

PRODUCT SPECIFICATION

Cylindrical Lithium-ion Cell

圆柱型锂离子电池产品规格书

35E(LR1865HC)

Customer Approval 客户认同	Signature 签名	Date 日期
	Company Name 公司名称:	
	Company Stamp 公司印章:	

Prepared By 首发	Checked By 核对	QA 质量确认	Approved By 批准



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Lishen Battery (Suzhou) Co., Ltd

Product Specification

TITLE: Cylindrical Lithium Ion Cell 35E (LR1865HC)

REV: V1

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History of revision 修订历史

Revision 版次	Date 日期	Originator 拟制人	Record of Revision 修订记录
0	22/08/2023	Zhang Bofeng 张波锋	Original Release 初版发布
1	20/01/2025	Zhang Bofeng 张波锋	Revision of Product name 2.2, Maximum charge current 3.5, Cycle performance 3.8 and 7.5, Operating Temperature 3.10, Dimension 4, Discharge method 7.2.6, Temperature Characteristics 7.7 and Welding area in handling instructions for lithium ion rechargeable cell 1.4.4 修订 2.2 中的产品名称, 3.5 中最大充电电流, 3.8 和 7.5 中的循环性能, 3.10 中的工作温度, 4 中的产品直径, 7.2.6 中的放电方法, 7.7 中的不同温度放电性能和圆型电芯安全准则 1.4.4 中的焊接区域

1 SCOPE 适用范围

The product specification describes the requirements of the Cylindrical Lithium-ion Cell to be supplied to the customer by Lishen Battery (Suzhou) Co., Ltd. If any additional information required by the customer, customer is advised to contact Lishen Battery (Suzhou) Co., Ltd.

本规格书规定了由力神电池（苏州）有限公司生产的圆柱型锂离子电池的技术要求，测试方法及注意事项，如需获取本规格书以外的技术要求，请与力神电池（苏州）有限公司联系相关事宜。

2 DESCRIPTION AND MODEL 说明及型号

2.1 Description 说明	Cylindrical Lithium Ion Cell 圆柱型锂离子电池
2.2 Model 型号	35E(LR1865HC)

3 GENERAL SPECIFICATIONS 常规指标

Item 项目	Specifications 规格
3.1 Discharge Capacity 放电容量	3.5Ah (Nominal) 3.4Ah (Minimum) - charge : 0.2C (0.7A), 4.20V, 0.02C (0.07A) cut-off @ 25°C - discharge : 0.2C (0.7A), 2.5V . 3.5Ah（标称容量） 3.4Ah（最低容量） - 充电：0.2C (0.7A) 4.20V, 0.02C(0.07A) 截止 @ 25°C - 放电：0.2C (0.7A), 2.5V
3.2 Charging Voltage 充电电压	4.2V
3.3 Nominal Voltage 标称电压	3.6V@0.2C
3.4 Standard Charge 标准充电方式	CC-CV 0.2C(0.7A), 4.20V, 0.02C(0.07A) cut-off, 25°C
3.5 Maximum Charge Current 最大充电电流	0.2C (0.7A) 0°C ≤ T ≤ 10°C 0.5C (1.75A) 10°C < T ≤ 25°C 1.0C (3.5A) 25°C < T ≤ 50°C
3.6 End of discharge voltage 放电终止电压	2.5V
3.7 Maximum Discharge Current (not for cycle) 最大放电电流（不支持循环）	3C (10.5A)
3.8 Cycle Life 循环寿命	800 th cycle ≥80% of 1st Capacity - Charge : 0.5C(1.75A), 4.20V, 0.05C(0.175A) cut-off @ 25°C - Discharge : 1C(3.5A), 2.75V 800 次循环放电容量≥80%首次容量@ 25°C - 充电：0.5C (1.75A) 4.20V, 0.05C (0.175A)截止 - 放电：1C(3.5A), 2.75V

3.9 Cell Weight 重量	50g (Max) (最大)
3.10 Ambient Temperature 环境温度	- Charge 充电 0°C to 50°C - Discharge 放电 -20°C to 60°C
3.11 Allowable maximum cell surface temperature (Tmax) 可允许的电芯最高表面温度(Tmax)	Charge 充电 55°C (再次重新充电电芯表面温度要求≤ 50°C) Discharge 放电 70°C (再次重新放电电芯表面温度要求≤ 60°C)
3.12 Storage Characteristics 存储性能	1) Storage for 28 days at 25°C:Capacity recovery ≥95% of 1st Capacity; 2) Storage for 28 days at 60°C:Capacity recovery ≥90% of 1st Capacity 1) 25°C存储 28 天: 恢复容量 ≥95% 首次容量; 2) 60°C存储 28 天: 恢复容量 ≥90% 首次容量
3.13 Storage Temperature※ (Shipping state, Recovery capacity≥80%) 存储温度 (出货态, 恢复容量≥80%)	1 month 1 月 -20°C~60°C 3 months 3 月 -20°C~45°C 12 months 12 月 -20°C~25°C
3.14 Shipping Voltage 出货电压	3.45V-3.52V

*Storage cautions: If the cell needs to be stored for a long time (more than three months), the recommended storage state is less than 50%SOC, and storage conditions are 0-25°C、humidity≤65%RH, and no corrosive gas. It is also recommended to charge and discharge the cell every six months.

*存储注意事项: 如电池需要进行长期存储(3 个月以上), 建议存储电态为 50%SOC 以下, 存储条件 0-25°C、湿度≤65%RH、无腐蚀气体。同时建议每 6 个月进行一次充放电。

*The maximum charge or discharge current herein is the allowable current to operate cell without possibility of dramatic degradation of the cell or sudden internal changes such as CID activation. Continuous use of Cell with Max. discharge current may accelerate degradation; The Cell shall not be fully discharged with Max. discharge current without temperature and voltage limits to avoid severe degradation, and must be protected by proper protective functions such as current cut-off, derating and permanent failure to prevent any safety risks.

*最大充电电流或放电电流是允许的电流, 可以在不造成电池严重退化或 CID 激活等突然内部变化的情况下运行电池。连续使用最大放电电流电池可能会加速退化。在不限制温度和电压的情况下, 不应该以最大放电电流完全放电, 以避免严重退化, 并必须通过适当的保护功能(电流切断、降额、永久故障)进行保护, 以防止任何安全风险。

4 OUTLINE DIMENSION (UNIT: mm)外形尺寸

Dimension 电池尺寸: Diameter 直径 18.35mm±0.15mm, Height 高度 65.4mm±0.2mm.

