

锂离子电池规格书

Specification of Product for Lithium-ion Rechargeable Cell

客户名称 _____

产品名称 磷酸铁锂电池 LiFePO₄ battery

产品型号 32700-6000mAh

参考标准 GB T31485-2015、GB T31486-2015 、GBT36276-2018、
GBT18287-2013

客户承认

客户承认		
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5	A4	修正倍率放电 1C 与常温容量标准不一致问题									曾严	2023.4.10	
6	A5	在第 8 项目中补充储存建议									曾严	2023.4.17	
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1. 适用范围 Scope

本产品规格书描述了所生产的二次锂离子电池主要性能指标,用户请务必按照本规格书中的测试和使用方法进行使用,如果有不明之处,请与供方协商解决。

This product specification describes of lithium-ion rechargeable battery main performance index, please according to the specification of testing and the use of methods were used, if unknown, please and supplier negotiation

2. 产品型号 Model

型号: 32700-6000mAh

Model: 32700-6000mAh

3. 产品规格 Specification

***注意:以下参数仅为单只裸电芯测试结果,但组合结构升级后,需要客户根据组合规格与组合条件,以及应用场景和条件,结合单只标准对成品进行评估。比如:充电电压、放电深度、电池散热、电池均流、电池功率等因素。不同产品与不同条件的互组合结果比较复杂,无法在此一一赘述,由客户自行评估。**

***Note: The following parameters are only the test results of a single bare cell, but after the combination structure is upgraded, the customer needs to evaluate the finished product according to the combination specifications and combination conditions,As well as application scenarios and application conditions, combined with the single standard.Such as: charging voltage, discharge depth, battery heat dissipation, battery current sharing, battery power and other factors. he combination results of different products and different conditions are complicated, so they can't be described here, and need to be evaluated separately.**

项目 Items	规格 Specification	备注 Remarks
3.1 标称容量 Nominal Capacity	6000mAh	27°C 1C 放电 2.0V
3.2 标称电压 Nominal Voltage	3.2V	
3.3 放电终止电压 Discharge Cut-off Voltage	2.0V	
3.4 充电限制电压 Charge Limited Voltage	3.65V	截止电流 $\leq 0.01C$
3.5 标准充电电流 Standard Charge Current	1 C	建议 0°C~60°C ;
3.6 标准放电电流 Standard Discharge Current	1 C	建议-20°C~ +60°C;
3.7 最大充/放电电流 Max. Charge/Discharge Current	3C	支持 3C 充放
3.8 最大脉冲放电电流 (瞬时 ms) (Max. Pulse Discharge Current)	5C	瞬时 10ms, 间隔 30min
3.9 内阻 Internal Impedance	$\leq 8m\Omega$	AC 1000Hz
3.10 重量 Weight	140.4 \pm 2g	含 PVC 和面垫等外包装 (1.4g)
3.11 压降 pressure drop	$\leq 1.5mv/天$	2%-5%SOC, 25 \pm 2°C
3.12 自耗电 Power consumption	$\leq 1\%$ 额定容量/月	1%-98%SOC, 25 \pm 2°C

4. 电性能 (electrical property)

***注意:**以下参数仅为单只裸电芯测试结果,但组合结构升级后,需要客户根据组合规格与组合条件,以及应用场景和条件,结合单只标准对成品进行评估。比如:充电电压、放电深度、电池散热、电池均流、电池功率等因素。不同产品与不同条件的互组合结果比较复杂,无法在此一一赘述,由客户自行评估。

***Note:** The following parameters are only the test results of a single bare cell, but after the combination structure is upgraded, the customer needs to evaluate the finished product according to the combination specifications and combination conditions,As well as application scenarios and application conditions, combined with the single standard.Such as: charging voltage, discharge depth, battery heat dissipation, battery current sharing, battery power and other factors. he combination results of different products and different conditions are complicated, so they can't be described here, and need to be evaluated separately.

