

圆柱型锂离子电池规格书

PRODUCT SPECIFICATION

Cylindrical Lithium-ion Cell

电芯型号: LR1865EA (1450mAh)

Model: LR1865EA (1450mAh)

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 修订记录

LS431.1407GS

Revision 修订状态	Date 日期	Originator 拟制人	Reason of Revision 修订记录
0	21/10/2010	刘顺乐	Original Release 首版发行
1	05/07/2011	刘顺乐	According to the results of the test: Change 5.8 60°C @≥100% to 60°C @≥90% 根据测试: 5.8 60°C @≥100% 改为 60°C @≥90%
2	23/02/2012	刘顺乐	Change to 1450mAh (Nominal) @ 0.2C discharge 更改为 1450mAh (标称) @0.2C 放电 Add to 1400mAh (Minimal) @ 0.2C discharge 增加 1400mAh (最小) @0.2C 放电
3	07/03/2012	刘顺乐	According to the results of the test: Change 5.6 800 th @≥70% to 1000 th @≥80% 根据测试: 5.6 800 th @≥70%更改为 1000 th @≥80%



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1 SCOPE 适用范围

The product specification describes the requirement of the Cylindrical Lithium-ion Cell to be supplied to the customer by Tianjin Lishen Battery J/S Co., Ltd. Should there be any additional information required by the customer, customer are advised to contact Tianjin Lishen Battery J/S Co., Ltd..

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

2 GENERAL SPECIFICATIONS 常规指标

No.	ITEM	SPECIFICATION
3-1	Type 类别	Cylindrical Nickle Steel Lithium Ion Cell 圆柱型钢壳锂离子电池
3-2	Model 型号	18650 18650
3-3	Rated Capacity 标称容量	1450mAh (Nominal) @ 0.2C discharge 1450mAh (标称) @0.2C 放电 1400mAh (Minimal) @ 0.2C discharge 1400mAh (最小) @0.2C 放电
3-4	Rated Voltage 标称电压	3.2V @0.2C discharge 3.2V @0.2C 放电
3-5	Internal Resistance 内阻	30~55mΩ(without PTC) 30~55mΩ (无 PTC)
3-6	Weight 重量	40±2.0g 40±2.0g
3-7	Maximum Charge Current 最大充电电流	1.0 C (1450mA) 1.0 C (1450mA)
3-8	Charge Voltage 充电电压	3.65 V±0.05 V 3.65 V±0.05 V
3-9	Maximum continuous Discharge Current 最大连续放电电流	2.0 C (2900mA) 2.0 C (2900mA)
3-10	End of Discharge Voltage 放电终止电压	2.0 V 2.0 V
3-11	Operating Temperature 使用温度	Charge : 0°C ~ 45°C 充 电: 0°C ~ 45°C Discharge : -20°C ~ 60°C 放 电: -20°C ~ 60°C
3-12	Storage Temperature 存储温度	-20 °C ~+50 °C* at the shipment state -20 °C ~+50 °C* 运输状态 -20 °C ~+45 °C* for one month storage -20 °C ~+45 °C* 30 天存储 -20 °C ~+35 °C* for six monthes storage -20 °C ~+35 °C* 180 天存储
3-13	Internal Protection Device 内部保护装置	CID / Safety Separator CID/安全保护隔膜
*: cells to be 30% charged state or under condition of 3.280V~3.315V. 电池荷电状态为 30%或者在电池电压为 3.280V~3.315V 状态下。		



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3 APPEARANCE AND DIMENSIONS 电池外观以及尺寸

Appearance and dimensions refer to attached drawing 1

电池外观以及尺寸请参考附图1.

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

电芯外观应不存在深度的划伤、明显的凹坑、破裂、锈蚀、漏液等能对电池的商业价值造成不利影响的外观缺陷。

4 TEST CONDITION AND DEFINITIONS 测试条件和定义

4.1 Definitions 定义:

C Rate ("C"): The rate (mill amperes) at which a fully charged cell is discharged to its end voltage in one (1) hour.

