



产品规格书 PRODUCT SPECIFICATION

可充电锂离子电池 Rechargeable Lithium Ion Battery

型号 Type: 48174133-086Ah

成品代码 PN: EC-AU086-48174133-51FA

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



更新记录

版本 Revision	描述 Description	日期 Date	承认 Approval
A0	新版本 Original Release	2021.03.02	David

客户要求 Customer Inquiry

型号 Model: 48174133-086Ah

版本 Version: A0

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产。

The Customer is requested to write down your information and contact GFL in advance, if and when the Customer needs applications or operating conditions other than those described in this document. GFL could design and build such products according to your special request.

编号 No.	特殊要求 Special Request	标准 Criteria
1		
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4		
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客户代码 Company code: 签字 Signature: 日期 Date:

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术语定义 Definition and Note

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 86Ah 3.2V 可充电磷酸铁锂体系动力电池。 Means the 86Ah 3.2V rechargeable lithium ion cells produced by GFL.
客户 Client	指《GFL 产品销售合同》中的买方。 Means the customer in the 《GFL product sales contract》.
赣锋锂电 GFL	指江西赣锋锂电科技有限公司。 Means Ganfeng Li-Energy Technology Co. Limited.
成品代码 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 86Ah 3.2V 可充电锂电池定义的物料编号。 Means the unique part number provided by GFL to identify the product supplied by GFL.
周围环境温度 Ambient Temperature	电池所处的周围环境温度。 Means the ambient temperature of the environment which the products are exposed.
电池管理系统 (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。 Means an active tracking and control system to be developed and implemented by GFL to monitor and record the operating parameters, including but not limited to voltage, current and temperature, of each product in its entire service life, and to control the operation of each product to ensure a safe operation of product.
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。 Means the temperature of the cell measured by the temperature sensor connected to the main part of cell.
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的容量值的比率。例如:电池容量为 86Ah,充电电流为 17.2A 时,则充电倍率为 0.2C;充电电流应根据最新电池容量不时进行调整,以便充电倍率符合 2.2 中规定的要求。 The ratio of charging current to the latest cell capacity as frequently measured by the Battery Management System, with a unit of measure denoted by 'C'. For example, the initial cell capacity is 86Ah and a Charge C-Rate of 0.2C equals to a charge current of 17.2A. The charge current shall be adjusted from time to time based on the latest cell capacity so that the Charge C-Rate complies with the requirement as set out in paragraph 2.2.
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。 Means a state when a total of charge and discharge according to rules from a cell as recorded by BMS and it may consist of a summation of a few segments of partial charge and discharges.
生产日期 Production date	电池的制造日期。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 battery manufacture. The clear date code on the top cap of each related battery is the manufacturing 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。 Open circuit voltage.
标准充电 Standard Charge	本规格书第 2.2.1 条所述的充电模式。 The default charging method set out in paragraph 2.2.1.

标准放电 Standard Discharge	符合本规格书第 2.3.1 条所述的放电电流以及本规格书第 2.3.5 条所述的电压的放电模式。A discharge current of 0.5C as set out in paragraph 2.3.1 with a discharge cut-off voltage of 2.50V or 2.00V as set out in paragraph 2.3.5.
充电状态 (SOC)	在无负载的情况下，以安培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：若将电芯满充至 3.65V 视为 100%SOC，电芯满放至 2.50V 视为 0%SOC。The linear scale of charge held by a cell as measured by capacity either in Ah or Wh. 100% SOC means a cell is fully charged at 3.65V while 0% SOC means a cell is fully discharged down to 2.50V. The SOC should indicate a no load situation.
温度上升 Temperature Rise	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。Means the temperature of the cell rises during the conditions specified in this document, such as the charging process or the discharging process.
测量单位 Unit of measurement	“V” (Volt) 伏特(V)，电压单位 “A” (Ampere) 安培(A)，电流单位 “Ah” (Ampere-Hour) 安培-小时(Ah)，负荷单位 “Wh” (Watt-Hour) 瓦特-小时(Wh)，能量单位 “Ω” (Ohm) 欧姆(Ω)，电阻单位 “mΩ” (Milliohm) 毫欧姆(mΩ)，电阻单位 “°C” (Degree Celsius) 摄氏度(°C)，温度单位 “mm” (Millimeter) 毫米(mm)，长度单位 “s” (Second) 秒(s)，时间单位 “Hz” (Hertz) 赫兹(Hz)，频率单位

