

Specification for Li-ion Rechargeable cylindrical battery

圆柱锂离子电池 规格书

MODEL/型号:
INR21700-4000 3.6V

Prepared By 编制	Checked By 审核	Approved By 批准	Effective date 生效日期
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Customer Approval 客户承认	Company Name: 公司名称:	
	Company Stamp: 客户印章:	

1.0 Scope 适用范围

This document describes the Product Specification of the Lithium-ion rechargeable battery cell supplied by Jiangsu SunPower CO., Ltd.

本规格说明书描述了长虹三杰新能源有限公司的可充电锂离子电芯的产品性能指标。

2.0 Specifications 基本规格

NO	Items 项目	Specifications 规格
1	Model 型号	INR21700-4000 3.6V
2	Nominal capacity 标称容量	4000mAh Charge: 2000mA, 4.20V, CCCV 80mA cut-off, Discharge: 800mA, 2.50V discharge cut-off
3	Min Capacity 最小容量	3900mAh Charge: 2000mA, 4.20V, CCCV 80mA cut-off, Discharge: 800mA, 2.50V discharge cut-off
4	Nominal Voltage 额定电压	3.60V
5	Max. Charge Voltage 最大充电电压	4.20V ± 0.05V
6	Standard Discharge Cut-off Voltage 标准放电截止电压	2.50V
7	Standard Charging Mode 标准充电模式	CC-CV (cut-off current is 80mA) 恒流恒压 (恒压截止电流为 80mA)
8	Standard Charge Current 标准充电电流	2A
9	Max. Charge Current 最大充电电流	8A
10	Charge Time 充电时间	180 分钟 (25 ± 3°C) 180min (25 ± 3°C)
11	Max. Continuous Discharge Current 最大持续放电电流	50A (With 80°C temperature cut)
12	Max. Pulse Discharge Current 最大瞬间放电电流	80A (2s pulse)
13	Standard Diameter of battery (include PET) 电池标准直径 (包含PET 外壳)	≤ 21.3mm
14	Standard Height of battery (include PET) 电池标准高度 (包含 PET 外壳)	≤ 70.4 mm

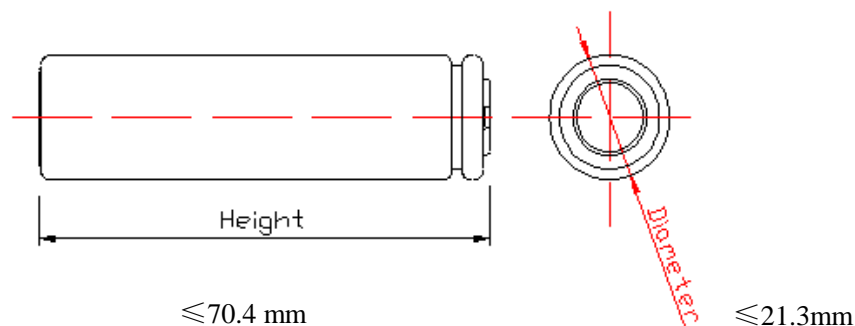
15	Weight 电池重量		$\leq 69\text{g}$
16	Initial Impedance (Max. at 1000Hz、charged status) 初始内阻 (Max, at 1000Hz、充电态)		$\leq 13.0\text{m}\Omega$
17	Pack consistency 配组一致性 (内控标准)		Δ Voltage 电压差 $\leq 10\text{mV}$ Δ Impedance 内阻差 $\leq 2\text{m}\Omega$ Δ Capacity 容量差 $\leq 1\%$ 标称容量
18	Status of the cell as of ex-factory 出厂电压		3.500V~3.650V
19	Operating temperature (surface temperature) 使用时电芯表面温度	Charge 充电	$0^\circ\text{C} < T \leq 50^\circ\text{C}$
		Discharge 放电	$-20^\circ\text{C} \sim 75^\circ\text{C}$
20	Storage temperature 储存温度	3 months 3 个月	$-20^\circ\text{C} \sim 45^\circ\text{C}$
		1 year 1 年	$-20^\circ\text{C} \sim 25^\circ\text{C}$

Note:

If the cell is kept as ex-factory status (30% of charge), the capacity recovery rate is more than 90% of standard discharge capacity.