C倍率 ("C")：满电电芯1小时放电至终止电压所用的电流大小 (mA)。

4.2 Test Conditions 测试条件:

4.2.1	Standard environmental test conditions 标准环境测试条件	Unless otherwise specified, all tests stated in this document shall be performed at: Temperature of 25±2 °C. Relative ambient humidity of 5-95% 如无特殊说明，所有文档中所列的测试均应该在 25±2 °C温度下，湿度为 5-95%的环境下进行。
4.2.2	Electrical characteristics 电性能	Unless otherwise specified, all electrical tests stated in this document shall be performed to no less than the following levels of precision: 除非特殊说明，所有的电性能测试必须满足以下精度等要求： 1. End of charge and end of discharge voltage: ± 0.050 V 充放电截至电压精度：± 0.050 V 2. Open circuit voltage (OCV): ± 0.001 V. Inner impedance>1000 Ω/V. 开路电压测试精度：± 0.001 V，电压表内阻>1000 Ω/V。 3. Charge and discharge current: ± 10 mA, or at 1% of full scale 充放电电流精度：± 10 mA 或者为最大量程的 1%。 4. Impedance: 0.2 mΩ, The impedance meter should be operated at AC 1kHz 内阻测试精度：0.2mΩ。内阻表必须在交流 1kHz 条件下操作。 5. Ampere-meter: Total external resistance (ammeter and wire)< 0.01Ω. 电流表：总外阻抗（安培表和线路）<0.01Ω
4.2.3	Dimension 尺寸	0.02 mm accuracy vernier calipers 游标卡尺，精度为 0.02mm。

5 CHARACTERISTICS 电性能

5.1 Charge method 充电方式:



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5.1.1 Charging shall consist of charging at a 0.5C constant current rate until the cell voltage reaches 3.65V. The cell shall then be charged at constant voltage of 3.65 volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.02C.

0.5C恒流充电至3.65V，再以3.65V恒压充电至电流衰减为29mA±5mA。

5.2 Discharge method 放电方式:

5.2.1 Cells shall be discharged at a constant current of 0.2C to 2.0 volts
0.2C恒流放电至2.0V

5.2.2 Cells shall be discharged at a constant current of 0.5C to 2.0 volts
0.5C恒流放电至2.0V

5.2.3 Cells shall be discharged at a constant current of 1C to 2.0 volts
1.0C恒流放电至2.0V

5.2.4 Cells shall be discharged at a constant current of 2C to 2.0 volts
2.0C恒流放电至2.0V

5.3 Weight of Bare Cell 电芯重量

Meet 3-6 by balance 见3-6标准

5.4 Internal Impedance 内阻

The impedance shall be measured at AC 1k Hz.
在1kHz交流条件下使用内阻测试仪测试电芯内阻

Initial Internal Impedance ≤ 55mohm 电芯内阻 ≤ 55mohm

5.5 Discharge Rate characteristics 倍率放电性能

Cells shall be charged per 5.1.1 (0.5C) at 25°C and discharged per 5.2.4(2C), 5.2.3 (1C), 5.2.2 (0.5C), 5.2.1(0.2C) at 25°C. 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°C下按照5.1.1 (0.5C) 方式充电，分别以5.2.1 (0.2C)，5.2.2 (0.5C)，5.2.3 (1.0C)，5.2.4 (2.0C) 方式放电，记录电芯放电容量，并计算与电芯0.2C放电容量百分比，满足表1要求。

Table 1 表1

0.2C	0.5C	1C	2C
100%	≥88%	≥83%	≥80%

Rate Capacity: The discharge capacity with 0.2C, Within 1hour after charge as per 5.1.1, discharge at 0.2C until end of discharge voltage, repeat the cycle maximum 5 cycles, mark down the capacity .Stop the test when "capacity /rated capacity" happens in one of the cycles.



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标称容量：指0.2C放电时的容量。电池应按照5.1.1所述的方式在充电完成1小时内使用0.2C放电到终止电压，重复充电放电5次，取5次内放电容量的最大值作为其标称容量。

5.6 Cycle Life 循环寿命

Charge cells with 0.5C. Rest for 10 minutes. Discharge per 5.2.2. Rest for 10 minutes before recharge. The test environmental temperature is 25± 2°C. A cycle is defined as one charge and one discharge. Discharge capacity shall be measured after 800 cycles.

25± 2°C测试环境下，使用0.5C对电芯进行充电，休眠10分钟，按5.2.2方式对电芯进行放电，休眠10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) >80% of design capacity

1000次循环后放电容量>80%标称容量

5.7 Storage Characteristics 存储性能

After charge as per 7.1.1, store the testing cells at 25±2°C for 28 days. Then discharge at 0.5C to 2.0V. The residual discharge capacity >90% of Initial capacity

电芯按7.1.1方式充电后，在25±2°C环境下存储28天后，以0.5C电流放电至2.0V并记录电芯容量。电芯残余容量>90%初始容量。

5.8 Temperature Characteristics 不同温度放电性能

Cells shall be charged per 5.1.1(0.5) and discharged per 5.2.2. 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. 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°C下按照7.1.1（0.5C）方式充满电，在测试温度下放置3小时候按7.2.2方式，记录不同温度下电芯放电容量，并计算与电芯25°C下放电容量百分比，满足表2要求。

Table 2 表2

-20°C @ 0.5C	0°C @ 0.5C	25°C @ 0.5C	60°C @ 0.5C
≥40%	≥60%	100%	≥90%

6 SAFETY 安全性能

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

Cell charged per 7.1.1, is to be short circuited by connecting the positive (+) and negative (-) terminals with a total external resistance of less than 50mohm. 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.