项目 Items	测试方法 Test Conditions	标准 Specification
4.1 标准充电 (Standard Charge) 参考标准: GB T31486-2015	标准充电是指电芯在环境温度 25-27℃下,以 1C 恒电流充电至电压 3.65V,恒电压 3.65V 充电至截止电流 0.01C (用锂离子电芯专用充电器,电压精度±0.05V),停止充电,总充电时间不超过 3 个小时。 (The "Standard Charge" means charging with constant current 1C to 3.65V, then charging with constant voltage 3.65V to 0.01C under 25±2℃, °C charging time will not more than 3h.) (Use Lithium-ion battery charger, which with an accuracy ±0.05V.)	
4.2 室温放电容量 oom temperature discharge capacity 参考标准: GB T31486-2015	电芯以标准充电后,在 25-27℃环境下,以 1C 电流放电至终止电压 2.0V,停止放电。如果没有特别说明,电芯充放电间隔时间为 5 分钟。 (The capacity means the discharge capacity of the cell, which is measured with discharge current 1C to cut-off voltage at 2.0V at 25-27℃ rest for 5 minutes after the Standard Charge.)	≥100%标称容量 (≥100%Nominal Capacity)
4.3 温度性能 Temperature Performance 参考标准: GBT36276-2018	电池充满电后,按 1C 的电流放电至 2.0V。电芯必需先在不同的试验温度中放置 4 个小时后放电,百分比按放电容量比最小容量计算。 (Cells shall be charged according to 5.1 and discharged at 1C to 2.0 V after full charged. Cells shall be stored for 4 hours at the test temperature prior to discharging and then shall be discharged at the test temperature, The percentage shall be calculated using discharging capacity compared to the minimum capacity.	不泄漏、无外观不良 No leakage, No Appearance defect -20℃/25℃≥50% 0℃/25℃≥70% 25℃/25℃≥100% 60℃/25℃≥98%
4.4 循环寿命 Cycle Life 参考标准: GB T31484-2015	在 25±2℃环境下,电池以 1C 充电至 3.65V,以 1C 的电流放电至 2.0V,充放电间隔 30min,循环 2000 次后,再以 1C 的电流放电至 2.0V 终止电压,测量其放电容量;其他不同环境温度、电流、电压、频率条件下的循环寿命不在此标准内; At 25±2℃, 1C charge to 3.65V and discharge to 2.0V with 1 C discharge current, 30 min between charge and discharge, after 2000 cycles the discharge capacity is measured with 1C discharge current and 2.0V cut-off voltage. The cycle life under different environmental temperature, current, voltage and frequency conditions is not within this standard;	≥80%初始容量 ≥80%Initial capacity

<p>4.5 倍率性能 (Rate Capacity) 参考标准: 在满足 GB T31486-2015 基 础上提高标准</p>	<p>1. 在充饱电后 1 小时内, 在 25-27°C 环境下, 以 0.5C 电流连续放电至 2.0V 终止电压。 Under the temperature of 25-27°C, the discharge capacity is measured with 0.5 C discharge current and 2.0V cut-off voltage after full charged.</p>	<p>≥100%标称容量 ≥100%Nominal Capacity</p>
	<p>2. 在充饱电后 1 小时内, 在 25-27°C 环境下, 以 1C 电流连续放电至 2.0V 终止电压。 Under the temperature of 25-27°C, the discharge capacity is measured with 1 C discharge current and 2.0V cut-off voltage after full charged.</p>	<p>≥100%标称容量 ≥100%Nominal Capacity</p>
	<p>3. 在充饱电后 1 小时内, 在 25-27°C 环境下, 以 3C 电流连续放电至 2.0V 终止电压。 Under the temperature of 25-27°C, the discharge capacity is measured with 3 C discharge current and 2.0V cut-off voltage after full charged.</p>	<p>≥97%标称容量 ≥97%Nominal Capacity</p>
<p>4.6 贮存特性 (Storage Characteristic) 参考标准: GB T31486-2015</p>	<p>1 用 1C 电流测量电芯在 25-27°C 的环境下的初始容量并记录为 C1, 充入 100% 的电量, 测量电芯存储前的初始状态, 分别 25 ± 2°C、相对湿度 0%~75% 的环境下贮存 3 个月、6 个月、12 个月, 测量电芯的最终状态, 然后在 25-27°C 的环境温度下以 1C 充放电, 循环 5 次并记录电芯的放电容量; 5 周循环的最大放电容量作为 Cn, Cn/C1=储存容量恢复率。 Measure the initial capacity of the battery cell at 25-27°C with 1C current and record it as C1, charge 100% of the electricity, measure the initial state of the battery cell before storage, and measure the final state of the battery cell after storage at 25 ± 2°C and 0%-75% relative humidity for 3 months, 6 months and 12 months, respectively, and then at 25-27°C. The maximum discharge capacity of 5 cycles is taken as CN, and CN/C1 = recovery rate of storage capacity.</p>	<p>Cn/C1: 3 个月 ≥95%; 6 个月 ≥93%; 12 个月 ≥91.5%; 两年 ≥88% Cn/C1: 3 months ≥95%; 6 months ≥93%; 12 months ≥91.5% 2years ≥88%</p>
	<p>2 电芯在 25-27°C 环境下按 0.5C 充放电, 放电容量为 C1, 满电电芯在 25-27°C 的温度下储存 28 天后, 在 25-27°C 环境下使用 0.5 C 电流放电, 容量为 C2。 (The cell is charged and discharged using 0.5C at 25-27°C. The discharge capacity is C1. The cell is stored for 28 days in 20 ± 5°C after fully charged and then is discharged using 0.5C at 25-27°C. The capacity is defined as C2.)</p>	<p>容量保持率 C2/C1 ≥93% Capacity Retention C2/C1 ≥93%</p>
	<p>3 进行完 C2 测试的电芯在 25-27°C 环境下按照 0.5C 测试恢复容量 (放电容量 C3)。 (After the test as C2, The cell is charged and discharged using 0.5C at 25-27°C, The discharge capacity is C3.)</p>	<p>容量恢复率: C3/C1 ≥ 95% Capacity recoverable ratio: C3/C1 ≥95%</p>