如果存储时电芯为出厂状态（约30%的充电容量），这种情况下，恢复的容量 \geq 标准放电容量的90%

3.0 Configuration 外形示意图



4.0 Characteristic 电池性能

a. Environmental conditions 环境条件

- b. Unless otherwise specified, all tests stated in this specification are conducted at temperature $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and humidity under 65%. 除另有说明外, 此规格书中的所有测试均在环境温度 $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$, 相对湿度小于 65% 的条件下进行。

c. Measuring equipment 测量设备

- (1) Amp-meter and volt-meter 电流计和电压计

The amp-meter and volt-meter should have an accuracy of the grade 0.5mA / mV or higher. 电流计和电压计的精度需达到 0.5mA/mV 级别或以上。

- (2) Slide caliper 游标卡尺

The slide caliper should have 0.01 mm scale. 游标卡尺的刻度应为 0.01 mm。

- (3) Impedance meter 阻抗计

The impedance meter with AC 1kHz should be used. 应使用交流 1kHz 阻抗计。

d. Standard charge 标准充电

Charging the cell CCCV with charge current 0.5C (2A), constant voltage 4.20V and 80mA cut-off in CV mode at $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for capacity.

在 $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ 环境温度下, 以充电电流 0.5C (2A) 为电池恒流恒压充电, 在恒压模式中恒压 4.20V, 80mA 截止。

e. Standard discharge capacity 标准放电容量

Discharge current of 800mA (0.2C) with 2.50V cut-off at $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ within 1hour after the standard charge.

标准充电后 1h, 在 $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ 环境温度下, 以 800mA (0.2C) 电流放电至 2.50V 截止。

4.1 Electrical Characteristic 电化学性能

序号 NO.	项目 Item	标准 Standard	测试方法 Test Method
1	Discharge rate capabilities (25°C±3°C) 放电倍率性能 (25°C±3°C)	A) 10A ≥ 3900mAh B) 20A ≥ 3820mAh C) 30A ≥ 3700mAh D) 40A ≥ 3600mAh	Standard charged under the condition of normal atmospheric pressure and the environmental temperature of 25°C±3°C and under 65%RH, then rest for 30mins and discharge at 10A、20A、30A、40A to the discharge cut-off voltage respectively (2.50V) . Charge/discharge cycle can be conducted for 3 times before meeting the Standards (the same below) 在标准大气压，环境温度 25°C±3°C，相对湿度小于 65% 的条件下标准充电，然后搁置 30mins，分别以 10A、20A、30A、40A 进行放电至终止电压 (2.50V)，在达到标准要求前，充电放电循环可进行 3 次 (下同)。
2	capacity retention and recovery (25°C±3°C) 容量保持及恢复能力 (25°C±3°C)	Residual capacity ≥ 90% Recoverable capacity ≥ 95% 剩余容量 ≥ 90% 恢复容量 ≥ 95%	Standard charged under the condition of normal atmospheric pressure and the environmental temperature of 25°C±3°C, Stored for 28 days, then discharge at 0.2 C to 2.50V measuring residual capacity; Then standard charge/discharge measure recoverable capacity. 在标准大气压，环境温度 25°C±3°C 的条件下标准充电，存储 28 天，然后以 0.2 C 电流放电至 2.50V，测量电池的剩余容量；然后标准充电/放电测量电池的恢复容量。