按照7.1.1方式将电芯充满电，使用外电路短路电芯正（+）负（-）极，要求外电路内阻小于50mohm。当电芯电压降到0.1V，或电芯温度降至测试温度10°C范围内，结束测试。



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Criteria: No Explosion, No Fire

标准: 电芯不起火, 不爆炸

6.2 Overcharge Test 过充电测试

Store the testing cells connecting with thermocouple in ventilated cabinet, connect the cathode and anode to a power supply with constant current-constant voltage function. Adjust current to 2.0C and voltage to 10V. Then charging at 2.0C until voltage reaches 10V, current decays nearly to 0A. Monitoring change of cell temperature during testing, Stop the test when battery temperature decays to about 10°C from the maximum..

将电池放置在通风橱内, 以2.0C电流进行充电至电压达到10V, 恒压充电至电流接近于0。测试过程中监测电芯温度变化, 当电芯温度下降至最高温度 10°C 以下时, 结束测试。

Criteria: No Explosion, No Fire

标准: 电芯不起火, 不爆炸

6.3 Heating Test 热箱测试

Cell charged per 5.1.1, 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 10 minutes after the box temperature reaches $130^{\circ}\text{C}\pm 2^{\circ}\text{C}$, then stop the test.

按照5.1.1方式充满电的电芯放置到恒温加热箱中, 用热电偶连接电芯监测电芯温度。恒温箱升温加热电芯, 要求恒温箱升温速度为每分钟 $5\pm 2^{\circ}\text{C}$ 。监测恒温箱温度变化, 当恒温箱温度达到 $130\pm 2^{\circ}\text{C}$ 后恒温保持10分钟, 结束测试。

Criteria: No Explosion, No Fire

标准: 电芯不起火, 不爆炸

6.4 Impact Test 冲击测试

Cell charged per 7.1.1, is to be placed on a flat surface. A 5/8 inch (15.8 mm) diameter bar is to be placed across the center of the cell. A 20 pound (9.1 kg) weight is to be dropped from a height of 24 ± 1 inch (610 ± 25 mm) onto the sample.

按照7.1.1方式充满电的电芯放置于水平表面上, 将一直径为5/8 inch (15.8mm) 的铁棒横跨放置在电芯中心, 用20pound (9.1kg) 的重物从 24 ± 1 inch ($610\pm 25\text{mm}$) 的高度自由落体砸落在样品上, 结束测试。

Criteria: No Explosion, No Fire

标准: 电芯不起火, 不爆炸

6.5 Crush Test 挤压测试

Cell, charged per 5.1.1, 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



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a 1.25 inch (32 mm) diameter piston. The crushing is to be continued until a pressure reading 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.

按照7.1.1方式充满电的电芯放置于两个水平平板之间，要求电芯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。

Criteria: No Explosion, No Fire

标准：电芯不起火，不爆炸

6.6 Drop test 跌落测试

After charge as per 5.1.1, Drop the cells from 4 feet above a wood floor for 9 times.

按照5.1.1方式充满电的电芯，从4英尺的高度自由落体跌落至木板上9次。

Criteria: Internal impedance $\leq 120\text{m}\Omega$; Change of open circuit voltage $\leq 10\%$

标准：内阻 $\leq 120\text{m}\Omega$ ；跌落前后电芯电压变化 $\leq 10\%$ 。

7 GUARANTEE 保证

Cells are guaranteed to be free from defects in workmanship and materials for a period of half a year provided that the manufacturer can confirm such defects are coming from manufacturing abnormality and not from abusive usage, or else manufacturer will solve the quality problem. Lishen won't replace a new cell for free if the defects are not due to the failure of manufacturing process or is due to customer's abuse or misuse.

