Specification for Li-ion Rechargeable Cylindrical battery

圆柱锂离子电池
规格书

MODEL/型号:

IFR18650 2000mAh

Prepared By 编 制	**Checked By** 审 核	**Approved By** 批 准	**Effective date** 生效日期

Customer Approval 客户承认	**Signature** 签字	**Date** 日期
	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	Item 项目		Specification 规格	
1	Model 型号		IFR18650-2000mAh	
2	Nominal capacity 标称容量		**2000mAh** @0.2C, 2.0V-3.65V, 25℃±3℃	
3	Min Capacity 最小容量		**1950mAh**	
4	Nominal Voltage 标称电压		3.2V	
5	Max. Charge Voltage 最大充电电压		3.65±0.05V	
6	Standard Discharge Cut-off Voltage 标准放电截止电压		2.0V	
7	Standard Charging Mode 标准充电模式		0.5C CC-CV（cut-off current: 60mA） 0.5C 恒流恒压（恒压截止电流为 60mA）	
8	Standard Charge Current 标准充电电流		1A	
9	Max. Charge Current 最大充电电流		2A	
10	Max. Continuous Discharge Current 最大持续放电电流		6A	
11	Standard Diameter of Cell（incl. PET）电池标准直径（包含PET 外壳）		18.30 ± 0.20 mm	
12	Standard Height of Cell (incl. PET) 电池标准高度（包含 PET 外壳）		65.7 ± 0.20mm	
13	Weight 电池重量		≤45g	
14	AC Impedance （1000Hz/17%SOC） 交流内阻 (1000Hz、17%SOC）		≤18mΩ	
		充电 Charge	0℃＜T≤20℃	Max. Charge Current 最大充电电流: 1A
			20℃＜T≤50℃	Max. Charge Current 最大充电电流: 2A
		放电 Discharge	-20℃～60℃	
16	Storage Temperature 储存温度	1 个月 1 months	-20℃～60℃	
		3 个月 3 months	-20℃～45℃	

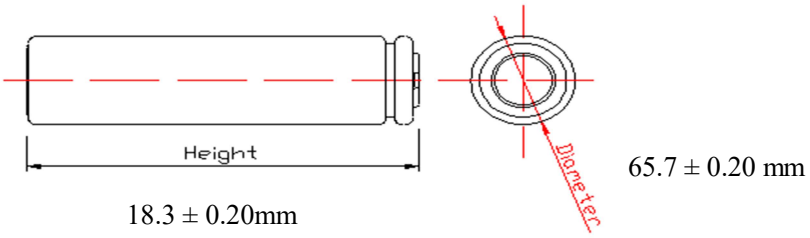
		1 年 1 year	-20℃～25℃

Note：

If the cell is kept as ex-factory status (17% 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17%的充电容量），这种情况下，恢复的容量≥标准放电容量的 90% 。

3.0 Configuration 外形示意图



4.0 Cell Marking 电芯喷码

Manufacture Name 公司名称

SunPower（长虹三杰新能源有限公司的缩写）

SunPower (Trade name of Jiangsu Sunpower Co., LTD）

a. Chemical system 化学体系

LI-ION

b. Nominal voltage 标称电压

3.2V

c. Nominal energy 标称能量

6.4Wh

d. Cell type 电池型号

IFR18650 2000mAh

e. Lot number 生产日期及地点

GK444

G: 年份代码 A-2015 年,B-2016 年…2022 年为 H，以此类推；

K: 月份代码 A-1 月，B-2 月…L-12 月，以此类推；

44：批次

4: 线体代码 1-1 号线…4-4 号线…8-8 号线

010217:包装日期 010217：月日年，2017 年 1 月 2 日

G: Year 2015 as A, 2016 as B…2022 as H...;