<p style="text-align: center;">3</p>	<p style="text-align: center;">Cycle Life (25°C±3°C) 循环寿命 (25°C±3°C)</p>	<p>A) 6A charge/ 10A discharge ≥ 500 cycles 6A 充电/10A 放电 ≥500 cycles</p> <p>B) 6A charge/ 20A discharge ≥ 500 cycles 6A 充电/20A 放电 ≥500 cycles</p> <p>C) 6A charge/ 30A discharge ≥ 300 cycles 6A 充电/30A 放电 ≥300 cycles</p> <p>D) 6A charge/ 40A discharge ≥ 300 cycles 6A 充电/40A 放电 ≥300 cycles</p>	<p>A) Charge: 6A charged the cell to 4.20V, then change to charge with constant voltage till the current less than or equal to 100mA, rest for 10mins; A) Discharge: 10A discharge to 2.50V (With 75°C temperature cut), one cycle is finished, rest for 40mins. Repeat the above steps, when the capacity retention rate is less than 70%, the test is over.</p> <p>B) Charge: 6A charged the cell to 4.20V, then change to charge with constant voltage till the current less than or equal to 100mA, rest for 10mins; B) Discharge: 20A discharge to 2.50V (With 75°C temperature cut), one cycle is finished, rest for 40mins. Repeat the above steps, when the capacity retention rate is less than 70%, the test is over.</p> <p>C) Charge: 6A charged the cell to 4.20V, then change to charge with constant voltage till the current less than or equal to 100mA, rest for 10mins; C) Discharge: 30A discharge to 2.50V (With 75°C temperature cut), one cycle is finished, rest for 40mins. Repeat the above steps, when the capacity retention rate is less than 60%, the test is over.</p> <p>D) Charge: 6A charged the cell to 4.20V, then change to charge with constant voltage till the current less than or equal to 100mA, rest for 10mins; D) Discharge: 40A discharge to 2.50V (With 75°C temperature cut), one cycle is finished, rest for 40mins. Repeat the above steps, when the capacity retention rate is less than 60%, the test is over.</p> <p>A) 充电: 6A 充电至 4.20V, 然后改为恒压充电直至电流小于或等于 100mA, 搁置 10min。 A) 放电: 10A 放电至 2.50V (电池表面温度达到 75°C 时截止), 完成一个循环, 搁置 40mins。重复上述步骤, 当容量保持率小于 70%, 测试结束。</p>
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3	<p>Cycle Life (25°C±3°C)</p> <p>循环寿命 (25°C±3°C)</p>		<p>B) 充电: 6A 充电至 4.20V, 然后改为恒压充电直至电流小于或等于 100mA, 搁置 10min。 B) 放电: 20A 放电至 2.50V (电池表面温度达到 75°C 时截止), 完成一个循环, 搁置 40mins。重复上述步骤, 当容量保持率小于 70%, 测试结束。</p> <p>C) 充电: 6A 充电至 4.20V, 然后改为恒压充电直至电流小于或等于 100mA, 搁置 10min。 C) 放电: 30A 放电至 2.50V (电池表面温度达到 75°C 时截止), 完成一个循环, 搁置 40mins。重复上述步骤, 当容量保持率小于 60%, 测试结束。</p> <p>D) 充电: 6A 充电至 4.20V, 然后改为恒压充电直至电流小于或等于 100mA, 搁置 10min。 D) 放电: 40A 放电至 2.50V (电池表面温度达到 75°C 时截止), 完成一个循环, 搁置 40mins。重复上述步骤, 当容量保持率小于 60%, 测试结束。</p>
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4.2 Safety Characteristic 安全性能

NO. 序号	Item 项目	Standard 标准	Test Method 测试方法
1	Overcharge 过充性能	No fire、No explosion 不起火、不爆炸	After standard charge, rest for 10mins; then charge at constant current of 3C to 10V.(or charge at 3C for 90mins). 按标准充电后, 搁置 10mins; 然后 3C 恒流充电至 10V。 (或 3C 充电 90mins)
2	Forced discharge 强制放电	No fire、No explosion 不起火、不爆炸	The battery to be discharged with standard discharging condition, Inverse charge current =1C; time: ≥90mins 按标准放电条件对电池放电, 以 1C 反向充电, 充电时间不低于 90mins。

