PRODUCT SPECIFICATION

Cylindrical Lithium-ion Cell

圆柱型锂离子电池产品规格书

LR2170 50PT

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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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	16/02/2025	Wei changhao	Original Release
1	31/03/2026	Wu Lan	Modify 40A Cycle Life

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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, customers are 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 Product name 产品名称 Cylindrical Lithium Ion Cell 圆柱型锂离子电池

2.2 Model 型号 LR2170 50PT

3 GENERAL SPECIFICATIONS 常规指标

Item 项目	Specifications 规格
3.1 Discharge Capacity 放电容量	Rate capacity 5000mAh 额定容量 5000mAh Minimum capacity 4900mAh 最低容量 4900mAh - Rate capacity is measured by the discharge at 0.2C-1.0A to 2.50V end voltage after standard fully charged according to specification (CCCV, 0.5C-2.5A, 4.20V, 100mA cut-off, 25℃). 标称 5000mAh(0.2C)，最低 4900mAh(0.2C) -标称容量是以标准充电方式(CCCV，0.5C-2.5A，4.20V，100mA 截止， 25℃)充满电，0.2C 放电至 2.50V 测的容量值。
3.2 Charge Voltage 充电电压	Limited Charging Voltage 充电限制电压 4.20V Upper limited Charging Voltage 充电上限电压 4.25V
3.3 Nominal Voltage 标称电压	3.60V@0.2C
3.4 Nominal Energy	18.0Wh
3.5 Standard Charging （Recommendation charging current） 标准充电电流（推荐充电电流）	CCCV, 0.5C(2.5A), 4.20V, 100mA cut-off, 25℃
3.6 Rapid Charge 快速充电	CCCV, 2.0C(10.0A), 4.20V, 100mA cut-off, 25℃
3.7 Maximum Charging Current 最大充电电流	CCCV, 3.0C(15.0A), 4.20V, 100mA cut-off, 25℃
3.8 Maximum Continues Charge Current 最大持续充电电流	0℃ ≤ T ≤ 15℃ 2.5A 15℃ < T ≤ 40℃ 15A 40℃ < T ≤ 50℃ 8A

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3.9 Standard Discharging（Recommendation discharging current） 标准放电电流（推荐放电电流）	0.2C-1.0A to 2.50V 0.2C-1.0A 放电至 2.50V
3.10 Maximum Discharge Current 最大放电电流	70A（80℃ cut off） 70A（80℃ 截止）
3.11 Discharge Cut-off Voltage 放电截止电压	2.5V
3.12 End of Discharge Voltage 放电终止电压	2.5V
3.13 Cycle Life 循环寿命	①1000th cycle ≥60% of 1st Capacity (25℃, 8A charge/10A discharge, 4.20V-2.5V，80℃ cut off) 1000 次循环≥60%首次容量 (25℃，8A 充/10A 放，4.20V-2.5V, 80℃截止) ②500th cycle ≥60% of 1st Capacity (25℃, 8A charge/40A discharge, 4.20V-2.5V，pause discharging when the surface temperature≥80℃, and continue discharging after the temperature≤ 50℃) 500 次循环≥60%首次容量 (25℃，8A 充/40A 放，4.20V-2.5V，表面温度达到 80℃暂停放电，待温度降低至 50℃后继续放电) ③300th cycle ≥50% of 1st Capacity (25℃, 8A charge/50A discharge, 4.20V-2.5V，pause discharging when the surface temperature≥80℃, and continue discharging after the temperature≤ 50℃) 300 次循环≥50%首次容量 (25℃，8A 充/50A 放，4.20V-2.5V，表面温度达到 80℃暂停放电，待温度降低至 50℃后继续放电)
3.14 Weight of Bare Cell 重量	≤69g
3.15 Charge Temperature（Ambient） 充电温度（环境温度）（*1）	Upper Limited Charging Temperature 上限充电温度 50℃ Lower Limited Charging Temperature 下限充电温度 0℃
3.16 Discharge Temperature（Ambient） 放电温度（环境温度）（*1）	Upper Limited Discharging Temperature 上限放电温度 60℃ Lower Limited Discharging Temperature 下限放电温度 -30℃
3.17 Cell Surface Temperature(*2) 电池表面温度	Charge 充电 0℃～55℃ Discharge 放电 -30℃～80℃
3.18 Storage Temperature and Humidity (For shipping state) (*3) 存储温湿度(出货态)	1 month 1 个月 -20℃～60 ℃(≤65%RH) 3 months 3 个月 -20℃～45 ℃(≤65%RH) 12 months 12 个月 -20℃～25℃(≤65%RH)