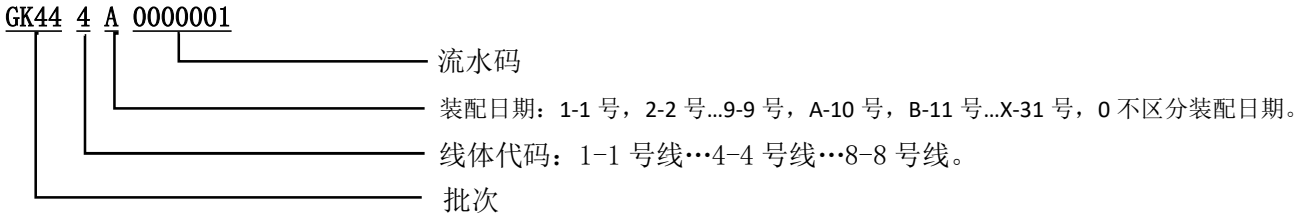
K: Month January as A，February as B…December as L...;

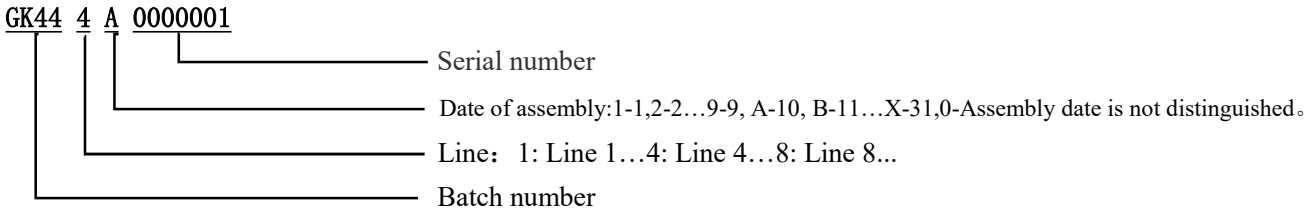
44：Batch number

4: Line 1: Line 1…4: Line 4…8: Line 8...

010217：Date of packaging 010217: Month day year，January 2,2017

f. Internal QR code for tracing purpose 内部二维追溯码





5.0 Characteristic 电池性能

a. Environmental conditions 测试环境

Unless otherwise specified, all tests stated in this specification are conducted at temperature 25℃±3℃and humidity under 65%.

若没有特别说明，电池均在环境温度 25℃±3℃，相对湿度小于 65%的条件下进行测试。

b. Measuring equipment 测试设备

(1) Amp-meter and volt-meter 容量电压测试

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

容量电压测试设备的精度需达到 0.5mA/mV 以上。

(2) Slide caliper 尺寸测试

The slide caliper should have 0.01 mm scale.

测量尺寸时量具需达 0.01 mm 以上精度。

(3) Impedance meter 内阻测试

The impedance meter with AC 1kHz should be used.

内阻测试在 AC 1kHz 的条件下进行。

c. Standard charge 标准充电

Charging the cell with charge current 1A, following constant voltage 3.65V and 60mA cut-off in CC-CV mode at 25℃±3℃ for capacity.

在 25℃±3℃环境温度下，充电电流为 1A，当电池电压达到 3.65V 时，改为恒压充电，截止电流 60mA。

d. Standard discharge capacity 标准放电容量

Discharge at 400mA (0.2C) with 2.0V cut-off at 25℃±3℃ within 1hour after the standard charge.