5 安全性能 Safety Characteristics

项 目 Items	测试方法 Test Conditions	标 准 Specification
5.1 自由跌落测试 (Free Fall Test) 参考标准 GB T31485-2015	将满充电的电芯重复 3 次由高度为 1500mm（电芯最低点）的位置自由跌落到水泥地板上；在跌落时应在随机的方向都有一个冲击力，测试完成后电芯放置 1h，然后目视检查； (The fully charged cell is dropped three times from a height of 1500 mm (the lowest point of the cell) onto a concrete floor. The cells or batteries are dropped so as to obtain impacts in random orientations. After the test, the cell shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.)	不爆炸、不起火、不冒烟，开路电压应不低于 90%的初始电压 (No explosion, No fire, No smoke. The OCV after the test no less than 90% before free-fall test.)
5.2 振动测试 (Vibration Test) 参考标准：GBT18287-2013	将满充电后的电芯固定在振动台上，沿 X、Y、Z 三个方向各振动 90~100 分钟，振幅 0.8mm，振动频率为 10Hz~55Hz，每分钟变化 1Hz，在测试完成后电芯回复到原位。样品在测试结束后观察 6 小时，并检查测试前后电芯的重量变化。 (A full-charged cell is to be subjected to simple harmonic motion with amplitude of 0.8mm total maximum excursion. The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz. After the test is completed, And the cell returned to the starting position. The cell shall be vibrated for 90~100 minutes per axis of XYZ axes. The samples should be observed for 6 hours after the test, and also check the weight loss of cells before and after the test.)	不爆炸、不起火、不冒烟、不泄漏，重量损失 $\leq 0.1\%$ (Not explosion, No fire, No leakage, Mass loss $\leq 0.1\%$)
5.3 挤压测试 (Crush Test) 参考标准 GB T31485-2015	电池标准充电后，将电池放置在挤压设备的平面之上，从最初接触点开始，使用半径为 75mm 的曲面，以约 1.5cm/s 的速度持续进行挤压，逐渐增加压力至 13KN，一旦获得最大压力或者电池变形 30%就停止测试。圆柱形或方形电池在接受挤压时，其纵轴要平行于挤压平面，垂直于挤压方向。方形电池最大面垂直于挤压方向。After standard charging of the battery, place the battery on the planes of the extrusion device. From the initial contact point, Use a surface with a diameter of 75mm, continue extrusion at a speed of about 1.5cm/s, and gradually increase the pressure to 13KN or Degenerate by 30% . Stop the test when the maximum pressure is obtained. When a cylindrical or square battery is squeezed, its longitudinal axis should be parallel to the extrusion plane and perpendicular to the extrusion direction. The largest surface of the square battery is perpendicular to the extrusion direction.	不爆炸、不起火 (No explosion, No fire)
5.4 低气压测试 (low pressure) 参考标准：GB T31485-2015	将充满电的电芯放入真空箱中，逐渐抽真空至气压小于或等于 11.6KPa，并在此气压下保存 6H，测试温度为 20 \pm 3℃。 (The full-charged cells are to be stored for 6 hours at an absolute pressure of 11.6 KPa and a temperature of 20 \pm 3 .)	不爆炸、不起火、不泄漏， (No explosion, No fire, No leakage.)

