电状态。

A state in which the battery voltage is higher than the maximum charging voltage, usually can be considered that the battery has entered the overcharged state.

能量型蓄电池

high energy density battery

以高能量密度为特点，主要用于高能量输出的蓄电池，俗称容量型电池。

Characterized by high energy density, it is mainly used for batteries with high energy output, commonly known as capacity-type batteries.

荷电保持能力 charge retention

完全充电的蓄电池在一定温度下储存一定时间后，放电容量与初始容量之比。

The ratio of the discharge capacity to the initial capacity of a fully charged battery after being stored at a certain temperature for a certain period of time.

容量恢复能力 charge recovery

完全充电的蓄电池在一定温度下储存一定时间后，再完全充满电，其后放电容量与初始容量之比。

A fully charged battery is stored at a certain temperature for a certain period of time, and then fully charged. The ratio of its discharge capacity to its initial capacity.

荷电状态 state of charge

蓄电池内存储的电流，一般以百分比显示，例如30%SOC即表示蓄电池目前存储了标称容量30%的电量，SOC是State of Charge的缩写，即电池（组）荷电状态。

The current stored in the battery, is generally shown as a percentage. For example, 30%SOC means that the battery currently stores 30% of its nominal capacity. SOC is the abbreviation of State of Charge, namely the State of Charge of the battery (group).

起火 fire breaking out

蓄电池壳体内存出明火。

The open fire breaks out in the battery shell.

注：此种状态表明电池已热失控。

Note: this state indicates that the battery has been thermal out of control.

电池管理系统 battery management system

一种能监控蓄电池电压、电流、温度，并能与充电器、负载、热管理系统及其他系统进行通讯，通过一系列控制动作以使蓄电池达到最佳使用性能的电子电器系统，BMS是Battery Management System的缩写。

The utility model relates to an electronic and electrical system which can monitor the voltage, current and temperature of the battery, communicate with the charger, load, thermal Management System and other systems, and achieve the best performance of the battery through a series of control actions. BMS is the abbreviation of Battery Management System.

爆炸 explode

蓄电池外壳破裂，内部有固体物质从蓄电池内冲出，并发出声音。

Battery shell ruptures, internal solid material rushes out from the battery, and makes a sound.

注：此种状态表明电池已热失控，是电池失效最危险的状态。

Note: This state indicates that the battery has been thermal out of control, is the most dangerous state of battery failure.

泄漏 leakage

蓄电池的内部成分（电解液、气体或其他物质）从电池中漏出，泄漏部分的总重量超过电池初始重量的1%时，即为泄漏。

The internal components of the battery (electrolyte, gas or other substances) leak from the battery, the total weight of the leakage part exceeds 1% of the initial weight of the battery, that is, leakage.

CAN通讯 CAN communications

控制器局域网

Control Area Network

充电模式CC/CV charging mode CC/CV

CC模式是恒流充电模式，CV是恒压充电模式。

CC mode is constant current charging mode, CV is constant voltage charging mode.

三、电池系统介绍 Battery system introduction

本系列电池系统以和鼎锂电叉车为主配套，以其他工业车辆整车厂和铅酸换锂电后市场为辅配套。本系列电池系统所选用的电芯正极材料类型为磷酸铁锂，能量密度高、安全性高。电池系统在0℃以下环境中将开启充电加热或放电加热，增加整车的续航时间和工作时间。电池系统具备远程监控、全时均衡、远程烧录等功能，可实时监测电池系统的状态信息并远程更新程序。

The battery system of this series is mainly supported by Heding lithium battery forklift, and is supplemented by other industrial vehicle manufacturers and lead-acid to lithium aftermarket. The cathode material used in this series battery system is lithium iron phosphate, which has high energy density and high safety. The battery system will start charging heating or discharging heating in the environment below 0℃ to increase the endurance and working time of the vehicle. The battery system has the functions of remote monitoring, full-time equalization, remote burning and so on. It can monitor the status information of the battery system in real time and update the program remotely.

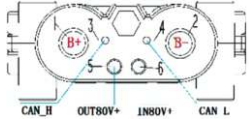
3.1 系统参数表 system parameters table

序号 No.	项目 project	技术参数 technical parameters
1	额定电压 Rated voltage	25.6V
2	额定容量 Rated capacity	202Ah
3	额定重量 Rated weight	65kg
4	推荐工作温度 Recommended working temperature	5-55℃
5	工作电压范围 Operating voltage range	20~29.2V(最大使用范围) (maximum range of use)
6	推荐SOC工作范围 Recommended SOC working range	10%~100%
7	长时间搁置电量要求 Electricity demands for long-term storage	20%~40% (荷电状态) (State of Charge)
8	短期 (1个月) 贮存温度 Short-term(1month)storage temperature	10℃~40℃
9	长期 (1年内) 贮存温度 Long-term (within 1 year) storage temperature	10℃~35℃