1. 适用范围 Scope

本规格书详细描述了赣锋锂电生产的 3.2V 86Ah 可充电磷酸铁锂体系动力电池的产品性能指标以及产品使用条件及风险警示。

The purpose of this document is to specify the specifications of 86Ah 3.2V rechargeable lithium ion LFP cells with GFL to be supplied by GFL

2. 产品性能指标 Electrical specification

在本规范中，标有“*”的数字标准意味着此类标准仅适用于 GFL 交付后 7 天内未使用的新产品。客户和/或其客户使用或存储产品的时间超过 30 天，其数值参数可能低于该标准。客户同意，此类问题不构成不符合规范。

Throughout this specification, numeric criteria annotated by ‘*’ means such criteria are only applicable to fresh unused Product within 7 days from delivery by GFL. Products either have been used or stored for a period longer than 30 days by Client and/or its customer may exhibit an inferior numeric parameter than such criteria. Client agrees that such occurrence does not constitute nonconformance of specification.

2.1 概要 General

编号 No.	参数 Parameter	产品规格 Specification	条件 Condition / Note
2.1.1	标准容量 Typical capacity	*86.0Ah	1C 放电电流 At a 1C discharge current (25±2°C)
2.1.2	工作电压 Operating voltage	2.50V~3.65V	0°C < T ≤ 60°C
		2.00V~3.65V	-20°C ≤ T ≤ 0°C
2.1.3	电池内阻 Impedance (1KHz)	≤ 0.40mΩ	新电池状态 at a fresh state
2.1.4	出货容量 Shipping capacity	3~30%的充电状态 3~30%SOC	
2.1.5	工作温度(充电) Operating temperature (charging)	0~60°C	参考第 2.2 节 See paragraph 2.2
2.1.6	工作温度(放电) Operating temperature (discharge)	-20~60°C	参考第 2.3 节 See paragraph 2.3
2.1.7	电池重量 Weight	≤ 2.30Kg	N.A.
2.1.8	自放电 Self-discharge	≤ 3.5%/月 ≤ 3.5%/month	25°C, 50%SOC, 新电池 3 个月后 Count after fresh cell need Standard Charge to 50%SOC and storage at 25±2°C for 3 month
2.1.9	电池尺寸 Cell dimension	请参考本规格书第 9 条 Reference specification 9	300Kgf 压力下 300Kgf pressure

2.2 充电模式/参数 Charging mode/Parameters

编号 No.	参数 Parameter	产品规格 Specification	条件 Condition /Note
2.2.1	标准充电电流 Standard charge current	0.5C	25±2°C
2.2.2	标准充电电压 Standard charge voltage	单体电池最大 3.65V Cell max voltage 3.65V	25±2°C
2.2.3	最大充电可持续电流 (continuous)	1.0C	25±2°C
2.2.4	标准充电模式 Standard charge method	0.5C 恒流持续充电至单体电池最大 3.65V, 然后在常压 3.65V 下恒压持续充电直至电流下限 0.05C。0.5C constant current charge to 3.65V for cell, then switch to constant voltage charge until charge current declines to 0.05C.	
2.2.5	标准充电温度 Standard charge temperature	25±2°C	

2.2.6	绝对充电温度 Absolute charge temperature (Cell temperature)	0~60℃	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。Stop charging once cell Temperature is outside this range regardless of the charging mode adopted.
2.2.7	绝对充电电压 Absolute charge voltage	最大 3.65V 3.65V max.	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。Stop charging once voltage exceeds this voltage regardless of the charging mode (including regeneration) adopted.