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Note(*1)：Operating at high humidity(＞65%RH), the cell performance will deteriorates.
在高湿环境下(>65%RH)应用，会使电池性能劣化。

Note(*2)：Discharge (over temp. protection) should not be over 80℃ of temperature. Protection set should be based on the location of the cell surface with the highest temp increase part of the battery pack.
放电 (超温保护)温度不应超过 80℃。保护装置应以电池组中温度升高最高的电池表面位置为基础。

Note(*3)：If cell is kept as ex-factory status (≤30%), the capacity recovery rate shall be more than 90%.
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℃, humidity≤65%RH, and no corrosive gas. It is also recommended to charge and discharge the cell every six months.
如果电池在出货态存储，恢复容量应在 90%以上。
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℃、湿度≤65%RH、无腐蚀气体。同时建议每 6 个月进行一次充放电。

4 OUTLINE DIMENSION (UNIT: mm)外形尺寸

Dimension 电池尺寸 Diameter 直径 21.2±0.2mm, Height 高度 70.5±0.2mm.

Refer to the attached drawing 1.见附录 1.

5 APPEARANCE 外观

There shall be no such defect as worn tube and 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

The electronic balance should have an accuracy of the grade 1mg or higher.

电子天平精度应为 1mg 或更高。

6.1.2 Impedance Tester 内阻测试仪

The impedance tester should have an accuracy of the grade 0.1mΩ or higher.

内阻测试仪精度应为 0.1mΩ 或更高。

The impedance meter should be operated at AC 1kHz.

电阻仪应在交流 1kHz 条件下测试。

6.1.3 Digital Caliper 数显卡尺

The digital caliper should have 0.01mm scale or higher.

数显卡尺刻度范围为 0.01mm 或更高。

6.1.4 Amp-meter and Volt-meter 安培表和伏特表

The amp-meter and volt-meter should have an accuracy of the grade 0.5mA and 0.5mV or higher.

安培表和伏特表的精度应分别为 0.5mA 和 0.5mV 或更高。

6.2 Unless otherwise specified, all tests shall be performed at 25℃±2℃ and humidity ≤65%RH. The cells used for the test mentioned should be new ones delivered a week before at most.

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除特殊要求外，所有测试均在标准温度 25℃±2℃和湿度≤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 (milliamperes) 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 0.5C(2.5A) 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 100mA.

0.5C(2.5A)恒流充电至 4.20V，再以 4.20V 恒压充电至电流衰减为 100mA。

7.1.2 Charging shall consist of charging at a 1.6C(8A) 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 100mA.

1.6C(8A)恒流充电至 4.20V，再以 4.20V 恒压充电至电流衰减为 100mA。

7.2 Discharge method 放电方式

7.2.1 Cells shall be discharged at a constant current of 1A to 2.50V 1A 恒流放电至 2.50V

7.2.2 Cells shall be discharged at a constant current of 10A to 2.50V 10A 恒流放电至 2.50V

7.2.3 Cells shall be discharged at a constant current of 40A to 2.50V 40A 恒流放电至 2.50V

When the cell surface temperature≥80℃, all discharge methods should be stopped.

7.2.4 Cells shall be discharged at a constant current of 50A to 2.50V 50A 恒流放电至 2.50V

When the cell surface temperature≥80℃, all discharge methods should be stopped.

当电池表面温度≥80℃，所有放电制式均应停止放电。

7.3 Internal Impedance 内阻

The impedance shall be measured by Voltage-Impedance Tester of 6.1.2.

25℃下，使用 6.1.2 电压内阻测试仪测试。

Initial Internal Impedance ≤ 5mΩ. 电池内阻≤5mΩ。

7.4 Discharge Rate characteristics 倍率放电性能

Cells shall be charged per 7.1.2 charge method (CCCV, 8A, 4.20V, 100mA cut-off, 25℃) and discharged per, 10A, 20A, 30A, 40A (when the cell surface temperature to 80℃ the discharging cut off). The discharge capacity of each cell at respective discharge rate shall be compared with the discharge capacity at 10A and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 1.