Refer to the attached drawing 1.见附录 1

5 APPEARANCE 外观

There shall be no such defect as deep scratch, flaw, crack, rust, leakage, which may adversely affect commercial value of the cell.

电池外观不存在热缩套破损及明显的刮痕、凹坑、裂痕、锈蚀、漏液等影响电池性能的外观不良。

6 TEST CONDITION AND DEFINITION 测试条件和定义

6.1 Measuring Equipment 测试设备

6.1.1 Electronic balance 电子天平

Parameter mileage 参数里程 0.01g-160g, accuracy 精度 1mg.

6.1.2 Impedance meter 内阻测试仪

Impedance 内阻: Parameter mileage 参数里程 0-3.1k Ω , accuracy 精度 0.1m Ω .

The impedance meter should be operated at AC 1kHz 电阻仪需要在 1kHz 交流体条件下测试.

6.1.3 Digital caliper 数显卡尺

The digital caliper should have a scale of 0.01mm 游标卡尺精度为 0.01mm.

6.2 The impedance meter should be operated at AC 1kHz. Unless otherwise specified, all tests shall be performed at 25 $\pm$ 2 $^{\circ}$ C and humidity of $\leq$ 65% RH. The cells used for the test mentioned should be new ones delivered a week before at most.

除特殊要求外, 所有测试均在标准温度 25 $\pm$ 2 $^{\circ}$ C和湿度 $\leq$ 65%RH 的条件下进行。测试使用电池为交货一周内的新电池。

6.3 Definitions 定义:

C Rate ("C"): The rate (milliampere) at which a fully charged cell is discharged to its end voltage in one hour.

C 倍率 ("C"): 满电电池 1 小时放电至终止电压所用的电流大小 (mA)。

7 CHARACTERISTICS 性能

7.1 Charge method 充电方式

7.1.1 Charging shall consist of charging at a 0.2C constant current rate until the cell voltage reaches 4.20V. The cell shall then be charged at constant voltage of 4.20V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.02C.

0.2C 恒流充电至 4.20V, 再以 4.20V 恒压充电至电流衰减为 0.02C。

7.1.2 Charging shall consist of charging at a 0.5C constant current rate until the cell voltage reaches 4.20V. The cell shall then be charged at constant voltage of 4.20V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.05C.

0.5C 恒流充电至 4.20V, 再以 4.20V 恒压充电至电流衰减为 0.05C。

7.2 Discharge method 放电方式

7.2.1 Cells shall be discharged at a constant current of 0.2C to 2.50V 0.2C 恒流放电至 2.50V

7.2.2 Cells shall be discharged at a constant current of 0.5C to 2.50V 0.5C 恒流放电至 2.50V

7.2.3 Cells shall be discharged at a constant current of 1.0C to 2.50V 1.0C 恒流放电至 2.50V

7.2.4 Cells shall be discharged at a constant current of 2.0C to 2.50V 2.0C 恒流放电至 2.50V

7.2.5 Cells shall be discharged at a constant current of 3.0C to 2.50V 3.0C 恒流放电至 2.50V

7.2.6 Cells shall be discharged at a constant current of 1.0C to 2.00V 1.0C 恒流放电至 2.00V

7.2.7 Cells shall be discharged at a constant current of 1.0C to 2.75V 1.0C 恒流放电至 2.75V

7.3 Internal Impedance 内阻

The impedance shall be measured by 6.1.2. 以 6.1.2 方式测试

Initial Internal Impedance $\leq$ 35m Ω . 电池内阻 $\leq$ 35m Ω

7.4 Discharge Rate characteristics 倍率放电性能

Cells shall be charged per standard charge method at $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ and discharged per 7.2.1(0.2C), 7.2.2 (0.5C), 7.2.3 (1C) , 7.2.4 (2C) , 7.2.5 (3C)The discharge capacity of each cell at respective discharge rate shall be compared with the discharge capacity at 0.2C and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 1.

25℃下按照标准方式充电，分别以 7.2.1 (0.2C)，7.2.2 (0.5C)，7.2.3 (1.0C)，7.2.4 (2.0C)，7.2.5 (3.0C) 方式放电，记录电池放电容量，并计算与电池 0.2C 放电容量百分比，满足表 1 要求。

Table 1

0.2C	0.5C	1C	2C	3C
100%	$\geq 95\%$	$\geq 93\%$	$\geq 90\%$	$\geq 85\%$

7.5 Cycle Life 循环寿命

Charge cells per 7.1.2. Rest 15 minutes. Discharge per 7.2.7. Rest 15 minutes before recharge. The test environmental temperature is $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 800 cycles.

25℃± 2℃测试环境下，按 7.1.2 方式对电池进行充电，休眠 15 分钟，按 7.2.7 方式对电池进行放电，休眠 15 分钟，充放电一次为一个循环，测试 800 次循环后放电容量。

Discharge capacity (800th Cycle) $\geq 80\%$ of 1st Cycle Capacity

800 次循环后放电容量 $\geq 80\%$ 首次容量

Note: If charged at high rate and high temperature ($\geq 35^{\circ}\text{C}$) frequently, cell cycle life will be shorten. If discharged at high temperature ($>60^{\circ}\text{C}$) frequently, cell safety may be occurred.

备注：经常在高温 ($\geq 35^{\circ}\text{C}$) 及高倍率或高电压情况下充电，会造成电池循环寿命缩短；经常在高温 ($> 60^{\circ}\text{C}$) 下放电，可能存在安全隐患。

7.6 Storage Characteristics 存储性能

7.6.1 After charge as per standard charge method 7.1.1, store the testing cells at $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 28 days. Then discharge as per 7.2.1. Then the same cell is fully charged as per 7.1.1 again and discharged a second time and measured as per 7.2.1.

电池按标准方式充电后，在 $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 环境下存储 28 天后，按 7.2.1 方式放电并记录电池容量；然后再按标准方式充电后，按 7.2.1 方式进行第二次放电。

The recovery discharge capacity (2nd discharge capacity) $\geq 95\%$ of Initial capacity.

电池恢复容量 (第二次放电容量) $\geq 95\%$ 初始容量

7.6.2 After charge as per standard charge method 7.1.1, store the testing cells at $60^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 28 days. Then discharge as per 7.2.1. Then the same cell is fully charged as per 7.1.1 again and discharged a second time and measured as per 7.2.1.

电池按标准方式充电后，在 $60^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 环境下存储 28 天后，按 7.2.1 方式放电并记录电池容量；然后再按标准方式充电后，按 7.2.1 方式进行第二次放电。

The recovery discharge capacity (2nd discharge capacity) $\geq 90\%$ of Initial capacity.

