



# SPECIFICATION

## 规格书

### Rechargeable Lithium Iron Phosphate Cell

### 可充电磷酸铁锂电芯

Product Model 产品型号	LFP18650-1500
Document No. 文件编码	KH-012
Edition 版本	C0
Pages 页数	11

Prepared By/Date 编制/日期	Checked By/Date 审核/日期	Approved By/Date 批准/日期
技术部/2019.7.23	王华/2019.7.23	王一/2019.7.23

Customer Approval 客户确认	Signature/签字	Date/日期
	Company Name/公司名称	
	Company Stamp/公司印章	

Add: Floor 3, Jinlong Industrial Zone, Sanzhong Village, Qingxi Town, Dongguan, Guangdong Province

地址: 中国广东省东莞市清溪镇三中莲中街7号瑞信恒业金龙园

Tel: +86-0755 21044322

Web: [www.keheng-battery.com](http://www.keheng-battery.com)

P.C.: 518000 邮编: 518000

Fax: +86-0755 21044322

E-mail: [sales@keheng-battery.com](mailto:sales@keheng-battery.com)



## 1. Preface 序言

This product specification covers the requirements for the following rechargeable Lithium Iron Phosphate cell manufactured and delivered by **Keheng New Energy Technology (Shenzhen) Co., Ltd.**

本产品规格书包含了下述由科恒新能源科技（深圳）有限公司制造和交付的可充电磷酸铁锂电芯的性能要求。

## 2. Product Description 产品描述

2.1 Product Name 品名	Rechargeable Lithium Iron Phosphate Cell 可充电磷酸铁锂电芯
2.2 Model 型号	LFP18650-1600
2.3 Description 描述	Cylindrical flat top 18650 1600mAh 3.2V LiFePO4 cell 圆柱平帽 18650 1600mAh 3.2V 磷酸铁锂电芯

## 3. Ratings 额定参数

3.1 Nominal Voltage 标称电压	3.2V
3.2 Nominal Capacity 标称容量	1600mAh
3.3 Typical Capacity 典型容量	1600mAh after standard charge and standard discharge 1600mAh 标准充电和放电条件下
3.4 Minimum Capacity 最低容量	1480mAh after standard charge and standard discharge 1480mAh 标准充电和放电条件下
3.5 Standard Charge 标准充电	Constant current at 750mA charge to 3.65V, then constant voltage at 3.65V charge till current decline to $\leq 15\text{mA}$ 750mA 恒流充电至 3.65V, 转恒压 3.65V 充电至电流 $\leq 15\text{mA}$
3.6 Fast Charge 快速充电	Constant current at 1500mA charge to 3.65V, then constant voltage at 3.65V charge till current decline to $\leq 15\text{mA}$ 1500mA 恒流充电至 3.65V, 转恒压 3.65V 充电至电流 $\leq 15\text{mA}$
3.7 Standard Discharge 标准放电	300mA to 2.0V. 300mA 放电至 2.0V
3.8 Fast Discharge 快速放电	1600mA to 2.0V. 1500mA 放电至 2.0V
3.9 Maximum Continuous Charge Current 最大连续充电电流	1600mA
3.10 Maximum Continuous Discharge Current 最大连续放电电流	1600mA
3.11 Operating Temperature 操作温度	Charge 充电 0°C to 45°C Discharge 放电 -20°C to 60°C
3.12 Storage Temperature 储存温度	<1 year 小于 1 年 -20°C to 25°C <3 months 小于 3 个月 -20°C to 40°C <30days 小于 30 天 -20°C to 50°C
3.13 Typical Weight 典型重量	38g

## 4. Electrical Performance 电气性能

Unless otherwise stated, tests should be conducted under the following conditions:  
除非另作说明, 测试应该在下列条件下进行:

Time frame 时间期限	Within one month after delivery 交货后的一个月內
Ambient temperature 环境温度	25°C ± 5°C
Relative Humidity 相对湿度	65% ± 20%
Atmospheric Pressure 大气压	86kPa-106kPa