<p>5.5 外部短路 (Short Circuit) 参考标准: GB T31485-2015</p>	<p>分别在 25-27℃和 55±5℃的环境温度下依次用内阻为 80±20mΩ 的铜线连接电芯的正负极持续放电直至发生爆炸、起火或至电压小于 0.2V, 电芯表面温度恢复到环境温度±10℃以内。电芯要求: 充满电的新电芯。 (Each test sample cell is to be short-circuited by connecting the positive and negative terminals of the cell with a Cu wire having a maximum resistance load of 80±20mΩ . The sample is to discharge until a fire or explosion is obtained, or until it has reached a completely discharge state of less than 0.2V and the sample case temperature has returned to ± 10 of the ambient temperature. Tests are to be conducted at 25-27℃ and 55±5℃ . Cell Condition: Fresh, Fully charged cell.)</p>	<p>电池应不起火、不爆炸; 温度<150℃。 No fire , No explosion ; Max.Temp.of battery surface should not exceed 150℃</p>
<p>5.6 过充电 Over-charge Characteristics 参考标准: GB T31485-2015</p>	<p>充满电后的电池, 用 1C 电流继续持续充电一小时、或充到额定终止电压的 1.5 倍。 After being fully charged, the battery shall be continuously charged with 1C current for one hour or charged to 1.5 times of the rated termination voltage.</p>	<p>电池应不起火、不爆炸; 温度<150℃。 No fire , No explosion ; Max.Temp.of battery surface should not exceed 150℃.</p>
<p>5.7 过放电 Over Discharge 参考标准: GB T31485-2015</p>	<p>标准充电后, 电芯以 0.5C 恒电流放电至 2.0V, 用一根内阻小于 30Ω 的导线连接电芯正负极 24 小时。 (After standard charge.Cells are discharged at constant Current of 0.2C to 2.0V, and the positive and negative terminal is connected by a 30Ω wire for 24 hours. Cell Condition: Fresh, Fully charged cell.)</p>	<p>不爆炸、不起火 (No explosion, No fire)</p>
<p>5.8 热冲击 Hot oven Characteristics 参考标准: GB T31485-2015</p>	<p>将电池充满电后, 放置于热箱中, 温度以 (5℃±2℃) /min 的速率升至 130℃±2℃并保温 30min。 The fully charged battery is placed the battery in the hot box, then rose to 130℃±2℃ in the temperature to 5℃±2℃/min rate , insulation 30min.</p>	<p>电池应不起火、不爆炸。 No fire, No explosion</p>
<p>5.9 冷热循环性能测试 Thermal-cold Cycling Performance Test)参考标准: GB T31485-2015</p>	<p>电芯在标准充电后, 在环境温度 75±2℃条件下开路放置 6 小时,然后-40℃条件下开路放置 6 小时, 温度转换时间小于 30 分钟, 温度循环 10 次, 最后室温条件下放置 24h, 观察电芯外观变化。 (The full-charged cell is placed in 75±2℃ for 6h, and then put the Cell in -40℃ for 6h; change temperature time <30min, then repeat it for 10 cycles. Finally the cell is placed in room temperature for 24h. Watch the appearance of cell.)</p>	<p>不起火、不爆炸、不冒烟, 试验后开路电压应不低于试验前的 90%,质量损失≤0.1% (No explosion, No fire, No smoke,Open circuit voltage changednot less than 90%, mass loss limit: ≤0.1%)</p>
<p>5.10 重物撞击 (Impact Test)参考标准: GB T18287-2013</p>	<p>用一条直径为 15.8±0.1mm 的圆棒放置在电芯中央, 将重量为 9.1±0.46Kg 的重锤从 610±25mm 的高度垂直落下在电芯长度的中心位置。电芯要求: 充满电的新电芯。 (A test sample cell is to be placed on a flat surface. A 15.8±0.1mm diameter bar is to be placed across the center of the sample. A 9.1Kg ± 0.46Kg mass is to be dropped from the height of 610 ± 25mm to the center of the cell vertically. Cell Condition: Fresh, Fully charged cell.)</p>	<p>不爆炸、不起火 (No explosion, No fire)</p>