标准充电搁置 1h 内，在 25℃±3℃环境温度下，以 400mA（0.2C）电流放电至 2.0V 的容量。

5.1 Electrical Characteristic 电化学性能

序号 NO.	项目 Item	标准 Standard	测试方法 Test Method
1	Rate Discharge Capacity （25℃±3℃） 倍率容量 （25℃±3℃）	0.2C=100% 0.5C≥97% 1.0C≥95% 2.0C≥90% 3.0C≥85% 5.0C≥85%	Fully standard-charged cell is discharged at 0.2C/0.5C/1C/2C/3C/5C to 2.0V, individually。 电池标准充电后，分别以 0.2C、0.5C、1C、2C、3C、5C 放电至 2.0V。
2-1	Capacity Retention and Recovery （25℃±3℃） 容量保持及恢复能力（25℃±3℃）	Retention capacity≥90％ Recovery capacity≥95％ 剩余容量≥90％ 恢复容量≥95％	Fully standard-charged cell is stored for 28 days at 25±3℃, then is discharged at 0.5C to 2.0V for retention capacity; After standard charge again, cell is discharged at 0.5C to 2.0V for recovery capacity. 电池标准充电后，在 25℃±3℃下放置 28 天，0.5C 放电至 2.0V，测量电池的剩余容量；然后标准充电，0.5C 放电至 2.0V，测试电池的恢复容量。
2-2	Capacity Retention and Recovery （55℃ / 7 days） 容量保持及恢复能力（55℃ / 7 天）	Retention capacity≥90％ Recovery capacity≥95％ 剩余容量≥90％ 恢复容量≥95％	Fully standard-charged cell is stored at 55±3℃ for 7 days, then is discharged at 0.5C to 2.0V at 25℃±3℃ for retention capacity; After standard-charge again , cell is discharged at 0.5C to 2.0V at 25℃±3℃ for recovery capacity. 电池标准充电后，在温度 55℃±3℃下放置 7 天，然后在 25℃±3℃下 0.5C 放电至 2.0V，测量电池的剩余容量；然后标准充电，0.5C 放电至 2.0V，测试电池的恢复容量。
3	Low Temperature Performance （-10℃） 低温性能（-10℃）	Discharge capacity/Initial capacity@25℃≥60% 放电容量/初始容量≥60%	After standard charge, cell is stored in the temperature of -10℃±2℃ for 4h, then is discharged to 1.6Vat 1A CC. 标准充电后，放入-10℃±2℃低温箱中恒温 4h，然后 1A 放电至 1.6V。

4-1	Cycle Life （25℃±3℃） 循环寿命 （25℃±3℃）	1C-capacity retention at C1500 ≥80% 1500 次 1C 放电循环后容量保持率≥80%	1）Charge: 0.5C CC to 3.65V, then CV to 0.06A, 10mins rest; 2) Discharge： 1C CC to 2.0V, rest for 10mins. 3） Repeat step 1 to 2 for 1500 cycles 充电：0.5C 恒流充电至 3.65V，然后恒压至 0.06A 截止，搁置 10min。 放电：1C 放电到 2.0V，搁置 10mins。 循环 1500 次
4-2	Cycle Life （25℃±3℃） 循环寿命 （25℃±3℃）	2.5C-capacity retention at C500 ≥70% 2.5C 放电循环 500 次后容量保持率≥70%	1）Charge: 1C CC to 3.65V, then CV to 0.06A, 10mins rest; 2) Discharge： 2.5C CC to 2.0V, rest for 10mins. 3） Repeat step 1 to 2 for 500 cycles 充电：1C 恒流充电至 3.65V，然后恒压至 0.06A 截止，搁置 10min。 放电：2.5C 放电到 2.0V，搁置 30mins。 循环 500 次

5.2 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 and No explosion 不起火不爆炸	After standard charge, rest for 10mins; then cell is overcharged at 1C to 5.475V. Monitoring cell temperature during testing. Stop the test when cell temperature decays to room temperature. 标准充电后，搁置 10mins；以 1C 电流充电至电压达到 5.475V。监测电芯温度变化，当电芯温度下降至室温时结束测试。
2	Forced Discharge 强制放电	No fire and No explosion 不起火、不爆炸	Cell is at first discharged at standard discharging condition, is inversely charged at 1C for more than 90mins 按标准放电要求对电池放电，以 1C 反向充电，充电时间不低于 90mins。
3	Short Circuit 短路性能	No fire and No explosion 不起火、不爆炸	Fully charged cell is shorted by external resistance of 80±20mΩ at 20℃±5℃ and 55℃ ±5℃, respectively, until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2V or its surface temperature comes down to ±10℃ of ambient temperature. 标准充电后，分别置于 20℃±5℃和 55℃ ±5℃环境下，正负极端 80±20mΩ 电阻短接。样品保持测试直到爆炸

