Specification for Lithium-ion Rechargeable Cell

锂离子电池规格书

Cell Type: 40160

电芯型号: 40160

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文件修订履历表

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A/2	增加针刺安全测试；	3/9；6/9	2025-07-23

目录

1. Scope 范围

This Product Specification describes the technique requirements, test procedures and precaution notes of cylindrical type Lithium-ion Rechargeable cell to be supplied to customer by Zhejiang Xinghai Energy Technology Co., Ltd..

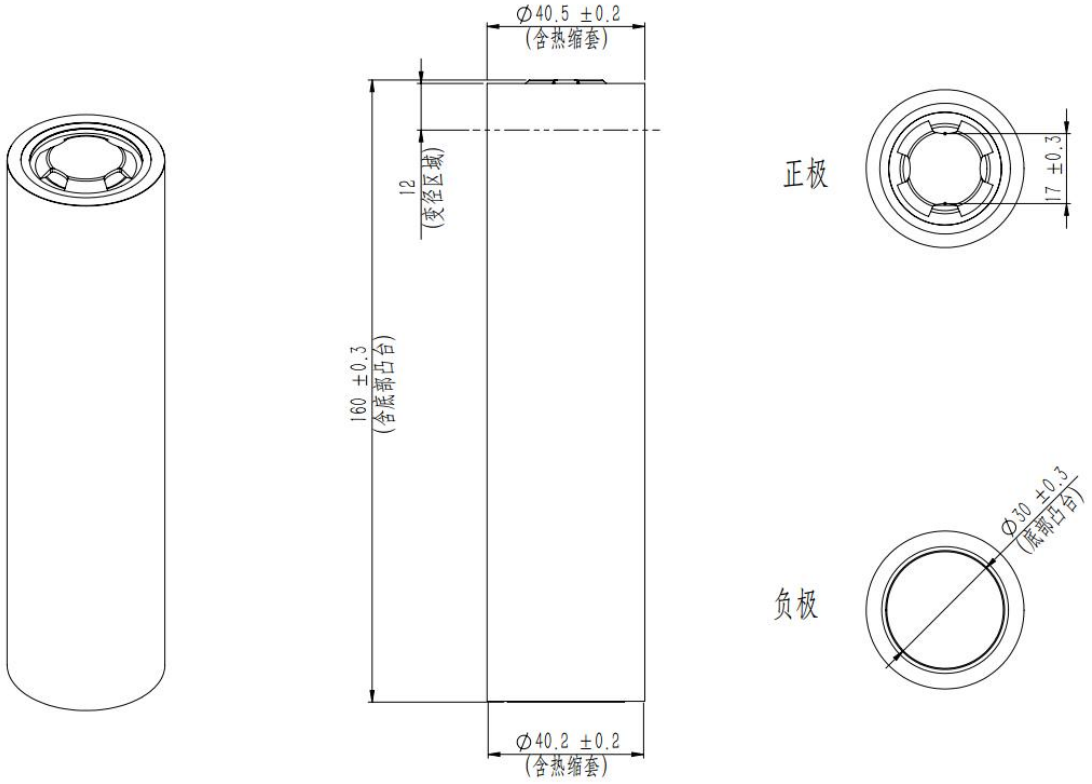
本规格书规定了由浙江兴海能源科技有限公司生产的锂离子电池的产品性能指标、技术要求、测试方法及产品使用条件和注意事项。

2. Cell Type 电池型号

40160-25Ah Lithium-ion Rechargeable cell

40160-25Ah 锂离子电池

3. Cell Dimension 电池尺寸



4. Electrical Performance Index 电性能指标

4.1 Parameters 基本参数

Item 项目	Specification 规格	Condition 条件
Nominal Capacity 标称容量	25Ah	25±2℃，0.5C/0.5C ，Fresh Cell Status 25±2℃，0.5C/0.5C，新电池状态
Minimum Capacity 最小容量	24Ah	
Operating Voltage 工作电压	2.5~3.65V	/