2.2.7 其他充电条件模式(C) Other Continuous Charge Conditions (C)

Temp. (°C)	SOC: 0%	SOC: 10%	SOC: 20%	SOC: 30%	SOC: 40%	SOC: 50%	SOC: 60%	SOC: 70%	SOC: 80%	SOC: 90%	SOC: 95%	SOC: 100%
[0~7)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.10	0
[7~15)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.45	0.40	0.30	0.20	0
[15~25)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.60	0.50	0.20	0
[25~35)	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.70	0.60	0.30	0
[35~45)	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.70	0.60	0.30	0
[45~50)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.50	0.30	0.20	0
[50~55)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.45	0.40	0.20	0.15	0
[55~60)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.45	0.40	0.20	0.15	0

2.3 放电模式/参数 Discharging mode/Parameters

编号 No.	参数 Parameter	产品规格 Specification	条件 Condition /Note
2.3.1	标准放电电流 Standard discharge current	0.5C	25±2℃
2.3.2	最大持续放电电流 Maximum discharge current (continuous)	1.0C	N.A.
2.3.3	最大脉冲放电电流（长脉冲） Maximum discharge current (long pulse)	2.0C	最长放电时间为 120S。120 seconds duration maximum followed by a 'zero current rest period' of same duration.
2.3.4	最大脉冲放电电流（短脉冲） Maximum discharge current (short pulse)	3.0C	电芯温度低于 50℃，且 SOC>40%时最长放电时间为 60s，SOC<40%最长放电时间为 10s。 60 seconds duration maximum while cell Temperature ≤ 50℃ and SOC>40%SOC; 10 seconds duration maximum while cell Temperature ≤ 50℃ and SOC≤40%SOC.
2.3.5	放电截止电压 Discharge cut-off voltage	2.50V	0℃ < T ≤ 60℃
		2.00V	-20℃ ≤ T ≤ 0℃

2.3.6	标准放电温度 Standard discharge temperature	25±2℃	N.A.
2.3.7	绝对放电温度 Absolute discharge temperature (Cell temperature)	-20~60℃	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。 Different current at different tmperature.

2.3.8 其他放电条件模式(C) Other continuous discharge Conditions (C)

Temp. (°C)	SOC: 0%	SOC: 10%	SOC: 20%	SOC: 30%	SOC: 40%	SOC: 50%	SOC: 60%	SOC: 70%	SOC: 80%	SOC: 90%	SOC: 100%
[-20~-10)	0.00	0.03	0.10	0.20	0.30	0.30	0.30	0.30	0.30	0.30	0.30
[-10~0)	0.00	0.10	0.30	0.40	0.50	0.50	0.50	0.50	0.50	0.50	0.50
[0~7)	0.00	0.15	0.50	0.60	0.70	0.80	0.80	0.80	0.80	0.80	0.80
[7~15)	0.00	0.20	0.60	0.70	0.80	0.90	0.90	0.90	0.90	0.90	0.90
[15~25)	0.00	0.30	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
[25~35)	0.00	0.30	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
[35~45)	0.00	0.30	0.70	0.80	0.90	1.00	1.00	1.00	1.00	1.00	1.00
[45~50)	0.00	0.20	0.50	0.60	0.70	0.80	0.80	0.80	0.80	0.80	0.80
[50~55)	0.00	0.05	0.15	0.25	0.30	0.30	0.30	0.30	0.30	0.30	0.30
[55~60)	0.00	0.05	0.15	0.25	0.30	0.30	0.30	0.30	0.30	0.30	0.30

2.4 再生脉冲充电模式 Regeneration

再生脉冲充电是指在产品使用过程中，脉冲电流对电芯的反充电。再生脉冲充电必须严格符合本规格书所述的充电状态和电芯温度条件。脉冲电流的大小和持续时间必须严格遵守下表所列的所有充电状态以及电芯温度等条件。违反再生脉冲充电条件可能会造成电芯永久性的损坏并进而免除赣锋锂电的产品质量责任。

Regeneration means a cell is charged by pulse current regenerated during application. The regenerated voltage should be strictly regulated at all SOC and Cell Temperature. The magnitude and duration of pulse charging current should be strictly regulated according to the SOC and Cell Temperature listed on the table below. Regeneration charging of the cell outside this allowable condition may cause permanent internal damage to the Product and shall render GFL's warranties under the Contract inapplicable, thereby releasing GFL from any liability in connection therewith.