### 4.1 Initial Capacity 初始容量

Initial capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V within 1 hour after the standard charge. Up to three cycles are permitted for this test.  
初始容量是指在标准充电后 1 小时内, 将电芯以 0.2C 电流放电至 2.0V 终止电压的放电容量。允许连续测试 3 次, 任意一次达到要求即可停止测试。

Criteria: Discharge capacity  $\geq$  minimum capacity  
标准: 放电容量  $\geq$  最低容量

### 4.2 Open Circuit Voltage 开路电压

The open circuit voltage is measured within 1 hour after standard charge.  
在标准充电后 1 小时内测量电芯的开路电压。

Criteria: Open circuit voltage  $\geq$  3.35V  
标准: 开路电压  $\geq$  3.35V

### 4.3 Initial Internal Impedance 初始内阻

The initial internal impedance is measured at the frequency of 1kHz within 1 hour after standard charge.  
在标准充电后 1 小时, 以 1kHz 的频率测量电芯的初始内阻。

Criteria: Initial internal impedance  $\leq$  60m $\Omega$   
标准: 初始内阻  $\leq$  60m $\Omega$

### 4.4 Fast Discharge Capacity 快速放电容量

The capacity is measured with a discharge current of 1C to a discharge final voltage of 2.0V within 1 hour after the standard charge.  
快速放电容量是指在标准充电后 1 小时内, 将电芯以 1C 电流放电至 2.0V 终止电压的放电容量。

Criteria: Discharge capacity  $\geq$  90% of initial capacity  
标准: 放电容量  $\geq$  初始容量的 90%

### 4.5 Charge Retention 荷电保持能力

Charge retention is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V after standard charge and storage time of 28 days.  
在标准充电后, 将电芯存放 28 天, 然后以 0.2C 电流放电到 2.0V 的终止电压。所得容量与初始容量的比率表示为荷电保持能力。

Criteria: Discharge capacity  $\geq$  85% of initial capacity  
标准: 放电容量  $\geq$  初始容量的 85%

#### 4.6 Charge Recovery 充电恢复能力

After charge retention test, the cell shall be done standard charge within 24 hours and stored for 1hour. Charge recovery is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V. 在完成荷电保持能力测试后 24 小时内, 将电芯进行标准充电, 搁置 1 小时, 然后以 0.2C 电流放电到 2.0V 的终止电压。所得容量与初始容量的比率表示为充电恢复能力。

Criteria: Discharge capacity  $\geq 90\%$  of initial capacity  
标准: 放电容量  $\geq$  初始容量的 90%

#### 4.7 Cycle Life 循环寿命

During this cycle life test, the ambient temperature should be kept at  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . The cell shall be charged at CC/CV=0.5C/3.65V, cut off till current decline to 0.05C, stored for 10mins, then discharged at a constant current of 0.5C to a final voltage of 2.0V, after that, stored 10mins prior to next charge/discharge cycle. The cell shall be continuously charged and discharged for 1000 times. 在循环寿命测试期间, 环境温度应维持在  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 。将电芯以 0.5C/3.65V 进行恒流恒压充电, 直到电流降低到 0.05C 切除, 搁置 10min, 然后以 0.5C 电流放电至 2.0V 终止电压, 之后搁置 10 分钟, 再进行下一次充放电循环。电芯应连续充放电 1000 次。

Criteria: Discharge capacity at the 1000th cycle  $\geq 80\%$  of initial capacity.  
标准: 第 1000 次的放电容量  $\geq$  初始容量的 80%

### 5. Environmental Performance 环境性能

#### 5.1 Discharge Capacity at High Temperature 高温放电容量

After the standard charge, the cell is stored at an ambient temperature of  $55^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for not less than 16h and not more than 24h. The capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

在标准充电后, 将电芯在  $55^{\circ}\text{C} \pm 2^{\circ}\text{C}$  的环境中存放 16-24 小时, 然后以 0.2C 电流放电到 2.0V 的终止电压。所得容量表示为高温放电容量。