25℃下按照 7.1.2 方式(CCCV, 8A, 4.20V, 100mA 截止，25℃)充电，分别以 10A，20A，30A，40A，50A 方式放电(当电池表面温度达到 80℃，放电终止)，记录电池放电容量，并计算与电池 10A 放电容量百分比，满足表 1 要求。

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Table 1

10A	20A	30A	40A	50A
100%	≥95%	≥93%	≥90%	≥60%

7.5 Cycle Life 循环寿命

7.5.1 Charge cells per 7.1.2 (Charging shall consist of charging at a 8A 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 100mA). Rest 15 minutes. Discharge per 7.2.2 (Cells shall be discharged at a constant current of 10A to 2.5V, when the cell surface temperature to 80℃ the discharging cut off). Rest 30 minutes before recharge. The test ambient temperature is 25℃. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 1000 cycles.

25℃测试环境下，按 7.1.2 方式(8A 恒流充电至 4.20V，再以 4.20V 恒压充电至电流衰减为 100mA)对电池进行充电，休眠 15 分钟，按 7.2.2 方式(10A 恒流放电至 2.5V,当电池表面温度达到 80℃，放电终止)对电池进行放电，休眠 30 分钟，充放电一次为一个循环，测试 1000 次循环后放电容量。

Discharge capacity (1000th Cycle) ≥60% of 1st Cycle Capacity 1000 次循环后放电容量≥60%首次容量

7.5.2 Charge cells per 7.1.2 (Charging shall consist of charging at a 8A 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 100mA). Rest 15 minutes. Discharge per 7.2.3 (Cells shall be discharged at a constant current of 40A to 2.5V, when the cell surface temperature to 80℃ the discharging cut off). Rest 30 minutes before recharge. The test environmental temperature is 25℃. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 500 cycles.

25℃测试环境下，按 7.1.2 方式(8A 恒流充电至 4.20V，再以 4.20V 恒压充电至电流衰减为 100mA)对电池进行充电，休眠 15 分钟，按 7.2.3 方式(40A 恒流放电至 2.5V，当电池表面温度达到 80℃，放电终止)对电池进行放电，休眠 30 分钟，充放电一次为一个循环，测试 500 次循环后放电容量。

Discharge capacity (400th Cycle) ≥60% of 1st Cycle Capacity 400 次循环后放电容量≥60%首次容量

7.5.3 Charge cells per 7.1.2 (Charging shall consist of charging at a 8A 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 100mA). Rest 15 minutes. Discharge per 7.2.4 (Cells shall be discharged at a constant current of 50A to 2.5V, when the cell surface temperature to 80℃ the discharging cut off). Rest 30 minutes before recharge. The test environmental temperature is 25℃. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 300 cycles.

25℃测试环境下，按 7.1.2 方式(8A 恒流充电至 4.20V，再以 4.20V 恒压充电至电流衰减为 100mA)对电池进行充电，休眠 15 分钟，按 7.2.4 方式(50A 恒流放电至 2.5V，当电池表面温度达到 80℃，放电终止)对电池进行放电，休眠 30 分钟，充放电一次为一个循环，测试 300 次循环后放电容量。

Discharge capacity (300th Cycle) ≥50% of 1st Cycle Capacity 300 次循环后放电容量≥50%首次容量

7.6 Storage Characteristics 存储性能

7.6.1 After charge as per standard charge method 7.1.2 (Charging shall consist of charging at a 1.6C 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), store the testing cells at 25℃ for 28 days. Then discharge as per 7.2.1 (Cells shall be discharged at a constant current of 0.2C to 2.50V). Then the same cell is fully charged as per 7.1.2 again and discharged a second time and measured as per 7.2.1.
电池按 7.1.2 方式(CCCV, 8A, 4.20V, 100mA 截止，25℃)充电后，在 25℃环境下存储 28 天后，按 7.2.1 方式(0.2C 恒流放电至 2.50V)放电并记录电池容量；然后再按 7.1.2 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) ≥90% of initial capacity.

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电池恢复容量(第二次放电容量)≥90%初始容量。

8 SAFETY 安全

8.1 External Short-circuiting Test at 25℃ 常温外部短路测试

Cell charged as 7.1.1 method (CCCV, 0.5C-2.5A, 4.20V, 100mA cut-off, 25℃), is to be short circuited by connecting the positive (+) and negative (-) terminals with a total external resistance of 80 mΩ±20mΩ. Stop the test when the cell voltage falls below 0.1V and the cell case temperature has returned to a value within 10℃ of the original testing temperature.

