

产品规格书 PRODUCT SPECIFICATIONS

固态锂离子电池
Solid-state Lithium-ion Battery

型号: 84162227
Model: 84162227

产品设计准备 Prepared by RD	产品设计审批 Approved by RD	销售审批 Approved by MS	项目工程审批 Approved by PE	品质保证审批 Approved by QA

客户确认 Customer Approval	签名 Signature :	公司印章 Company Stamp :
	日期 Date :	
	客户代码 Company Code :	



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更新记录 Version History

版本 Version	描述 Descriptions	日期 Date	承认 Approved by
A0	新版本 Original Release	12/06/2019	
A1	技术参数修订 Technical specification revised	07/28/2021	
A2	修改了充放电温度范围及循环参数 Charge/discharge temperature range and cycle number revised	09/10/2021	
A3	技术参数修订 Technical specification revised	11/17/2021	

客户要求
Customer Specific Requirements

客户根据终端产品使用需求提出对电芯的需求并与赣锋锂电沟通，如客户有一些特别的应用或者操作条件不同于此文件中所描述的，赣锋锂电可以根据客户的特别要求进行产品的设计和生

The Customer shall write down special requirements and discuss with GFB in advance. If the product needs to be applied or operated under conditions other than those described in this document, GFB could design and build such products according to Customer's special requirements.

编号 No.	特殊要求 Special Requirements	标准 Criteria
1		
2		
3		
4		
5		

客户代码 : _____
Company Code: _____

签字 : _____
Signature: _____

日期 : _____
Date: _____

术语定义 Terminology

术语 Terms	定义 Definition / Note
产品 Product	本规格书中的“产品”是指赣锋锂电生产的 42Ah/3.65V 固态动力三元锂电池 Refers to the 42Ah/3.65V NMC solid-state lithium-ion cells produced by GFB.
客户 Customer	指《GFB 产品销售合同》中的买方。 Refers to the Buyer in the Sales Contract.
赣锋锂电 Ganfeng Battery (GFB)	指江西赣锋锂电科技有限公司。 Refers to Ganfeng Battery Technology Co., Limited, the Seller in the Sales Contract.
成品代码 Part Number (PN)	为了区别电池应用于不同的使用区域或不同的应用条件下，赣锋锂电为 42Ah/3.65V 固态动力三元锂电池定义的物料编号。 Refers to the unique number provided by GFB to identify the product 42Ah/3.65V NMC solid-state lithium-ion cells supplied by GFB.
周围环境温度 Ambient Temperature	电池所处的周围环境温度。 Refers to the ambient temperature of the environment which the products are exposed to.
电池管理系统 Battery Management System (BMS)	客户用于监测和记录产品在整个服务期限内的运行参数的一种有效的追踪和控制系统。其追踪和记录的参数包括但不限于电压、电流、温度等，以控制产品的运行并确保产品运行环境及运行条件符合本规格书的规定。 Refers to a tracking and monitoring system integrated in each battery pack to track and record parameters such as voltage, current, temperature, etc. in the entire service life of the product to ensure that the operating conditions would conform with this specification.
电芯温度 Cell Temperature	由接入电池的温度传感器测量的电芯大面温度。 Refers to the surface temperature of a battery cell typically captured by sensors.
新电池状态 Battery's Initial Status	是指电芯自产品的制造完成算起，7 天以内的状态。 Refers to the cell status within 7 days since its date of completion of production.
充电倍率 Charge C-Rate	充电电流与电池管理系统多次测量的电池容量值的比率。例如：电池容量为 42Ah，充电电流为 8.4A 时，则充电倍率为 0.2C；当电池容量跌落为 32Ah，充电电流为 6.4A 时，则充电倍率为 0.2C。 Refers to the ratio of the charging current to the battery capacity value measured multiple times by the battery management system. For example, if the initial capacity is 42Ah, and the charging current is 8.4A, then the C-rate will be 0.2C. If the capacity decreases to 32Ah, and the charging current is 6.4A, the C-rate will be 0.2C.
循环 Cycle	电池按规定的充放标准充放一次为一个循环。充电可以由一些部分充电组合在一起形成。放电可以由一些部分放电组合在一起形成。 The battery is charged and discharged according to the prescribed charging and discharging standards, and that is a cycle. Charge can consist of some partial charges. Discharge can consist of some partial discharges.
生产日期 Production date	电池的制造完成日期。每个相关的电池的顶端贴纸上标示的明确的日期代码为制造日期。