Criteria: Discharge capacity  $\geq 95\%$  of initial capacity  
标准: 放电容量  $\geq$  初始容量的 95%

#### 5.2 Discharge Capacity at Low Temperature 低温放电容量

After the standard charge, the cell is stored at an ambient temperature of  $-10^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for not less than 16h and not more than 24h. The discharge capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

在标准充电后, 将电芯在  $-10^{\circ}\text{C} \pm 2^{\circ}\text{C}$  的环境中存放 16-24 小时, 然后以 0.2C 电流放电到 2.0V 的终止电压。所得容量表示为低温放电容量。

Criteria: Discharge capacity  $\geq 50\%$  of initial capacity  
标准: 放电容量  $\geq$  初始容量的 50%

#### 5.3 Constant Temperature and Humidity 恒定湿热

After the standard charge, the cell is stored in an ambient temperature of  $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$  (90-95%RH) for 48h, then placed in room temperature for 2h. After that, check its appearance, the discharge capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

在标准充电后, 将电芯放入  $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$  (90%-95%RH) 的恒温恒湿箱中搁置 48 小时, 然后取出电芯在室温下搁置 2 小时, 目测电芯外观, 再以 0.2C 电流放电至 2.0V 的终止电压。所得容量表示为恒定湿热测试

放电容量。

Criteria: No explosion, no fire, no leakage. Discharging capacity  $\geq$  60% of initial capacity.  
标准: 无爆炸、起火、漏液, 放电容量  $\geq$  初始容量的 60%。

## 6 Mechanical Performance 机械性能

### 6.1 Vibration Test 振动测试

After standard charge, the cell is installed onto the vibration desk with clamps. The test is to be varied at the rate of 1oct/min between 10 and 55Hz. Repeat vibration for 30min in three mutually perpendicular directions. Equipment parameters of frequency and amplitude are as follows:

在标准充电后, 将电芯用夹具安装在振动台的台面上, 然后按 1oct/分钟的扫频速率在 10-55Hz 之间变动进行测试, 三个相互垂直的方向各振动 30 分钟。仪器振动频率和振幅参数如下:

Vibration frequency: 10-30Hz, amplitude: 0.38mm; 30-55Hz, amplitude: 0.19mm  
振动频率: 10-30Hz , 振幅: 0.38mm; 30-55Hz, 振幅: 0.19mm。

Criteria: No scratch, no leakage, no fume, no explosion. Cell voltage  $\geq$ 3.2V.  
标准: 无损伤、漏液、冒烟或爆炸, 电芯电压  $\geq$ 3.2V。

### 6.2 Drop Test 跌落测试

After standard charge, the cell is dropped from a height of 1m to a concrete surface. Each cell is to be dropped once in the positive and negative directions of three mutually perpendicular mounting positions for a total of 6 times, then rest for 1 hrs.

在标准充电后, 将电芯从 1m 高度自由落体跌落到水泥地板上, 电芯的正负极方向分别跌落三次, 共计 6 次, 跌落后搁置 1 小时。

Criteria: No leakage, no fume, no explosion  
标准: 无漏液、冒烟或爆炸

## 7 Safety Performance 安全性能

### 7.1 Overcharge 过充

At standard testing condition, the cell is charged with constant current 3C to voltage 5.0V, then charged with constant voltage of 5.0V till current decline to 0.005C. Charge time is no less than 8hrs.

在标准测试环境下, 将电芯用 3C 电流充电至 5.0V, 然后恒压 5.0V 充电至电流下降到 0.005C, 充电时间不少于 8 小时。

Criteria: No fire, no explosion.  
标准: 不起火、不爆炸

### 7.2 Over-discharge 过放

At standard testing condition, the cell is discharged at 0.2C current to final voltage of 2.0V, then connect 30 $\Omega$  load to discharge for 24 hours.