Nominal Voltage 标称电压		3.2V	/
AC Internal Resistance 交流内阻		IR < 1.5mΩ	AC 1kHz，30% SOC，25±2℃ Standard Deviation≤0.2mΩ 标准差≤0.2mΩ
Cell Weight 电池重量		490±10g	contain package 包含外包装
Energy Density 能量密度		163Wh/kg 398Wh/L	/
Operating Temperature 工作温度	Charging Temperature 充电温度	0~60℃	No matter what charging and discharging mode the cell is in, once the cell surface temperature exceeds this range, the charging and discharging should be stopped. 无论电池处在何种充放电模式，一旦发现电池表面温度超过此范围即停止充放电
	Discharge Temperature 放电温度	-20~60℃	
Storage Temperature 存储温度		-20 ~ 45℃	3 months（3 个月）
		-10 ~ 25℃	6 months（6 个月）
Cycle Life 循环寿命		≥2000 cycles	25±2℃，0.5C/0.5C，80% SOH
Appearance 外观		Without break, scratch, distortion, contamination, leakage and so on 无破裂、划痕、变形、污迹、电解液泄露等	

4.2 Charging Parameters 充电参数

Item 项目	Specification 规格	Condition 条件
Standard Charging Mode 标准充电模式	0.5C CC/CV, cut off 3.65V/0.05C 0.5C 恒流恒压充电至 3.65V/0.05C 截止	
Standard Charging Current 标准充电电流	0.5C	/
Max. Continuous Charging Current 最大持续充电电流	1 C	20~40℃
Standard End-of-charge Voltage 标准充电截止电压	3.65V	/
Optimum Charging Temperature Range 最佳充电温度范围	15~40℃	cell surface temperature 电池表面温度

4.3 Discharge Parameters 放电参数

Item 项目	Specification 规格	Condition 条件
Standard Discharge Mode 标准放电模式	0.5C CC, cut off 2.5 V 0.5C 恒流放电至 2.5 V 截止	
Standard Discharge Current 标准放电电流	0.5C	/
Max. Continuous Discharge Current 最大持续放电电流	2C	15~45℃

Max. Discharge Pulse Current 最大脉冲放电电流	6C	15~45℃，10s，50%SOC
End-of-discharge Voltage 放电截止电压	2.5V	/

4.4 Electrical Performance 电性能

Item 项目		Specification 规格	Condition 条件
Discharge Capacity Retention Rate at Different Temperatures 高低温性能	55℃/25℃	≥100%	55±2℃，0.5C discharge capacity 55±2℃，0.5C 放电容量
	-10℃/25℃	≥50%	-10±2℃，0.5C discharge capacity -10±2℃，0.5C 放电容量
Discharge Capacity Retention Rate at Different Rates 倍率性能	1C/0.5C	≥99%	25±2℃，1C discharge capacity 25±2℃，1C 放电容量
	2C/0.5C	≥98%	25±2℃，2C discharge capacity 25±2℃，2C 放电容量
High Temperature Storage 高温存储	Charge Retention Rate 荷电保持率	≥96%	55±2℃，7 days，0.5C/0.5C 55±2℃，7 天，0.5C/0.5C
	Capacity Recovery Rate 容量恢复率	≥97%	
Normal Temperature Storage 常温存储	Charge Retention Rate 荷电保持率	≥97%	25±2℃，28 days，0.5C/0.5C 25±2℃，28 天，0.5C/0.5C
	Capacity Recovery Rate 容量恢复率	≥98%	

5. Safety Performance 安全性能

Item 项目	Test Method 测试方法	Inspection Standard 检验标准
Forced-discharge Test 过放电	详见 6.4.1 (GB 38031 8.1.2)	No fire, no explosion. 电池应不起火、不爆炸
Overcharge Test 过充电	详见 6.4.2 (GB 38031 8.1.3)	No fire, no explosion. 电池应不起火、不爆炸
Short-circuit Test 外部短路测试	详见 6.4.3 (GB 38031 8.1.4)	No fire, no explosion. 电池应不起火、不爆炸
Heating Test 加热测试	详见 6.4.4 (GB 38031 8.1.5)	No fire, no explosion. 电池应不起火、不爆炸
Temperature Test 温度循环测试	详见 6.4.5 (GB 38031 8.1.6)	No fire, no explosion. 电池应不起火、不爆炸
Crush Test 挤压测试	详见 6.4.6 (GB 38031 8.1.7)	No fire, no explosion. 电池应不起火、不爆炸
Drop Test 跌落测试	详见 6.4.7 (GB/T 31485 6.2.5)	No fire, no explosion. 电池应不起火、不爆炸
Nail Penetration Test 针刺测试	详见 6.4.8 (GB 43854 6.3.5)	No fire, no explosion 电池应不起火、不爆炸
Impact Test	详见 6.4.9 (UL 1642 14)	No fire, no explosion.