	Date of completion of battery production. The date code sticker on the top side of each battery indicates the production date.
开路电压 OCV	没有接入任何负载和电路时测得的电池的电压。 Refers to the voltage of the battery measured when no load or circuit is connected.
标准充电 Standard Charge	本规格书第 2.3 条所述的充电模式。 Refers to the charge method stated in 2.3.
标准放电 Standard Discharge	符合本规格书第 2.4 条所述的放电模式。 Refers to the discharge method stated in 2.4.
充电状态 SOC	在无负载的情况下，以安倍小时或者以瓦特小时为单位计量的电池充电容量状态的所有的线性关系。如：若将容量为 42Ah 的状态视为 100%SOC，则容量为 0Ah，SOC 为 0%。 In the case of no load, all linear relationships of the state of battery charge capacity measured in ampere-hours or watt-hours. If the state with a capacity of 42Ah is regarded as 100% SOC, SOC is 0% when the capacity is 0Ah.
温升 Temperature Rise / ΔT	在本技术协议规定的条件如充电过程或者放电过程中电芯温度的升高。 Refers to the temperature rise of cells during charge or discharge under the standard charge/discharge conditions specified in this Specification.
测量单位 Unit of measurement	伏特(V)，电压单位 “V” (Volt) 安培(A)，电流单位 “A” (Ampere) 安培-小时(Ah)，负荷单位 “Ah” (Ampere-Hour) 瓦特-小时(Wh)，能量单位 “Wh” (Watt-Hour) 欧姆(Ω)，电阻单位 “ Ω ” (Ohm) 毫欧姆(m Ω)，电阻单位 “m Ω ” (Milliohm) 摄氏度($^{\circ}$ C)，温度单位 “ $^{\circ}$ C” (Degree Celsius) 毫米(mm)，长度单位 “mm” (Millimeter) 秒(s)，时间单位 “s” (Second) 赫兹(Hz)，频率单位 “Hz” (Hertz)

1. 适用范围 Scope

本规格书详细描述了赣锋锂电生产的 3.65V 42Ah 可充电三元锂动力电池的产品性能指标、使用条件及风险警示。

The purpose of this document is to specify the specifications, application conditions and hazard warnings of 3.65V 42Ah rechargeable NMC lithium-ion cells manufactured by GFB.

2. 产品性能 Product Performance

2.1 试验条件 Test Conditions

2.1.1 环境条件 Test Environment

除另有规定外，试验应在温度 $25\pm 5^{\circ}\text{C}$ ，相对湿度为 15~80%，大气压为 86~106kPa 的环境中进行，本规格书中所提到的室温，是指 $25\pm 2^{\circ}\text{C}$ 。

The test condition for all tests, if not otherwise described in detailed test procedure, is temperature of $25\pm 5^{\circ}\text{C}$, humidity of 15~80%, and atmospheric pressure of 86~106kPa. Room temperature (RT) mentioned in this specification is $25\pm 2^{\circ}\text{C}$

2.1.2 测量仪器、仪表准确度 Accuracy of Test Equipment

测量仪器、仪表准确度应满足以下要求：

The accuracy of measuring instruments and meters should meet the following requirements:

(1) 电压测量装置：不低于 0.5 级；

Voltage measuring device: maximum absolute failure shall be $\pm(0.05\%\text{FS}+0.05\%\text{RD})$

(2) 电流测量装置：不低于 0.5 级；

Current measuring device: maximum absolute failure shall be $\pm(0.05\%\text{FS}+0.05\%\text{RD})$

(3) 温度测量装置： $\pm 0.5^{\circ}\text{C}$ ；

Temperature measuring device: maximum absolute failure shall be $\pm 0.5^{\circ}\text{C}$