Criteria: No Fire, No Explosion

按照 7.1.1 方式(CCCV, 0.5C-2.5A, 4.20V, 100mA 截止，25℃)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 80mΩ±20mΩ。当电池电压降到 0.1V，或电池温度降至测试温度 10℃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 charged as 7.1.1 method (CCCV, 0.5C-2.5A, 4.20V, 100mA cut-off, 25℃), is to be overcharged with 10A to 20V while tapering the charge current, monitor change of cell temperature during testing. Stop the test when cell temperature decays to room temperature.

Criteria: No Fire, No Explosion

按照 7.1.1 方式(CCCV, 0.5C-2.5A, 4.20V, 100mA 截止，25℃)将电池充满电，以 10A 电流进行充电至电压达到 6V。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 Over Discharge Test 过放电测试

Cell, discharged as 7.2.1 method (CCCV, 0.2C-1A, 2.5V, cut-off，25℃), then discharged at constant current of 1C for 90min.

Criteria: No Fire, No Explosion

按照 7.2.1 方式(恒流放电, 0.2C-1.0A,2.5V，25℃)将电池放完电，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

8.4 Thermal Abuse 热滥用

Cell,charged as 7.1.1 method (CCCV, 0.5C-2.5A, 4.20V, 100mA cut-off, 25℃), 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℃±2℃ per min) together at room temperature simultaneity, monitor the temperature change of the box, keep for 30 minutes after the box temperature reaches 130℃±2℃,then stop the test.

Criteria: No Fire, No Explosion

按照 7.1.1 方式(CCCV, 0.5C-2.5A, 4.20V, 100mA 截止，25℃)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。恒温箱升温加热电池，要求恒温箱升温速度为每分钟 5℃±2℃。监测恒温箱温度变化，当恒温箱温度达到 130℃±2℃后恒温保持 30 分钟，结束测试。

标准：电池不起火，不爆炸

8.5 Crush Test 挤压测试

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Cell,charged as 7.1.1 method (CCCV, 0.5C-2.5A, 4.20V, 100mA cut-off, 25℃), 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 7.1.1 方式(CCCV, 0.5C-2.5A, 4.20V, 100mA 截止，25℃)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 130 cells per box. Sketch map refer to attached drawing 2. 电池包装每盒装 130 只电池，见附录 2.

10 OTHERS 其他

Lishen warrants that Cell will be free from defects for a period of 12 months from the date of shipping (“Warranty Period”). In case of quality problems occurring within the warranty period and confirmed by both sides as Lishen should be liable for it, Lishen can replace problem batteries for free(Note: If the cycle life exceeds 300 times during the warranty period, the warranty period shall be based on the time when the cell reaches 300 cycles). 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).

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(注：如质保期内，循环寿命超过 300 次，则质保期时间以电池达到 300 次循环寿命为准)；力神不对以下情况负责：(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、存储或分发方式以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。

Any matter not included in this specification shall be confered between the both parties.

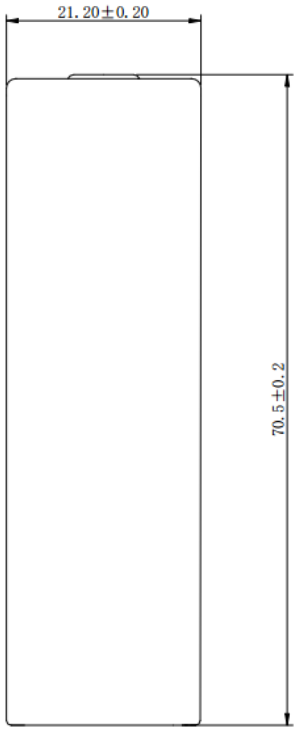
不包含在此产品规格书之内的任何问题，由双方协商解决。

11 SHIPPING 运输

The capacity of delivery cell is 20%-30%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20%-30%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。

