



合肥国轩高科动力能源有限公司

HEFEI GUOXUAN HIGH-TECH POWER ENERGY Co.,Ltd

编号 No

QGX034-2022

标题:
Title

IFP81175200-300Ah 锂离子充电电池产品规格书

Product Specification of IFP81175200 -300Ah Lithium Ion Rechargeable Cell

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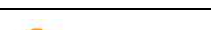
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IFP81175200-300Ah 锂离子充电电池 产品规格书

Product Specification of

IFP81175200-300Ah Lithium-ion Rechargeable Cell

制 定 Formulated by		审 核 Checked by		批 准 Approved by	
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前 言 Preface

本标准为公司统一执行的企业标准。

The specification is the enterprise standard uniformly implemented by the company.

本标准的编写格式符合 GB/T 1.1-2020 《标准化工作导则 第 1 部分：标准化文件的结构和起草规则》的规定。

The format of this specification is in accordance with the provisions of GB/T 1.1-2020, Directives for standardization Part1 : Rules for the structure and drafting of standardizing documents.

本标准参照：GB/T36276-2018 《电力储能用锂离子电池》、GB/T 31484-2015 《电动汽车用动力蓄电池循环寿命要求及试验方法》、GB 38031-2020 《电动汽车用动力蓄电池安全要求》、GB/T 31486-2015 《电动汽车用动力蓄电池电性能要求及试验方法》、IEC62619-2017、IEC 62660-2-2018、Q/GX 60013-2020 《电动汽车用锂离子动力电池单体电性能测试方法》的基础上，结合我公司产品实际和试验条件，特制定《IFP81175200-300Ah 锂离子电池产品规格书》标准，并对试验方法、判定标准内容进行了阐述，以指导 IFP81175200-300Ah 锂离子电池产品的性能检测。

This specification refers to GB/T36276-2018 Lithium ion batteries for electric energy storage, GB/T 31484-2015 cycle life requirements and test methods for power cell for electric vehicles, GB/T 38031-2020 safety requirements and test methods for power cell for electrical vehicles, GB/T 31486-2015 electrical performance requirements and test methods for power cell for electric vehicles, IEC62619-2017, IEC 62660-2-2018, Q/GX 60013-2020 electrical performance test method of lithium ion power cell for electrical vehicles. Combined with the actual and test conditions of our company's product, the standard of QGX034-2022 product specification for IFP81175200-300Ah Lithium-ion rechargeable cell is specially formulated. The test method and criteria is revised and supplemented to guide the manufacturing and approval of IFP81175200-300Ah Lithium ion rechargeable cell.

注：若修改，以最新发布标准为准。

Remark: If modified, please take the latest version as standard.

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修订记录 Modification Record

版本号 Version Number	变更内容 Description of Changes	修订日期 Revision Date	修订者 Reviser
QGX034-2022	首次发布 1 st Edition	2022.5.23	王世旭/曹利娜 Shixu Wang/Lina Cao
QGX034-2023	1、“IFP81175200-300Ah 锂离子电池产品规格书”修改名称为“IFP81175200-300Ah 锂离子充电电池产品规格书”； 2、标称能量由 950wh 修改为 960wh 3、电芯厚度由 $81.2 \pm 0.5\text{mm}$ 修改为 $81 \pm 0.5\text{mm}$ ；电芯肩高由 200.3 ± 0.5 修改为 200.5 ± 0.5 ；电芯总高由 202.6 ± 0.5 修改为 $202.5 \pm 0.5\text{mm}$	2023.6	王世旭/曹利娜 Shixu Wang/Lina Cao

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1.基本信息 Basic Information				
1.1 适用范围 Scope				
本产品规格书由合肥国轩高科动力能源有限公司提供给客户，描述了其锂离子二次电池的性能。 This specification is provided to customers by HEFEI GUOXUAN HIGH-TECH POWER ENERGY Co. Ltd., describing Lithium ion rechargeable cell properties.				
1.2 用途 Application: 储能 ES、EV				
1.3 产品类型 Product type:				
锂离子二次电池，方形，LFP 电芯 Lithium ion rechargeable battery				
1.4 型号名称 Model Name: IFP81175200-300Ah				
2.规格 Specification				
2.1 标准技术参数 Standard Technical Parameters				
项目 Items		参数 Specification		条件/注释 Condition/Notes
2.1.1 标称容量 Nominal Capacity		300Ah		参考 4.1.1 与 4.1.2 标准充放电模式测试 Refer to 4.1.1&4.1.2 standard charge and discharge procedure
2.1.2 标称能量 Nominal Energy		960Wh		参考 4.1.1 与 4.1.2 标准充放电模式测试 Refer to 4.1.1&4.1.2 standard charge and discharge procedure
2.1.3 标称电压 Nominal Voltage		3.2V		
2.1.4 充放电电压范围 Charge/Discharge Voltage Range		2.5V~3.65V		T>0°C
		2.0 V~3.65V		T≤0°C，不允许连续充电 Forbid continuous charging
2.1.5 重量 Cell Weight		5998±300g		
2.1.6 质量能量密度 Weight Energy Density		160Wh/kg		
2.1.7 体积能量密度 Volume Energy Density		330Wh/L		
2.1.8 交流内阻 ACR		0.1mΩ≤R≤0.3mΩ		25°C±2°C 新电池状态（17%±3%SOC） Fresh cell（17%±3%SOC）
2.1.9 直流内阻 DCR		<0.5mΩ		50%SOC@3C30S, 25±2°C
2.2 推荐充电规范 Recommended Charge Specification				
项目 Items		参数 Specification		条件/注释 Condition/Notes
2.2.1 恒功率充电 Standard Power Charge		0.5P(475W) 3.65V 15°C≤T<45°C		恒功率 Constant Power 截止条件（终止）Cut off condition (terminating) 温度 Temperature
2.2.2 常规充电（慢充）Regular Charge (Slow Charge)		150A 3.65V 15A 15°C≤T<45°C		恒流 Constant current 恒压 Constant voltage 截止条件（终止）Cut off condition (terminating) 温度 Temperature
2.2.3 阶梯充电（快充）Step Charge		见附件 A.1 See appendix A.1		不同温度的快充策略 Fast charging strategy at different temperature

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2.3 工作温度范围 Working Temperature Range

项目 Items	参数 Specification	条件/注释 Condition/Notes
2.3.1 最佳工作温度 Optimum Working Temperature	15~35℃	
2.3.2 充电温度范围 Charge Temperature Range	0~55℃	充电电流, 见附件 A.1 Charging current, see appendix A.1
2.3.3 放电温度范围 Discharge Temperature Range	-30~60℃	电芯温度≤60℃ Cell temperature T≤60℃

3.外观尺寸 Appearance And Dimension

3.1 外观 Appearance

电池外表面无明显的划痕、裂痕、铜极柱无明显铜绿腐蚀异常、焊缝无明显炸点漏液异常、防爆膜无破损异常。

Without obvious scratches, cracks, rust, discoloration or electrolyte leakage, no other appearance defects affecting cell normal operation