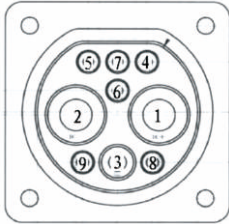
3.2 接口定义 Interface definition

本系列锂电池系统主要有以下两种接口定义：
 This series of batteries mainly have the following interface definitions:

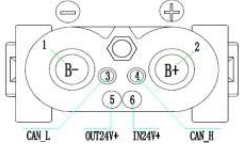
3.2.1、REMA320母端放电电缆束插件
 REMA320 Female discharge harness plug-in

REMA型号 Rema model: 95515-39  (插合面视图) (Plug plane view)	适用项目 For the project	80V272AH (H3 model)
	6PIN插座插孔号码 6PIN socket number	号码管定义说明 Description of definition of number tube
	1	放电 discharging80V+
	2	放电 discharging80V-
	3	整车 CAN H Whole vehicleCANH
	4	整车 CAN L Whole vehicleCANL
	5	OUT80V+
	6	IN80V+

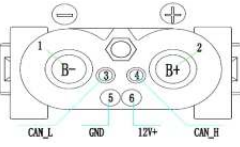
3.2.2、国标250A充电插座 GB 250A charging socket

 充电座 (沃尔 250) Charging socket (Wal 250) 型号: 680411101062 Model: 680411101062	9PIN 插座插孔号码 9PIN socket number	号码管定义说明 Description of definition of number tube
	1(DC+)	充电 Rechargeable electric 80V+
	2(DC-)	充电 Rechargeable electric 80V-
	3(GND)	保护接地 protective grounding (PE)
	4(S+)	充电 Rechargeable electric CANH
	5(S-)	充电 Rechargeable electric CANL
	6(CC1)	充电连接 The charging connection CC1
	7(CC2)	充电连接确认 Charging Connection Confirmation CC2
	8(A+)	充电 Rechargeable electric 12V+
	9(A-)	充电 Rechargeable electric 12V-

3.2.3、REMA160母端放电电线束插件 REMA160 female discharge harness plug-in

REMA型号: 95005-32 Rema model: 95005-32  (插合面视图) (Plug plane view)	适用项目 For the project	铅酸换锂电 (25.6V电压平台) Lead-acid for lithium (25.6V voltage platform)
	6PIN插座插孔号码 6PIN socket number	号码管定义说明 Description of definition of number tube
	1	放电 discharge 25.6V-
	2	放电 discharge 25.6V+
	3	整车 CAN H Whole vehicle CAN H
	4	整车 CAN L Whole vehicle CAN L
	5	OUT25.6V+
	6	IN25.6V+

3.2.4、REMA320母端放电电线束插件 REMA320 female discharge harness plug-in

REMA型号: 95615-39 Rema model: 95615-39  (插合面视图) (Plug plane view)	适用项目 For the project	铅酸换锂电 (51.2V电压平台) Lead-acid for lithium (51.2V voltage platform)
	6PIN插座插孔号码 6PIN socket number	号码管定义说明 Description of definition of number tube
	1	放电 discharge 51.2V-
	2	放电 discharge 51.2V+
	3	整车 CAN H Whole vehicle CAN H
	4	整车 CAN L Whole vehicle CAN L
	5	OUT51.2V+
	6	IN51.2V+

备注：具体插件型号见对应的锂电池系统。
 Note: refer to the corresponding lithium battery system for the specific connector model.

四、锂离子电池为何需要保护电路
 Why lithium-ion batteries need circuits protection

所有的电池在充电或放电（即电能与化学能相互转换）过程中，对接受或释放电荷的能力是有一定限度的，电池本身并不能主动阻止电荷流进或流出。所有种类的电池都会有这样的问题，当然锂电池也不例外。电池在充电过程中，电池接受电荷使自身产生化学能，当自身内部的化学能量全部转换完毕后，如果外部电能还源源不断地输送进来，这就需要电池将过剩的能量转变为其他形式能量释放出来或切断外部能量的继续输入。

All batteries are limited in their ability to receive or release charge during charging or discharging (i.e. the exchange of electrical and chemical energy). The battery itself does not actively prevent charge from flowing in or out. All types of batteries have this problem, but lithium-ion batteries are no exception. In the process of battery charging, the battery receives charge to produce chemical energy itself. When all the internal chemical energy is converted, if the external electricity is still flowing in, it requires the battery to convert the excess energy into other forms of energy to release or cut off the continued input of external energy.