6. 配组以及验收 Group and acceptance

6.1 容量配组 Capacity matching

6.1.2 配组范围 Matching range: 6000mah-6350mah; 波动范围 5950-6350

6.1.3.配组档次 Matching grade: 50mah; 偏差: ±1.2% (额定容量), 即实际极差最大 194mah;

6.1.4.测试环境温度 Test ambient temperature : 25-27°C;

6.1.5.测试参数 Test parameters:

- ①1C 恒流(DC)放电 2.0V 65min;
- ②搁置 5min
- ③1C 恒流恒压 (CCCV) 充电 3.65V 95min 截流 180ma;
- ④搁置 5min
- ⑤1C 恒流(DC)放电 2.0V 65min (此工步采集容量) ;
- ⑥搁置 5min
- ⑦补电 (根据需求补电) ;

6.2.电压配组 Voltage matching

6.2.1.配组范围 Matching range: $\leq 10\%SOC$ ($\leq 3.2V$)

6.2.2.配组档次 Matching grade : $10mv \pm 2mv$;

6.3.内阻配组 Internal resistance matching

6.3.1.配组范围 Matching range: 6-8m Ω

6.3.2.配组档次 Matching grade: 2m Ω (偏差 0.3m Ω)

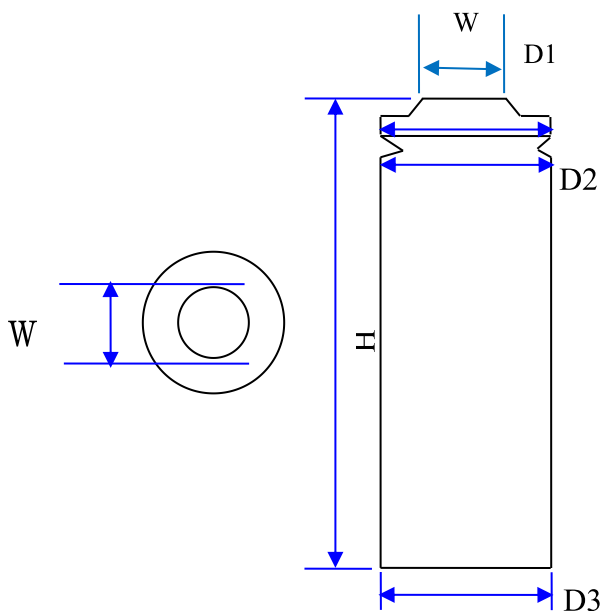
7. 外观与尺寸 Outside Appearance and size

7.1 外观 Outside Appearance

不允许有任何影响电芯性能的外观缺陷, 如漏液、生锈、变形、严重炸火等。

There should not be any appearance defect such as leakage, rust, deformation, severe blow fire effect on cell performance.

7.2 尺寸 size (含 PVC 和面垫 with PVC and cushion)



项目 Items	尺寸 Size(mm)	公差 Tolerance(mm)
铆钉顶部宽度 Width	10.75	± 0.2
电池高度 Height	70.6	0.3
		-0.3
头部直径 Diameter 1	32.15	± 0.05
滚槽位直径 Diameter 2	32.5	± 0.2
底部直径 Diameter 3	32.4	± 0.1

8. 应用与储存环境 Application and storage environment

电芯应用以及贮存的最佳环境温度范围为 0°C~35°C, 相对湿度在 0%~75%的清洁、干燥、通风的环境内, 避免与腐蚀性物质接触, 远离火源及热源。

按照 1%的储存保持率与 80%的恢复率, 储存建议如下:

The best environmental temperature range for application and storage of batteries is 0°C ~ 35°C, and the relative humidity is 0%~75% in a clean, dry and ventilated environment, so as to avoid contact with corrosive substances and keep away from fire and heat sources..

If it needs to be stored for a long time, when it exceeds three months, the battery should be fully charged and discharged, and then the battery should be stored under the condition of charging about 3.0-3.2V/ battery。

With a storage retention rate of 1% and a recovery rate of 80% , storage recommendations are as follows:

储存后，单电芯的电量保持率 $\geq 1\%$ ，容量恢复率 $\geq 80\%$ 的前提下，建议按以下方式储存 After storage, if the power holding rate of single cell is $\geq 1\%$ and the capacity recovery rate is $\geq 80\%$, the following storage method is recommended				
°C	初始带电量 5%储存时	初始带电量 10%储存时	初始带电量 30%储存时	初始带电量 100%储存时
-20~25°C	8 个月	15 个月	40 个月	40 个月
25-35°C	5 个月	10 个月	30 个月	30 个月
35-60°C	2 个月	5 个月	8 个月	5 个月