电芯正常使用半年内，经确认出现任何制程而非滥用原因造成的质量问题，均由生产厂方予以解决。此期限外，非制程原因而是客户误用造成的电芯质量问题，力神不承诺免费更换。

7.1 Lishen will not be responsible for trouble occurred by handling outside of the precautions in instructions.

力神公司对违反安全守则操作所产生的问题不承担任何责任。

7.2 Lishen will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.

力神公司对于电路，电芯组以及充电器搭配使用所产生的问题不承担任何责任。

7.3 Lishen will be exempt from warranty any defect cells during assembling after acceptance.

力神公司对于出货后客户在电芯组装过程中产生的不良电芯不予以质量保证。

8 PRECAUTIONS AND SAFETY INSTRUCTIONS 注意事项和安全介绍

Abuse lithium-ion rechargeable batteries can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before using utilization.

滥用锂离子可充电电芯可能会造成电芯的损害或人身的伤害，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：



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- 8.1 Customer is required to contact Lishen in advance, if and when the customer needs other applications or operating conditions than those described in this specification.

客户需要将电芯在该规格书说明以外的条件下操作或应用，请先咨询力神公司相关事宜。

- 8.2 Lishen will take no responsibility for any accident when the cell is used under other conditions than those described in this specification.

在该规格书说明条件之外使用该电芯而产生的事故，力神公司不承担任何责任。

9 **PACKAGING** 包装

Loading 100 cells per box, 2 boxes per case for a total of 200 cells. Sketch map refer to attached drawing 4

电芯包装每盒装100只电芯，每箱装2盒，共200只电芯。包装示意图见附图2。

10 **OTHERS** 其它

Any matter not included in this specification shall be conferred 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

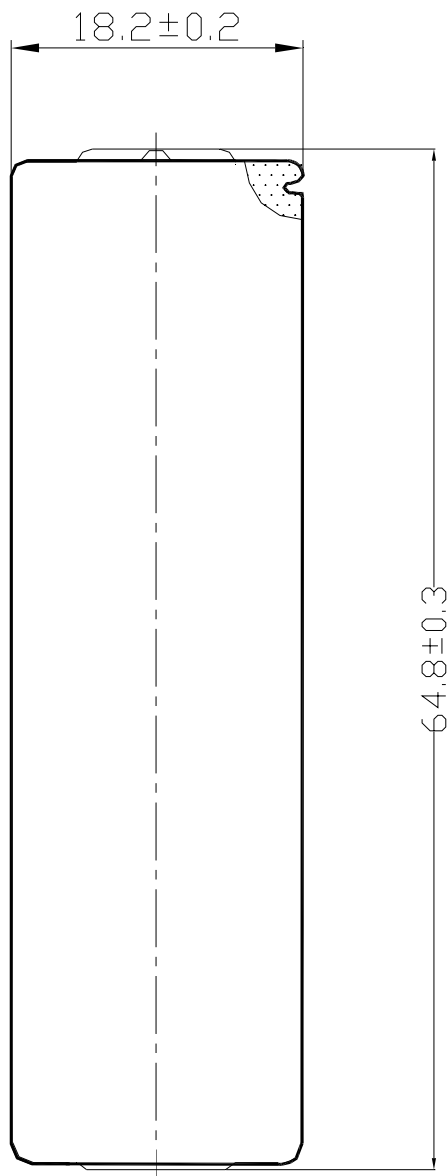
The capacity of delivery cell is approximately at 30% of charging. During transportation, keep the cell from acutely vibration, impacting, solarization, drenching.