(4) 时间测量装置： $\pm 0.1\%$ ；

Time measuring device: maximum absolute failure shall be $\pm 0.1\%$

(5) 尺寸测量装置： $\pm 0.1\%$ ；

Dimension measuring device: maximum absolute failure shall be $\pm 0.1\%$

(6) 质量测量装置： $\pm 0.1\%$ 。

Weight measuring device: maximum absolute failure shall be $\pm 0.1\%$

2.2 基本技术参数 General Specifications

序号 No.	参数 Parameters	产品规格 Specifications	条件 Conditions
1	电芯重量 Weight of Cell	671±10g	
2	电芯尺寸 Dimensions	厚度/Thickness: 8.4±0.30mm 宽度/Width: 162.0±2.0mm 长度/Length: 227.0±2.0mmx	1) 不含 PET 膜 Thickness of PET film excluded 2) 游标卡尺 Measured by Vernier scales; 3) 厚度 3.72V 测试 Thickness @3.72V
3	标称容量 Nominal Capacity	≥42Ah @13.8A	
4	标称电压 Nominal Voltage	3.65V	
5	质量比能量 / 体积比能量 Gravimetric Energy Density/ Volumetric Energy Density	≥235Wh/kg / ≥500Wh/L	25°C, 1/3C
6	工作电压 Operating Voltage Range	3.0~4.25 V	
7	标准充电电流 Standard Charge Current	1/3C (13.8A)	
8	标准放电电流 Standard Discharge Current	1/3C (13.8A)	
9	-30°C 低温放电性能 Low temperature performance (Discharge @ -30°C)	≥65%	Charge: Standard Charge Mode as per 2.3.3 Discharge: -30°C, 1/3C, 2.5V
10	-20°C 低温放电性能 Low temperature performance (Discharge @ -20°C)	≥75%	Charge: Standard Charge Mode as per 2.3.3 Discharge: -20°C, 1/3C, 2.5V
11	循环寿命 Cycle Life	≥1200	25°C, 0.33C/1C, 3~4.25V
12	出货 SOC Shipping SOC	50%	
13	1kHz 交流内阻 ACIR (1kHz)	1.1±0.2mΩ	@3.72V
14	工作温度 (充电) Charge Temperature Range	-20~55°C	
15	工作温度 (放电) Discharge Temperature Range	-30~60°C	
16	推荐存储条件 Recommended Storage Condition	-10~35°C 15~80%RH 30~70%SOC	

2.3 充电模式 Charging Mode

序号 No.	参数 Parameters	产品规格 Specifications	条件 Conditions
1	标准充电电流 Standard Charge Current	1/3C (13.8A)	25°C
2	标准充电电压 Standard Charge Voltage	Max. 4.25V	
3	标准充电模式 Standard Charging Mode	1/3C 恒流持续充电至单体电池最大 4.25V，然后在常压 4.25V 下恒压持续充电直至电流下限≤2.1A. Using 1/3C Constant Current (CC) to charge to 4.25V, then Charge with Constant Voltage (CV) at 4.25V until charge current drops below 2.1A.	
4	标准充电温度 Standard Charging Temperature	25°C	电芯温度 Temperature of cell
5	绝对充电温度 (电芯温度) Absolute Charge Temperature Range (Cell Temperature)	-20~55°C	无论电芯处在何种充电模式，一旦发现电芯温度超过绝对充电温度范围即停止充电 Terminate charge process, once the cell temperature is beyond the absolute charge temperature range.
6	绝对充电电压 Absolute Charge Voltage	Max. 4.25V	无论电芯处在何种充电模式包括再生充电状态，一旦发现电芯电压超过绝对充电电压范围即停止充电 Terminate charge process, once the cell temperature is beyond absolute charge voltage.

2.4 放电模式 Discharging Mode

序号 No.	参数 Parameters	产品规格 Specifications	条件 Conditions
1	标准放电电流 Standard Discharge Current	1/3C (13.8A)	25°C
2	放电截止电压 Discharge cutoff Voltage	单体电池最小 3.0V Min.3.0V (cell)	
3	标准放电温度 Standard Discharge Temperature	25°C	电芯温度 Temperature of cell
4	绝对放电温度 Absolute Discharge Temperature	-30~60°C	无论电芯处在持续放电模式或脉冲放电模式，若电芯温度超过绝对放电温度，则停止放电 Regardless of the discharge mode, the discharge process should be terminated, once the cell temperature is beyond absolute discharge temperature.