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

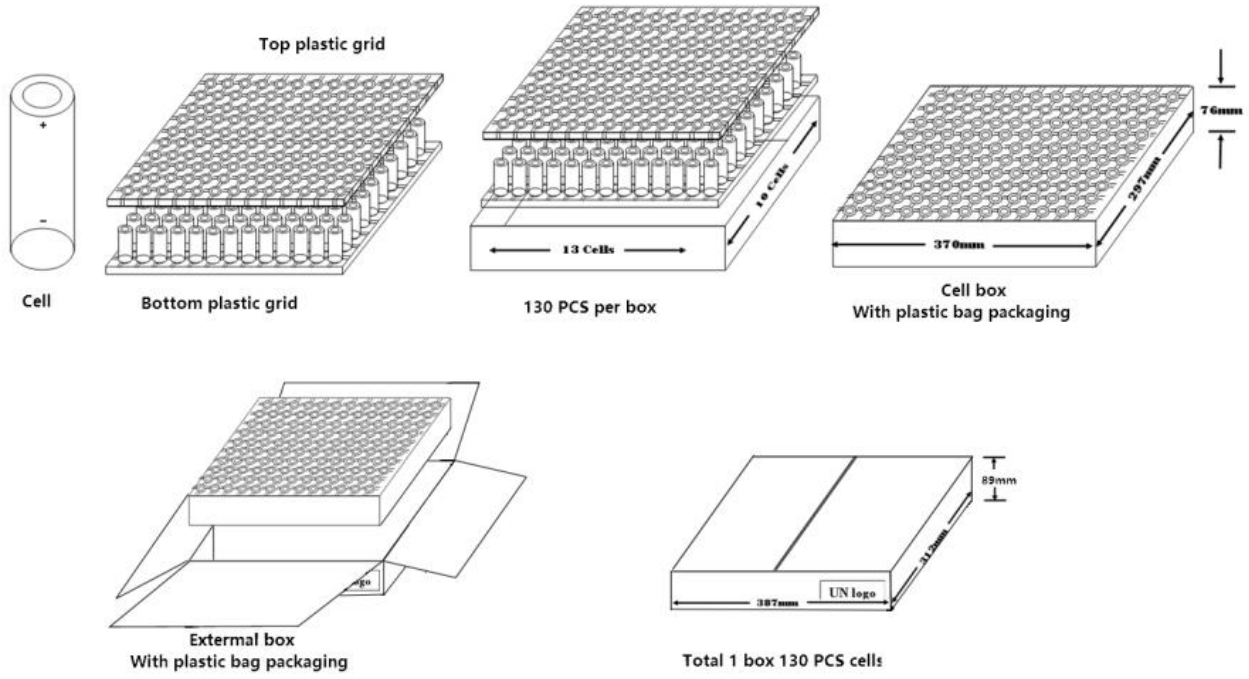


With sleeve

带热缩套

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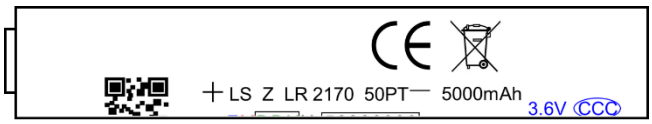
Attached 2: Packaging Sketch map Drawing 附录 2：包装图

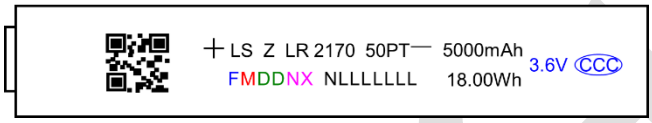


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Attached 3: Coding Rules 附录 3：打码规则

Schematic diagram：
示意图：





Notes 备注

1) The inkjet position is the front of the battery, including "+" and "-".
喷码位置为电池的正面，包含“+”、“-”。

2) Company logo "LS" represents Lishen Battery (Suzhou) Co., Ltd.
公司表示"LS"代表生产厂力神电池(苏州)有限公司。
"LR2170 50PT" represents battery model.
"LR2170 50PT"代表电池型号

3）"YMDDNX" represents production date, "Y" from A-Z represents the year，A represents 2020, B represents 2021,…L represents 2030; "M" from K-V represents the month，K represents January, L represents February,…L represents December, "DD" represents batch code, corresponding month's work order sequence number, "NX" represents day.
“FMDDMX”代表生产日期
F：年份代码：A-Z
M：月份代码：K-V
DD：批次代码：对应月份内工令顺序号。
NX：代表生产日