出货电芯处于30%充电状态，运输过程应防止剧烈振动、冲击、日晒雨淋。

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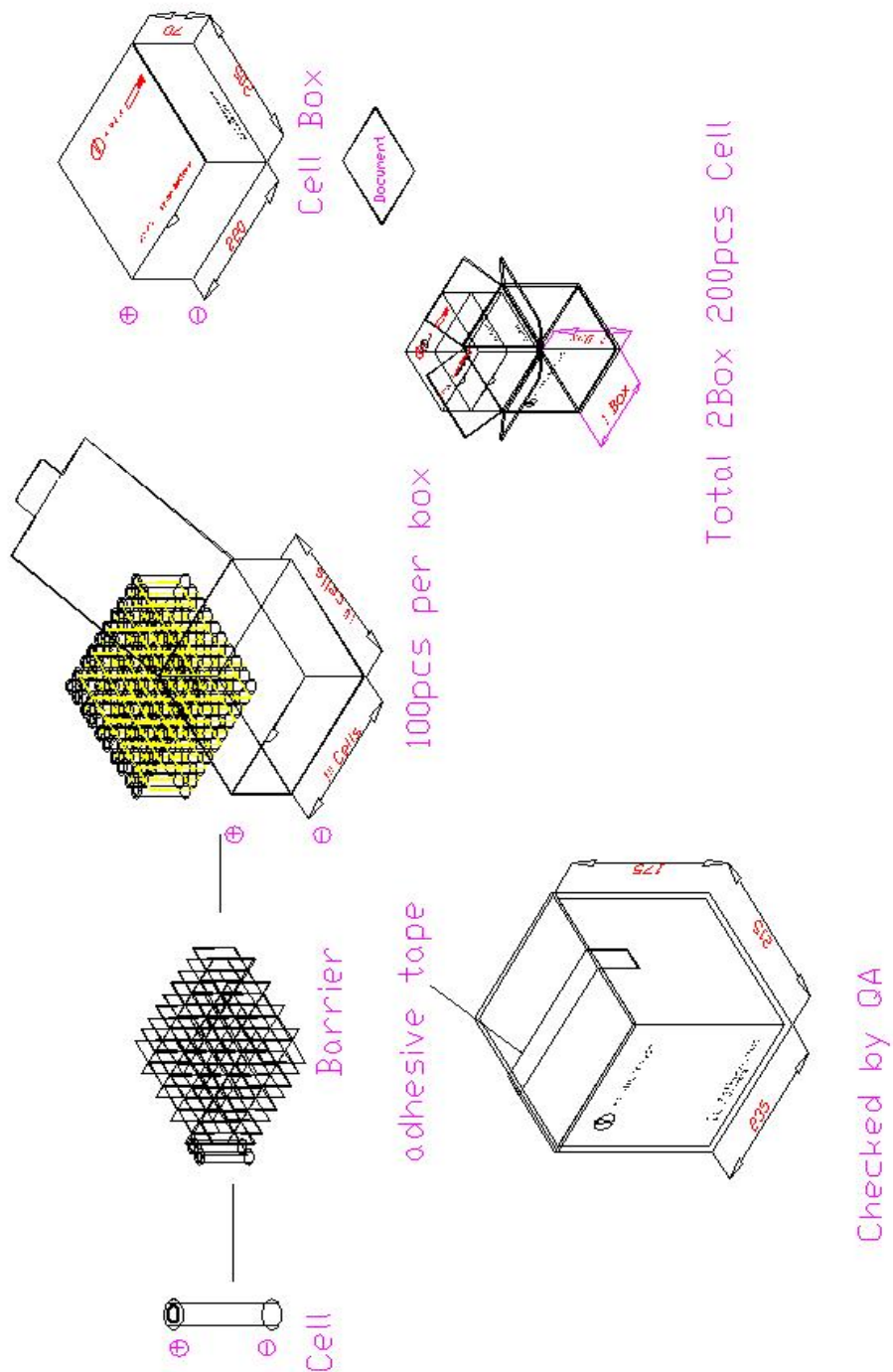
Attached 1: LR1865EA Cell Size Drawing

附图1: LR1865EA 电芯尺寸图



Attached 2: LR1865EA Packaging Sketch map Drawing

附图2: LR1865EA包装结构图





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

以下提醒及警告作为锂离子电芯客户使用说明，使用前请仔细阅读。

HANDLING INSTRUCTIONS FOR LITHIUM ION RECHARGEABLE BATTERY

锂离子可充电电芯使用说明

1 CAUTION AND PRECAUTION 提醒与预防

1.1 Charging 充电

- a) Charging voltage must be set 3.65V/cell. Concerning charge voltage tolerance of charger, charging voltage must be set below 3.65V/cell. Even if the charge could be out of order, charge voltage of charger should not be above 3.70V/cell to avoid over-charging. Cell life will be shorten by charging voltage above 3.65V

电芯充电电压设定为3.65V，考虑到充电器的控制偏差，必须保证电芯充电电压低于3.65V，即使在异常情况下，充电电压不可超过3.70V以避免过充电。充电电压高于3.65V会导致电芯循环寿命缩短。

- b) Charger should start charging at temperature range 0 ~ +45°C.

电芯充电温度范围为0 ~ +45°C。

- c) Charge the cell at a constant current of 0.5C until 3.65V is attained. Charge rates greater than 1C are NOT recommended. (C: Rated Capacity of cell)

以0.5C的电流恒流充电至3.65V，超过1C的电流建议不要使用（C：标称容量）。

- d) Maintain charge voltage at 3.65V for 1.0 hours (recommended for maximum capacity).

恒压3.65V充电1小时（最大容量）。

- e) Cell must be charged with constant current-constant voltage method. Do not use the continuous current charging method.