电池恢复容量 (第二次放电容量) $\geq 90\%$ 初始容量

7.7 Temperature Characteristics 不同温度放电性能

Cells shall be charged per standard charge method and discharged per 7.2.3. Cells, full charged, shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature, when -20°C discharge per 7.2.6 (Cells shall be discharged at a constant current of 0.2C to 2.00V). The capacity of a cell at each temperature shall be compared to the capacity achieved at 25°C and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 2.

25℃下按照标准方式充满电，在测试温度下放置 3 小时后按 7.2.3 方式放电， -20°C 按 7.2.6 方式 (1.0C 恒流放电至 2.00V) 放电，记录不同温度下电池放电容量，并计算与电池 25℃下放电容量百分比，满足表 2 要求。

Table 2

TITLE: Cylindrical Lithium Ion Cell 35E (LR1865HC)

-20°C	-10°C	0°C	25°C	45°C	60°C
≥70%	≥70%	≥80%	100%	≥95%	≥90%

8 SAFETY 安全性能

8.1 External Short-circuiting Test at 25°C 25°C外部短路测试

Cell charged per standard charge method, is to be short circuited by connecting the positive (+) and negative (-) terminals with a total external resistance of $80\pm 20\text{mohm}$. Stop the test when the cell voltage falls below 0.1V and the cell case temperature has returned to a value within 10°C of the original testing temperature.

Criteria: No Fire, No Explosion

按照标准方式将电池充满电，使用外电路短路电池正（+）负（-）极，要求外电路内阻 $80\pm 20\text{m}\Omega$ 。当电池电压降到 0.1V，或电池温度降至测试温度 10°C 范围内，结束测试。

标准：电池不起火，不爆炸

8.2 Overcharge Test 过充电测试

Cell discharged per standard discharge method, is to be overcharged with 3C to 4.6V while tapering the charge current. Monitoring change of cell temperature during testing. The charge duration is 7 hours. Stop the test when cell temperature decays to room temperature.

Criteria: No Fire, No Explosion

按照标准方式将电池放电至 2.5V，以 3C 电流进行充电至电压达到 4.6V，整个过程充电时间持续 7h。测试过程中监测电池温度变化，当电池温度下降至室温时，结束测试。

标准：电池不起火，不爆炸

8.3 Heating Test 热箱测试

Cell charged per standard charge method, is to be placed in the hot oven. Store the testing cells connecting with thermocouple in constant temperature box, heating the cells and box (speed of ascending temperature is $5^\circ\text{C}\pm 2^\circ\text{C}$ per min) together at room temperature simultaneity, monitor the temperature change of the box, keep for 30 minutes after the box temperature reaches $130^\circ\text{C}\pm 2^\circ\text{C}$, then stop the test.

Criteria: No Fire, No Explosion

按照标准方式充满电的电池放置到恒温加热箱中，用热电偶连接电池监测电池温度。恒温箱升温加池，要求恒温箱升温速度为每分钟 $5^\circ\text{C}\pm 2^\circ\text{C}$ 。监测恒温箱温度变化，当恒温箱温度达到 $130^\circ\text{C}\pm 2^\circ\text{C}$ 后恒温保持 30 分钟，结束测试。

标准：电池不起火，不爆炸

8.4 Overdischarge Test 过放电测试

Cell discharged per 7.2.3, is discharged at constant current of 1C for 90min.

Criteria: No Fire, No Explosion

按照 7.2.3 将电池放电，然后以 1.0C 的电流对电池进行放电，放电时间为 90 分钟。

标准：电池不起火，不爆炸

8.5 Crush Test 挤压测试

Cell charged with standard charge method, is to be crushed between two flat surfaces and with cell longitudinal axis parallel to the flat surfaces of the crushing apparatus. The force for the crushing is to be applied by a hydraulic ram with a 1.25 inch (32 mm) diameter piston. The crushing is to be continued until a pressurereading of 2500 psig (17.2 MPa) is

reached on the hydraulic ram, applied force of 3000 pounds (13 kN). Once the maximum pressure has been obtained it is to be released.

Criteria: No Fire, No Explosion

按照标准方式充满电的电池放置于两个水平平板之间，要求电池长度方向与平板平行。采用直径为 1.25 inch (32mm) 的活塞泵作为动力供给的液压设备对两平板持续加压，直到液压达到 2500psig (17.2MPa)，两平板间压力到达 3000pounds (13kN) 的挤压力，结束测试。

标准：电池不起火，不爆炸

9 PACKAGING 包装

Loading 100 cells per box, 2 boxes per case for a total of 200 cells. Refer to attached drawing 2.

电池包装每盒装 100 只电池，每箱装 2 盒，共 200 只电池。见附录 2。

10 OTHERS 其他

Lishen promises that the warranty period of batteries of this specification shall be 12 months from the date of delivery. In case of quality problems occurring within the warranty period and confirmed by both parties, Lishen can replace the defective batteries for customers free of charge. However, Lishen shall not be liable for if (i) Cell was improperly installed, repaired, altered or otherwise modified (other than by Lishen), (ii) Cell was subjected to misuse, abuse, negligence or accident, or (iii) Cell was used, handled, stored, sold or distributed in a manner contrary or inconsistent to the handling / use instructions provided in this product specification sheet and the customer environment test guidelines (if any). (iiii) Quality problems occurring outside the warranty period.

力神承诺本规格电池的质量保证期为力神发货之日起 12 个月，如产品在质保期内发生质量问题且经双方确定确为力神责任的，力神可为客户免费更换问题电池。

力神不对以下情况承担任何责任：（i）电池被不正确的安装、修理、替换或其他方式修理（力神提供方式除外）；（ii）电池受到误用、滥用、疏忽或其他事故的影响，或（iii）电池的使用、处理、存储或分销方式与本产品规格表和客户环境测试指南（如果有）中提供的处理/使用说明相反或不一致；（iiii）质保期外发生的质量问题。