2.5 电性能 Electrical Performance

序号 No.	测试项目 Items	测试条件 Test Conditions	评判标准 Criteria
1	存储 Storage	容量恢复 Capacity Recovery (25°C 30D 100% SOC)	≥97%
2		荷电保持 Capacity Retention (25°C 30D 100% SOC)	≥96%
3		容量恢复 Capacity Recovery (40°C 30D 100% SOC)	≥97%
4		荷电保持 Capacity Retention (40°C 30D 100% SOC)	≥94%
5	25°C 循环寿命 Cycle life @ 25°C	25±2°C, 100% DOD, 0.33C/1C	≥1200
6	日历寿命 Calendar Life	8 years	

2.6 安全性能 Safety Performance

序号 No.	测试项目 Test Items	测试条件 Test Conditions	评判标准 Criteria
1	过放测试 Overdischarge	电芯依据 2.3 规定的标准充电模式充电，以 1C 恒电流放电 90min，观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3, then discharged at a constant current of 1C for 90 minutes. Observe for 1 hour.	无着火，无爆炸 No fire; No explosion
2	过充测试 Overcharge	电芯依据 2.3 规定的标准充电模式充电，将电芯放入温度均衡装置中，以 1C 的电流过充电，直到充电终止电压的 1.1 倍或 115%SOC 后停止充电，观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3, then placed in a temperature balancer, and then overcharged with 1C current until it reaches to 1.1 Vmax or 115% SOC. Observe for 1 hour.	无着火，无爆炸 No fire; No explosion
3	短路测试 Short Circuit	电芯依据 2.3 规定的标准充电模式充电，正极和负极连接的总电阻小于 5mΩ，短路时间 10 分钟，观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3. Then externally short circuit the cell with a total resistance of less than 5mΩ for 10 minutes. Observe for 1 hour.	无着火，无爆炸 No fire; No explosion
4	加热测试 Thermal Stability	电芯依据 2.3 规定的标准充电模式充电，将电芯放入温度均衡装置中，随后整体放入温度箱，按照 5°C/min 的速率由室温加热到 150±2°C，并保持此温度 30min 后停止加热，	无着火，无爆炸 No fire; No explosion

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		<p>观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3, then put into the temperature balancer, and then put into the temperature chamber. Increase the chamber temperature from RT to 150±2°C at a rate of 5°C/min, and keep for 30 minutes. Observe for 1h.</p>	
5	<p>温度循环 Temperature Cycling</p>	<p>电芯依据 2.3 规定的标准充电模式充电，单体电芯放入温度箱中，温度箱温度按照 GB/T 38031-2020 8.1.6 表 1 和图 1 进行调节，循环次数 5 次，观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3, then placed in a temperature chamber. Adjust the chamber temperature in accordance with GB/T 38031-2020 8.1.6 Table 1 and Figure 1. Cycle for 5 times and observe for 1h.</p>	<p>无着火，无爆炸 No fire; No explosion</p>
6	<p>挤压测试 Crush Test</p>	<p>电芯依据 2.3 规定的标准充电模式充电，测试挤压依据 (GB/T 38031-2020)。当电压达到 0V 或变形量达到 15%或挤压力达到 100kN 后停止挤压，观察 1h。 The cell is charged according to the Standard Charging Mode specified in 2.3. Conduct crush test according to GB/T 38031-2020. When the voltage reaches 0V or the deformation rate reaches 15% or the force reaches 100kN, stop and observe for 1h.</p>	<p>无着火，无爆炸 No fire; No explosion</p>