2.4.1 最大再生脉冲充电电压 3.65V Regeneration voltage 3.65V maximum.

2.4.2 允许的再生脉冲充电电流和持续时间 Allowable regeneration current and duration

10s 再生脉冲充电电流(C) Regen for 10s (C)

Temp. (°C)	SOC: 0%	SOC: 10%	SOC: 20%	SOC: 30%	SOC: 40%	SOC: 50%	SOC: 60%	SOC: 70%	SOC: 80%	SOC: 90%	SOC: 95%	SOC: 100%
[0~7)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.30	0.25	0.20	0.10	0.00
[7~15)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.60	0.55	0.20	0.00
[15~25)	1.20	1.20	1.20	1.20	1.20	1.20	1.10	1.00	0.90	0.80	0.30	0.00
[25~35)	1.50	1.50	1.50	1.50	1.50	1.50	1.30	1.20	1.00	0.90	0.50	0.00
[35~45)	1.50	1.50	1.50	1.50	1.50	1.50	1.30	1.20	1.00	0.90	0.50	0.00
[45~50)	1.20	1.20	1.20	1.20	1.20	1.20	1.10	1.00	0.90	0.80	0.40	0.00
[50~55)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.60	0.55	0.20	0.00
[55~60)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.60	0.55	0.20	0.00

30s 再生脉冲充电电流(C) Regen for 30s (C)

Temp. (°C)	SOC: 0%	SOC: 10%	SOC: 20%	SOC: 30%	SOC: 40%	SOC: 50%	SOC: 60%	SOC: 70%	SOC: 80%	SOC: 90%	SOC: 95%	SOC: 100%
[0~7)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.25	0.18	0.15	0.10	0.00
[7~15)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.55	0.50	0.30	0.20	0.00
[15~25)	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.72	0.60	0.30	0.00
[25~35)	1.20	1.20	1.20	1.20	1.20	1.20	1.00	0.90	0.80	0.60	0.30	0.00
[35~45)	1.20	1.20	1.20	1.20	1.20	1.20	1.00	0.90	0.80	0.60	0.30	0.00
[45~50)	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.60	0.30	0.20	0.00
[50~55)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.55	0.50	0.20	0.15	0.00
[55~60)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.55	0.50	0.20	0.15	0.00

2.4.3 每次再生脉冲充电后，电池需要有段休眠时期，时间应等于或长于再生脉冲持续时间。休眠时期内，电池可以处于放电状态，也可以处于零电流不工作状态，但在休眠时期内，不允许电池再次发生再生脉冲充电现象。

2.4.3 After each regeneration pulse, there should be a 'rest period' with duration equal to or long than the relevant regeneration pulse. A 'rest period' can either be discharging or zero current state. No regeneration is allowed within a 'rest period'.

2.5 不同温度放电容量 Discharge Capacity of different temperature

编号 No.	参数 Parameter	产品规格 Specification	条件 Condition / Note
2.5.1	25℃的容量 Capacity at 25°C	* $\geq 86.0\text{Ah}$	25 $\pm 2^\circ\text{C}$ 温度 1.0C 充/放电（电芯表面温度）。Standard Charge at 25 $\pm 2^\circ\text{C}$, Standard Discharge at 25 $\pm 2^\circ\text{C}$ (Cell Temperature in both cases).
2.5.2	55℃的容量 Capacity at 55°C	* $\geq 81.7\text{Ah}$	25 $\pm 2^\circ\text{C}$ 温度标准充电，55 $\pm 2^\circ\text{C}$ 温度 1.0C 放电（电芯表面温度）。Standard Charge at 25 $\pm 2^\circ\text{C}$, 1.0C Discharge at 55 $\pm 2^\circ\text{C}$ (Cell Temperature in both cases).
2.5.3	-20℃的容量 Capacity at -20°C	* $\geq 60.2\text{Ah}$	25 $\pm 2^\circ\text{C}$ 温度标准充电，-20 $\pm 2^\circ\text{C}$ 温度 1.0C 放电至 2.00V（电芯表面温度）。Standard Charge at 25 $\pm 2^\circ\text{C}$, 1.0C Discharge at -20 $\pm 2^\circ\text{C}$ (Cell Temperature in both cases).