3	Short Circuit test 短路性能	No fire No explosion 不起火、不爆炸	Standard charged, and short the positive and negative terminals with wire, and the resistance of $80 \pm 20m\Omega$. Tests are to be conducted at $20^{\circ}C \pm 5^{\circ}C$ and $55^{\circ}C \pm 5^{\circ}C$ respectively, The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 V and the battery case temperature has returned to $\pm 10^{\circ}C$ of ambient temperature. 标准充电, 并将正负极用电线短接, 电阻 $80 \pm 20m\Omega$ 。测试分别在 $20^{\circ}C \pm 5^{\circ}C$ 和 $55^{\circ}C \pm 5^{\circ}C$ 环境下进行, 电池放电直至起火或爆炸, 或直至电池达到小于 0.2V 的完全放电状态且电池壳温度恢复到环境温度的 $\pm 10^{\circ}C$ 。
4	Crush test 挤压实验	No fire、No explosion 不起火、不爆炸	Standard charged, and crushed between two flat surfaces, the applied force is $13 kN \pm 1kN$ by hydrocylinder, once the maximum pressure has been obtained then release pressure. 标准充电, 于两个平面间挤压, 由液压油缸施加 $13 kN \pm 1kN$ 的挤压力, 一旦达到最大压力则卸压。
5	Heating test ($130^{\circ}C$) 热滥用测试	No fire、No explosion 不起火、不爆炸	Standard charged, and put into incubator with nature air or circulating air convecting, heat by velocity of $5^{\circ}C \pm 2^{\circ}C$ per minute to $130^{\circ}C \pm 2^{\circ}C$, and maintain for 10minutes. 标准充电后, 放于自然或循环空气对流的恒温箱中, 温度以 $5^{\circ}C \pm 2^{\circ}C$ 每分钟的速率升至 $130^{\circ}C \pm 2^{\circ}C$ 并保持 10 分钟。
6	Temperature Cycling Test 温度循环试验	No leakage, No fire, No explosion 不泄漏, 不起火、不爆炸	Standard charged, and placed in a test chamber and subjected to the following cycles: a) Raising the temperature to $72^{\circ}C \pm 2^{\circ}C$ within 30 minutes and maintaining this temperature for 6 hours; b) Reducing the temperature to minus $-40^{\circ}C \pm 2^{\circ}C$ within 30 minutes and maintaining this temperature for 6 hours; c) Repeating the sequences for 10 times, and storing the cells for 24 hours in the condition of temperature $20^{\circ}C \pm 5^{\circ}C$. 标准充电, 放置在测试箱内并做如下处理: a) 在 30 分钟内将温度升高到 $72^{\circ}C \pm 2^{\circ}C$, 并保持该温度 6 小时; b) 在 30 分钟内将温度降至 $-40^{\circ}C \pm 2^{\circ}C$, 并保持该温度 6 小时; c) 重复循环 10 次, 将电芯在 $20^{\circ}C \pm 5^{\circ}C$ 温度条件下存储 24 小时。