3.2 尺寸 Dimension

厚度 Thickness: (81±0.5) mm (含外包膜厚度, 17%±3%SOC, 200±20kgf)

Thickness: (81±0.5)mm (including outer film thickness, 17%±3%SOC, 200±20kgf)

宽度 Width: (175.4±0.5) mm (含外包膜)

Width: (175.4±0.5)mm (including outer film thickness)

高度 Height: (200.5±0.5) mm (不含极柱, 含外包膜和顶盖贴片)

(202.5±0.5) mm (含极柱, 含外包膜和顶盖贴片)

Height: (200.5±0.5)mm (including outer film thickness and excluding terminals)

Height: (202.5±0.5)mm (including outer film thickness and terminals)

4.性能测试规范 Performance Specification

4.1 标准测试条件 Standard Test Condition

4.1.1 标准充电模式 Standard Charge Method

室温下 (25℃±2℃), 单体蓄电池以 0.5P(475W)恒功率放电至电压为 2.5V, 静置 30min, 然后在以 0.5P(475W) 恒功率充电至 3.65V,静置 30min。

At room temperature (25℃±2℃), 0.5P(475w) constant power discharge to 2.5V, rest 30min, then 0.5P (475w)constant power charge to 3.65V, rest 30min.

4.1.2 标准放电模式 Standard Discharge Method

室温下 (25℃±2℃), 单体蓄电池以 0.5P(475W)恒功率放电至电压为 2.5V, 静置 30min。

At room temperature (25℃±2℃), 0.5P(475w) constant power discharge to 2.5V, rest 30min.

4.2 电气特性 Electrical Specification

项目 Items	参数 Specification	条件/注释 Condition/Notes
4.2.1 初始容量/能量 Initial Capacity/Energy	≥300Ah/960Wh	参考 4.1.1 与 4.1.2 标准充放电模式 测试 Refer to 4.1.1&4.1.2 standard charge and discharge procedure

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4.2.2 容量与温度的相关性 Capacity And Temperature Correlation	55℃, ≥95% 初始容量 25℃, 100% 初始容量 0℃, ≥90% 初始容量 -20℃, ≥80% 初始容量 -30℃, ≥70% 初始容量 55℃, ≥95% Initial Capacity 25℃, 100% Initial Capacity 0℃, ≥85% Initial Capacity -20℃, ≥80% Initial Capacity -30℃, ≥70% Initial Capacity	25℃±2℃温度下, 按照 300A CC-CV 至 3.65V 15A 截止充电, 在测试温度下静置 20h, 以 300A 放电至 2.5V (0℃及以下 2.0V) At room temperature(25℃±2℃), 300A charge to 3.65V followed by constant voltage charging until current drops down to 15A, rest 20h at testing temperature, 300A discharge to 2.5V (to 2.0V at or below 0℃) .		
4.2.3 能量与温度的相关性 Energy And Temperature Correlation	45℃, ≥98% 初始能量 5℃, ≥75% 初始能量 45℃, ≥98% Initial Energy 5℃, ≥75% Initial Energy	参照 GB/T36276-2018 《电力储能用锂离子电池》测试 Refers to GB/T36276-2018 Lithium ion batteries for electric energy storage		
4.2.4 SOC-OCV 表 SOC-OCV Table	见附件 A.4 See appendix A.4	25℃±2℃温度下, 按照 300A CCCV 至 3.65V 0.05C 截止充电, 静置 1h 后, 然后以 300A 放电 5% 容量 (此容量为按照 300A 放电至对应截止电压 ([-30℃~0℃) 2.0V, [0℃~10℃) 2.3V, [10℃~55℃] 2.5V) 对应的容量, 静置 1h, 重复 20 次, 记录静置后的电压数据。 At room temperature (25℃±2℃) , charge at 300A to 3.65V followed by constant voltage charging until current drops down to 15A, rest 1h, then 300A discharge for 5% capacity (The capacity is obtained by 300A discharging to certain cut-off voltage (-30℃-0℃)2.0V,(0℃-10℃)2.3V, (10℃-55℃) 2.5V, rest 1h, repeat 20 times, record voltage after rest.		
4.2.5 不同温度&不同 SOC 放电电阻(DCR) Discharge DCR At Different Temperature and SOC	见附件 A.5 See appendix A.5	25℃±2℃温度下, 按照 300A CCCV 至 3.65V 0.05C 截止充电, 静置 1h 后然后以 300A 按照 4.2.2 不同温度下放电容量调整 SOC (截止电压参照 4.2.2), 静置 1h, 测试 3C 放电 30s 的 DCR。 放电电阻为开路电压与放电末端电压的差值除以电流, 静置 1h, 测试 2.25C 充电 15s 的 DCR。 充电电阻为充电末端电压与开路电压的差值除以电流测试 SOC 为 95%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 5%。		
4.2.6 不同温度&不同 SOC 充电电阻(DCR) Charge DCR At Different Temperature And SOC	见附件 A.6 See appendix A.6	At room temperature (25℃±2℃) , 300A charge to 3.65V followed by constant voltage charging until current drops down to 15A, rest 1h , then 300A Discharge to adjust SOC according to the 4.2.2 discharge capacity at different		

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temperatures (refer to 4.2.3 for cut-off voltage), rest 1h, and test the DCR under the condition of discharge at 3C for 30s, rest 40s, charge at 2.25C for 15s The discharge resistance is the difference between the open circuit voltage and the discharge end voltage divided by the current, tested SOC is 95%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 5%; The charging resistance is difference between the charging terminal voltage and the open circuit voltage divided by the current, tested SOC at 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95%.				
4.3 最大脉冲功率（极限能力值）Maximum Plus Power（Ultimate Capacity Value）				
项目 Items		参数 Specification	条件/注释 Condition/Notes	
4.3.1 不同温度&不同 SOC 脉冲放电峰值功率 Peak Power Plus Discharge At Different Temperature And SOC		见附件 A.7 See appendix A.7	按 4.2.5 测试数据计算的 DCR 和最大脉冲放电电流，计算出在不同温度规定的放电下限电压时的脉冲放电功率。 According to the DCR and the maximum pulse charging current calculated from the test data of 4.2.5, the pulse discharge power at the lowest limit voltage specified at different temperature.	
4.3.2 不同温度&不同 SOC 脉冲回馈峰值功率 Peak Power Plus Feedback At Different Temperature And SOC		见附件 A.8 See appendix A.8	按 4.2.6 测试数据计算的 DCR 和最大脉冲充电电流，计算出在充电上限电压 3.65V 时的脉冲回馈功率。 According to the DCR and the maximum pulse charging current calculated from the test data of 4.2.5, the pulse feedback power at the upper charging voltage of 3.65v was calculated.	
4.4 最大允许脉冲功率（使用允许值）Maximum Allowable Pulse Charge Power（Use Allowable Values）				
项目 Items		参数 Specification	条件/注释 Condition/Notes	
4.4.1 不同温度&不同 SOC 最大允许脉冲放电功率 Maximum allowable pulse discharge power at different Temperature and SOC		见附件 A.9 See appendix A.9	依据 4.3.1 电芯最大脉冲放电倍率能力和放电过程温度保护考虑，对电芯脉冲放电功率上限进行限定。 According to 4.3.1 maximum pulse discharge multiplier capacity of the cell and temperature protection of the discharge process, the upper limit of the pulse discharge power of the cell is limited.	
4.4.2 不同温度&不同 SOC 最大允许脉冲回馈功率 Maximum allowable pulse feedback power at different Temperature and SOC		见附件 A.10 See appendix A.10	依据 4.3.2 电芯最大脉冲充电倍率能力，结合电芯在大倍率下的脉冲充电可靠的上限电压和充电过程温度保护考虑，对电芯脉冲回馈功率上限进行限定。 According to 4.3.2 maximum pulse charging capacity of the cell, the upper limit of the feedback power of the cell is limited in	