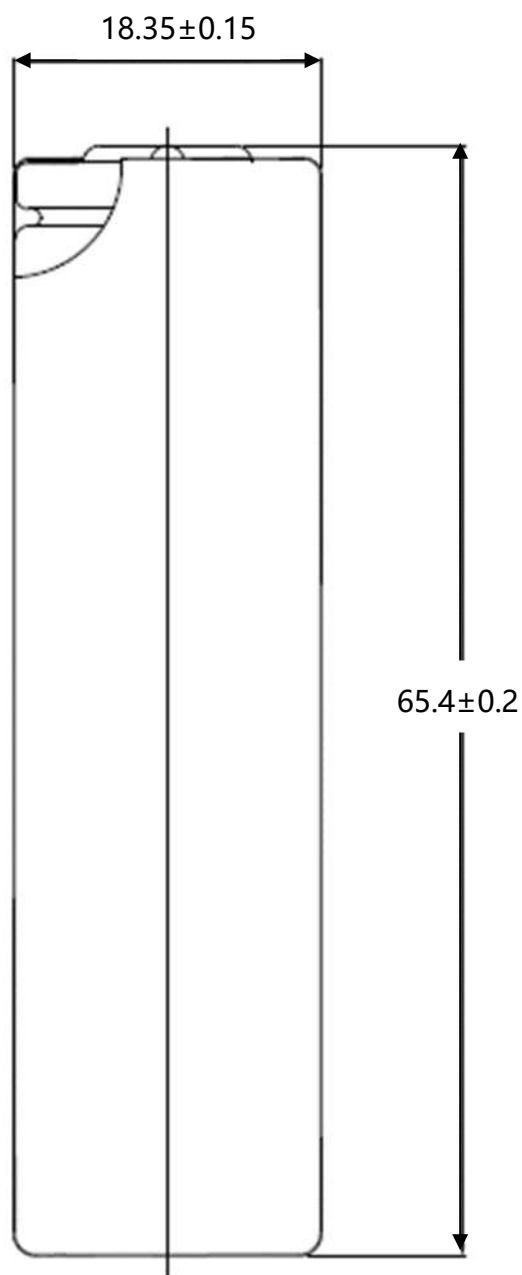
Any matter not included in this specification should be raised before use and conferred between the both parties..

不包含在此产品规格书之内的事项，请在使用前提出，双方协商解决。

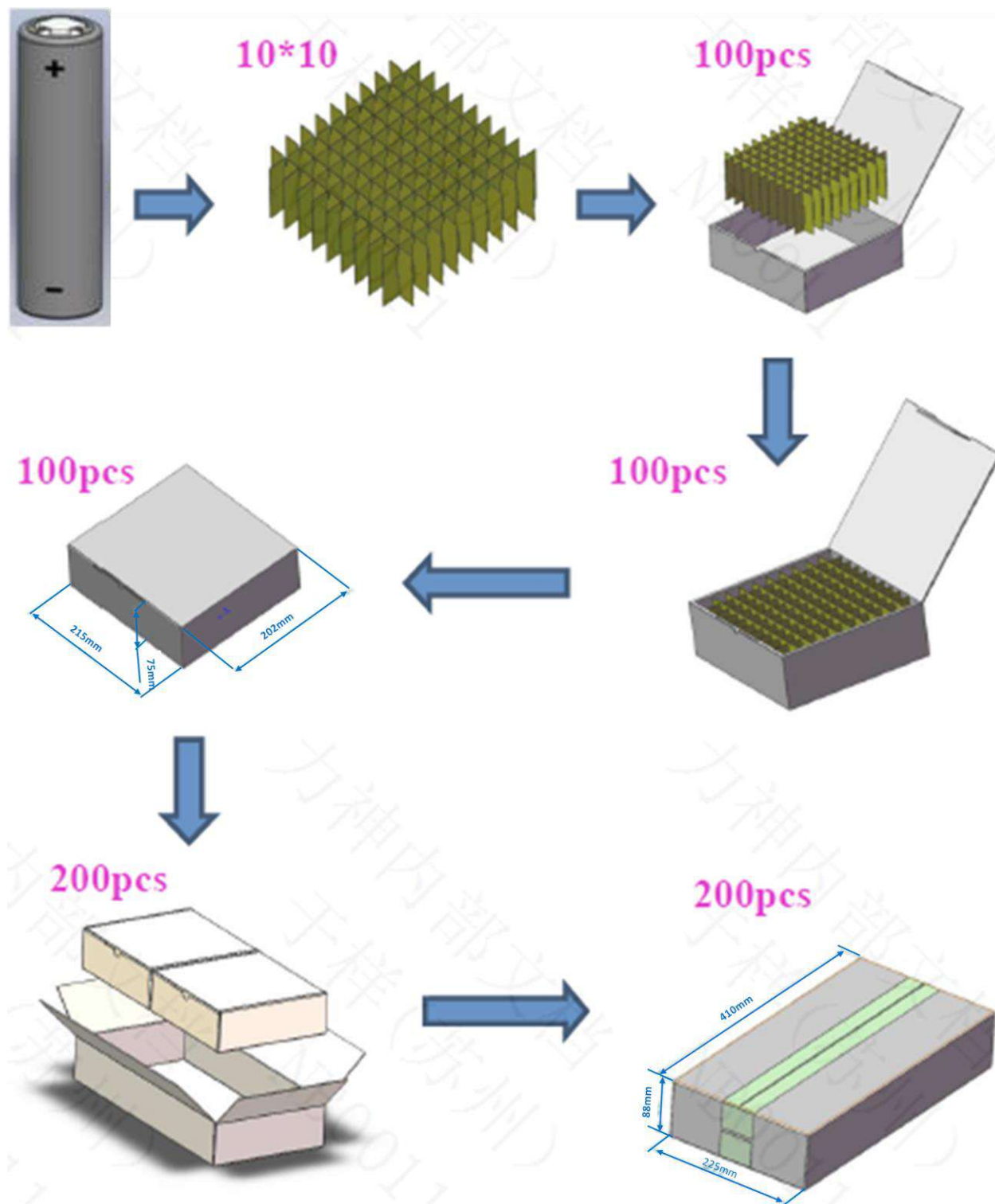
11 SHIPPING 运输

The capacity of delivery cell is 10%-40%SOC. It is not specified more than capacity remain at customer, because of self-discharge. During transportation, keep the cell from acutely vibration, impacting, solarization, drenching.

出货电池处于10%-40%充电状态，由于电池存在自耗，运送到客户端的电池无法完全保证荷电量。运输过程应防止剧烈振动、冲击、日晒雨淋。

Attached 1: Cell Size Drawing 附录1: 外观尺寸图

With thermoplastic sleeve
带热缩套

Attached 2: Packaging Sketch map Drawing 附录2: 包装图

The following caution and warning should appear in manuals and/or instructions for users, especially at the point of use.