3. 电芯尺寸图纸 Cell Drawing

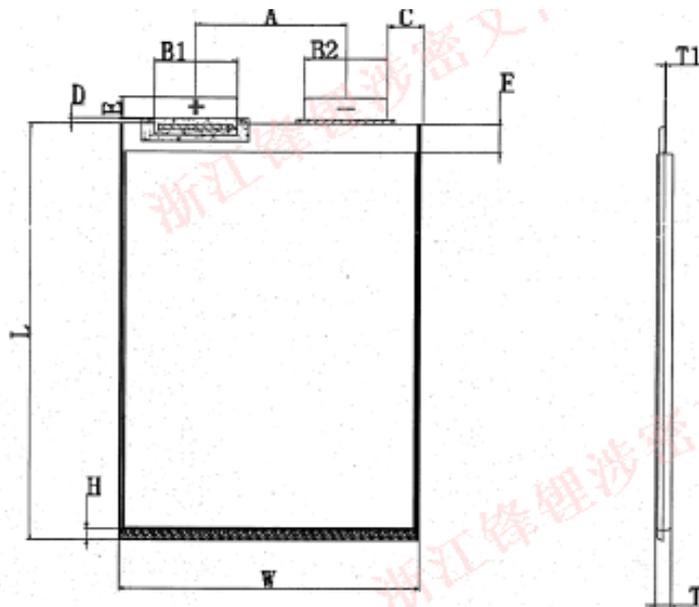


图 1. 电芯尺寸示意图

Figure 1. Cell Drawing

项目 Items	参数/mm Parameter/mm	公差/mm Tolerance/mm
电芯宽度 Cell Width (W)	162.0	±2.0
电芯长度 Cell Full Length (L)	227.0	±2.0
电芯厚度 Cell Thickness (T)	8.4	±0.3
极耳中心距 Center-to-center Distance between Positive and Negative Tabs (A)	81.0	±1.0
正极耳宽度 Width of Positive Tab (B1)	45.0	±0.5
负极耳宽度 Width of Negative Tab (B2)	45.0	±0.5
负极极耳边距 Negative-to-side Distance (C)	17.5	±1.0
Sealant 外露 Exposed Sealant (D)	1.5	±1.0
极耳长度 Tab Length (E)	12.0	±0.5
电芯顶边宽 Top Border Width (F)	15.5	±1.0
电芯底边宽 Bottom Border Width (H)	6.4	±1.0
正极极耳厚度 Thickness of Positive Tab (T1)	0.20	±0.05
负极极耳厚度 Thickness of Negative Tab (T2)	0.20	±0.05

4. 产品寿命终止管理 Product End-of-life Management

电池的使用期限是有限的。客户应该建立有效的跟踪系统监测并记录每个使用期限内电池的内阻。内阻的测量方法和计算方法需要客户和赣锋锂电共同讨论和双方同意。当使用中的电池的内阻超过这个电池最初的内阻的 250%时，应停止使用电池。违反该项要求，将免除赣锋锂电依据产品销售协议以及本规格书所应承担的产品质量保证责任。

The customer should monitor and record the internal resistance of each battery. Both parties should agree on the method to measure internal resistance. When the internal resistance of a cell reaches 250% of that of its initial status, the customer must

stop using the battery immediately. Violation of this requirement will exempt Ganfeng Battery from its responsibility for product quality assurance in accordance with the product sales agreement and this specification.

5. 应用条件 Application Conditions

客户应当确保严格遵守以下与电池相关的应用条件：

The customer shall ensure that the following application conditions in connection with the products are strictly observed:

- 1) 客户应配置电池管理系统，严密监控、管理与保护每个电池。

A BMS should be integrated in battery packs to monitor, control and protect each battery.

- 2) 客户应向赣锋锂电提供电池管理系统详细的设计方案、系统特点、框架、系统数据、格式等相关信息，以供赣锋锂电对该系统进行设计评估，并建立电池管理档案。

The customer should provide BMS requirements, such as system specifications, framework, data and format, so GanFeng Battery would deliver BMS design and establish battery management profile accordingly.

- 3) 未经赣锋锂电同意，客户不可擅自修改或者改变电池管理系统的设计和框架，以免影响电池的使用性能。

Without the consent of GanFeng Battery, no changes should be made to BMS design or framework.

- 4) 客户应保存完整的电池运转的监测数据，用作产品质量责任划分的参考。不具备完整的电池系统使用期限内的监测数据的，赣锋锂电不承担产品质量保证责任。

The customer should keep the complete monitoring data of battery operation as a reference for the division of product quality responsibility. Those who do not have complete monitoring data during the life of the battery system, Ganfeng Battery will not be responsible for product quality assurance.