2.6 安全与可靠性 Safety and Reliability

2.6.1 使用条件说明：安全测试、寿命测试、系统成组设计需要施加预紧力，新鲜电芯的预紧力范围为 2000N~5000N，全生命周期受力范围为 2000N~15000N。

2.6.1 Description of service conditions: safety test、cycle life test and pack design need to add pre-tightening force, and the range of pre-tightening force of fresh cell is 2000N~5000N, the range of stress force of the whole life cycle is 2000N~15000N.

2.6.2 所有测试符合国标 GB/T 31485-2015, GB/T 31486-2015 标准。

2.6.2 All test meet GB/T 31485-2015, GB/T 31486-2015 requirements.

2.6.3 存在风险项目：此样品仍处于样品开发阶段，暂未完成工艺冻结，量产阶段产品规格需重新定义，提供正式产品规格书。此样品仍处于样品开发阶段，暂未完成工艺可靠性验证，存在批次稳定性风险。量产阶段产品规格需重新定义，提供正式产品规格书。

2.6.3 Risk Project: this sample is still in the development stage, the process freeze has not been completed yet, and the product specifications in the mass production phase need to be redefined to provide formal product specifications. Due to during the development stage, the process reliability verification of the sample has not been completed yet, and there is a risk of batch stability. Product specifications for the and there is a risk of batch stability. Product specifications for the mass production phase need to be redefined to provide formal product specifications.

3. 电芯寿命 Cycle Performance

编号 No.	参数 Parameter	产品规格 Specification	条件 Condition / Note
3.1	常温存储性能 RT Storage performance	剩余容量* $\geq$ 95% Cap. Retention* $\geq$ 95%	标准充电到 100%SOC 的充电状态, 25 $\pm$ 2°C 温度储存 30 天 Standard Charge to 100% SOC, storage at 25 $\pm$ 2°C for 30 days, discharge 1.0C at 25 $\pm$ 2°C
3.2	循环寿命 Cycled Capacity	剩余容量* $\geq$ 80% Cap. Retention* $\geq$ 80%	25 $\pm$ 2°C, 0.5C 充放电 3000 循环, 300 $\pm$ 20Kgf 初始压力下 Within 3000 Cycles, 0.5C charge and discharge, Temp.25 $\pm$ 2°C 300 $\pm$ 20Kgf preload.

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 150%或容量小于 70% (25°C) 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。

This cell is designed to service with a finite life time. Client shall develop and implement an active tracking system to monitor and record impedance of each Product in its entire service life. Client and/or its customer shall stop using any of the Products when its impedance exceeds 150% or capacity less than 70% (25°C) of the value when it was fresh. Failure to comply with this requirement shall render GFL's warranties under the Contract inapplicable, thereby releasing GFL from any liability in connection therewith.

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:

Client shall ensure that the following application conditions in connection with the Products are strictly observed:

5.1 客户应在使用中的每个产品附近安装合理数量的热传感器, 以感应和测量电池温度。客户应使用该传感器在电池的整个使用寿命内监测和记录电池温度。电池温度是决定客户是否有权根据合同获得 GFL 保证的关键参数。

5.1 A reasonable number of thermal sensors shall be installed by Client in proximity each Product in use to sense and measure Cell Temperature. Client shall make use of this sensor to monitor and record Cell Temperature throughout the entire service life of such cell. The Cell Temperature is a critical parameter for determining whether Client shall be entitled to GFL's warranties under the Contract.

5.2 客户应配置电池管理系统, 严密监控、管理与保护每个电池。

5.2 Client shall procure that each Product shall be used under the strict monitor, control and protection by the Battery Management System to be incorporated by Client.

5.3 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。

5.3 Client shall provide detailed information of the BMS, including but not limited to its design, features, setting, and data file format to GFL for design review and record keeping.

5.4 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。

5.4 Once the detailed information of the BMS has been reviewed and agreed by GFL, Client shall not modify or change the design, features, setting or data file format of the BMS without the prior written agreement by Client.