HANDLING INSTRUCTIONS FOR LITHIUM ION RECHARGEABLE CELL 圆型电芯安全准则

1 ELECTRIC CAR, CHARGER AND BATTERY PACK DESIGN CONSIDERATIONS 电动汽车、充电器和电池组设计注意事项

1.1 Charging 充电

- 1.1.1 Cell should be charged with constant current-constant voltage method. Charging voltage must below 4.20V/cell and the charging cut-off current is greater than or equal to 1/20C. Even if the charge could be under fault condition, charge voltage of charger should not be above 4.25V/cell to prevent from over-charging. Cell life can be shortened by charging above 4.20V voltage.

电芯应该使用恒流-恒压充电的方式进行充电。单体电芯的充电电压不能超过 4.20V，充电截止电流大于等于 1/20C。考虑到充电器的控制偏差，必须保证电芯充电电压低于 4.20V。即使在异常情况下，充电电压不可超过 4.25V 以避免过充电。充电电压高于 4.2V 会导致电芯循环寿命缩短。

- 1.1.2 Charger should be equipped with a pre-charging system, and the function should be used to prevent the abnormal high rate charging after the deep discharging. In case of cell voltage is below 2.50V (and higher than 2.00V), cell should be pre-charged with current below 0.35A (0.1C) and until cell voltage reach 2.50V, use standard charging method. And if cell voltage can not reaches 2.50V in 30 minutes, stop charging. Do not charge if voltage is below 2.00V.

充电器应该带有预充电系统，预充电功能应该应用于阻止深度放电后不正常的大倍率充电。当长期存储电芯电压低于 2.50V（且高于 2.00V）时，必须使用低于 0.35A（0.1C）电流对电芯进行预充电，直到电芯电压高于 2.50V 再进行标准方式充电。如果电芯电压在 30 分钟内无法充至 2.50V，充电器需停止充电；低于 2.00V 禁止充电。

- 1.1.3 Charger should be equipped with a complete charging detection device including the timer, current detector, and open circuit voltage detector to monitor until full state of charge. Whichever one of the time, current and voltage detected as full charge, charge should be cut off to avoid trickle charge.

电芯充电器应该配备一个完整的充电检测装置。充电检测装置能够通过计时器、电流检测以及开路电压检测，检测到电池充满电的状态。当充电时间、电流或电压其中之一检测到电池充满电后，应该完全切断充电电路，避免产生涓流充电。

- 1.1.4 Cells should be charged at the temperature range of 0°C~50°C according to the specified current (see spec 3.5). When the cell temperature exceeds 55°C, it should be rested until the temperature cool down to within the range and then start charging again.

电芯充电应在温度为0°C~50°C下按规定（见规格书中3.5）电流进行，当电芯表面温度超出时55°C时，应静置到电池温度恢复以上范围后再行充电。

- 1.1.5 To ensure cycle life, it is recommended to use the normal charging or low current charging method, and minimize the rapid charge.

为确保电池寿命，推荐使用标准充电方法或小电流充电，减少快充。

1.2 Discharging 放电

- 1.2.1 Discharge end voltage must be over 2.5V.

电芯放电终止电压需高于2.5V。

- 1.2.2 Discharge temperature range should be -20°C ~ 70°C at specified current. If surface temperature of the cell exceeds 70°C, the discharge must be stopped.

电芯放电温度范围为-20℃~70℃，按规定电流进行。放电过程中，当电池表面温度超出70℃时，必须终止放电。

1.3 Storage 储存

Cell should be stored in low humidity (less than 65%RH), no corrosive gas atmosphere. And cell should not under pressure or condensation liquid on the cell surface. The optimum storage temperature range is 0℃~25℃. For long time storage, charging state of cell should be less than 50% SOC, and must check the voltage of the cell before usage.

电芯应在干燥（低于 65%RH）无腐蚀性气体的环境下储存，不要让电芯承受任何压力，且不能有冷凝液体附在电芯表面，最佳储存温度为 0℃~25℃。长期存储，电芯荷电状态建议处于 50%SOC 以下，并且使用前需要进行电压检测。

When stored within 1 month 储存期小于 1 个月: -20℃ ~ 60℃

When stored within 3 months 储存期小于 3 个月: -20℃ ~ 45℃

When stored within 12 months 储存期小于 12 个月: -20℃ ~ 25℃

1.4 Precautions on battery pack design 电池组设计注意事项

1.4.1 Battery pack Shape, Mechanism and Material 电池组的形态，机理和材料

The battery pack should be designed to ensure that it should only be used with its specified charger.

电池组设计应该保证其不能被未授权的充电器进行充电。

The battery pack should be designed to ensure that it should only be connected to its specified equipment;

电池组设计应该保证其不能与未授权的装备和设备进行连接。

The positive and negative terminals of the battery pack should be designed to avoid short circuits or reverse connection.

电池组正负极两端应该设计成避免短路或正负极避免发生反接的结构。

The positive and negative connection wires of the battery should no overlap.

电池正、负极连接导线不应有重叠现象。

The battery pack should be designed with anti-static function and can prevent intrusion from intruding dust, liquid, etc.

电池组设计应该具有防静电功能并且能够阻止灰尘、液体等侵入。

The battery pack should have a device with over-current protection function to avoid external short-circuiting.

电池组应该有过电流保护功能的装置，来避免外短路的情况发生。

The battery should be designed so that even if the battery leakage occurs, the electrolyte can not reach the protection circuit board;

电池组应该设计成即便电池发生了漏液，电解液也不能到达保护线路板。

The battery pack should be designed to ensure that the cell is fixed in the battery pack and can not move freely.

电池组设计上应保证电池固定在电池组内，不能任意移动。

The structure of the battery pack should be designed to ensure that the dent, deformation and other mechanical stresses of the battery should not be caused after the foreseeable fall.

电池组在结构上应保证在出现可预见的跌落后不能使电池出现凹痕，变形和其他机械应力。

The materials of battery pack such as double-sided tape and rubber should be nonflammable.

电池组使用的材料例如双面胶带和橡胶应该验证其可燃性。

The welding mold should be sealed with glue. Lishen is not liable for any problem caused by ultrasonic welding when sealing the welding mold.

熔接模具应该用胶密封。如果在熔接模具密封时使用超声波焊接的方法，对于出现的任何问题，力神不承担任何责任。

1.4.2 Battery pack structure (battery pack limits the number of batteries used)

电池组结构（电池组限制使用的电池数量）

The battery pack should pass the overcharge test (charging current of the overcharge test is the maximum charging current of the charger multiple the paralleled number)

电池组必须通过过充电测试（过充电测试的充电电流为充电器的最大充电电流与并联数量的乘积）。

The pack fuse is required.