4.1、各种类型电池的不同处理方式：
 Different treatment methods of various types of batteries:

- 铅酸电池 Lead-acid batteries**
 产品设计中有泄气阀装置，当过充电时，多余的能量可以转变为热能，由水蒸气通过泄气阀释放。这样，一定程度上的电池过充失衡的问题就在电池的内部解决了。
 There is a vent valve device in the design of the product. When overcharged, the excess energy can be converted into heat energy, which is released by water vapor through the vent valve. In this way, a certain degree of overcharge imbalance is resolved inside the battery.

● 镍氢电池 NI-MH battery

产品设计中引入: Introduction to product design:

- A. 负极过量以产生镉氧循环效应;
A. Excessive negative electrode to produce Cadmium oxygen cycling effect;
- B. 半密封泄气装置, 使电池既能密封使用, 又能达到过充释放气体的功能, 一定程度上的电池过充失衡的问题也能在电池的内部解决了。
B. Semi-sealed air discharge device, so that the battery can not only be sealed for use, but also achieve the function of overcharging and releasing gas. To some extent, the problem of overcharging imbalance of the battery can also be solved inside the battery.

● 锂离子电池 lithium ion battery

产品的全密封结构决定了解决预防过充的功能只能设在外部电池中如果过度充电把太多的锂离子硬塞进负极碳结构里去, 而使得其中一些锂离子再也无法释放出来。同样, 在放电过程中, 电池通过释放化学能产生电能, 当自身内部的化学能量全部转换完毕后, 如果电池继续被过度放电, 负极片的铜箔在电压的驱使下会以离子的形式附着到正极上, 正极片表面将会出现微红色的紫铜, 将对锂离子电池的正负极造成永久性损坏, 从分子层面看, 可以直观的理解, 过度放电将导致负极碳过度释出锂离子而使得其片层结构出现塌陷, 造成电池失效。这就是锂离子电池为什么通常配有充放电的控制保护电路的原因。

The fully sealed structure of the product determines that the function to prevent overcharging can only be located in the external battery. If overcharging, it will force too many lithium ions into the carbon structure of the negative electrode, some of them will never be released again. Similarly, in the process of discharge, battery generate electricity by releasing chemical energy, when all the chemical energy within itself has been converted, if the battery discharge continue to be excessive, the cathode piece of copper foil in voltage driven in the form of ions will be attached to the anode, cathode surface will appear red copper, will cause permanent damage to cathode and anode of lithium ion battery, from molecular level, it can be intuitively understood that, discharge will cause excessive release of lithium ion from the anode carbon and its layer structure appeared to collapse, causing the battery failure. This is why lithium-ion batteries are often equipped with protective circuitry to control charge and discharge.

4.2. 单体锂电池的保护方案:

Protection scheme of lithium battery unit: Different treatment methods of various types of batteries:

根据锂离子电池的化学特性, 在正常使用过程中, 其内部进行电能与化学能相互转化的化学反应, 但在某些条件下, 如对其过充电、过放电和过电流将会导致电池内部发生非正常化学反应, 会严重影响电池性能与使用寿命, 并可能产生大量气体, 使电池内部压力迅速增大后而导致电池鼓胀后失效。因此, 所有的锂离子电池都需要一个保护电路, 用于对电池的充、放电状态进行有效监测和管理, 并在某些条件下关断充、放电回路以防止对电池的进一步损坏。

因此, 电池保护电路一般包括过充保护、过放保护、过电流保护、温度保护、短路保护、绝缘保护等来有效的保障电池的正常使用。

According to the chemical characteristics of lithium ion battery, in the process of normal use, its internal energy and chemical energy converted to normal chemical reaction. However, under certain conditions, such as overcharge, over discharge and overcurrent, abnormal chemical reactions will occur in the battery, which will rapidly increase the internal pressure of the battery and lead to the failure of the battery after bulging. Therefore, all lithium-ion batteries need a protection circuit to effectively monitor and manage the battery's charge and discharge status, and to shut off the charge and discharge circuit under certain conditions to prevent further damage to the battery.

Therefore, the battery protection circuit generally includes overcharge protection, over discharge protection, overcurrent protection, temperature protection, short circuit protection, insulation protection and so on to effectively guarantee the normal use of the battery.

五、动力电池使用说明和保养注意事项

Battery instructions and maintenance precautions

5.1 电池运输基本要求 Basic requirements for battery transportation

1) 运输车辆应是符合锂电池运输的合法车辆。

The transport vehicle shall be a legal vehicle in line with the lithium battery transport.

2) 车厢内应保持干净、无杂物、无积水、无易燃易爆物品、无有机溶剂等; 并采取防雨、防潮措施。

The compartment should be kept clean, without debris, no water, no flammable and explosive goods, no organic solvents, etc.; and take measures against rain and moisture.