9. 保质期 **Guarantee Period of Quality**

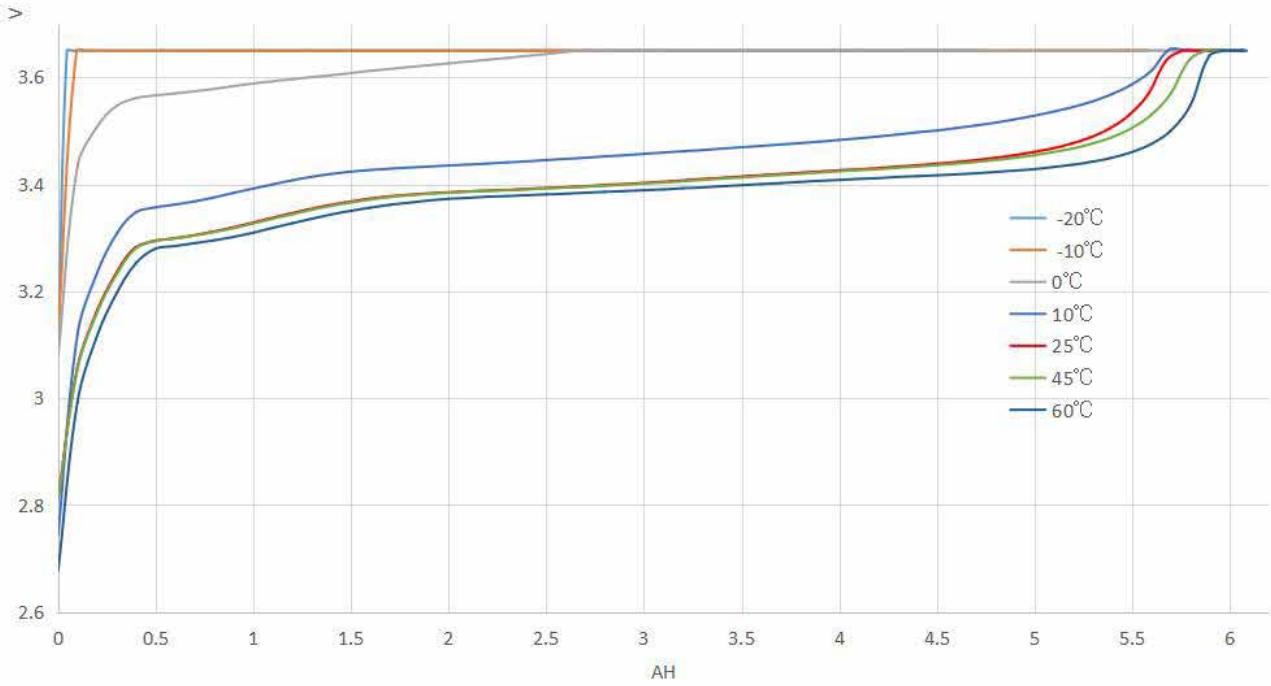
电池保质期为打码出厂后的 2 年。若电池在此期间内出现异常情况，并且使用过程中电芯所表现出的性能与该规格书所述性标准下的性能不符时，我司才免费更换新电池。

The guarantee period of quality extend for 2 year after code. If the battery is abnormal during this period, and the performance of the battery cell during use is inconsistent with the performance under the specification, LongTTech will replace the new battery for free.