- 5) 电池管理系统需满足以下最基本的检测和控制要求：

A BMS should meet the following primary requirements：

No.	参数 Items	产品规格 Specifications	保护动作 Protection Actions
1	充电终止电压 Charging Cutoff Voltage	4.25V	当电池的电压达到 4.25V 时终止充电 Stop charging when battery voltage reaches 4.25V.
2	第一级过充电保护 L1 Overcharge Protection	≥4.25V	当电池电压达到 4.25 V，将充电电流限制为 0。 When the battery voltage reaches 4.25 V, the charging current must be limited to 0.
3	第二级过充电保护 L2 Overcharge Protection	> 4.4V	当电池电压达到 4.4 V，将充电电流限制为 0，并锁定电池管理系统直到技术人员解决问题 When the battery voltage reaches 4.4 V, the charging current must be limited to 0, and lock the battery management system until the technician solves the problem.

4	放电终止 Stop Discharging	Min. 3.0 V	终止放电当电池的电压到达 3.0 V,将电流降到最小 Stop discharging when battery voltage reaches 3.0 V, and decrease the current to a minimum.
5	第一级过放保护 L1 Overdischarge Protection	Min. 3.0 V	终止放电当电池的电压到达 3.0 V,将电流降到最小 Stop discharging when battery voltage reaches 3.0 V, and decrease the current to a minimum.
6	第二级过放保护 L2 Overdischarge Protection	Min. 2.5 V	当电池电压低于 2.5V 时, 锁定电池管理系统直到技术人员解决问题 When the battery voltage is lower than 2.5V, lock the battery management system until the technician solves the problem.
7	短路保护 Short Circuit Protection	不允许短路 No short circuit allowed	发生短路时, 由过流器断开电池(电路) Disconnect cell terminals by over-current protector or internal fuse when short circuit occurs
8	过流保护 Over Current Protection	参考第 2.4 条放电要求 Refer to 2.4	电池管理系统控制放电电流符合规格 The battery management system controls the discharge current to meet specifications.
9	过热保护 Overheating Protection	参考第 2.3 和第 2.4 Refer to 2.3 & 2.4	当温度超过本规格书规定时, 终止充电/放电 Stop charging and discharging when temperature exceeds what is specified in this specification.
10	充电时间过长保护 Charging Timeout Limit	充电时间在 8 小时内 The charging time must be within 8 hours	充电时间长于 8 小时, 则终止充电 Stop charging if charging time exceeds 8 hours

备注：以上 2、3、5、6 为警示条款，提请客户注意：当电池达到上述任何一项条款描述的指标和参数状态时，意味着电池已超出本规格书规定的使用条件，客户需依“保护动作”及本规格书其他相关规定对电池采取保护措施，同时，赣锋锂电声明对上述使用状态的电池质量不承担任何保证责任，并对因此而导致的客户及第三方的任何损失不予赔偿。

Note: The above No. 2, 3, 5 and 6 are the warning clauses, please note: When the battery reaches any of the terms described in the above, means that the battery is beyond the conditions of use specified in this specification, the customer shall take protective measures in accordance with the ‘protection actions’ and other relevant provisions of this specification. At the same time, Ganfeng Battery declares that it does not assume any guarantee responsibility for the battery quality in the above-mentioned use state, and will not compensate customers and third parties for any losses caused thereby.

1) 避免电池到达过放状态。电池电压低于 3.0V 时，电池内部可能会遭到永久性的损坏，此时赣锋锂电的产品质量保证责任失效。根据本规格书第 2.4 条，当放电截止电压低于 3.5V 时，系统内部能耗降低到最小，并在重新充电之前延长休眠时间。客户需要培训使用者在最短的时间内重新充电，防止电池进入过放状态。

Prevent the battery from over discharging. When the battery voltage is lower than 1.5V, the inside of the battery may be permanently damaged. Under these circumstances, the product quality assurance responsibility of Ganfeng Battery will be invalid. According to Article 2.4 of this specification, when the discharge cut-off voltage is lower than 3.5V, the internal energy consumption of the system is reduced to a minimum, and the sleep time is extended before recharging. Customers need to train users to recharge in the shortest possible time to prevent the battery from entering an over-discharged state.