5.5 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

赣锋锂电
GanfengLiEnergy
产品规格书 PRODUCT SPECIFICATION

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时间 DATE.:
页码 SHEET: 12 / 17

数据的，赣锋锂电不承担产品质量保证责任。

5.5 Client shall keep complete records of the BMS monitoring data throughout the entire service life of each Product, including keeping record of number of occurrence of Rush Charge, which will be used in the determination and judgment of any product warranty and liability claim entitlement. No warranty or liability claim will be considered without a complete set of BMS monitoring records capturing the entire service life of the relevant Product.

5.6 电池管理系统需满足以下最基本的检测和控制要求：

5.6 The BMS shall include the following monitoring and control features as a minimum requirement.

No.	参数 Parameter	产品规格 Specification	保护动作 Action
5.6.1	充电终止 Stop charging	最大 3.65V 3.65V maximum	当电池的电压达到 3.65V 时终止充电 Stop charging when cell voltage reaches 3.65V
5.6.2	第一级过充电保护 1st Overcharge protection	$\geq 3.69V$	当电池电压达到 3.69V 终止充电 Stop charging when cell voltage reaches 3.69V
5.6.3	第二级过充电保护 2nd Overcharge protection	$\geq 3.80V$	当电池电压达到 3.80V 终止充电,并锁定电池管理系统直到技术人员解决问题 When cell voltage reaches 3.80V, lock up BMS until technical trouble shooting
5.6.4	放电终止 Stop discharging	最小 2.80V 2.80V minimum	终止放电当电池的电压到达 2.80V,将电流降到最小 When cell voltage falls lower than 2.80V, decrease the current to a minimum
5.6.5	第一级过放保护 1st Over discharge protection	最小 2.50V 2.50V minimum	终止放电当电池的电压到达 2.50V,将电流降到最小 When cell voltage falls lower than 2.50V, decrease the current to a minimum
5.6.6	第二级过放保护 2nd Over discharge protection	最小 2.00V 2.00V minimum	当电池电压低于 2.00V 时，锁定电池管理系统直到技术人员解决问题 When cell voltage falls lower than 2.00V, lock up BMS until technical trouble shooting
5.6.7	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
5.6.8	过流保护 Over current protection	参考第 2.3 条放电要求 See paragraph 2.3	电池管理系统控制放电电流符合规格 Limit discharge current by BMS to values within specification
5.6.9	过热保护 Overtemperature protection	参考第 2.2 条和第 2.3 条 See paragraphs 2.2 and 2.3	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 specification
5.6.10	充电时间过长保护 Charging time out limit	充电时间在 8 小时内 The charging time is within 8 hours	充电时间长于 8 小时，则终止充电 Stop charging if changing time exceeds 8 hours

备注：以上 No.5.6.2、5.6.3、5.6.5、5.6.6 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技术协议规定的使用条件，客户需依“保护动作”及本技术协议其他相关规定对电池采取保护措施，同时，GFL 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. 5.6.2, 5.6.3, 5.6.5, 5.6.6 are the warning clause, draw the attention of customers: When the battery reaches any of the terms described in the above, means that the battery has been used beyond the specifications, the customer shall take protective measures on the battery in accordance with the 'protection action' and other relevant provisions of this specification. At the same time, the GFL shall not take any responsibility for the damage in connection therewith.

5.7 避免电池到达过放状态。电池电压低于 2.00V 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 2.3.5 条，当放电截止电压低于标准放电截至电压时，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。

5.7 Prevent draining any Product down to over discharge state. A Product may be permanently damaged internally when the Products voltage is lower than 2.00V and therefore should be strictly prohibited, failing which GFL's warranties under the Contract shall cease to apply, thereby releasing the GFL from any liability in connection therewith. After discharge cut-off in accordance with paragraph 2.3.5, internal power consumption of the system should be reduced to a minimum to prolong the idle time before recharge. Client undertakes to educate the users of the Products or other parties who may come to handle the Products to recharge the Products at minimum time intervals to prevent reaching the over discharge state.