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			consideration of the reliable upper limit voltage and temperature protection of the charging process of the cell under the high voltage.	
4.5 耐久性能 Durability Performance				
项目 Items		参数 Specification	条件/注释 Condition/Notes	
4.5.1 存储温度范围 Optimum Storage Temperature Range		-30~60℃	30%~50%SOC	
4.5.2 室温荷电保持率 Room Temperature SOC Retention Rate		≥95%	25±2℃, 100%SOC, 28 days	
4.5.3 室温容量恢复率 Room Temperature Capacity Recovery Rate		≥96%		
4.5.4 高温荷电保持率 High Temperature SOC Retention Rate		≥94%	45℃±2℃, 100%SOC, 7 days	
4.5.5 高温容量恢复率 High Temperature Capacity Recovery Rate		≥95%		
4.5.6 储存容量恢复率 Storage Capacity Recovery Rate		≥95%	45℃,50%SOC,28 days	
4.5.7 室温能量保持率/充放电能量恢复率 Room Temperature Energy Retention Rate/ Recovery Rate		≥90%/≥92%	25±2℃, 100%SOC, 28 days 参照 GB/T36276-2018 《电力储能用锂离子电池》测试 Refers to GB/T36276-2018 Lithium ion batteries for electric energy storage	
4.5.8 高温能量保持率/充放电能量恢复率 High Temperature Energy Retention Rate/ Recovery Rate		≥90%/≥92%	45±2℃, 100%SOC, 7 days 参照 GB/T36276-2018 《电力储能用锂离子电池》测试 Refers to GB/T36276-2018 Lithium ion batteries for electric energy storage	
4.5.9 储存能量恢复率 Storage Energy Recovery Rate		≥90%	45±2℃, 50%SOC, 28 days 参照 GB/T36276-2018 《电力储能用锂离子电池》测试 Refers to GB/T36276-2018 Lithium ion batteries for electric energy storage	
4.5.10 常温循环寿命 Room Temperature Cycle Life		6000 cycles	使用企业钢板夹具约束单体蓄电池，初始夹紧力 150±50kgf 25±2℃, 0.5P/0.5P 100%DOD, 80%EOL	
		7000 cycles	使用企业钢板夹具约束单体蓄电池，初始夹紧力 150±50kgf 25±2℃, 0.5P/0.5P 90%DOD, 80%EOL	
		8000 cycles	使用企业钢板夹具约束单体蓄电池，初始夹紧力 150±50kgf 25±2℃, 0.5P/0.5P 90%DOD, 70%EOL	
4.5.11 高温循环寿命 High Temperature Cycle Life		2000 cycles	使用企业钢板夹具约束单体蓄电池，初始夹紧力 150±50kgf 45℃, 0.5P/0.5P 100%DOD, 80%EOL	
4.5.12 日历寿命 Calendar Life		15 years	25±2℃, 50%SOC ,70%EOL	
4.6 安全测试规范 Specification Of Safety Test				

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项目 Items		参数 Specification	条件/注释 Condition/Notes	
4.6.1 过放电 Over discharge Test		不爆炸，不起火， No explosion, no fire	单体蓄电池按 4.1.1 方法充电，电池单体（使用企业钢板夹具约束单体蓄电池，夹紧力 150±50kgf）以恒流方式放电至时间达到 90 min 或电压达到 0V 时停止放电，并观察 1h。（放电电流取 1Cr _{dn} '与产品的最大持续放电电流中的较小值） The cell was charged according to the method of 4.1.1, and the single cell was discharged with a constant current for 90 min and observed for 1 h. (Discharge current is the smaller value between 1Cr _{dn} ' and the maximum continuous discharge current of the product;)	
4.6.2 过充电 Overcharge Test		不爆炸，不起火 No explosion, no fire	单体蓄电池按 4.1.1 方法充电，电池单体（使用企业钢板夹具约束单体蓄电池，夹紧力 150±50kgf）以恒流方式充电至电压达到电池单体充电终止电压的 1.5 倍或时间达到 1h 时停止充电，并观察 1h。（充电电流取 1Cr _{cn} 与产品的最大持续充电电流中的较小值） The cell is charged according to the method of 4.1.1, and is charged with a constant current until the voltage reaches 1.5 times of the charging end voltage specified in the technical conditions of the enterprise or the charging time reaches 1 h, and the charging is stopped and observed for 1h. (Charge current is the smaller value between 1Cr _{cn} ' and the maximum continuous discharge current of the product)	
4.6.3 短路 Short Circuit Test		不爆炸，不起火 No explosion, no fire	单体蓄电池按 4.1.1 方法充电，将电池单体（使用企业钢板夹具约束单体蓄电池，夹紧力 150±50kgf）正、负极经外部短路 10 min,外部线路电阻应小于 5 mΩ，并观察 1h。 The cell is charged according to the method of 4.1.1, and the cathode and anode terminals of the cell are externally short-circuited for 10 min, and the external line resistance should be less than 5 mΩ, and observed for 1 h.	
4.6.4 跌落 Drop Test		不爆炸，不起火， No explosion, no fire	单体蓄电池按 4.1.1 方法充电，将电池单体的正极或负极端子朝下从 1.5 m 高度处自由跌落到水泥地面上 1 次，并观察 1h。 The cell is charged according to the method of 4.1.1. The positive or negative terminals of the cell are freely dropped one time from the height of 1.5 m onto the concrete floor and observed for 1 h.	
4.6.5 加热 Heating Test		不爆炸，不起火 No explosion, no fire	单体蓄电池按 4.1.1 方法充电，将电池单体放入加热试验箱，以 5 °C/ min 的速率由环境温度升至(130±2)°C，并保持此温度，并保持此温度 30min 后停止加热，并观察 1h。 The cell was charged according to the method of 4.1.1, and the temperature box was raised from room temperature to 130 °C ± 2 °C at a rate of 5 °C / min. After maintaining this temperature for 30 min, the heating was stopped and observed for 1 h.	