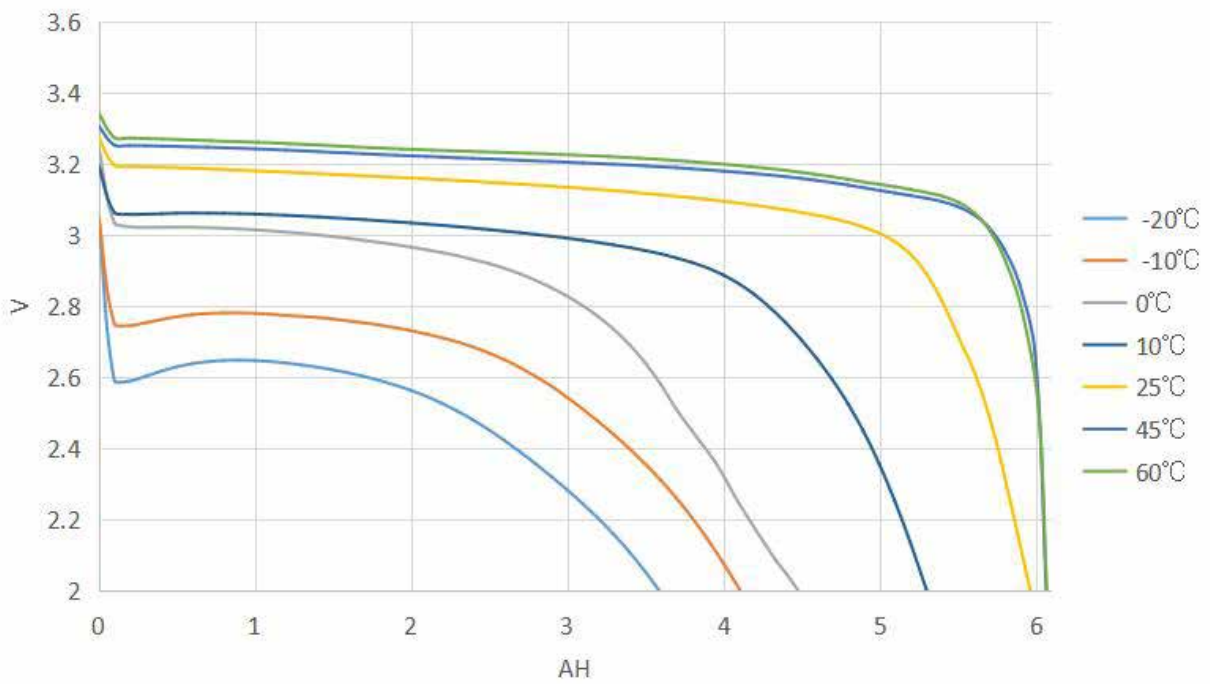
10. 曲线特征 **Curve characteristics**

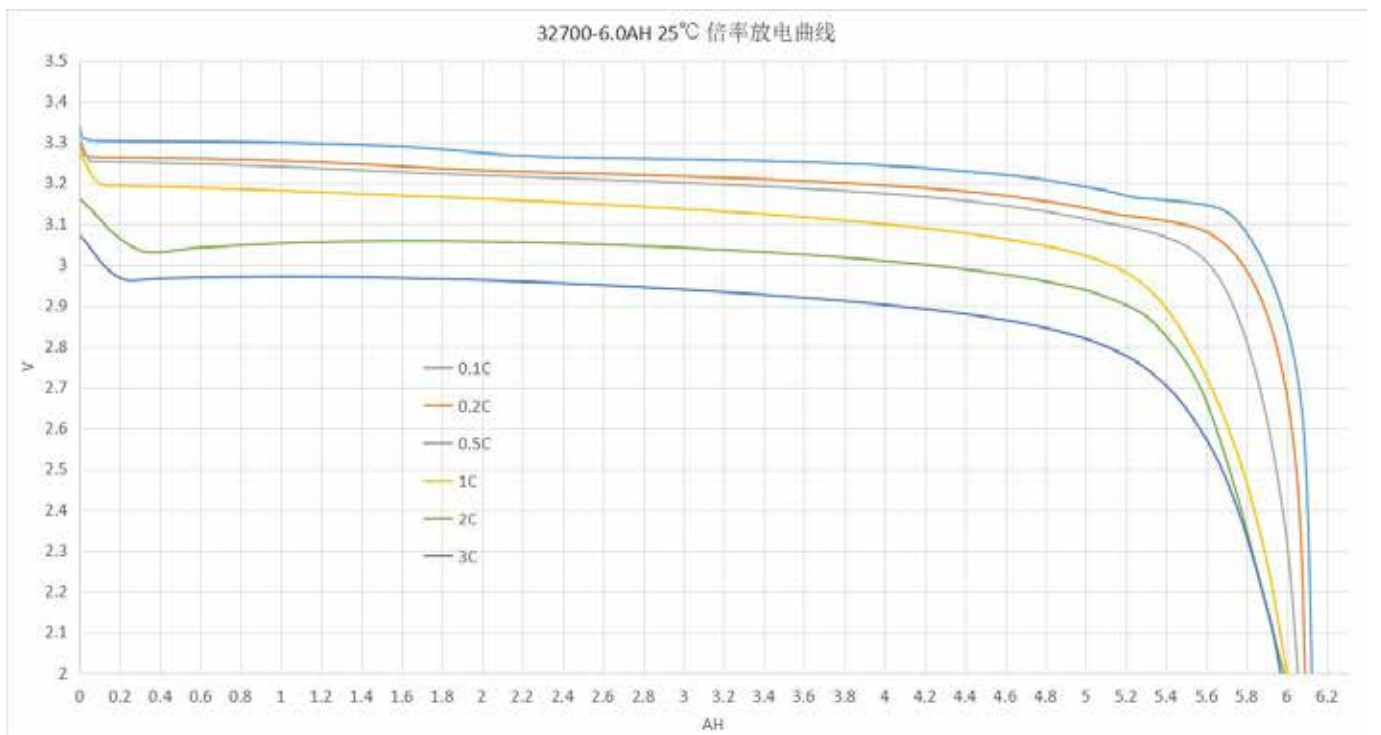