重物冲击测试		电池应不起火、不爆炸
Vibration Test 振动测试	详见 6.4.10 (UL 1642 16)	No leakage, no fire, no explosion 电池应不漏液、不起火、不爆炸
Low-pressure Test 低气压测试	详见 6.4.11 (UL1642 19)	No leakage, no fire, no explosion 电池应不漏液、不起火、不爆炸

6. Test Method 测试方法

6.1 Standard Test Conditions 标准测试条件

Unless otherwise specified, all tests stated in this Specification are conducted at temp. 25±2℃ and humidity 15-90%RH with fresh cell.

若无特别要求，此规格书上的产品测试条件均为温度：25±2℃，湿度：15-90%RH，新电池状态。

6.2 Standard Charge and Discharge Method 标准充放电制式

The "Standard Charge" means charging the Cell at a constant current of 0.5C until the voltage is 3.65V, then charged at a constant voltage of 3.65V until its current is less than 0.05C.

“标准充电制式”即以恒定电流 0.5C 充电至 3.65V，再以 3.65V 恒压充电至电流小于 0.05C。

The "Standard Discharge" means discharging the Cell at a constant current of 0.5C until the voltage is 2.5V.

“标准放电制式”即以恒定电流 0.5C 放电至 2.5V。

6.3 Electrical Performance Test 电性能测试

6.3.1 Discharge Capacity Test at Different Temperatures 高低温性能测试

A cell is charged in accordance with Standard Charge, and stored in a constant temperature box at the corresponding temperature for 4 hours, then discharged at a constant current of 0.5C to 2.5V.

电池按标准充电制式充电结束后，放入对应温度的恒温箱中恒温 4 小时，然后以 0.5C 恒流放电至 2.5V。

6.3.2 Discharge Capacity Test at Different Rates 倍率性能测试

A cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged to cut-off voltage of 2.5V at a constant current of 0.5C, after that, stored 30min; then the cell is charged and discharged as above except that at a discharged constant current of 1C; then the cell is charged and discharged as above except that at a discharged constant current of 2C.

电池按标准充电制式充电结束后搁置 30min，然后以 0.5C 恒流放电至 2.5V，放电结束后搁置 30min；这颗电池继续进行下一次充放电循环，需以 1C 进行恒流放电；继续进行下一次充放电循环，需以 2C 进行恒流放电。

6.3.3 High Temperature Storage Performance Test 高温存储性能测试

A cell is charged in accordance with Standard Charge, and stored in 55±2℃ for 7d, after that stored for 5 hours at room temperature, then discharged in accordance with Standard Discharge. After that, stored for 30min, the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharge.

电池按标准充电制式充电结束后，将电池在 55±2℃搁置 7 天，然后在室温下搁置 5 小时，再以标准放电制式放电，放电结束后搁置 30min；然后以标准充电制式充电结束后搁置 30min，再以标准放电制式放电。

6.3.4 Normal Temperature Storage Performance Test 常温存储性能测试

A cell is charged in accordance with Standard Charge, and stored in Standard Test Conditions for 28d, then discharged in accordance with Standard Discharge. After that stored for 30min, the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharge.

电池按标准充电制式充电结束后，在标准测试条件下，将电池搁置 28 天，再以标准放电制式放电，放电结束后搁置 30min；此电池标准充电制式充电结束后，搁置 30min，然后以标准放电制式放电。

6.3.5 Standard Cycle Life Test 标准循环寿命测试

At Temp.:25℃±2℃, a cell is charged at a constant current of 0.5C until the voltage is 3.65V, then charged at a constant voltage of 3.65V until its current is less than 0.05C, after that stored for 30min; then discharged at a constant current of 0.5C until the voltage is 2.5V, after that, stored 30min prior to next charge-discharge cycle. The charge and discharge cycle is carried out until the capacity retention rate is reduced to 80%.