3) 电池运输过程中, 须避免遭受日光暴晒, 避免被雨水淋湿。

In the process of battery transportation, avoid being exposed to sunlight and wet by rain.

4) 锂电池正立方式堆码整齐, 其高度不得超过包装箱上规定的层数。

Lithium-ion batteries are stacked neatly in the upright way, and their height shall not exceed the number of layers specified on the packing box.

5) 电池在装卸过程中, 应轻搬轻放、严防摔掷、翻滚、重压、倒置等。

In the process of loading and unloading, the battery should be moved gently and prevented from throwing, rolling, heavy pressure, upside down etc.

6) 电池在转运和使用的过程中, 须避免受到外力的强烈撞击和过分挤压, 以免造成电池外壳破损或内部结构损坏造成的内短路。

In the process of transporting and using the battery, it is necessary to avoid strong impact and excessive extrusion from external forces, so as to avoid internal short circuit caused by damage to the battery shell or internal structure.

5.2 电池使用基本要求 Basic requirements for battery use

1) 在使用电池前, 须认真阅读电池使用手册和其他指导性说明材料, 充分了解磷酸铁锂电池充放电特性, 掌握BMS (或锂电池保护板) 和锂电池充电机的使用方法。

Before using the battery, read the battery operating manual and other instructive materials carefully, fully understand the charging and discharging characteristics of lithium iron phosphate battery, and master the usage of BMS (or lithium battery protection plate) and lithium battery charger.

2) 除特殊说明外, 电池产品充放电参数为:

Unless otherwise specified, the battery product charge and discharge parameters are:

2.1、单体电池充电截止电压: 3.6 V (多阶段恒流模式充电, 单体电池最高充电截止电压。即单体电池的充电上限电压, 一旦单体电池电压上升到3.6 V, 应立即切断充电电流), 不同电池技术参数设置以电池实际设定值为准。

Battery unit charging cut-off voltage: 3.6V (multi-stage constant current mode charging, the highest charging cut-off voltage of battery unit. That is, the upper limit of the charging voltage of the battery unit. Once the voltage of the battery unit rises to 3.6V, the charging current should be cut off immediately). Different battery technical parameters are set according to the actual set value of the battery.

2.2、N支电池串联充电电压: $N \times 3.6V$ (多阶段恒流模式充电, 充电机须能够依据相应单体电压自动转换相应的恒流充电电流), 不同电池技术参数设置以电池实际设定值为准。

N battery series charging voltage: $N \times 3.6V$ (multi-stage constant current mode charging, the charger shall be able to automatically convert the corresponding constant charging current according to the unit voltage), different battery technical parameters are set according to the actual set value of the battery.

2.3、单体电池放电报警电压: 3.0V (电池处于放电状态时对应的单体最低电压值, 车辆仪表对应电量显示约为10%) (当单体电池开路电压下降到3.1V时, 电池组放电深度已超过85%放电深度; 当单体电池开路电压下降到3.0V时, 电池组放电深度已超过90%放电深度。强烈建议用户坚持浅充浅放的电池使用方法, BMS监测到单体电池电压下降至3.0V时, 应提醒用户及时给电池充电)。

Battery unit discharge alarm voltage: 3.0V (corresponding to the lowest voltage value of the unit when the battery is in the discharge state, the vehicle instrument's display corresponding to the power is about 10%) (When the open circuit voltage of the battery unit drops to 3.1V, the depth of discharge of the battery pack has exceeded 85%; when the open circuit voltage of the battery unit drops to 3.0 V, the depth of discharge has exceeded 90%. It is strongly recommended that user stick to the usage of shallow charging and shallow discharge of the battery. It should remind user to charge the battery in time when BMS detect that the voltage of a battery unit drops to 3.0V.).

2.4、单体电池放电截止电压: 2.5V (电池处于放电状态时对应的单体最低电压值, 车辆仪表对应电量显示约为0%) (-20℃条件电池放电截止电压为2.0V, 单体电池电压下降到该值时须马上将电池的放电功率限制为0%, 电池若被严重过放电, 造成的容量损失不可恢复。

Discharge cutoff voltage of battery unit: 2.5V (the lowest voltage value of the battery unit when the battery is in discharge state, and the corresponding figure displayed by vehicle instrument is about 0%). (The discharge cutoff voltage of the battery under -20℃ condition is 2.0V, and the discharge power of the battery shall be limited to 0% immediately when the voltage of the battery unit drops to this value. If the battery is seriously over-discharged, the capacity loss could not be recovered).