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4.6.6 挤压 Crush Test	不爆炸，不起火 No explosion, no fire	单体蓄电池按 4.1.1 方法充电； 按下列条件进行试验： a) 挤压方向：垂直于蓄电池极板方向施压； b) 挤压板形式：半径为 75mm 的半圆柱体，半圆柱体的长度(L)大于被挤压电池的尺寸； c) 挤压速度：(5±1) mm/s； d) 挤压程度：电压达到 0V 或变形量达到 30%或挤压力达到(13±0.78)kN 时停止挤压，保持 10min； 并观察 1h。 The cell is charged according to the method of 4.1.1; Test according to the following conditions: a) Crushing direction: apply pressure perpendicular to the battery plate; b) Crushing flat form: a semi-cylindrical body with a radius of 75 mm, the length (L) of the semi-cylindrical body is larger than the size of the battery to be squeezed; c) Crushing speed: (5 ± 1) mm / s; d) Degree of crushing : after the voltage reaches 0V or the deformation amount reaches 30% or the applied force reaches (13±0.78)kN, the crushing is stopped and kept for 10 minutes; And observe 1h.	
4.6.7 低气压 Low Pressure Test	不爆炸，不起火，不漏液 No explosion, no fire, no leakage	单体蓄电池按 4.1.1 方法充电，将电池单体放入低气压箱中，将气压调节至 11.6kPa，温度为(25±5)°C，静置 6h，观察 1h。 The cell is charged according to the method of 4.1.1, the cell is placed in the low pressure box, the air pressure in the test chamber is adjusted to 11.6KPa, the temperature is room temperature, and it is allowed to stand for 6h, and observed for 1h.	

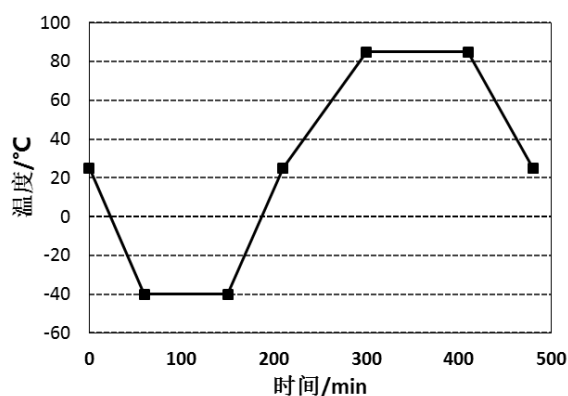
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	4.6.8 热失控 Thermal Runaway Test	不爆炸，不起火， No explosion, no fire	1、测试方法：a)使用平面状或棒状加热装置，并且其表面应覆盖陶瓷，金属或绝缘层，加热装置加热功率应符合表 A.1 的规定。完成电池单体与加热装置的装配，加热装置与电池应直接接触,加热装置的尺寸规格不应大于电池单体的被加热面；安装温度监测器，监测点温度传感器布置在远离热传导的一侧，即安装在加热装置的对侧，温度数据的采样间隔不应大于 1s，准确度应为$\pm 2\text{ }^{\circ}\text{C}$，温度传感器尖端的直径应小于 1 mm； b)电池单体初始化充电后，使用企业钢板夹具约束单体蓄电池（夹紧力 $150\pm 50\text{kgf}$），再用 1C_{rcn} 恒流继续充电 12 min； c)启动加热装置，并以其最大功率对测试对象持续加热，当发生热失控或监测点温度达到 300 $^{\circ}\text{C}$时，停止触发，关闭加热装置； d)记录试验结果。 2、判定方法：是否发生热失控应按下列条件判定： a)测试对象产生电压降； b)监测点温度达到电池的保护温度； c)监测点的温升速率$\geq 1\text{ }^{\circ}\text{C/s}$； d)当 a)+c)或 b)+c)发生时,判定电池单体发生热失控； e)加热过程中及加热结束 1h 内，如果发生起火、爆炸现象，试验应终止并判定为发生热失控。 1.Test method: a) Use flat or rod shaped heating device, and its surface shall be covered with ceramic、metal or insulating layer. The heating power of the heating device shall conform to the provisions in Table A.1. Complete the assembly of the cell and the heating device, the heating device and the cell should be in direct contact, the size of the heating device should not be larger than the heating surface of the cell; Install a temperature monitor and the temperature sensor of the monitoring point is arranged on the side away from the heat conduction, that is, installed on the opposite side of the heating device (see Figure A.2). The sampling interval of temperature data should not be more than 1s, the accuracy should be $\pm 2\text{ }^{\circ}\text{C}$, and the diameter of the temperature sensor tip should be less than 1 mm. b) After the initial charging of the cell ,continue charging for 12 min with 1C constant current; c) Start the heating device and continue heating the test object with its maximum power. When thermal runaway occurs or the temperature of the monitoring point reaches 300 $^{\circ}\text{C}$, stop triggering and close the heating device; d) Record test results. 2 .Determination method: whether the occurrence of thermal control should be determined according to the following conditions: a) The test object generates voltage drop; b) The temperature of the monitoring point reaches the protection temperature of the battery; c) Temperature rise rate of monitoring point $\geq 1\text{ }^{\circ}\text{C/s}$; d) When a)+ c) or b)+ c) occurs, the cell is judged to have thermal runaway; e) In the process of heating and within 1 hour after heating, if fire or explosion occurs, the test shall be terminated and judged as thermal runaway.

4.6.9 温度循环
 Temperature Cycle
 Test

不爆炸，不起火
 No explosion, no fire

单体蓄电池按 4.1.1 方法充电，单体蓄电池放入温度箱中，温度箱温度按照下表进行调节，循环次数 5 次，观察 1h。
 The single cell is charged according to the method of 4.1.1. The single cell is placed in the temperature box, and the temperature of the temperature box is adjusted according to the following table. The number of cycles is 5 times and observed for 1 hour.

温度 Temp ℃	时间增量 Time increasing min	累计时间 cumulative time min	温度变化率 Temperature change rate℃/min
25	0	0	0
-40	60	60	13/12
-40	90	150	0
25	60	210	13/12
85	90	300	2/3
85	110	410	0
25	70	480	6/7



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5.使用注意事项 Notes

锂离子充电电池的使用警告，操作不当可能会造成电池发热、起火和性能劣化，务必认真阅读以下条款。
 Warning for using the lithium-ion rechargeable cell. Mishandling of the cell may cause heat, fire and deterioration in performance. Be sure to observe the following.