4.3 Environment Adaptation Performance 环境适应性能

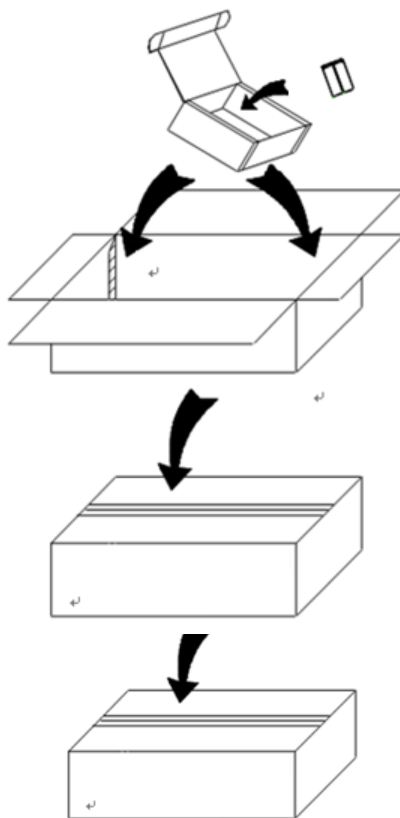
NO. 序号	Item 项目	Standard 标准	Test Method 测试方法
1	Altitude/Low pressure simulation test 高空低压模拟测试	No leakage, No fire, No explosion 不泄漏, 不起火、不爆炸	Standard charged and stored for 6 hours in an vacuum environment with pressure of less than 11.6kPa and temperature of 20°C±5°C. 标准充电并且在 20°C±5°C、大气压≤11.6 kPa 的真空环境中储存 6 小时。
2	Free drop test 自由跌落试验	No fire, No explosion 不起火, 不爆炸	The fully charged battery drops on the concrete ground from height (1m), total 3 times, to obtain the shock of random directions. 充满电的电池从 1m 高的地方跌落到混凝土地面, 总共 3 次以此获得随机方向的冲击。
3	Vibration test 振动试验	No leakage, No fire, No explosion 不泄漏, 不起火、不爆炸	Standard charged and fixed on the vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, battery is to be subjected to simple harmonic motion with an amplitude of 0.8 mm (0.03 in) [1.6mm (0.06 in) total maximum excursion]The cells shall be vibrated for 90 -100minutes per axis of X, Y axes. 标准充电后固定在振动台上并进行振动循环, 频率在 10Hz 和 55Hz 之间以每分钟 1Hz 的速率变化, 电池将受到振幅 0.8mm (0.03in)总最大位移 1.6mm (0.06in)的单谐振动, 沿 X、Y 两个个方向振动, 每个方向振动 90-100 分钟。

5.0 Package 包装

The cells are packed with JIANGSU SUNPOWER CO.,LTD. standard carton box, which hold four inner boxes.

There are 80pcs 21700 cells per inner box.

电芯使用长虹三杰新能源有限公司标准的纸盒包装，每箱有 4 盒，每盒 80pcs.



6.0 Warranty Period & Product Liability 保质期及产品责任

Warranty period of this product is 12 months from manufacturing code. JIANGSU SUNPOWER CO., LTD. is not responsible for the troubles caused by mishandling of the battery which is against the instructions in this specification.

保质期是从出厂日期（喷码）开始起 12 个月；长虹三杰新能源有限公司对因没有按本规格书规定操作而造成的故障不承担责任。

7.0 Warnings and Cautions in Using the Battery 电池使用警告及注意事项

To prevent a possibility of the battery from leaking, heating or explosion please observe the following precautions:

为防止电池可能发生泄漏,发热、爆炸,请注意以下预防措施:

- When using a new battery for the first time or after long term storage, please use the battery charger specifically for that purpose fully charge the battery before use.
在使用新电池前, 或者长期存放后第一次使用电池, 在使用前请使用专用充电器将电池充满电。
- Do not disassemble or open, crush, bend or deform, puncture, or shred;
请勿拆解或打开、挤压、弯折、变形、刺穿、敲碎;
- Do not modify or remanufacture, attempt to insert foreign objects into the battery, immerse or expose to water or other liquids such as water, seawater, drinks such as soft drinks, juices, coffee or others, or expose to fire, explosion, or other hazard.
请勿修改或改装, 不要试图将外物插入电池, 不要浸入或暴露在水或其它液体中如淡水、海水、饮料(果汁、咖啡等), 远离火源、爆炸物和其他危险;
- Do not short circuit a battery or allow metallic or conductive objects to contact the battery terminals.
请勿使电池短路, 也不要让金属或其它导体接触电池接电端子;
- When use the battery , must to ensure the charge and discharge voltage of the battery is between 2.50V to 4.25V.
使用电池时需保证每个电池的充放电上下限电压在 2.50V 至 4.25V 之间。
- Avoid dropping the phone or battery. If the phone or battery is dropped, especially on a hard surface, and the user suspects damage, take it to a service center for inspection.
不要跌落主机或电池, 如果主机或电池不慎跌落(尤其在硬表面上), 用户怀疑电池损坏, 则应找服务中心检查;
- The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.
更换电芯应由电芯供应商或设备供应商完成, 用户不得自行更换。
- Replace the battery only with another battery that has been qualified with the system per standard. Use of an unqualified battery may present a risk of fire, explosion, leakage, or other hazard.
更换电池时只能使用通过标准认证的电池, 使用未经认证的电池可能存在起火、爆炸、或其它危险;
- Don't keep a battery at rest for a long time (over 6 months). Safety accident may happen when recharging battery which has a rest for a long time.
避免电池长时间放置不用, 长期放置不用的电池重新充电时可能会发生安全问题。
- In the event of a battery leak, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with large amounts of water and seek medical advice.
如果电池发生漏液, 不要让电池接触皮肤和眼睛, 如果接触不幸发生, 则用大量的水冲洗接触部位或寻求医生帮助;