3) 电池温度参数 (测量电池极柱处温度) : 电池温度上升至60°C时, BMS控制电机降功率运行; 电池温度上升至65°C时, BMS控制电机停止运行; 不同电池技术参数设置以电池实际设定值为准。

Battery temperature parameters (measure the temperature at the battery pole) : when the battery temperature rises to 60°C, BMS controls the motor to run with power down; when the battery temperature rises to 65°C, the BMS controls the motor to stop running; technical parameters of different battery are set according to the actual set value of the battery.

4) 为保证安全而有效地使用电池, 必须使用专属配套的动力锂离子电池管理系统和锂电池充电机, 由非配套设备导致电池性能异常, 所造成的任何损失, 电池售方将不负任何责任。

In order to ensure safe and effective use of the battery, the exclusive supporting power lithium-ion battery management system and lithium-ion battery charger must be used. The battery seller shall not be responsible for any loss caused by abnormal battery performance caused by the non-supporting equipment.

5) 任何情况下, 测试或使用电池时都必须对单体电池的端电压进行实时监测, 严禁在无电池管理系统或保护板的情况下对电池组进行串联充放电试验, 以免造成对电池过充电或过放电。

In any case, the terminal voltage of the battery unit must be monitored in real time when testing or using the battery. It is strictly prohibited to carry out series charging and discharging test on the battery pack without battery management system or protection plate, so as to avoid overcharge or overdischarge of the battery.

6) 严禁对电池进行反向充电, 一次反向充电即可导致电池电压归零, 电池系统提前报废。

It is strictly prohibited to reversely charge the battery. A single reverse charge will result in the battery voltage returning to zero and the battery system being scrapped in advance.

7) 必须确定BMS与锂电充电机之间的通讯规范, 做好BMS与锂电充电机之间的信号对接 (使用CAN协议通讯), 确保充电过程中锂电充电机受BMS实时监测, 避免电池被过充电。

It is necessary to determine the communication specification between BMS and lithium battery charger, and do a good job in the signal docking between the BMS and the lithium battery charger (using CAN protocol to communicate), so as to ensure that the lithium battery is monitored by BMS in

real time during the charging process and to avoid the battery being overcharged.

8) 必须确定BMS与电机控制器之间的通讯规范, 做好BMS与电机控制器之间的信号对接 (使用CAN协议通讯), 确保充电过程中锂电充电机受BMS实时监测, 避免电池被过放电。

The communication specification between BMS and motor controller must be determined, and the signal docking between BMS and motor controller should be done well (CAN protocol is used for communication), so as to ensure that the lithium-ion charger is monitored by BMS in real time during the charging process and to avoid the battery being overdischarged.

9) 新电池出厂一般只有30%荷电 (SOC), BMS和锂电充电机调试完成之前请不要长时间使用, 以免电池被过放电。

Generally, the new battery is only 30% SOC when it leaves the factory. Please do not use it for a long time before the debugging of BMS and lithium-ion charger is completed to avoid overdischarge of the battery.

10) 电池在使用过程中, 强烈建议坚持充电电量90 % (90 % SOC), 放电电量80% (80%DOD) 的浅充浅放原则, 单体电池开路电压下降到3.1V时实际荷电已不足20%, 此时应及时给电池组充电。

In the process of using the battery, it is strongly recommended to insist on charging 90% (90% SOC) and discharging 80% (80%DOD) principle of shallow charge and shallow discharge. When the open circuit voltage of the battery unit drops to 3.1V, the actual SOC is lower 20%, and the battery pack should be charged in time.

11) 测试或使用车辆时应时刻注意观察电池组的剩余电量, 切忌电量用尽时才拖车回去充电, 拖车过程中车载DC-DC (给灯光、雨刷器、喇叭等供电)、转向、刹车等系统仍在消耗电量, 拖车距离较远时同样会导致电池过放电。

When testing or using the vehicle, attention should be paid to the remaining charge of battery pack. Do not tow back to charge after the battery is exhausted. In the process of trailing, the vehicle's DC-DC (to supply power to lights, windshield wipers, speakers, etc.), steering, braking and other systems are still consuming power.

5.3 电池存储和保养基本要求

Basic requirements for battery storage and maintenance

1) 如果暂时不用, 电池应贮存在温度5~40°C干燥、清洁及通风良好的仓库内。
If not used temporarily, the battery should be stored in a dry, clean and well-ventilated warehouse with a temperature of 5~40°C.

2) 仓库内须设置专门的电池放置区, 区域内严禁存放其他易燃易爆等危险品, 电池距离热源不得少于2m。

A special battery storage area shall be set up in the warehouse. Flammable, explosive and other dangerous goods shall not be stored in the area. The battery distance from the heat source shall not be less than 2m.