注意事项 Precautions

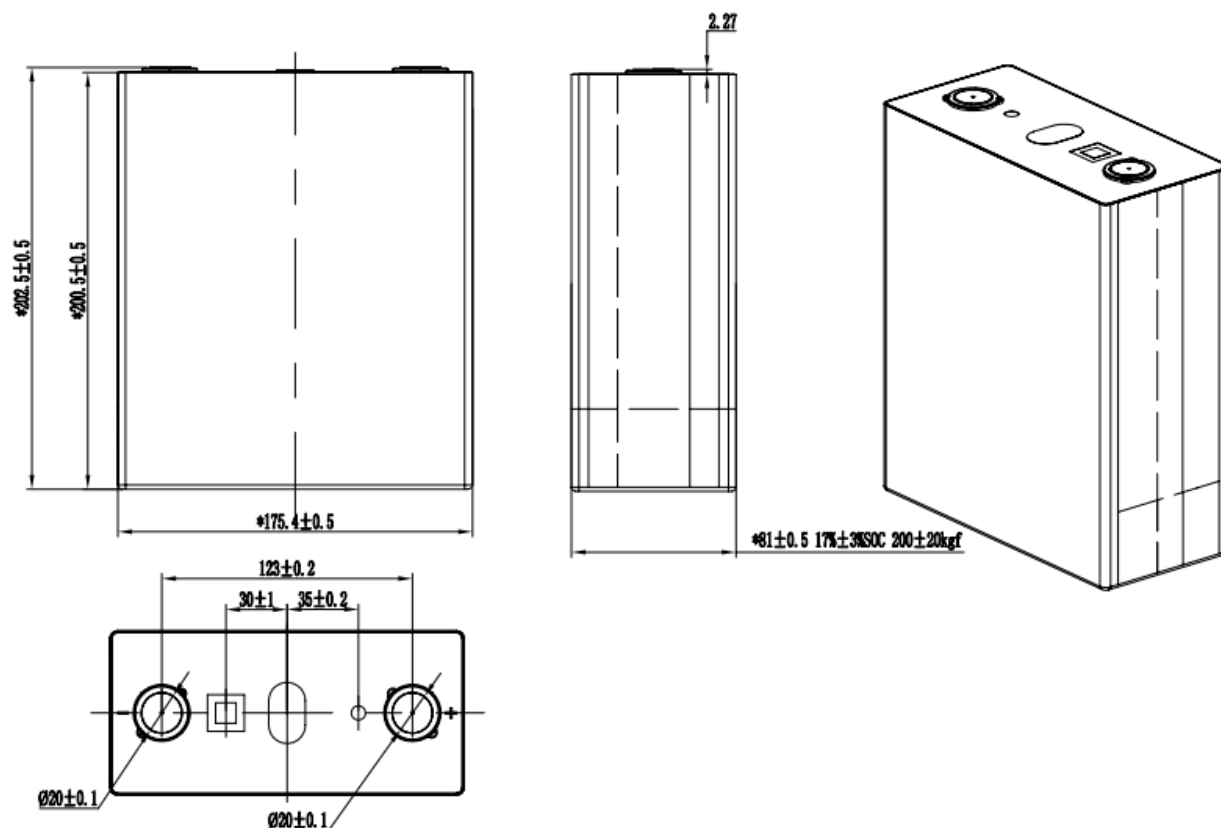
- 应用配有电池的设备时，使用前请参阅用户手册。
 When using a device equipped with a battery, refer to the user manual before use.
- 包装前请检查正极和负极端子的方向。
 Check the orientation of the cathode and anode terminals before packaging.
- 端子或导线与电池模块相连，注意绝缘防止短路。
 The terminal or wire is connected to the cell module, pay attention to the insulation to prevent short circuit.
- 长期不用时，电池要存放于阴凉干燥处 ($\leq 35^{\circ}\text{C}$, 30%~50%SOC, 环境湿度 $\leq 85\%\text{ROH}$, 无凝露, 3个月进行一次充放电)。
 Store the cell in a cool dry place ($\leq 35^{\circ}\text{C}$, 30%~50%SOC, Storage ambient humidity $< 85\% \text{ ROH}$, no Condensation, charge and discharge once every 3 months) when not in use for a long time.
- 不要将电池放置于阳光直射处或热源。
 Do not place the cell in direct sunlight or heat source to prevent high temperature of the cell.
- 处理电池单元时请勿穿戴金属饰品 (如戒指, 手表, 饰件等)。
 Do not wear metal accessories (such as rings, watches, accessories, etc.) when handling cell units.,
- 请勿将电池放置在本文件规定的使用温度范围之外的地方。
 Do not place the cell outside the operating temperature range specified in this document.

禁止事项 Prohibited Items

- 请勿超过最大充电倍率充电。
 Do not charge more than the maximum charge rate.
- 请勿拆卸或改装电池。
 Do not disassemble or modify the Cell.
- 请勿抛掷或撞击电池。
 Do not throw or hit the battery.
- 请勿用锐器刺穿电池。(例如钉子, 刀子, 笔, 电钻)

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Do not pierce the battery with a sharp object. (eg nails, knives, pens, electric drills) - 请勿与其它型号电池或模块单元混用。 Do not mix with other cell or module units. - 勿将新、旧电池在 PACK 中同时使用。 Do not use both new and old cell in PACK. - 请勿将电池放置于大于 60℃ 高温处。 Do not place the cell at a temperature higher than 60 °C. - 不要将电池放入微波炉或高压容器中。 Do not put the cell in a microwave or high pressure container. - 请勿用导电材料连接正、负极端子。(例如金属, 电线) Do not connect the positive and negative terminals with conductive materials. (eg metal, wire) - 不允许弄湿或将电池浸入水或海水中。 Do not allow to wet or immerse the cell in water or sea water. - 请勿以制造商书面协议之外的方式使用电池。 Do not use the battery in a manner other than the manufacturer's written agreement		

6.外形图纸 Mechanical Drawing



电芯尺寸 Cell Dimension

注：图中尺寸单位为毫米（mm）。

Remark: The dimensions are shown in millimeters（mm）

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附录 Appendix

A.1 阶梯充电矩阵表 Step Charge Table

步骤 Procedure	温度 Temperature	$<0^{\circ}\text{C}$	$0^{\circ}\text{C}\leq T<5^{\circ}\text{C}$	$5^{\circ}\text{C}\leq T<15^{\circ}\text{C}$	$15^{\circ}\text{C}\leq T<25^{\circ}\text{C}$	$25^{\circ}\text{C}\leq T<45^{\circ}\text{C}$	$45^{\circ}\text{C}\leq T<50^{\circ}\text{C}$	$50^{\circ}\text{C}\leq T<55^{\circ}\text{C}$
1	充电电流 Charge current (C)	不允许充电 Forbid charging	0.1	0.2	0.5	1	0.5	0.2
	跳转电压 Jumping voltage (V)	/	3.50	3.50	3.50	3.45	3.50	3.50
2	充电电流 Charge current (C)	/	0.05	0.05	0.2	0.50	0.20	0.10
	跳转电压 Jumping voltage (V)	/	3.60	3.60	3.60	3.60	3.6	3.60
3	充电电流 Charge current (C)	/	0.02	0.02	0.1	0.2	0.05	0.05
	截止电压 Cutoff voltage (V)	/	3.65	3.65	3.65	3.65	3.65	3.65