必须使用恒流恒压方式对电芯进行充电，不可使用持续电流充电方式。

- f) Do not continue to charge cell over specified time.

不要超过标准时间持续充电

- g) No reverse charging

不可反向充电



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- h) By timer, current detection and open circuit voltage detection, charger detects full charge. When charger detect cell is full charged, charger stop charging.

充电器必须能够通过计时，电流检测，开路电压检测监控电芯充电状态，如检测到电芯充满电，充电器需停止充电。

1.2 Discharging 放电

- a) Discharge current must be below 2C (2900mA) /cell.

电芯放电电流需小于2C（2900mA）。

- b) Discharge end voltage must be over 2.0V.

电芯放电终止电压需高于2.0V。

- c) Do not over-discharge cell below 1.5V/cell.

电芯不可过放电至电压低于1.5V。

- d) Discharge temperature range should be -20 °C ~ +60°C(0.5C discharge).

电芯放电温度范围为-20 °C ~ +60°C（0.5C放电）

1.3 Environmental using conditions 电芯使用环境条件

When the cell is charged : 0°C ~ +45°C

电芯充电 : 0°C ~ +45°C

When the cell is discharged : -20°C ~ +60°C

电芯放电 : -20°C ~ +60°C

Charge or discharge out of recommended range might cause the generating heat or serious damage of cell. And also, it might cause the deterioration of cell's characteristics and cycle life.

在超出限定温度范围进行充电或放电，会引发电芯产热或严重的损伤，也会造成循环寿命缩短及性能衰降。

1.4 Storage 储存

Any storage, cell should be in low humidity, no corrosive gas atmosphere area. And there is no press and condensation on the cell. Best temperature range -20~+35°C.

电芯应在干燥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着在电芯表面，最佳储存温度为-20~+35°C

Long period storage, charge condition of cell is Lishen shipment charge state or discharge state.

长期存储，电芯必需处于力神出货时的状态

When stored within 1 month : -20°C ~ +45°C



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储存期1个月	:	-20°C ~ +45°C
When stored within 3 months	:	-20°C ~ +35°C
储存期3个月	:	-20°C ~ +35°C
When stored within 12 months	:	-20°C ~ +20°C
储存期12个月	:	-20°C ~ +20°C

1.5 Precautions on Handling Lithium Ion Cells 电芯使用方式

- a) When the cells are connected in series, use same rank cells, use same lot number cells and use same charging date cells. These date show label for carton on the master carton. Further, the cell's voltage and impedance have to be checked and matched as uses of cells. Lishen recommend match cells keep voltage within 6mV(@30% SOC) difference and impedance within 10mohm difference at least.

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电压差6mV(@30% SOC)以内，内阻差10mohm以内。

- b) Inspect voltage and internal impedance before using.

使用前需检测电芯电压及内阻。

- c) When cells are re-shipped to assembling factory, make enough attention the packing to avoid stress by shipping. Lishen recommends the same package shipped from Lishen when re-shipping. Even if after open package, when re-shipping, use the same parts and materials from Lishen for re-packing.

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。

- d) Do not use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.

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。

- e) Do not use or leave the cell under the blazing sun (or in heated car by sunshine). The cell may generate heat, smoke or flame. And also, it might cause the deterioration of cell's characteristics or cycle life.

不要使用或将电芯放在太阳光直射的地方（或阳光直接照射的车内）。这种情况会使得电芯产热，冒烟或起火，也可能使得电芯性能衰减及循环寿命缩短。

- f) When cell used in pack with protection circuit to avoid the danger .Do not use nearby the place where generates static electricity higher than PCM ESD value, which gives damage to the protection circuit. If protection circuit were broken, the battery would generate smoke, rupture or flame.

当电芯在带有保护电路的电池包中应用时，使用环境不能超过电路板的 ESD 值，否则可能导致保护电路损坏，保护电路的损坏可能导致电池发生冒烟，起火或爆炸。



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g) Please read the manual before using the cell and please reread if necessary.

请在使用电芯前阅读使用手册，必要情况需要重新仔细阅读。

h) Please read the manual of specified charger about charging method.

请阅读使用手册并了解规定充电器的充电方式

i) When the cell has rust, bad smell or something abnormal at first-time-using, do not use the equipment and go to bring the cell to the place which it was bought.

电芯第一次使用如发生生锈，有异味或异常之处，不要进行使用，将其带至购买处进行处理

j) In case younger children use the cell, their parents teach how to use cells according to the manual with care.

儿童在使用电芯时，需有父母陪伴并知道其按照使用手册要求操作。

k) Keep the cell out of the reach of younger children. And also, pay attention to cell be taken out it from the charger or equipment by little children.