Y	生产年代码	1	2	3	4	5	6	7	8	9	A	B	C	D
	年份	2011	2012	2103	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	生产年代码	E	F	G	H	J	K	L	M	N	P	R	S	T
	年份	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
M	生产月代码	K	L	M	N	O	P	Q	R	S	T	U	V	
	月份	01 月	02 月	03 月	04 月	05 月	06 月	07 月	08 月	09 月	10 月	11 月	12 月	
DD	serial number of the batch after year and month													

4）" NLLLLLLL " represents serial number.
" NLLLLLLL "代表流水码。

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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 CAUTIONS 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 suggested to 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 1/50C. Even if the charge could be under fault condition, charge voltage of charger should not be above 4.23V/cell to prevent from over-charging. Cell life can be shortened by charging above 4.20V voltage.
电芯建议使用恒流-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 1/50C。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 4.23V 以避免过充电。充电电压高于 4.20V 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 2.5A (0.5C) and until cell voltage reach 2.50V, use standard charging method. And if cell voltage can not reach 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 2.5A(0.5C)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.
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 under 0℃~50℃ temperature range (see spec 3.12). When the cell temperature exceeds 50℃, it should be placed until the temperature cool down to within the range and then start charging again.
电芯充电应在温度为 0℃~50℃下按规定(见规格书中 3.12)电流进行，当电芯表面温度超出时 50℃时，应静置到电池温度恢复以上范围后再行充电。

1.1.5 For cycle life, use the normal charging or trickle charging method and minimize the fast 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℃~60℃,≤65%RH (see spec 3.16). If surface temperature exceeds 80 degrees, it should be placed until temperature cool down into above range and start discharging again.

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电芯放电温度范围为-20℃~60℃,湿度≤65%，按规定(见规格书中3.16)电流进行，放电过程中，当电池表面温度超出80℃时，应静置到电池温度恢复以上范围后再行放电。

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 pression 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. It is also recommended to charge and discharge the cell every six months.
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。建议每6个月进行一次充放电。

When stored within 1 month 储存期小于 1 个月:	-20℃ ~ 60℃(≤65%RH)
When stored within 3 months 储存期小于 3 个月:	-20℃ ~ 45℃(≤65%RH)
When stored within 12 months 储存期小于 12 个月:	-20℃ ~ 25℃(≤65%RH)

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 defect caused by ultrasonic welding when sealing the welding mold.
熔接模具应使用胶密封。如果在熔接模具密封时使用超声波焊接的方法，对于出现的任何缺陷，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。

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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 (≥35℃) frequently, cell cycle life can be shorten. If discharged at high temperature (≥80℃) 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(≥35℃)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 (≥80℃)下放电，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 4.23V (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4.23V(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2.50V，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 50A, 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50A，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 ℃.

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℃。

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In order to avoid over discharge mode under long-term storage, the consuming current of battery pack protection circuit should be set as low as possible. Should regularly check the remaining state of capacity when cell is not used for long time, to ensure that the single cell in battery not in the 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.
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。

The battery pack should be designed with anti-vibration function to prevent from deformation damage of cell.
电池组要有防振动设计，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 10mV and the internal resistance difference is within 4mΩ at least. (If the cell is in the sample stage, it cannot guarantee the consistency of the cell)
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10mV以内，内阻差4mΩ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℃) 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.

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不要使用或放置电芯于高温(高于 60℃)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，可能会引起电池发热、冒烟、着火或爆炸。

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，电池可能会引起发热、冒烟、着火或爆炸。

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。在这种状况下，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 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 Do not 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 generate heat, smoke, fire or explode.
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，可能会引起电池发热、冒烟、着火或爆炸。

2.2.3 Do not 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、不同化学体系或者不同生产商的电池混用可能会引起电池发热、冒烟、着火或爆炸。

2.2.4 Do not use an abnormal battery. If there is obvious abnormity, 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.

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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 can not complete within its specified period of time 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

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。可能会造成电池性能和寿命的劣化，同时可能会引起电池发热、 冒烟、着火或爆炸。

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.
电池包需有保护线路。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，可能会引起电池发热、冒烟、着火或爆炸。

2.3.3 Specified the charging temperature range 0℃~50℃. 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℃~50℃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。请妥善保存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.

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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. Lightening, 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。

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 useage 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, Huqiu District, 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

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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。

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