A.2 单体电芯故障阈值 Single Cell Failure Threshold (Recommended Value)

A.2.1 单体电芯故障阈值 Single Cell Failure Threshold (BMS)

参数 Parameter	规格 Specification	解释说明 Description	保护动作 Action
单体过电压严重报警阈值(V)Single cell overvoltage critical alarm threshold (V)	3.8	充电时过电压超过报警阈值, 将影响电池的循环寿命, 用户充电不允许超过此电压值 When the overvoltage exceeds the alarm threshold during charging, it will affect the cycle life of the cell. User charging is not allowed to exceed this voltage value.	强制断电 Power must be turned off
单体过电压一般报警阈值 (V) Single cell overvoltage general alarm threshold (V)	3.7	充电时过电压的临界值 Critical value of overvoltage during charging	超过 5 强制断电 Power must be turned off over 5s
最大工作电压 (V) Maximum working voltage (V)	3.65	正常工作的最大极限值 Maximum limit of normal operation	
单体欠压严重报警阈值 (V)Single under voltage critical alarm threshold (V)	$[-30^{\circ}\text{C}-0^{\circ}\text{C}]$ 1.8 $[0^{\circ}\text{C}-55^{\circ}\text{C}]$ 2.0	放电时欠压超过报警阈值, 将影响电池的循环寿命, 用户放电不允许超过此电压值 When the under-voltage exceeds the alarm threshold during discharge, it will affect the cycle life of the cell. The user discharge must not exceed this voltage value	

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单体欠压一般报警阈值 Single under voltage critical alarm threshold V	[-30℃~0℃) 1.9 [0℃~55℃] 2.2	放电时欠压超过报警阈值，将影响电池的循环寿命，用户放电不允许超过此电压值 When the under voltage exceeds the alarm threshold during discharge, it will affect the cycle life of the battery. The user discharge must not exceed this voltage value.		
最小工作电压 (V) Minimum operating voltage (V)	[-30℃-0℃) 2.0 [0℃-55℃] 2.5	正常工作的最小临界值 Minimum threshold for normal operation		
电池温度过高一般报警阈值℃ Cell temperature is too high general alarm threshold °C	55	充电温度超过 55℃，禁止充电 放电温度超过 55℃，降功率 Battery operating temperature above this temperature will limit cell power		
电池温度过高严重报警阈值℃ Battery temperature is too high, critical alarm threshold °C	60	电池温度超过此报警阈值，将会影响电池安全性能，用户使用时不应超过此温度 If the cell temperature exceeds this alarm threshold, it will affect the cell safety performance. The user should not exceed this temperature when using it.		
电池温度过低一般报警阈值 °C Low battery temperature general alarm threshold °C	-20	电池工作温度低于此温度，将会限制电池使用功率 If the operating temperature of the battery is lower than this temperature, the power of the battery will be limited		
电池温度过低严重报警阈值℃ Battery temperature is too low, critical alarm threshold °C	-30	电池温度低于此报警阈值，将会影响电池安全性能，用户使用时不应低于此温度 If the cell temperature is lower than this alarm threshold, it will affect the safety performance of the cell. The user should not use it below this temperature.		

A.2.2 为 Pack 设计提供的电池信息 Cell Information for Pack Design

电池型号 Cell Model	符号 Symbol	数值 Numerical value	意见 Suggestions	参考 Reference
Pack 装配过程最大允许压力 Maximum allowable pressure during Pack assembly	Fmax	TBD		600kgf, 17%±3%SOC
Pack 装配后电芯最终压力 Optimal pressure after Pack assembly	Fmin	TBD		150±50kgf, 17%±3%SOC

A.3 在选定条件下的循环寿命 Cycle Life at Certain Condition

A.3.1 常温循环寿命 Room Temperature Cycle Life

测试条件 Test Conditions

充电：单体蓄电池以 0.5P(475W)恒功率放电至电压为 2.5V，静置 30min，然后在以 0.5P(475W) 恒功率

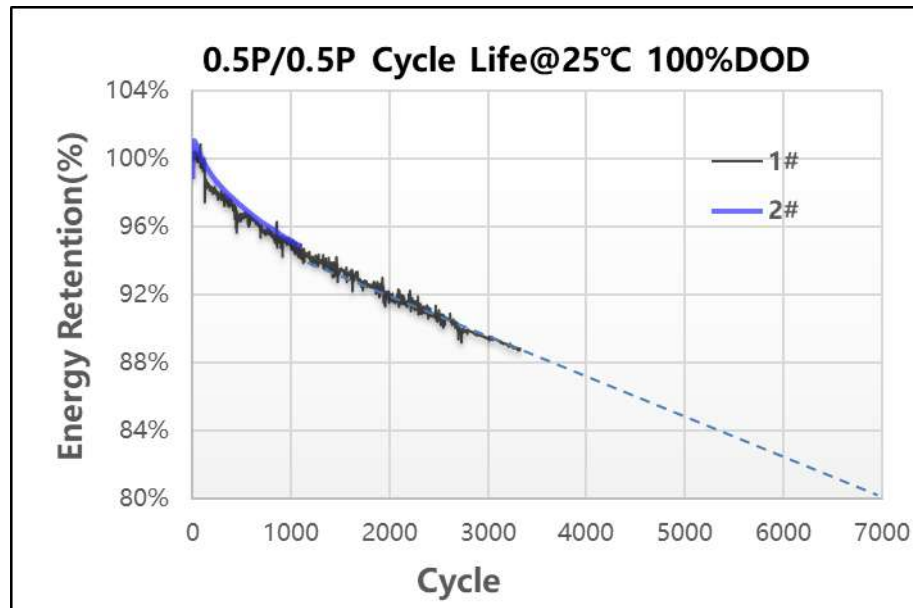
充电至 3.65V,静置 30min。

Charge: 0.5P(475w) constant power discharge to 2.5V, rest 30min, then 0.5P (475w)constant power charge to 3.65V, rest 30min.

放电: 单体蓄电池以 0.5P(475W)恒功率放电至电压为 2.5V, 静置 30min。

Discharge : 0.5P(475w) constant power discharge to 2.5V, rest 30min.