- 2) 若预计将电池存放 30 天以上的, 应将 SOC 调整为 50%左右。

If the battery is expected to be stored for more than 30 days, the SOC should be adjusted to about 50%.

- 3) 电池避免在本规格书禁止的低温条件下充电 (包括标准充电, 快充, 紧急情况充电和再生充电), 否则可能出现意外的容量降低现象。电池管理系统应依照最小的充电和再生充电温度进行控制。禁止在低于本规格书规定的温度条件下充电, 否则, 赣锋锂电不承担质量保证责任。

Charging at low temperature is prohibited regardless of the charge mode. Any violation may considerably lower the battery capacity, for which GanFeng Battery will be relieved from liability. The BMS should monitor and manage the ambient temperature according to the temperature range of standard charge and regenerate charge.

- 4) 电箱设计中应充分考虑电芯的散热问题, 由于电箱散热设计问题导致的电芯或电池过热 损坏, 赣锋锂电不承担质量保证责任。

Batteries should be placed in a container with enough ventilation or other effective cooling system. Otherwise, GanFeng Battery will be relieved from liability for quality issues and subsequent damage (to the customer or to a third party) caused by overheating of batteries.

- 5) 电箱设计中应充分考虑电芯的防水、防尘问题, 电箱必须满足国家有关标准规定的防水、防尘等级。由于防水、防尘问题而导致的电芯或电池的损坏 (如腐蚀、生锈等), 赣锋锂电不承担质量保证责任。

Batteries should be placed in a container which complies with the requirements of State-set standard of waterproof and dustproof. Otherwise, GanFeng Battery will be relieved from liability for quality issues and subsequent damage (to the customer or to a third party) caused by corrosion of batteries

6. 安全防范 Safety Precautions

- 1) 禁止将电池浸入水中。

Prevent batteries from being immersed in water.

- 2) 禁止将电池投入火中或长时间暴露在超过本规格书规定的温度条件的高温环境中, 否则可能会导致火灾。在任何正常的使用情况下, 电池电芯温度不能超过 60°C, 如果电池中电芯温度超过 60°C, 电池管理系统需关闭电池, 停止电池运行。

Prevent batteries from fire or overexposure to any high temperature environment. Cell temperature should never exceed

60°C or the BMS should shut down the battery system.

- 3) 禁止电池正负极短路，否则强电流和高温可能导致人身伤害或者火灾。由于电池的正负极暴露于塑料保护套中，在电池系统组装和连接时，应有足够的安全保护，以避免短路。

Prevent direct connection between the positive and negative terminal of a cell. The resulting short circuit could damage the product and generate heat that can cause fires. Special caution is required to prevent short circuiting any battery since the consequences can be very dangerous. Care must be taken during the installation of the battery pack to ensure batteries cannot be inserted in reverse. Also, caution must be given to prevent accidental short-circuiting of the battery.

- 4) 严格按照标示和说明连接电池正负极，禁止反向充电。

Never reverse charge for it causes rapid gas generation and increased gas pressure, thus causing batteries to swell or rupture.

- 5) 禁止电池过充，否则，可能引起电池过热和火灾事故的发生。在电池安装和使用中，硬件和软件需实行多重过充失效安全保护。

Prevent batteries from overcharge. It is extremely dangerous to overcharge a cell which may cause overheating and fire hazards. Multiple level of overcharge protection should be implemented in a BMS.

- 6) 当持续充电时间超过合理的时间限制，电池会出现过热现象可能会引起热失控和火灾。应安装上一个定时器加以保护，一旦充电电流达到过冲状态而不能终止，定时器将会起作用从而终止充电。

When charging continues longer than charging timeout limit, it tends to overheat the cells which may cause overheating and fire hazards. A timer should be implemented in the charger circuit and set up properly. In case charging does not terminate normally within charging timeout limit, make sure that the timer will intervene and stop the charging.

- 7) 客户应将电池安全地固定在固体平面上，并将电源线安全地束缚在合适的位置，以避免摩擦而引起电弧和火花。Products should be securely fixed to solid platform, and power cables should be securely attached by fastener to avoid intermittent contact which may cause arcing and sparks.