3) 一般情况下库存电池应装箱存放, 直接摆放在地面上的电池上须平铺一层绝缘覆盖物, 并悬挂警示标志。

Under normal circumstances, the stock battery should be stored in boxes, and batteries placed directly on the ground shall be covered with a layer of insulating cover and hung with warning signs.

4) 库存电池不得倒置及卧放, 应避免机械冲击或重压, 严禁将电池暴晒和淋雨。
The battery in stock shall not be placed upside down or lying down. Mechanical impact or heavy pressure shall be avoided. It is strictly prohibited to expose the battery to the sun and rain.

5) 制定库存电池电压跟踪表, 每3个月检查一次库存电池电压, 并做好详细记录。
Develop a voltage tracking table for stored batteries, check the voltage of stored batteries every 3 months, and make detailed records.

6) 每6个月对库存电池进行一次全充全放测试, 充放电倍率0.3 C, 并做好详细记录。

Carry out a full charge and discharge test on the stock battery once every 6 months, with a charge and discharge rate of 0.3C, and make detailed records.

电池的工作温度要求分为充电温度要求和放电温度要求

Battery operating temperature requirements are divided into charging temperature requirements and discharge temperature requirements.

7) 充电温度范围为: 0 ~ 55°C, 0°C以下低温环境下大倍率充电会对电池造成损害。

Charging temperature range: 0~55°C. Under low temperature environment below 0°C large rate charging will cause damage to the battery.

8) 放电温度范围为-20~60°C, 低温下 (-20~0°C) 的放电容量较常温下相比可能会有所降低; 电池可以在40~50°C环境温度下使用, 但电池的环境温度过高, 尤其电池长期处于高温环境下会加速电池内部材料的老化, 缩短电池的使用寿命, 因此不推荐电池长期在高温下使用。

The discharge temperature ranges from -20 °C to 60°C, and the discharge capacity at low temperature (-20 °C to 0°C) may be lower than that at normal temperature. Battery can be used at the ambient temperature of 40~50°C, but too high ambient temperature of the battery, especially when the battery is in a high temperature environment for a long time, will accelerate the aging of the internal materials of the battery and shorten the service life of the battery, so it is not recommended to use battery at high temperature for a long time.

9) 环境温度超出上述充放电温度范围使用时会对电池性能造成负面影响或损害, 可能缩短电池的使用寿命, 请避免。

If the ambient temperature exceeds the above range of charging and discharging temperature, the battery performance will be negatively affected or damaged, which may shorten the service life of the battery. Please avoid it.

5.4警告 warning

- 请严格按照电池系统使用说明书规定条件使用电池系统, 否则可能不被包含在质保范围内。

Please use the battery system in strict accordance with the conditions specified in the battery system instruction manual, otherwise it may not be included in the warranty scope.

- 请勿在温度超过55°C或低于-20°C环境下操作装有锂电池的电动车辆。
Do not operate electric vehicles equipped with lithium batteries at temperatures above 55°C or below -20°C.

- 0 °C以下可通过电加热系统给电池加热, 待电池加热到最低温度为1°C时方能充电 (从纯加热模式到充电模式均由BMS控制); 无电加热功能时, 禁止在0°C以下给电池充电。

The battery can be heated by electric heating system below 0 °C, and can only be charged when the battery is heated to the lowest temperature of 1°C(from pure heating mode to charging mode are controlled by BMS); When there is no electric heating function, it is forbidden to charge the battery below 0°C.

- 请勿直接冲洗电池箱体，防止电池箱体进水后发生触电事故，损坏电池系统。
Do not directly wash the battery box, to prevent electric shock accident after the battery box enters water, with damages to the battery system;
- 非专业人员，请勿触碰、移动、拆解电池系统及相应的高压线缆，或其他带有高压警示标识的电气部件。
Non-professionals are not allowed to touch, move or disassemble the battery system and the corresponding high-voltage cables or other electrical components with high-voltage warning marks.

5.5注意 attention

- 根据电池的特性，在三包范围内电池的容量衰减范围为0%~25%。
According to the characteristics of the battery, the capacity attenuation range of the battery in the range of three guarantees is 0%~25% .
- 为达到更好的使用效果，延长电池使用寿命，建议每年联系厂家，并由厂家技术人员进行一次电池性能检测及均衡充电。
In order to achieve better use effect and prolong the battery service life, it is recommended to contact the manufacturer every year, and the technical personnel of the manufacturer will conduct a battery performance test and balanced charging.
- 如果车辆行驶过程中受到强烈碰撞，在安全区域停止车辆并检查电池系统是否受损。
If the vehicle is subjected to a strong collision during driving, stop the vehicle in a safe area and check for damage to the battery system.
- 如发现电池系统泄漏（液体或烟雾）、破损，请远离至安全距离，并联系厂家售后服务人员；当发生电解液泄漏时，请勿接触，并佩戴好防毒面具或口罩；若不慎接触时，迅速用大量清水冲洗，并及时就医。
If the battery system leaks (liquid or smoke) or is damaged, please stay away from it to a safe distance and contact the manufacturer's after-sales service personnel. When electrolyte leakage occurs, do not contact, and wear a gas mask or mask; In case of accidental contact, rinse immediately with plenty of water and seek medical attention in time.