温度: 25±2℃ Temperature: 25±2℃



A.4 SOC-OCV 表 SOC-OCV table

T SOC	55°C	45°C	35°C	25°C	10°C	5°C	0°C	-10°C
0%	2.797	2.814	2.855	3.065	3.190	3.142	3.200	3.211
5%	3.140	3.158	3.178	3.203	3.204	3.197	3.205	3.220
10%	3.206	3.206	3.206	3.210	3.217	3.206	3.213	3.229
15%	3.219	3.222	3.226	3.238	3.244	3.220	3.236	3.239
20%	3.246	3.248	3.251	3.258	3.264	3.248	3.258	3.250
25%	3.261	3.263	3.266	3.276	3.278	3.267	3.271	3.262
30%	3.278	3.280	3.284	3.286	3.282	3.278	3.277	3.270
35%	3.296	3.294	3.291	3.288	3.283	3.281	3.279	3.273
40%	3.297	3.295	3.292	3.288	3.284	3.282	3.280	3.275
45%	3.298	3.295	3.293	3.289	3.284	3.282	3.280	3.276
50%	3.298	3.296	3.293	3.290	3.285	3.283	3.281	3.277
55%	3.300	3.297	3.295	3.294	3.289	3.285	3.284	3.279
60%	3.307	3.305	3.304	3.311	3.301	3.292	3.292	3.283
65%	3.330	3.329	3.328	3.326	3.319	3.308	3.307	3.290
70%	3.331	3.330	3.329	3.327	3.324	3.320	3.318	3.298
75%	3.331	3.330	3.329	3.328	3.324	3.322	3.320	3.307
80%	3.331	3.330	3.330	3.328	3.324	3.322	3.320	3.311
85%	3.332	3.331	3.330	3.328	3.324	3.321	3.319	3.312
90%	3.333	3.331	3.330	3.328	3.323	3.320	3.318	3.310
95%	3.334	3.333	3.331	3.329	3.323	3.320	3.318	3.310
100%	3.400	3.418	3.449	3.470	3.477	3.497	3.504	3.493

A.5 不同温度&不同 SOC 的放电电阻 Discharge DCR at Different Temperature and SOC

DCR/mΩ@3C 30s							
T SOC	-20℃	-10℃	0℃	10℃	25℃	45℃	55℃
10%	/	/	1.03	0.80	0.58	0.34	0.32
20%	/	/	0.89	0.64	0.45	0.31	0.29
30%	/	1.21	0.78	0.58	0.41	0.30	0.28
40%	/	1.08	0.71	0.54	0.39	0.29	0.28
50%	/	0.99	0.67	0.52	0.37	0.28	0.26
60%	1.24	0.93	0.64	0.50	0.36	0.27	0.25
70%	1.17	0.88	0.64	0.51	0.37	0.29	0.27
80%	1.11	0.85	0.63	0.49	0.36	0.28	0.26
90%	1.08	0.84	0.62	0.49	0.34	0.27	0.25

注: /表示不支持 30 s Note: / indicates that 30s,

A.6 不同温度&不同 SOC 的充电电阻 Regeneration DCR at Different Temperature and SOC

DCR/mΩ@2.25C 15s				
T SOC	10℃	25℃	45℃	55℃
10%	0.52	0.38	0.32	0.28
20%	0.50	0.36	0.31	0.28
30%	0.50	0.35	0.30	0.27
40%	0.49	0.35	0.29	0.27
50%	0.49	0.34	0.29	0.26
60%	0.48	0.33	0.28	0.25
70%	0.48	0.34	0.29	0.27
80%	0.47	0.33	0.29	0.26
90%	0.47	0.32	0.28	0.25

A.7 不同温度&不同 SOC 脉冲放电峰值功率 Peak power pulse discharge at different temperatures and SOC

30s 脉冲放电峰值功率/W Peak power pulse discharge @30s /W							
T SOC	-20℃	-10℃	0℃	10℃	25℃	45℃	55℃
10%	/	/	1427	1540	2111	3650	3905
20%	/	/	1727	2056	2943	4206	4487
30%	/	1469	2023	2354	3327	4549	4891
40%	/	1656	2215	2528	3549	4735	5065
50%	/	1806	2352	2662	3737	4942	5279
60%	1449	1940	2478	2794	3918	5129	5538

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	70%	1548	2061	2550	2854	3934	5022	5406		
	80%	1636	2147	2609	2919	4048	5176	5561		
	90%	1697	2196	2644	2971	4210	5332	5743		
	注: /表示不支持 30s Note: / indicates that 30s									

A.8 不同温度&不同 SOC 脉冲回馈峰值功率 Peak power pulse feedback at different temperatures and SOC

15s 脉冲回馈峰值功率/W Peak power pulse feedback@15s /W				
T \ SOC	10°C	25°C	45°C	55°C
10%	2605	3441	4325	4595
20%	2399	3284	4106	4389
30%	2244	3075	3849	4099
40%	2210	3026	3746	3939
50%	2198	3028	3734	3938
60%	2205	3044	3749	3986
70%	2140	2895	3464	3649
80%	2125	2869	3433	3646
90%	2115	2895	3475	3706

A.9 不同温度和不同 SOC 最大允许脉冲放电功率/倍率 Maximum allowable pulse discharge power/rate at different temperature and SOC

30 s 最大允许脉冲放电功率/W Maximum allowable pulse discharge power @30s /W								
T/SOC	-30°C	-20°C	-10°C	0°C	10°C	25°C	45°C	55°C
0%~10%	112	224	338	564	2260	2263	2265	1133
10%~20%	223	560	450	1129	2260	2263	2265	1133
20%~30%	557	894	785	1128	2260	3394	2830	1132
30%~40%	556	892	893	1119	2245	3377	2809	1124
40%~50%	556	890	1003	1115	2234	3356	2802	1121
50%~60%	555	889	1113	1115	2233	3354	2800	1121
60%~70%	555	887	1223	1114	2232	3352	2788	1115
70%~80%	555	886	1215	1661	3329	3323	2761	1104
80%~90%	555	886	1318	1639	3281	3274	2725	1090

30 s 最大允许脉冲放电倍率/C Maximum pulse discharge rate @30s /C								
T/SOC	-30°C	-20°C	-10°C	0°C	10°C	25°C	45°C	55°C
0%~10%	0.1	0.2	0.3	0.5	2	2	2	1
10%~20%	0.2	0.5	0.4	1	2	2	2	1
20%~30%	0.5	0.8	0.7	1	2	3	2.5	1

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30%~40%	0.5	0.8	0.8	1	2	3	2.5	1	
40%~50%	0.5	0.8	0.9	1	2	3	2.5	1	
50%~60%	0.5	0.8	1	1	2	3	2.5	1	
60%~70%	0.5	0.8	1.1	1	2	3	2.5	1	
70%~80%	0.5	0.8	1.1	1.5	3	3	2.5	1	
80%~90%	0.5	0.8	1.2	1.5	3	3	2.5	1	

注：SOC 区间范围，左区间为闭区间，右区间为开区间。例如：10%~20%为 10%≤SOC<20%

Remark: For SOC is the range of interval, the left interval is the closed interval, and the right interval is the open interval. For example: 10%~20% is 10%≤SOC<20%

A.10 不同温度和不同 SOC 最大允许脉冲回馈功率/倍率 Maximum allowable pulse feedback power/rate at different temperature and SOC