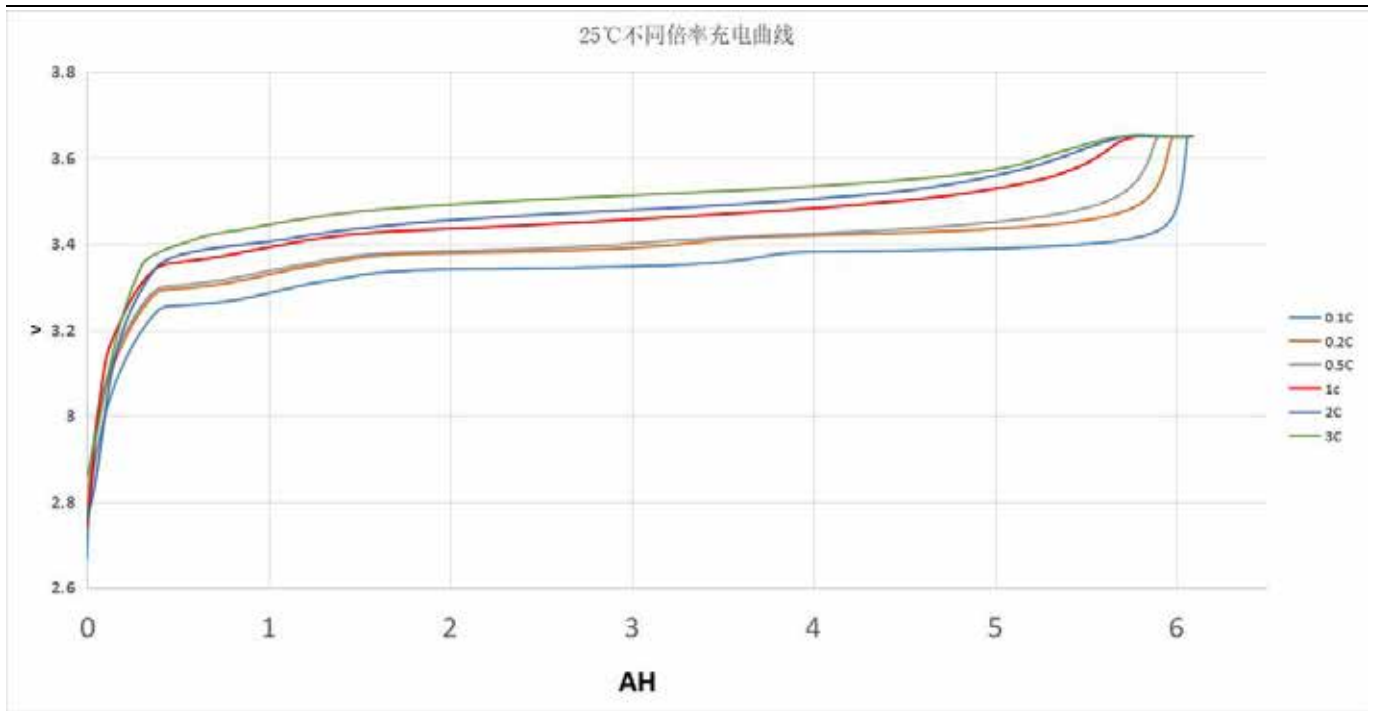
10.1 充放电特征 **Charge and discharge characteristics**

1C高低温充电



1C 高低温放电





10.2 SOC/OCV 曲线