- 当车辆或电池系统起火时，迅速离开车辆至安全距离，请使用黄沙、干粉灭火器或将电池系统浸入水池中（如现场具备条件）进行处理，使用水灭火或不正确灭火器灭火可能会发生人员触电事故。
In case of a fire in the vehicle or battery system, leave the vehicle quickly to a safe distance, using a yellow sand, dry powder extinguisher or immerse the battery system in the pool (if the site is available) for disposal, using water or incorrect fire extinguisher to extinguish the fire may cause electric shock accident.
- 电池组长期储存（储存时间超过6个月）时，需完全断电（按下车辆紧急断电开关或拔下整车与电池组对插的REMA插件），厂家推荐在40%~60%电量下储存，储存环境湿度不高于95%RH。
When the battery pack is stored for a long time (more than 6 months), it shall be completely powered off (press the emergency power off switch of the vehicle or unplug the REMA plug-in that the vehicle plugs into the battery pack). The manufacturer recommends storing it at 40%-60% power, and the humidity of the storage environment is not higher than 95%RH.
- 在指定时间内进行一次满充满放（见表格），之后按要求储存。
Make a full discharge and a full charge within the specified time (see table), and then store as required.

储存环境 Storage Temperature	储存环境相对湿度 Stores ambient relative humidity	储存时间 storage time	推荐存储SOC Storing SOC values is recommended
-10~0℃	5%~95%	≤6 months	20%~40%SOC
10~40℃	5%~95%	≤6 months	20%~40%SOC
40~45℃	5%~95%	≤2 months	20%~40%SOC

六、电池维护周期与维护措施 Battery maintenance cycle and maintenance measures

1)每月对电池的使用情况，以及BMS和充电机的工作情况进行一次系统地例行检查，并详细记录，确保及时发现隐患并及时解决问题。

Conduct a monthly systematic routine inspection of the battery usage, BMS and the working condition of the charger, and make detailed records to ensure timely detection of hidden dangers and timely solution.

2)认真检查动力主回路上的熔断器连接螺栓、接触器连接螺栓和断路器连接螺栓，以及所有的电池极柱连接螺栓的紧固程度。

Carefully check the fuse connecting bolts, contactor connecting bolts and circuit breaker connecting bolts on the power main circuit and the tightness of the plug and all battery pole connecting bolts.

3)认真检查所有电源连接器和电气连接件的连接可靠性，检查电气线路的绝缘性，以及电缆线、铜排的破损和老化情况。

Carefully check the connection reliability of all power connectors and electrical connectors, check the insulation of electrical lines, as well as damage and aging of cables and copper bars.

4)检查BMS检测到的数据与实际测量的电池电压数据和电流数据之间的差异，检查BMS信号采集精度、SOC计算精度是否需要校准。

Check the difference between the data detected by the BMS and the actual measured battery voltage data and current data, check whether the BMS signal acquisition accuracy and SoC calculation accuracy need to be calibrated.

5)检查整组电池系统的电压一致性，如果电池的静态压差和动态压差表现出较大差异时，请按故障排除方法操作。

Check the voltage consistency of the whole battery system. If the static pressure difference between the battery and the dynamic pressure difference show a big difference, please operate according to the troubleshooting method.

七、故障排除方法 Troubleshooting method

1) 检修和维护操作施工须注意电池系统的高压安全。

Pay attention to the high-voltage safety of the battery system during inspection and maintenance operations.

2)电池充放电过程中，尤其是大电流充放电时，若BMS检测到某单体电池的电压变化幅度很大，且明显异于其它电池，请认真检查电池极柱螺栓是否拧紧，如果没有拧紧，请拧紧极柱螺栓。

In the process of battery charging and discharging, especially in the process of high current charging and discharging, if the BMS detects that the voltage of a battery unit varies greatly and is obviously different from that of other batteries, please carefully check: Whether the battery pole bolt is tightened, if not, please tighten the pole bolt.

3) 检查电气连接处是否存在严重的氧化层，如果电池极柱表面、铜排表面、电缆线接线鼻子表面产生了大量氧化层，请用砂纸去除这些电气接触面的氧化层。

Check whether there is a serious oxide layer at the electrical connection. If there is a large amount of oxide layer on the surface of the battery pole column, the surface of the copper bar and the surface of the cable nose, please remove the oxide layer on the electrical contact surface with sandpaper.