温度 25℃±2℃，电池以 0.5C 恒流充电至 3.65V，以 3.65V 恒压充电至电流小于 0.05C，结束后搁置 30min，然后以 0.5C 恒流放电至 2.5V，放电结束后搁置 30min，再进行下一次充放电循环，直到容量保持率降低至 80%。

6.4 Safety Performance Test 安全性能测试

All below tests are carried out on the equipment with forced ventilation and explosion-proof device. Before test, all cells are charged in accordance with Standard Charge, and stored 1 hours prior to testing.

下述试验应在有强制排风条件及防爆措施的装置内进行，在试验前所有的电池都按标准充电制式充电，并搁置 1 小时后，再进行以下试验。

6.4.1 Forced-discharge Test 过放电 (GB 38031 8.1.2)

A cell is discharged at a constant current of 1C until the discharge time reaches 90min, then observed the cell for 1h.

电池以 1C 电流放电，直至放电时间到达 90min，观察 1 小时。

6.4.2 Overcharge Test 过充电 (GB 38031 8.1.3)

A cell is charged in accordance with Standard Charge, then charged the cell up to 4.1V or 115% SOC at CC of 1C, then observed the cell for 1h.

电池按标准充电制式充电结束后，对电池以 1C 恒流充电至 4.1V 或 115% SOC 后停止充电，观察 1 小时。

6.4.3 Short-circuit Test 外部短路测试 (GB 38031 8.1.4)

Short circuit the positive terminal and negative terminal of the cell externally for 10min (external line resistance <5mΩ), then observe for 1h.

将电池正极端子和负极端子经外部短路 10min（外部线路电阻<5mΩ），观察 1 小时。

6.4.4 Heating Test 加热测试 (GB 38031 8.1.5)

A cell is heated in a circulating air oven. The temperature of the oven is raised at a rate of 5℃±2℃ per minute to a temperature of 130℃±2℃ and remain for 30min at that temperature before the test is discontinued, then observed the cell for 1h.

将电池放在电热鼓风干燥箱中，温度以 5℃±2℃/min 的速率由室温升至 130℃±2℃并保持 30min 后停止加热，观察 1 小时。

6.4.5 Temperature Test 温度循环测试 (GB 38031 8.1.6)

A cell is charged in accordance with Standard Charge, heated the cell in an oven. In 60min, the temperature of the oven is dropped to the temperature of -40℃ and remain for 90min at -40℃; In 60min, the temperature of the oven is raised to the temperature of 25℃; In 90min, the temperature of the oven is raised to the temperature of 85℃ and remain for 110min at 85℃; In 70min, the temperature of the oven is dropped to the temperature of 25℃; Repeat this for 5 cycles, after that observed the cell for 1h.

电池按标准充电制式充电结束后，将电池放入温控箱内，在 60 分钟内，温控箱温度降至-40℃，并在-40℃温度下保持 90min；在 60 分钟内，温控箱温度升至 25℃；在 90 分钟内，温控箱温度升至 85℃，并在 85℃温度下保持 110min；在 70 分钟内，温控箱温度降至 25℃；重复以上步骤 5 次，观察 1h，目测电池外观。

6.4.6 Crush Test 挤压测试 (GB 38031 8.1.7)

A cell is to be placed on the crush surface, the axis is parallel to the crush surface, it is to be crushed between two flat surfaces. The pressure is gradually increased at an extrusion speed of ≤2mm/s until the voltage reaches 0V or the deformation reaches 15% or the squeezing force reaches 100kN or 1000 times the weight of the cell, keep the pressure for 10 minutes, and observe for 1 hour.

电池放在挤压设备的两个挤压面之间，圆柱电池芯轴平行于挤压平面，以≤2mm/s 的挤压速度，逐渐增加压力至电压达到 0V 或变形量达到 15%或挤压力达到 100kN 或 1000 倍电池重量，保持压力 10min，观察 1 小时。

6.4.7 Drop Test 跌落测试 (GB/T 31485 6.2.5)

A cell is charged in accordance with Standard Charge, then dropped the cell from a height of 1.5m to the concrete ground with positive and negative terminals downward, then observed the cell for 1h.

电池按标准充电制式充电结束后，将电池样品的正负极端子向下由高度为 1.5m 的位置自由跌落到水泥地面上，观察 1 小时。

6.4.8 Nail Penetration Test 针刺测试 (GB 43854 6.3.5)

A cell is charged in accordance with Standard Charge, then the steel needle with a diameter of ϕ5mm (such as tungsten steel, the cone angle of the needle tip is 45°) at a speed of (25±5) mm/s, penetrates the geometric center of the cell from the direction perpendicular to the cell plate. The steel needle stays in the cell and observes for 1 h.