15 s 最大允许脉冲回馈功率/W Maximum pulse feedback power@15s /W							
T/SOC	-10℃	-5℃	0℃	10℃	25℃	45℃	55℃
0%~10%	/	/	564	904	1358	1359	1133
10%~20%	/	/	564	904	1358	1359	1133
20%~30%	/	/	564	904	1358	1359	1132
30%~40%	/	/	560	898	1126	1348	1124
40%~50%	/	/	558	894	1119	1345	1121
50%~60%	/	/	335	670	1118	1344	1121
60%~70%	/	/	334	670	1117	1338	1115
70%~80%	/	/	332	555	1108	1104	1104
80%~90%	/	/	218	328	873	1090	1090

注：SOC 区间范围，左区间为闭区间，右区间为开区间。例如：10%~20%为 10%≤SOC<20%

Remark: For SOC is the range of interval, the left interval is the closed interval, and the right interval is the open interval. For example: 10%~20% is 10%≤SOC<20%

15s 最大允许脉冲回馈倍率/C Maximum pulse feedback rate@15s /C							
T/SOC	-10℃	-5℃	0℃	10℃	25℃	45℃	55℃
0%~10%	0.2	0.3	0.5	0.8	1.2	1.2	1
10%~20%	0.2	0.3	0.5	0.8	1.2	1.2	1
20%~30%	0.2	0.3	0.5	0.8	1.2	1.2	1
30%~40%	0.2	0.3	0.5	0.8	1	1.2	1
40%~50%	0.2	0.3	0.5	0.8	1	1.2	1
50%~60%	0.1	0.2	0.3	0.6	1	1.2	1
60%~70%	0.1	0.2	0.3	0.6	1	1.2	1
70%~80%	0.1	0.2	0.3	0.5	1	1	1
80%~90%	0.1	0.12	0.2	0.3	0.8	1	1

注：SOC 区间范围，左区间为闭区间，右区间为开区间。例如：10%~20%为 10%≤SOC<20%

Remark: For SOC is the range of interval, the left interval is the closed interval, and the right interval is the open interval. For example:10%~20% is 10%≤SOC<20%.

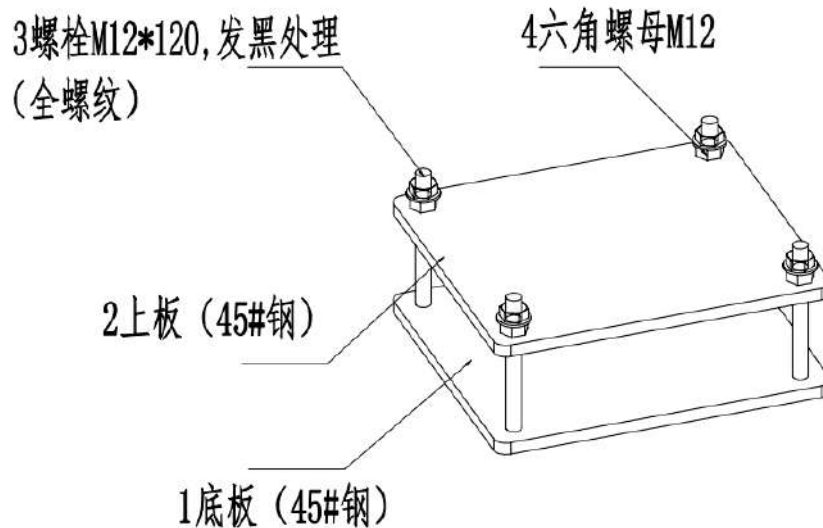
备注：脉冲回馈电流的大小必须严格遵守上表所列的所有充电状态以及电芯温度等条件。违反脉冲回馈条件可能会造成电芯永久性的损伤导致使用寿命下降。

Remark: The high/low of the pulse feedback current must strictly comply with all charging states and cell temperature listed in the table above. Violation of pulse feedback conditions may result in permanent damage to the cell and decrease of service life.

A.11 企业钢板夹具的使用 Using of steel plate

钢制夹板（45#钢，厚度 1cm）：夹具需覆盖住电芯大面，并做好绝缘处理，以免接触正负极导致电芯短路，夹板之间用 4 个 M12 螺栓固定，夹具工装如下图所示：

Steel plate(45#, thickness of 1 cm):The plates should cover the cell, and pay attention to the insulation to prevent short circuits, the plates should to be secured with four M12 bolts, as shown below:



电芯夹具示意图 Steel plate

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IFP81175200-300Ah 锂离子电池产品环保声明

Environmental Declaration Of IFP81175200-300Ah Lithium Battery Product

根据欧盟(EU)2015/863 指令；2006-66-EC 电池指令要求，如下表所示 镉、铅、汞、六价铬、多溴联苯(PBB)、多溴二苯醚(PBDE)及邻苯二甲酸酯(PAEs)共计 10 种物质纳入禁用物质清单。

In accordance with EU directive 2015/863, battery instruction requirements in 2006-66-EC, as shown in the following table, a total of 10 substances are included in the RSL, for example Cadmium、Lead 、Mercury、Hexavalent chromium、Polybrominated biphenyls (PBB)、Polybrominated diphenyl ethers (PBDE) and phthalate (PAEs).

A.12 十种禁用物质清单 Table

A.12 List of 10 restricted substances

RoHS 禁用物质 RoHS restricted substance	最高限值 (PPM) The highest limit (PPM)	说明 Description
镉(Cd) Cadmium(Cd)	20	2006-66-EC 指令要求 2006-66-EC Directive Requirement
铅 (Pb) Lead (Pb)	40	2006-66-EC 指令要求 2006-66-EC Directive Requirement
汞 (Hg) Mercury (Hg)	5	2006-66-EC 指令要求 2006-66-EC Directive Requirement
六价铬 (Cr ⁶⁺) Hexavalent chromium (Cr ⁶⁺)	1000	RoHS 1.0 已有限用物质 RoHS 1.0 limited substance
多溴联苯 (PBB) Polybrominated biphenyls (PBB)	1000	RoHS 1.0 已有限用物质 RoHS 1.0 limited substance
多溴二苯醚 (PBDE) Polybrominated diphenyl ethers (PBDE)	1000	RoHS 1.0 已有限用物质 RoHS 1.0 limited substance
邻苯二甲酸二(2-乙基己基)酯 Diphthalate (2-ethylhexyl) ester (DEHP- Di(2-ethylhexyl)Phthalate)	1000	RoHS 2.0 新增限用物质 RoHS 1.0 limited substance
邻苯二甲酸丁苄酯 Benzyl butyl phthalate (BBP- Benzyl Butyl Phthalate)	1000	RoHS 2.0 新增限用物质 RoHS 2.0 limited substance
邻苯二甲酸二丁酯 Dibutyl phthalate (DBP-Di-n-butyl Phthalate)	1000	RoHS 2.0 新增限用物质 RoHS 2.0 limited substance
邻苯二甲酸二异丁酯 Diisobutyl phthalate (DIBP-Diiso butyl Phthalate)	1000	RoHS 2.0 新增限用物质 RoHS 2.0 limited substance

从发布日期立即实施执行。

Execute immediately from release date.