- 8) 严禁用塑料封装电池或用塑料进行电气连接。不正确的电气连接方式可能会造成电池使用过程中发生过热现象。Do not service cells and electrical connections within plastic package of cell. Improper electrical connection within a cell may cause overheating in service.

- 9) 尽力保护电池，使其免受机械震动、碰撞及压力冲击，否则电池内部可能短路，产生高温和火灾。

Protect cells from mechanical shock, impact and pressure. Short circuit may occur, which will generate high temperature and fire hazards.

- 10) 电池充电过程中可能发生不适当的终止充电现象。如：超出允许的充电时间充电，充电电压过高而终止充电或充电电流过强而终止充电。上述现象被定义为“不适当的终止充电”。当发生以上现象时，可能意味着电池系统出现漏电或某些部件出现故障。在没有找到根本原因并彻底解决之前继续对该电池充电可能会引起电池过热或

发生火灾。当发生以上现象时，电池管理系统应该通过自动锁定功能，禁止后续的充电，并提醒使用者将装载有该电池的交通工具退回到经销商处进行系统维护。该电池只有经过有认证资格的技术人员全面检查，确定根本原因并彻底解决、改善后方可恢复充电。

When charging is terminated improperly for reasons such as exceeding allowable charging time, exceeding charging voltage or charging current, all these events are defined as ‘improper charge termination’. Such event may indicate that there is current leaking within a cell system or some components have started to malfunction and subsequent charging of such cell system without finding and fixing root cause of problem may cause potential overheat or fire hazards. When such event occurs, the BMS should lock itself up to prevent subsequent charging and notice should be given to the user to return the vehicle to seller for maintenance. Subsequent charging should only be resumed after the system has been thoroughly checked by qualified technician who can identify and fix root cause attributed to the ‘improper charge termination’.

7. 风险警告 Hazard Warnings

7.1 警示声明 Warning Statement

警告 WARNINGS

电池存在潜在的危險，在操作和维护时必须采取适当的防护措施！

BATTERIES ARE POTENTIALLY DANGEROUS AND PROPER PRECAUTIONS MUST BE TAKEN DURING HANDLING AND MAINTENANCE.

不正确地操作本规格书所描述的测试实验，可能导致严重的人身伤害和财产损失！

RUNNING TESTS DESCRIBED IN THE SEPCIFICATION IMPROPERLY MAY RESULT IN SEVERE PERSONAL INJURY OR PROPERTY DAMAGES.

必须使用正确的工具和防护装备操作电池。

USE APPROPRIATE TOOLS AND PROTECTIVE EQUIPMENT TO OPERATE THE BATTERY.

电池的维护必须由具有电池专业知识并经过安全培训的人士执行。

THE MAINTENANCE OF THE BATTERY MUST BE PERFORMED BY PFOSSIONALS WITH BATTERY EXPERTISE AND SAFETY TRAINING.

不遵守上述警告可能会造成多种灾难。

FAILURE TO COMPLY WITH THE ABOVE WARNINGS MAY CAUSE A VARIETY OF DISASTERS.

7.2 危险类型 Types of Hazards

客户知悉在电池使用和操作过程中存在以下潜在的危險：

The customer is aware of the following potential hazards during use and operations of the battery.

- 1) 操作者在操作时可能会受到化学品、电击或者电弧的伤害。尽管人体对遭受直流电与交流电的反应不同，但是高于 50V 的直流电压与交流电对人体的伤害是同样严重的，因此客户必须在操作中采取保守的姿势以避免电流的伤害。

The operator may be injured by chemicals, electric shocks or arcs during operation. Although the human body responds differently to direct current and alternating current, DC voltage higher than 50V and alternating current are equally harmful to the human body, so customers must take a conservative posture during operation to avoid current damage.

- 2) 存在来自电池中的电解液的化学风险。

There is a chemical risk from the electrolyte in the battery.

- 3) 在操作电池和选择个人防护装备时，客户及其雇员必须考虑到以上潜在的风险，防止发生意外短路，造成电弧、爆炸或热失控。

While operating batteries or selecting personal protective equipment, customers and their employees must consider the above potential risks to prevent accidental short circuits that may cause arcs, explosions, or thermal runaway.