5.8 若预计将电池存放 30 天以上的，应将 SOC 调整为 50%左右。50%SOC 存储三个月后，应做一次充放电调整 SOC 到 50%。50%SOC 存储超过 6 个月不做一次充放电维护将造成不可逆容量损失 4%左右。50%SOC 存储超过 9 个月不做充放电维护对电池造成的容量损失或其他缺陷赣锋锂电将不承担质量保护责任。

5.8 When the Products are intended to be stored for a prolonged period of time (more than one month), reduce SOC to around 50%. After three months of 50% SOC storage, should be charged and discharged once, reduce SOC to around 50%. 50% SOC storage lasts for more than 6 months, irreversible capacity loss will be about 4% without charge-discharge maintenance. If 50% SOC storage exceeds 9 months without charge and discharge maintenance, GFL will not be responsible for quality protection due to capacity loss or other defects.

Method of storage maintenance to 50%SOC:

Discharge at the rated current or power to the minimum cut-off voltage specified by the system manufacturer.

Charge at the rated current or power to the maximum cut-off voltage specified by the system manufacturer.

Discharge at the rated current or power to the minimum cut-off voltage specified by the system manufacturer.

Charge to 50% of the rated capacity of the system with the rated current or power specified by the system manufacturer.

5.9 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。

5.9 Prevent charging the Products at a temperature which is not allowed under the specification hereunder (including standard charge, optional fast charge, emergency charge and regeneration), otherwise unnecessary degradation of the capacity of the Products may occur. Follow the specification on minimum charging and regeneration temperature and use the BMS to control it. Charging at temperature lower than the specification hereunder shall render GFL's warranties under the Contract inapplicable, thereby releasing GFL from any liability in connection therewith.

5.10 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。

5.10 The heat dissipation of the Products should be fully considered in the design of the battery system. Because of the overheating damage of the Products caused by the heat dissipation design of the battery system. GFL will not responsible for quality assurance.

5.11 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。

5.11 The problem of waterproof and dust-proof of the battery system should be fully considered. The battery system must meet the waterproof and dust-proof grades stipulated by the relevant national standards. GFL are not responsible for quality assurance due to damages (such as corrosion, rust, etc.) of Products caused by waterproof and dust-proof problems.

5.12 禁止不同 P/N 料号电芯在同一电池系统（或整车）中混用，否则，赣锋锂电不承担质量保护责任。

5.12 It is forbidden to mix different P/N Products in the same battery system (or vehicle), otherwise GFL will not responsible for quality protection.

6. 安全防范 Safety Precautions

6.1 禁止将电池浸入水中。Do not immerse cells into water.

6.2 禁止将电池投入火中或长时间暴露在超过本规格书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，存储情况下，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。

6.2 Do not drop cells into fire or expose them to any high temperature environment exceeding operation temperature as set out in the specification, otherwise fire hazards may present. At all time, Cell Temperature should not exceed 55°C, shut down system by BMS when it occurs.

6.3 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。

6.3 Do not short circuit cell terminals, otherwise high current and temperature may cause body injury or fire hazards. Metallic cell terminals are exposed from plastic packaging and ample safety precautions should be implemented to avoid short circuiting them during system integration or connections.

6.4 严格按照标示和说明连接电池正负极，禁止反向充电。

6.4 Always connect cell terminals according to its label(s) in right polarity. Reverse charging is strictly prohibited.

6.5 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。最低保护要求见本规格书第 5.6.3 条和第 6.11 条。

6.5 It is extremely dangerous to overcharge a cell which may cause overheating and fire hazards. Multiple level of fail safe overcharge protection should be implemented in a BMS. See paragraph 5.6.3 for minimum requirement to be adopted by the BMS for protection. See also paragraph 6.11.

6.6 根据本规格书第 5.6.10 条充电后，应结束正常充电。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充状态而不能终止，定时器将会起作用从而终止充电，见本规格书第 6.11 条。

6.6 Normal charging should finish within a charging time out limit as set out in paragraph 5.6.10. When charging continues longer than charging time out 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 time out limit, ensure that the timer will intervene and stop the charging. See also paragraph 6.11.

6.7 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。

6.7 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.

6.8 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。

6.8 Do not service cells and electrical connections within plastic package of cell. Improper electrical connection within a cell may cause overheating in service.