电芯要放置在儿童无法触及的地方，同时要注意儿童自行将电芯从充电器或使用产品中取出。

l) If the skin or cloth is smeared with liquid from the cell, wash with fresh water. It may cause the skin inflammation, see a doctor immediately.

如果电芯流出液体接触到皮肤或衣服，使用清水清洗。可能会引起皮肤炎症，请立即就医。

1.6 Cell position in equipment and charger. 电芯在使用设备及充电器上的部位

To avoid degradation of cell performance by heat, a cell should set the place apart from heat generating electronic parts inside equipment and charger.

避免电芯由于受热造成性能下降，电芯使用时要求远离使用设备及充电器上的发热部件。

1.7 Precautions on Battery Pack Design. 电池包设计预防措施

a) Battery pack Shape, Mechanism and Material 电池包外形，构造及材料

· Do not make the shape and mechanism which easy connect to other equipment and charger.

电池包外形与构造设计应考虑不易与其他的设备以及充电器连接。



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- Do not make the terminal shape which easy cause short circuit by metal object such as necklaces, hairpins, etc. And further, have over current protection function to prevent outer short circuit.

电池包接口外形应能够避免如项链、发夹等金属物偶然掉落引起短路，而且要对外部短路引起的过流情况具有保护及防止功能

- Do not make the terminal shape and mechanism which connect reverse to equipment.

终端外形及构造设计能够避免电池包与使用设备正负极反接

- Do not make the shape and mechanism which static electricity and water easy go through the battery pack inside.

终端外形与构造设计能够有效阻止静电及水进入电池包内部

- Make the shape and mechanism which can inspect protection circuit function before the battery pack makes completely.

终端外形及构造设计能够在电池包完成组装前检测电路保护功能

- Fix cells with mold case by rib, tape, glue etc., but do not make damage cells (especially sealing part) by rib or sharp part of mold case. In case of the battery pack is struck by hard shock or vibration, the battery pack has possibility to cause leakage, smoke, explosion.

内部电芯要使用骨架，胶带，胶水等材料进行定位，以避免电池包受到冲击及振动引发漏液，冒烟和爆炸的可能。但骨架及模具尖锐部分不能对电芯造成损伤（尤其是封口部分）。

- Weld mold case by glue. Not weld mold case by ultra sonic welding.

熔接模具要使用胶水进行密封，非熔接模具使用超声焊接进行密封

b) Protection Circuit insure safety of battery 保护线路保证电池包安全

- Overcharge protection should work below 3.70V/cell by charge. Then charge current shall be shut down.

过充保护能够确保电芯充电电压低于3.70V，若电芯电压高于3.70V则停止充电。

- At the voltage range 1.50~2.00V/cell, over-discharge protection should work. Then discharge current shall be shut down and consumption current is below 1 μ A.

过放保护能够在电芯电压达到1.50~2.00V时停止放电且漏电流需小于1 μ A。

- When discharge current exceed about 2.7A, over-discharge current protection should work. Then over-discharge current shall be shut down.

电芯放电电流超过2.7A时，过流保护作用并停止放电。

c) Electric circuit 电路



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- To avoid to discharge during storage, design the low consumption current electronic circuit(e.g. Protection circuit, fuel gauge, etc) inside battery pack.

电池包电路设计低漏电流（例如保护电路，电量监控等）以避免电芯储存过程被放电

d) Cell connection 电芯连接

- Do not solder onto a cell in order to avoid a damage on the cell. Weld spot welding lead plate onto cell, and solder lead wire or lead plate.

不可使用锡焊以避免对电芯造成损伤，电池包组装使用点焊方式在电芯上连接导线及线路板

2 PRECAUTIONS AND SAFETY INSTRUCTIONS 安全守则

The cell includes the flammable objects such as the organic solvent. If the handling is missed there will be possibility that the cell rupture flames or hot, or it will cause the damage to the cell and/or personal injury. Please observe the following prohibitive matters. And also, add the protection device the equipment for fear that the trouble would affect the cell by the abnormality of equipment. Please read and observe the standard cell precautions below before using utilization.

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。请注意使用禁止事项，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。

- 2.1 Don't use or expose the cell to extreme heat, flame, disposed in fire or water or get it wet. Don't modify or disassemble the cell. It will be dangerous, and may cause ignition, heating, leakage or explosion.