需要保险丝。

The battery should be away from the heat Device to avoid deterioration of battery performance;

电池应该远离发热电子元器件以避免电池性能的劣化。

PCBA circuit board and battery pack should be insulated (by such as plastic barrier air isolation or non-heat conducting insulation material).

PCBA线路板和电池组之间应该有绝热材料进行隔绝（例如塑料屏障给予空气隔离或非导热电材料隔离）。

Cell module should be used with cooling system. (Note: If charged and discharged at high rate and high temperature ($\geq 35^{\circ}\text{C}$) frequently, cell cycle life can be shortened. If charged and discharged at high temperature ($\geq 60^{\circ}\text{C}$) frequently, cell safety risk can be occurred.)

电池组需在有冷却设备的条件下进行使用。（备注：经常在高温（ $\geq 35^{\circ}\text{C}$ ）及高倍率或高电压情况下充放电，会造成电池循环寿命缩短；经常在高温（ $\geq 60^{\circ}\text{C}$ ）下充放电，可能存在安全隐患。）

Cell voltage monitoring system. The system (charger or pack) should be equipped with a device to monitor each voltage of cell block to avoid cell imbalance which can cause damage to the cells.

电池电压监测系统。系统（充电器或电池组）应配备一个装置来监控电池模块中每个电池的电压，以避免电池间电压失衡，从而对电池造成损坏。

The recommended spacing between the cells is more than 1mm.

建议电池间距大于1mm。

1.4.3 Protection Circuit ensure safety of battery 保护电路确保电池的安全

The following protection circuit should be installed in the battery pack:

下面的保护电路应该安装在电池包内：

Over charge protection: for safety and in order not to shorten the cycle life, the maximum overcharge protection voltage for the individual cells within each module should be less than 4.25V (including tolerances);

过充电保护：出于安全的原因和为了不缩短循环寿命，每个模块内的单体电池的最大过充保护电压应该低于4.25V（包含公差）。

Over discharge protection: if the single cell voltage reaches 2.5V, recommend that discharge protection should cut off the discharge current, the consuming circuit current should be as low as possible;

过放电保护：如果单体电芯电压达到2.5V，我们建议过放电保护应该切断放电电流，电路的消耗电流要尽量小。

Over current protection: if the single cell discharge current exceeds about 3C, the overcurrent protection should cut off the discharge current circuit.

过电流保护：如果单体电池放电电流超过约3C，过电流保护应该切断放电电流电路。

External short protection: the battery pack should have function prevent from external short cut.

外短路保护：电池组要有防止外短路功能。

Over temperature protection: set pack over temperature protection according to the cell using condition in the specification.

过温保护：按电芯使用条件进行电池组过温保护。

Battery pack should have cell voltage balancing function and cell imbalance protection function.

电池组要有电压平衡保护和电池不平衡保护。

Battery pack should have function to avoid thermal propagation when the cell goes failure.
电池组应在电芯失效的时候有防止热失控的保护功能。

The battery pack should have thermal balance and when pack discharge, temperature of cell in the pack should be less or equal to 5°C.

电池组应该尽量热均衡，电池包在放电时，内部电芯温差应小于等于5°C。

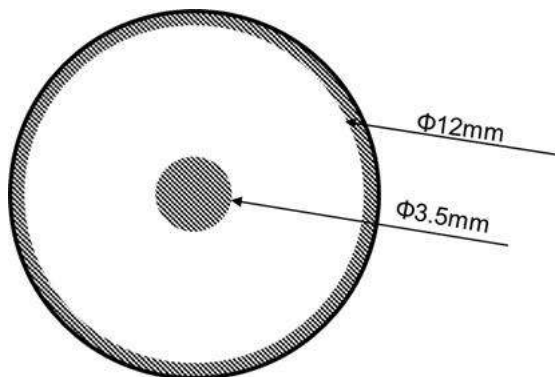
In order to avoid long-term storage over discharge mode, battery pack protection circuit current consumption should be set as small as possible. Long-term use, to regularly check the remaining state of electricity, to ensure that the battery within the single cell can not achieve over-discharge state.

为了避免长期存储出现过放电模式，电池包保护线路的消耗电流应该设置的尽量小。长期未使用时，要定期检查电量剩余状态，要确保电池组内各单体电芯不能达到过放状态。

1.4.4 Cell connection 电池连接

Do not use soldering or ultrasonic welding to in connection process. In order to avoid a damage on the cell, use spot welding to connect. As shown in the following figure, the weldable areas are filled in white: $\Phi 3.5\text{mm}$ - $\Phi 12\text{mm}$, the nonweldable areas are filled in black shades. (When welding, it is necessary to pay attention to the welding energy to avoid excessive energy and leakage of weld penetration)

电池不能使用锡焊及超声焊的工艺进行连接。为了避免任何损伤，电池应通过点焊的方式连接到引线上。如下图所示，可焊区域用白色填充： $\Phi 3.5\text{mm}$ - $\Phi 12\text{mm}$ ，不可焊区域则用黑色阴影。（焊接时需注意焊接能量，避免能量过高焊穿漏液）



The battery pack should be designed with anti-vibration function to prevent from deformation damage of cell.
电池组要有防震动设计，否则产生形变，损坏电池。

1.5 Cell usage 电芯的适用

- 1.5.1 When cells are used in series and parallel connection, they need to use the same grade, the same batch code and the same state of charge. This information can be obtained from the inside and outside box labels. Before using the cell, the voltage and internal resistance need to be detected and the cells should be assembled according to its purpose. Lishen recommends that the cell voltage difference is within 15mV and the internal resistance difference is within 5mΩ at least. (If the cells are in the sample stage, the consistency of cells cannot be guaranteed.)

电芯进行串并使用时，需使用相同档位、相同批次及相同充电状态的电芯，可以从内外箱标签上获得此信息。电芯使用前需检测电压内阻，并按照其用途进行组配，力神建议至少保证组配使用电芯压差15mV以内，内阻差5mΩ以内。（如电池处于样品阶段，则其电池一致性不能被保证）

- 1.5.2 The pack manufacturers should check the voltage, internal resistance, protection circuit function, thermistor of the battery pack before shipment.

出货前电池包检查电压、内阻、保护线路功能、热敏电阻、热熔断器等。

- 1.5.3 During the transfer of the cells to the assembly factory, special attention should be paid to prohibiting causing damage from external forces during transportation. Lishen recommends that the same transportation packaging is used during the transfer process, even if there is a process of opening the package.