- Battery usage by children should be supervised. Seek medical advice immediately if a battery has been swallowed
儿童使用电池应受到监督；如果电池被吞食了，立即就医；
- Never disassemble cells. The disassembling may generate internal short circuit in the cell, which may cause firing or other problems.
在任何情况下不得拆卸电芯。拆卸电芯可能会导致内部短路，进而引起着火及其它问题。
- Never incinerate nor dispose the cells in fire. These may cause firing of the cells, which is very dangerous and is prohibited.
在任何情况下，不得燃烧电芯或将电芯投入火中，否则会引起电芯燃烧，这是非常危险的，应绝对禁止。
- Do not remove the outer sleeve from a battery pack nor cut into its housing.
不要把电池（电池组）的外套去除。Do not mix our batteries with other battery brands or batteries of a different chemistry such as alkaline and zinc carbon.
不要将我公司电池与其他品牌的电池或者不同种类的电池，比如碱性锌电池混用。
- Do not mix new batteries in use with semi-used batteries, over-discharge may occur.
不要将新旧电池混用，可能会导致过放电。
- Promptly dispose of used batteries in accordance with local regulations.
按当地法规迅速处理报废电池；

8.0 ship 运输

The cells might be damaged during shipping by shock. If any abnormal features of the cells are found such as deformation of the cell package, smelling of an electrolyte, an electrolyte leakage and others, the cells shall never be used any more. The Cells with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing.

电芯在运输过程中可能因撞击等原因而损坏，若发现电芯有任何异常特征，如外壳破损，闻到电解液气味，电解液泄漏等，该电芯不要使用。有电解液泄漏或闻到异常味道的电池应远离火源以避免着火。

9.0 Storage 贮存

The cell shall be stored at the environmental condition of $-20^{\circ}\text{C}\sim 45^{\circ}\text{C}$ and $65\%\pm 20\%$ RH. The voltage for long time storage shall be 3.5V-3.7V range. If the cell has to be storied for a long time (Over 3 months), the environmental condition should be: Temperature: $-20^{\circ}\text{C}\sim 25^{\circ}\text{C}$ Humidity: $65\%\pm 20\%$ RH; please activate the battery once every 3 months according to the following method: Charge with current 0.5C until the voltage achieve to 3.7V.

电芯储存温度必须在 $-20^{\circ}\text{C}\sim 45^{\circ}\text{C}$ ，相对湿度 $65\%\pm 20\%$ 的环境条件下。长期贮存电压范围为 3.5V~3.7V，长期存储电池（超过 3 个月）须置于温度为 $-20^{\circ}\text{C}\sim 25^{\circ}\text{C}$ 、湿度为 $65\%\pm 20\%$ RH 的环境中。请每隔 3 个月按以下方式激活电池一次：用 0.5C 电流充电直至电压达到 3.7V。

10.0 Revision Page 修订记录

Version 版本	Date 日期	Changes 变化	Author 作者
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