电池按标准充电制式充电结束后，用直径ϕ5mm 的耐高温钢针(如钨钢,针尖的圆锥角为 45°),以(25±5)mm/s 的速度,从垂直于电池极板的方向贯穿电池的几何中心,钢针停留在电池中,并观察 1h。

6.4.9 Impact Test 重物冲击测试 (UL 1642 14)

A cell is to be placed on the impact flat. A Φ15.8mm bar is to be placed on the center of the cell. A 9.1kg weight is to be dropped from a height of 610mm onto the cell, the distortion is allowed.

将电池放在冲击台上，将一个Φ15.8mm 的钢柱置放电池中心，钢柱的纵轴平行于平面，让重量 9.1kg 重锤自 610mm 高度自由落下，冲击电池，电池允许发生变形。

6.4.10 Vibration Test 振动测试 (UL 1642 16)

A cell is charged in accordance with Standard Charge, then installed onto the vibration desk with clamps.

Equipment parameters of frequency and amplitude are as follows (the frequency is varied at the rate of 1Hz/min between 10 and 55 hertz, and repeat vibration for 90-100min, amplitude: 0.16mm. The cell is tested in three mutually perpendicular directions).

电池按标准充电制式充电结束后，将电池用夹具安装在振动台的台面上，按下面的振动频率和对应的振幅调整好实验设备。X、Y、Z 三个方向每个方向上从 10～55Hz 循环扫频振动 90-100min，扫频速率为 1Hz/min, 位移幅值(单振幅)：0.16mm。

6.4.11 Low-pressure Test 低气压测试 (UL1642 19)

A cell is charged in accordance with Standard Charge, then stored it for 6 hours at an absolute pressure of 11.6kPa, then check cell's appearance.

电池按标准充电制式充电结束后，将电池放入在绝对压力为 11.6kPa 下搁置 6 小时，目测电池外观。

7. Warranty 质量保证

a) The Warranty period of cell is made according to business contract, However, even though the problem occurs within this period, Zhejiang Xinghai Energy Technology Co., Ltd. won't replace a Fresh Cell for free as long as the problem is not due to the failure of Zhejiang Xinghai Energy Technology Co., Ltd. manufacturing process or is due to customer's abuse or misuse.

自出货之日起，电池的保质期限依合同而定。但是，在此期限内，如果不是浙江兴海能源科技有限公司的制程原因而是客户的误用造成的电池质量问题，浙江兴海能源科技有限公司不承诺免费更换。

b) Zhejiang Xinghai Energy Technology Co., Ltd. will not be responsible for trouble occurred by handling outside of the precautions in instructions.

浙江兴海能源科技有限公司对违反安全守则操作所产生的问题不承担任何责任。

c) Zhejiang Xinghai Energy Technology Co., Ltd. will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.

浙江兴海能源科技有限公司对与电路、电池组、充电器搭配使用所产生的问题不承担任何责任。

d) Zhejiang Xinghai Energy Technology Co., Ltd. will be exempt from warrantee any defect cells during assembling after acceptance.

出货后客户在电池组装过程中产生的不良电池不在浙江兴海能源科技有限公司质量保证的范围之列。

8. Precautions and Safety Instructions 安全守则

8.1 Lithium-ion rechargeable batteries subject to abusive conditions can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before using utilization.

滥用锂离子充电电池可能会造成电池损害或人身伤害，在使用以前，请仔细阅读以下的安全守则：

Note 1. The customer is required to contact Zhejiang Xinghai Energy Technology Co., Ltd. in advance, if and when the customer needs other applications or operating conditions than those described in this document.