6.9 当电解液泄露时，应避免皮肤和眼睛接触电解液。如有接触，应使用大量的清水清洗接触到的区域并向医生寻求帮助。禁止任何人或动物吞食电池的任何部件或电池所含物质。

6.9 In the event of electrolyte leakage, avoid contacting electrolyte with skin or eyes. In case come into contact, wash affected area with large amount of water and seek medical help. Do not swallow any parts or substances within a cell.

6.10 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。

6.10 Protect cells from mechanical shock, impact and pressure. Internal electrical circuit may short circuit to generate high temperature and fire hazards.

6.11 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。

6.11 When cells charging is terminated improperly for reasons such as exceeding allowable charging time, cut-off due to exceeding charging voltage or cut-off due to exceeding 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 dealer for servicing. 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'.

6.12 电芯测试实验如操作不当可能会引起电池起火或者爆炸。该测试实验只能由配备适当的防护装备的专业人员在专业的实验室进行。否则，可能会导致严重的人身伤害和财产损失。

6.12 Performing tests may result in fire or explosion of the Products. Such tests shall only be performed in qualified laboratories by qualified personnel with proper safety precautions taken. Running these tests in an improper way may result in severe personal body injury or property damages.

6.13 严禁使用没有 BMS 或类似系统的电池。

6.13 The usage of the cells without a BMS or similar System is strictly prohibited.

7. 免责声明 Disclaimer

7.1 如果由于产品需要单位不按本说明书中的规定进行使用，造成社会性影响，并对赣锋锂电的声誉造成影响的，赣锋锂电将会追究需求单位的责任。根据对赣锋锂电造成的影响程度，产品需求单位需向赣锋锂电提供赔偿。

7.1 If the product demand company is not used according to the regulations in the specification, the social influence is caused, and the reputation of the GFL is influenced, the GFL will be investigated for the responsibility of the requirement unit. According to the degree of influence on the GFL, the product demand company needs to provide compensation for the GFL.

7.2 赣锋锂电保留对产品的规格及性能参数修改的权利。买方在订购赣锋锂电产品前，需要与赣锋锂电提前确认产品的最新状态。

7.2 GFL reserves the right to modify the specifications and performance parameters of the product. The buyer needs to confirm the latest status of the GFL in advance before ordering the GFL product.

7.3 英文规格释义仅供参考，请以中文版技术规格要求为准。

7.3 English specifications are for reference only. Please refer to the technical specifications of the Chinese version.

8. 风险警告 Hazard Warning

8.1 警示声明 Warning statement

警 告 WARNING

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

不正确地操作本规格书第 2.6 条所描述的测试实验，可能导致严重的人身伤害和财产损失！RUNNING TESTS ON THE CELLS IMPROPERLY MAY RESULT IN SEVERE PERSONAL BODY INJURY OR PROPERTY DAMAGES.

必须使用正确的工具和防护装备操作电池。WORK ON CELLS MUST BE PERFORMED ONLY WITH PROPER TOOLS AND PROTECTIVE EQUIPMENT MUST BE USED.

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

不遵守上述警告可能造成多种灾难。FAILURE TO OBSERVE THE ABOVE MAY CAUSE VARIOUS HAZARDS.

8.2 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：

Client acknowledges the following potential hazards in connection with the usage and handling of the Products.

8.2.1 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。

8.2.1 Working with battery can expose the handler to chemical, shock and/or arcing hazards. Although a person's body might react to contact with direct current voltage differently than from contact with alternate current voltage, Client shall take a conservative position and consider the risk of shock or electrocution to be the same for both alternate current and direct current exposures greater than 50 volts.

8.2.2 存在来自电池中的电解液的化学风险。

8.2.2 Cells expose its handler to chemical hazards associated with the electrolyte used in the cell.

8.2.3 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。

8.2.3 When selecting work practices and personal protective equipment, Client and its employees shall consider potential exposure to these hazards and therefore prevent accidental short-circuit that can result in electrical arcing, explosion, and/or 'thermal runaway' of the cells.

9. 电芯图纸 Mechanical Drawing