电芯中转至组装工厂过程要特别注意禁止运输过程造成外力损伤，转运过程力神建议使用相同的运输包装，即使过程中存在打开包装的情况。

- 1.5.4 Do not use damaged or leaked batteries due to transport damage, drop, short circuit or other reasons.
不要使用由于运输损伤，跌落，短路或其它原因造成破损或漏液电芯。

2 SAFETY INSTRUCTIONS安全守则

Batteries containing organic solvents and other flammable substances, improper use may cause cell produce heat or get fire, which can cause damage to cell or personal injury. Please pay attention to compliance with the use of prohibited items, while add protection device to avoid any cell accident caused by abnormal equipment using. Before using lithium-ion chargeable cells, please read the following safety guidelines carefully. In addition, Lishen strongly recommend adding these instructions to the user manual.

电芯含有有机溶剂等易燃物质，如使用不当可能引起电芯产热或起火，造成电芯的损害或人身的伤害。请注意遵守安全守则，同时应增加保护装置以避免使用设备异常造成电芯事故。在使用锂离子可充电电芯以前，请仔细阅读以下的安全守则。此外，力神强烈建议把这些指令加入到用户手册中。

2.1 Dangerous matter 危险事项

- 2.1.1 Do not use or place cells in high temperature (above 60°C) environment. Do not put it into fire, water or moisturize it. Do not repair or disassemble cells, which has risk of causing the cells overheated, leak, fire or explode.
不要使用或放置电芯于高温（高于 60°C）环境中，不要将其投入火中、水中或使其吸湿，不要修理或拆解电芯，其存在引发电芯过热、漏液、起火或爆炸的危险。
- 2.1.2 Do not place the cells out of order, away from metal and other conductive materials to avoid positive (+) negative (-) short circuit, do not reverse the positive (+) negative (-) pole.
不要将电芯混乱摆放，同时需远离金属等导电材料，以避免正（+）负（-）极短路，不要颠倒电芯正（+）负（-）极使用。
- 2.1.3 Do not use non-specified charger and violate charging instructions. Charging under non-specified conditions will cause the cell to overcharge or abnormal chemical reactions, causing heat generation, smoke, fire or explode.
不要使用非规定充电设备和违反充电要求。非规定条件充电会引发电芯过充电或异常化学反应，发生产热，冒烟，破裂或起火情况。
- 2.1.4 Do not directly connect the battery to the AC plug (outlet) or the car plug. The battery needs to have a specific charger. If the battery is connected directly to the plug, the battery may generate heat, smoke, fire or explode.
不要将电池与 AC 插头（出口）或汽车插头连接。电池需要有特定的充电器。如果电池与插头直接连接，电池可能会着火，冒烟，爆炸或者引起发热。
- 2.1.5 Do not overcharge, over-discharge, drive nail into the cell, strike it by hammer or tread and step on it.
不要过充、过放、针刺、锤击及踩踏电芯。
- 2.1.6 Do not hit or throw cells. If the cells fall, please dispose it as a waste product and can not continue to use.
不要撞击或投掷电芯。如果电芯出现跌落，请当废品处理，不能继续使用。
- 2.1.7 Do not disassemble cell. If the protection circuit is damaged, battery will no longer be protected. Then the battery may generate heat, smoke, fire or explode.
不要解剖电池。如果保护线路受到破坏，电池将不再被保护。可能会引起发热、冒烟、着火或爆炸。
- 2.1.8 Do not charge under high temperatures. If the battery is charged near a high temperature, the battery cannot be recharged due to the protection circuit. In this case, the protection circuit might be interrupted and the battery may generate heat, smoke, fire or explode.
不要在靠近高温处充电。如果电池在靠近高温处充电，电池由于保护线路动作，不能再充电。在这种情况下，保护线路可能发生中断，电池可能发热、冒烟、着火或爆炸。
- 2.1.9 Do not use obviously damaged or deformed batteries, which may generate heat, smoke, rupture or fire.
不要使用明显损坏或者形变的电池。可能会造成电池发热，冒烟，破裂或者燃烧。

2.1.10 Do not solder on the cell directly. Overheating may cause deformation of cell and cell components such as insulation gaskets cell deformation, and cause leakage, fire or explode.

不要直接用锡焊焊接电芯，过热会导致绝缘垫圈等电芯部件变形，引发电芯变形、漏液、起火或爆炸。

2.1.11 Do not reverse charging. If the battery is reverse charging, will occur abnormal chemical reaction and may cause an unpredictable high current during discharging. These may cause heat generation, smoke, rupture or fire.

不要反极性充电。在充电时，电池被反向充电会发生不正常的化学反应，且在放电时会有不可预料的大电流通过的情况。这些可能会造成电池发热，冒烟，破裂或者燃烧。

2.2 Warning 警告事项

2.2.1 Batteries should be kept away from infants and young children. In case of swallowing the battery, please seek medical attention immediately.

电池应该远离婴幼儿存放。出现吞咽电池的情况，请立即就医。

2.2.2 Don't place the battery in a microwave oven or other cooking utensils. Due to the heating and electrical shock of the microwave oven, the battery may ignite, smoke, explode or cause heat.

不要把电池放在微波炉或其他煮食用具中。由于微波炉的加热和电气冲击，电池可能会着火，冒烟，爆炸或者引起发热。

2.2.3 Don't mix with other batteries. The battery can not be mixed with other different capacities, chemical systems, or manufacturers' batteries. Do not connect other batteries or mix other batteries. The battery may catch fire, smoke, explode or cause heat.

不要和其他电池一起混用。电池不能和其他不同容量，化学体系或者生产商的电池混用。不要连接其他电池或者混合其他电池。电池可能会着火，冒烟，爆炸或者引起发热。

2.2.4 Do not use an abnormal battery. If there is obvious abnormality, such as odor, heating, deformation, or discoloration, stop using the battery. Using such battery might generate heating, smoke, fire or explode due to the defect.

不要使用不正常的电池。如果有明显的异常，例如异味、发热、畸形或者变色，请停止使用电池。这样的电池可能有缺陷，如果继续使用，可能会引起电池发热、冒烟、着火或爆炸。

2.2.5 If the charging cannot complete within its specified period of time, stop charging process. Otherwise, battery may generate heat, smoke, fire or explode.

如果电池在规定的时间内不能完成充电过程，请停止充电步骤，否则可能会引起电池发热、冒烟、着火或爆炸。

2.2.6 If battery or leaking battery has a pungent odor, the battery should remain away from the flame. Otherwise, battery may generate heat, smoke, fire or explode.