注释 1：如果客户需要将电池在该文件之外条件下操作或应用，请先咨询浙江兴海能源科技有限公司相关事宜。

Note 2. Zhejiang Xinghai Energy Technology Co., Ltd. will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

注释 2：在该文件说明的条件之外使用该电池而产生的事故，浙江兴海能源科技有限公司不承担任何责任。

8.2 Standard cell Precautions 电池防范措施

a) Do not throw the Battery cell into fire or heat it.
不要将电池投入火中或加热。

b) Do not short circuit, over-charge or over-discharge the cell.
不要将电池短路，过充或过放。

c) Do not subject the cell to strong mechanical shocks.
不要使电池承受过重的机械冲击。

d) Do not immerse the cell in water or sea water, or get it wet.
不要将电池浸入海水或水中，或者使其吸湿。

e) Do not reverse the polarity of the cell for any reason.
不要颠倒电池的正负极。

f) Do not disassemble or modify the cell.
不要拆卸或修整电池。

g) Do not handle or store with metallic like necklaces, coins or hairpins, etc.
不要和项链，硬币或发夹等金属物品放置在一起。

h) Do not use the cell with conspicuous damage or deformation.
不要使电池受到明显的损害或变形。

i) Do not connect cell to the plug socket or car-cigarette-plug.
不要将电池与插座连接。

j) Do not touch a leaked cell directly.
不要直接接触泄漏的电池。

k) Do not use Lithium-ion cell in mixture.
不要将锂离子电池混合使用。

l) Do not use or leave the cell under the blazing sun (or in heated car by sunshine).
不要将电池放置在太阳光直射的地方。

m) Keep cell away from children.
将电池放置在远离儿童的地方。

n) Do not drive a nail into the cell, strike it by hammer or tread it.
不要针刺，锤打或践踏电池。

o) Do not give cell impact or fling it.
不要撞击或投掷电池。

p) Do not put Battery Cell into microwave oven or high pressure container.
不要将电池放入微波炉或高压容器中。

8.3 Cell Operation Instructions 电池使用说明

8.3.1 Charging 充电

a) When the Cell is charged, the specified charge method and current described in this PS-Document should apply. If charge current exceeds the upper limit of the specified range, characteristics and safety of the Battery Cell could be deteriorated, or it may cause heat, explosion and fire.
应遵守本规格书的充电方式。如果超过电流上限，电池的安全性将不能被保证，会引起发热，爆炸，起火。

b) When the module is used, the charging voltage of a single string cannot exceed 3.65V.
模组使用时，单串充电电压不能超过 3.65V。

c) Charge the cell in a temperature range of 0°C to 60°C.

电池充电温度范围为 0℃～60℃。

d) Use a constant current, constant voltage (CC/CV) Lithium-ion (Li^+) cell charge controller.
使用恒流恒压锂离子电池充电器。

8.3.2 Discharging 放电

a) The discharge current should not exceed the designated current described in this PS-Document. If the discharge current exceeds the specified value, discharge capacity could be extremely deteriorated or the Cell could be heated.
放电电流不能超过本规格书的规定值，如果电流超过了规定值，电池容量将被破坏或者电池会出现发热情况。

b) When the module is used, the discharge voltage of a single string cannot exceed 2.0V.
模组使用时，单串放电电压不能超过 2.0V。

c) For maximum performance, discharge the cell in a temperature range of 15°C to 40°C.
为了达到较好的性能，电池的放电温度范围为 15℃～40℃。

8.3.3 Storage Recommendations 储存建议

a) Do not store the Cell together with combustibles.
不要将电池和易燃物一起存放。

b) The cell shall be stored in a clean, dry and ventilated environment. In case of long period storage (more than 3 months), the storage temperature of the cell should be within the range of -10 to 25°C. It is recommended to charge/discharge once every 3 months, and the SOC remains between 25-75%.
电池应存储在相对湿度≤75%RH 和不含腐蚀性气体的清洁、干燥、通风的环境中。如果要长时间存放（超过 3 个月），电池存储温度应在-10～25℃范围内，建议每隔 3 个月充放电一次，SOC 保持在 25-75%之间。

c) No press on the cell.
不要让电池承受任何压力。

9. Consultation 技术咨询

As to the obscurity, contact the Zhejiang Xinghai Energy Technology Co., Ltd. .
如有疑问，请咨询浙江兴海能源科技有限公司。

10. Requirement for Safety Assurance 安全保证要求

For the sake of safety, please consult Zhejiang Xinghai Energy Technology Co., Ltd. for equipment design, Lithium-ion cell system protection circuit or high current, fast charging and other special applications.
为了安全起见，如有设备设计，锂离子电池系统保护电路或高电流，快速充电及其它方面的特殊应用，请先咨询浙江兴海能源科技有限公司相关事宜。