			起火或样品达到完全放电状态(样品电压低于 0.2V)或样品表面温度降低至测试温度±10℃.。
4	Crush 挤压实验	No fire and No explosion 不起火、不爆炸	Fully charged cell is crushed between two flat surfaces, under the applied force of 13 kN±1kN by a hydraulic cylinder. Once the maximum pressure has been obtained, then the force is released. 标准充电后，在两个平面间承受挤压，由液压油缸施加 13 kN±1kN 的挤压力，一旦挤压力达到卸压。
5	Impact 重物冲击测试	No fire and No explosion 不起火、不爆炸	Fully charged cell is placed on a flat surface, then 15.8 ±0.1mm diameter bar is placed across the center of the sample. 9.1 ±0.46kg weight is dropped from a height of 610 ±25 mm onto the intersection of the steel bar and the sample. 标准充电后,将样品放置在平台,直径 15.8±0.1mm 的钢棒横穿样品中心放置,9.1±0.46 Kg 的重锤从 610±25mm 的高度跌落到钢棒和样品交叉处。
6	Heating (130°C) 热滥用测试	No fire and No explosion 不起火、不爆炸	Fully charged cell is placed into incubator with nature air or circulating air convection, and heated at 5°C ±2°C per minute to 130°C±2°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℃±2℃每分钟的速率升至 130℃±2℃ 并保持 10 分钟。
7	Temperature Cycling 温度循环试验	No leakage, No fire, No explosion 不泄漏，不起火、不爆炸	Fully charged cell is placed in a test chamber and subjected to the following cycles: a) Raising the temperature to 72°C ±2°C within 30 minutes and maintaining this temperature for 6 hours; b) Reducing the temperature to -40°C ±2°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 at the condition of temperature 20°C±5°C . 标准充电后电池放置在测试箱内并做如下处理： a) 30min 内温度升至 72°C±2°C，搁置 6 小时； b) 30min 内温度降至-40°C±2°C，搁置 6 小时； c) 循环 10 次，将电芯在 20°C±5°C下搁置 24 小时。
8	Free Frop 自由跌落试验	No fire, No explosion 不起火，不爆炸	The fully charged cell drops on the concrete ground from height (1m), total 3 times, to obtain the shock of random directions. 充满电的电池三次从 1m 高的地方跌落到混凝土地面，以此获得随机方向的冲击。
9	Nail 针刺	No fire, No explosion 不起火，不爆炸	Fully charged cell placed in a test board is penetrated quickly using a φ5.0-8.0mm steel needle perpendicular to

			the cell electrode through the middle part of it, then watch it for 1h; 电池标准充电后，将电池放置于针刺测试台上用 Φ 5.0-8.0mm 的钢针垂直于极片快速刺穿电池中间部位，观察 1h

5.3 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 高空低压模拟测试	No leakage, No fire, No explosion 不泄漏，不起火、不爆炸	Fully charged cell is stored in an vacuum environment for 6 hours with pressure of less than 11.6kPa and temperature of 20℃±5℃. 标准充电后，储存在 20℃±5℃、大气压≤11.6 kPa 的真空环境中储存 6 小时。
2	Vibration 振动试验	No leakage, No fire, No explosion 不泄漏，不起火、不爆炸	Fully charged cell is fixed on the vibration table and subjected to simple harmonic motion vibration at frequency rate of 1Hz per minute between 10Hz and 55Hz with an amplitude of 0.8 mm and total maximum excursion of 1.6mm. Cells shall be vibrated for 90 -100minutes per axis of X, Y axes, respectively. 标准充电后固定在振动台上，以振幅 0.8mm,总位移 1.6mm 的单谐振动，振动频率范围为 10Hz~55Hz，频率变化速率 1Hz/min。沿 X、Y 两个方向振动，每个方向振动 90-100 分钟。

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

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

保质期是从包装日期开始起 **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导致的意外不负责任。

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 re-manufacture, 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 ensure that the charge and discharge voltage of the battery is between 2.0V to 3.65V.
  使用电池时需保证每个电池的充放电上下限电压在 2.0V 至 3.65V 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（超出 6 个月），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；

8.1 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。

8.2 Storage 贮存

The cell shall be stored at the environmental condition of -20℃～45℃ and 65%±20% RH. The voltage for long time storage shall be 2.8V-3.0V range. If the cell has to be storied for a long time (Over 3 months), the environmental condition should be: Temperature: 0℃～25℃ Humidity: 65%±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 3.0V.

电芯储存必须在温度-20℃～45℃，相对湿度65%±20%的环境条件下。长期贮存电压为2.8V~3.0V。如果电池需要长期存储（超过 3 个月）须置于温度为 0℃～25℃、湿度为 65％±20％RH 的环境中。请每隔 3 个月激活一次电池，方法为：0.5C 电流充电至电压达到 3.0V。

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