如果电池或者有液体流出的电池产生刺鼻性气味，应该使电池远离火焰，否则可能会引起电池发热、冒烟、着火或爆炸。

2.2.7 Do not touch the leaking battery. If the liquid leaking from the battery into eyes, will cause serious injury. If the liquid gets into your eyes, rinse your eyes with water immediately and consult a doctor immediately.

不要触摸漏液电池。如果从电池漏出的液体进入眼中，将会造成严重损害，请立即用清水冲洗眼睛，并立即咨询就医。

2.2.8 To avoid short circuit or damage, please put the battery into a box or carton tightly.

为了避免出现短路或损伤，请紧密地将电池装入有间隔的盒体或纸箱内。

2.2.9 Do not store the cell together with metallic objects such as keys, necklaces, hairpins, coins, or screws.

不要将电池与金属放一起，比如钥匙，项链，头饰，硬币或螺丝等。

2.2.10 Soaking the cell in water is strictly prohibited, because it may cause corrosion and leakage of components to be damaged to functions.

严禁将电池浸泡在水中，因为它可能会导致腐蚀和组件泄漏损坏功能。

2.3 Precautions 注意事项

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- 2.3.1 Do not use or place batteries in high temperature environments. It may cause battery performance and life degradation. It may also generate heat, smoke, fire or explode.
不要在高温环境使用或放置电池，例如在阳光直射下的汽车中。电池可能会着火，冒烟，爆炸或者引起发热。同时，可能会造成电池性能和寿命的劣化。
- 2.3.2 Battery pack has a protective circuit. Do not use batteries in places where static electricity (over 100V) is generated, which may damage the protection circuit. If the protective circuit is damaged, battery may generate heat, smoke, fire or explode.
电池包有保护线路。在产生静电（超过100V）的地方，不要使用电池，可能会损害保护线路。如果电池的保护线路被破坏，电池可能会着火，冒烟，爆炸或者引起发热。
- 2.3.3 Specified the charging temperature range 0°C~50°C. Do not charge the battery outside the specified temperature range. Otherwise, it may cause battery performance and life degradation. It may also generate heat, smoke, fire or explode.
充电温度范围规定在 0°C~50°C之间。不要在规定的温度范围外对电池进行充电。否则，可能会造成电池性能和寿命的劣化，同时可能会导致产热、漏液、或者严重损害。
- 2.3.4 Please read the manual before use. Please keep this manual for future reference.
在使用前请阅读手册。请妥善保管本手册以供将来参考。
- 2.3.5 Please read the charging method of the charger manual.
请阅读充电器手册的充电方法。
- 2.3.6 In the first use, if the battery has an abnormal smell, heat or rust, please contact the supplier.
在首次使用时，如果电池有不正常气味、发热或者生锈，请联系供货商。
- 2.3.7 Keep away from flammable materials during charging and discharging. May cause heat generation, smoke, fire or explode.
在充放电过程中，请远离易燃材料。可能会引起电池发热、冒烟、着火或爆炸。
- 2.3.8 If electrolyte leaks from the battery, gets on the clothes or on the skin, rinse it immediately with water. Otherwise, it may irritate skin.
如果电解液从电池中泄露，沾到衣服或者皮肤上，应立即用水进行冲洗。否则，可能会刺激皮肤。
- 2.3.9 If wires or metal objects get out of battery, seal and insulate them completely. Otherwise, the battery may cause short circuit, and heat generation, smoke, fire or explode.
如果导线或金属物体从电池出来，请把它们完全密封和绝缘。否则，可能造成电池短路，引起电池 发热、冒烟、着火或爆炸。
- 2.3.10 After use, please carry out battery recycling according to local laws and regulations.
使用后，请根据当地的法律、法规进行电池回收。

3 EXCLUSION LIABILITY 免责申明

- 3.1 Lishen is not liable for any loss caused by breach of notice in the specification;
力神对因违反规格书内注意事项及安全准则操作所产生的问题及造成的任何损失不承担责任；
- 3.2 Lishen is not responsible for any problems caused by design defects in electric circuit, battery packs, electric cars and chargers;
力神对因电路、电池包、电动车和充电器的设计及搭配所造成的任何问题不承担责任；
- 3.3 Lishen does not accept abnormal batteries caused by improper assembly;
力神不接受因不正确的组装过程造成的异常电池；
- 3.4 Lishen is not liable for any loss caused by incorrect, failed to comply with the SPEC charge and discharge method or under inappropriate environment;
力神对使用不正确的或与规格书中不符的充、放电方法及不合适的使用环境造成的任何问题不承担责任；
- 3.5 Lishen is not liable for any problems caused by force majeure (ex. Lightning, storm, flood, fire, earthquake, etc)
力神对于因不可抗力（如雷电，暴风雨，洪水，火灾，地震等）造成的任何问题不承担责任。

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- 3.6 In order to standardize the use of sample batteries, the rights, obligation and responsibilities of every customer and Lishen are clarified. Before using battery, please read carefully and understand the contents of the specification thoroughly. In order to ensure the safety of the battery, please contact LISHEN to discuss design of the application. Also, if there are special usage patterns (for example: large current loading, quick charge method or low temperature, high temperature condition), please consult LISHEN before finalizing the product specification.

为了规范样品电池使用,使每一位客户和力神的权利、义务、责任得到明确。在使用电池之前,请仔细阅读并透彻理解规格书内容。为了确保电池安全,请联系力神讨论设计应用,如果有特殊使用条件(比如大电流负载,快充方法,低温和高温使用),请咨询力神。

If you choose to use this battery, your usage will be regarded as an endorsement of all the contents of this statement.
如果您选择使用本款电池,您的使用行为将被视为对本声明全部内容的认可。

The amendment, renewal and final interpretation of this statement are belong to Lishen.
本声明的修改权、更新权及最终解释权均属力神所有。

4 CONSULTATION咨询

If there is any problem in this specification, please contact us as following:

如有任何疑问,请按照以下方式咨询:

Add: 88 Kunlun Mountain Road, Suzhou City, Jiangsu, China--Lishen Battery (Suzhou) Co., Ltd.

厂址: 苏州科技城昆仑山路88号-力神电池(苏州)有限公司

Tel No.: 86-0512-88605019

电话: 86-0512-88605019

URL: <http://www.lishen.com.cn>

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion cell with Lishen in advance. And consult about the high rate current, rapid charge and special application in the same way.

为了安全起见,如有设备设计,锂离子电芯系统保护电路或高电流,快速充电和其它方面的特殊应用,请先咨询力神公司相关事宜。