4) 连接到该电池的BMS电压采集线是否连接可靠，如果存在虚接现象，请加以改正。

Whether the BMS voltage acquisition line connected to the battery is reliably connected. If there is a virtual connection, please correct it.

5)一旦不小心造成了电池过放电，请首先用20A以下电流对电池进行修复性充电，待该支电池电压上升到3.2V以上时再按正常倍率充电。如果该电池的电压不能恢复，或者不能保持正常值，请用备用电池更换。

Once the battery is over discharged accidentally, please first use the current below 20 A to perform a repair charge. When the voltage of the battery rises to more than 3.2V, charge it at the normal rate. If the voltage of the battery cannot be restored, or the normal value cannot be maintained, please replace it with a spare battery.

6)一旦电池被反向充电，请用备用电池更换，必须将新更换的电池与其他电池的荷电状态调整一致。

Once the battery is charged in reverse, please replace it with the spare

battery. The newly replaced battery must be adjusted to the state of charge of other batteries.

7)BMS电压采集线是否存在跨箱接线、连接线过长等问题。如果某根电压采集线经过较长的电缆线才连接到电池的极柱上,由于充放电过程中电缆线上的压降很大,给该电池电压测量带来了非常大的误差,请改进接线方式。

Whether the BMS voltage acquisition line has cross-box wiring, too long connecting wire and other problems. If a certain voltage collection line is connected to the pole of the battery after a long cable, because the voltage drop on the cable is very large in the process of charging and discharging, it brings very large error to the battery voltage measurement. Please improve the wiring mode.

8)铜排由若干单片组成,片与片之间如有氧化层,较难处理,请用备用铜排更换。

The copper row is composed of a number of single sheets. If there is an oxide layer between sheets, it is difficult to deal with, please replace it with a spare copper row.

八、突发事件处理 Emergency Management

1)一旦不小心使某种导体同时接触了单体电池或电池组的正负极柱造成短路现象,务必在最短的时间内将造成短路的电路回路断开。

Once a conductor accidentally contacts the positive and negative poles of a battery unit or battery pack at the same time and causes a short circuit phenomenon, be sure to disconnect the circuit causing a short circuit in the shortest time.

2)一旦车辆发生碰撞等事故,导致电池受到破坏性撞击,电池内储存的大量能量会在瞬间释放,可使用干粉灭火器对电池进行降温处理。

In the event of a vehicle collision and other accidents, resulting in a destructive impact on the battery, a large amount of energy stored in the battery will be released instantly, and the battery can be cooled with a dry powder fire extinguisher.

3)遇有突发事件请遵循以人身安全为第一原则,如出现不可控状态,请尽量将车辆停在空旷地区,等待专业人员进行检修。

In case of emergency, please follow the first principle of personal safety, In case of uncontrollable state, please park the vehicle in an open area as far as possible and wait for professional personnel to repair.

九、免责声明 Disclaimer

所有电池产品经鉴定属于用户使用不当造成损坏的,或者经鉴定为下述事实,而造成的损失或导致的事故,售卖方不承担相关责任。

The Seller shall not be liable for any loss or accident caused by any of the battery products which are identified as being caused by the user's improper use or the following facts.

1)使用电池或对电池组进行充放电测试时未可靠使用BMS或保护板,造成部分或者整组电池过充电或过放电。

Failure to use the BMS or protection plate reliably when charging or discharging batteries or battery packs, resulting in overcharging or over-discharging of partial or the whole group of batteries.

2)因为接法错误,导致电池被反向充电,造成部分或者整组电池提前报废。Because of the wrong connection method, the battery is reverse charged, resulting in partial or the whole group of batteries scrapped in advance.

3)未能有效对电池组进行充电控制,导致部分或整组电池被过充电。

The battery pack is not effectively charged, causing partial or the whole group of batteries to be overcharged.

4)未能有效对电池组进行放电控制,导致部分或整组电池被过放电。

Failed to effectively control the discharge of the battery pack, resulting in partial or whole group of batteries being over discharged.

5)由于电气回路的电缆线、连接器、接线端子等电气元件的规格选型不当,造成因线路过热自燃而引起了火灾等重大安全事故。

Due to the improper specification selection of electrical components such as cables, connectors and terminals of the electrical circuit, causing major safety accidents such as fire due to overheating and spontaneous combustion of the circuit.

6)未定期对电池使用情况进行检查和维护,没有及时发现并排除事故隐患,最终导致事故发生。

Failure to check and maintain the battery usage regularly, and failure to discover and eliminate potential accidents in time, which eventually led to accidents.