不要使用或放置电芯于过热，有火星的环境。不要将其投入火中，水中或使其吸湿。不要修理或拆解电芯，存在引发电芯起火、过热、漏液或爆炸的危险。

- 2.2 Don't short-circuit cell positive(+) and negative(-) terminals. Keep away from metal or other conductive materials. Jumbling the cells of direct contact with positive(+) and negative(-) terminals or other conductive materials may cause short-circuit. Don't reverse the positive (+) and negative (-) terminals for any reason.

不要将电芯混乱摆放，同时远离金属或导电材料，以避免正（+）负（-）极短路，不要颠倒电芯正（+）负（-）极使用

- 2.3 Don't use the unspecified charger and breach charging requirement. Cell charged with unspecified condition maybe lead cell to be overcharged or abnormal chemical reaction. It causes the generating heat, smoke, rupture or flame.

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



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2.4 Don't overcharge, over-discharge, drive nail into the cell, strike it by hammer or tread it.

不要过充、过放、针刺、锤击或践踏电芯。

2.5 Don't give cell impact or drop, and not use the cell with conspicuous damage or deformation.

不要撞击或投掷电芯，不要使用受到明显的损害或变形的电芯

2.6 Don't connect cell to the plug socket or car-cigarette-plug. Don't use lithium-ion cell in mixture of different batch or use cell for other equipment.

不要将电芯与插座直接连接，不同批次锂离子电芯不可混合使用，或将电芯用于其它设备。

2.7 Do not use Lithium ion cell with the primary batteries or secondary batteries whose capacity or kinds or maker is different. If do that, the cell will be discharged or charged excessively in use. And it may cause the generating heat, smoke, rupture or flame because of the abnormal chemical reaction in cells.

不要将锂离子电芯与一次电芯或不同厂家生产的二次电芯混合使用，混合使用会造成电芯充电或放电过度，引发电芯由于非正常化学反应产热，冒烟，破裂或起火。

2.8 Do not use or leave the cell under the blazing sun (or in heated car by sunshine), and keep cell away from little children in order to avoid troubles by Swallowing. In case of swallowing the cell, see a doctor immediately.

不要将电芯放置在太阳光直射的地方（或阳光直接照射的车内），电芯要远离儿童放置以避免儿童吞咽事故，如发生吞咽情况，请立即就医。

2.9 If the cell gives off an odor, generates heat, becomes discolored, or in any way appears abnormal during use, recharging or storage, immediately remove (Don't touch a abnormal cell directly) it from the device or cell charger and stop using it.

电芯在使用、充电或储存过程中，出现释放气味、过度产热或变色等异常情况，立即将电芯从使用设备或充电器取出（不要直接接触异常电芯）并停止使用。

2.10 Do not continue to charge cell over specified time. If the cell is not finished charging over regulated time, let it stop charging. There is possibility that the cell might generate heat, smoke, rupture or flame.

电芯不要持续充电超过限定时间。如电芯在限定时间内仍无法完成充电，要停止充电，继续充电有可能发生电芯产热，冒烟，破裂或起火。



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2.11 Do not get cell into a microwave or a high pressure container. It causes the generating heat, smoke, rupture or flame because of a sudden heat or damage of sealing condition of cell.

不要将电芯至于微波或高压容器内，突然高温或密封状态破坏会引起电芯产热，冒烟，破裂或起火。

2.12 Don't solder the cell directly. Excessive heating may cause deformation of the cell components such as the gasket, which may lead to the cell swelling, leakage, explosion, or ignition.

不要直接锡焊焊接电芯，过热会导致绝缘垫圈等电芯部件变形，引发电芯变形、漏液、爆炸或者起火。

2.13 Do not touch a leaked cell directly or put a leaked cell nearby fire.

不要直接接触漏液电芯或将漏液电芯放置在火源旁。

2.14 Don't use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.

不要使用由于运输碰撞、跌落、短路或其它原因造成损伤以及有电解液泄露的异常电芯。

3 CONSULTATION 技术咨询

3.1 If there are problems in this specification, Lishen can consider to change specification after discussion, please contact us as following:

Add: Tianjin Lishen Battery Joint-Stock Co., Ltd.

No.38 Haitai South Road Huayuan Technological Park Binhai Hi-tech Industrial Development Area, Tianjin, China

Tel No.: 0086-22-23868000

Fax No.: 0086-22-23866088

<http://www.lishen.com.cn> Mail: webmaster@lishen.com.cn

如有任何疑问，商讨后力神可以进行相应修改，请按照以下方式咨询：

厂址：天津滨海高新技术产业开发区华苑科技园区海泰南路38号

电话：0086-22-23868000



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3.2 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。