在标准测试环境下, 将电芯以 0.2C 电流放电至 2.0V 终止电压, 再连接 30 $\Omega$  负载放电 24 小时。

Criteria: No leakage, no fume, no fire  
标准: 无漏液、冒烟或起火

### 7.3 Crush 挤压

At standard testing condition, the cell is charged by standard charge, then placed on the crush flat, the axis is parallel to the crush flat, it is to be crushed between two flat surfaces. Crushing force is approximately 13kN and hold for 1 min

在标准测试环境下, 将电芯进行标准充电, 然后放在挤压设备的两个挤压面之间, 电芯轴向平行于挤压平面, 逐渐增加压力至13kN, 保持压力1分钟。

Criteria: No fire, no explosion.

标准: 不起火、不爆炸

#### 7.4 Short-circuit 短路

At standard testing condition, the cell is charged by standard charge, then connect the positive and negative terminals of the cell with a circuit load having a resistance load of  $80\text{m}\Omega \pm 20\text{m}\Omega$ . The temperature of the battery case is to be recorded during the test. Stop the test until the cell surface temperature lower  $10^\circ\text{C}$  than the temperature max.

在标准测试环境下, 将电芯进行标准充电, 然后将电芯正负极连接 $80\text{m}\Omega \pm 20\text{m}\Omega$ 的电阻, 直至电芯表面温度低于最高温度 $10^\circ\text{C}$ 停止。

Criteria: No fire, no explosion

标准: 不起火、不爆炸

#### 7.5 Heating 加热

At standard testing condition, the cell is charged at standard charge, put the cells in the oven, the temperature of the oven is to be raised at  $5^\circ\text{C} \pm 2^\circ\text{C}$  per minute to a temperature of  $130^\circ\text{C} \pm 2^\circ\text{C}$  and remain for 30 minutes.

在标准测试环境下, 将电芯进行标准充电, 然后放在烘箱中, 烘箱以 $5^\circ\text{C} \pm 2^\circ\text{C}$ /分钟升温至 $130^\circ\text{C} \pm 2^\circ\text{C}$ , 并在该温度下维持30分钟

Criteria: No fire, no explosion

标准: 不起火、不爆炸

#### 7.6 Impact 重物冲击

At standard testing condition, the cell is charged at standard charge, then is placed on a flat surface so that the longitudinal axis of the cell shall be parallel with it. A 7.9mm diameter bar is to be placed across the center of the sample. A 9.1kg weight is to be dropped from a height of 610mm on the sample.

在标准测试环境下, 将电芯进行标准充电, 然后水平放置于一个与电芯纵轴平行的平板上, 将一直径 $\Phi 7.9\text{mm}$ 的棒放在样品中心, 让重量9.1kg的重物从610mm的高度落到样品上。

Criteria: No fire, no explosion

标准: 不起火、不爆炸

#### 7.7 Low Pressure 低气压

At standard testing condition, charge the cell at standard charge, then store for 6hrs at absolute pressure of 11.6kPa. After that, rest for 2hrs at  $20^\circ\text{C} \pm 5^\circ\text{C}$ .

在标准测试环境下, 将电芯进行标准充电, 然后在11.6kPa的绝对压力下存放6小时, 之后在 $20^\circ\text{C} \pm 5^\circ\text{C}$ 的环境中搁置2小时。

Criteria: No leakage, no fire, no explosion

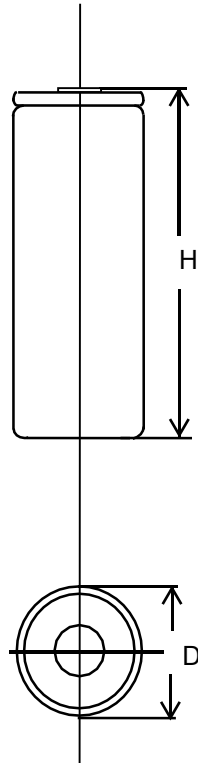
标准: 不漏液、不起火、不爆炸

## 8 Appearance 外观

The cell shall be free from deformation, cracks, scratches, rusts and leakage.  
 电芯应无变形、破裂、划痕、生锈和漏液现象。

## 9 Outline Dimensions 外形尺寸

Cell outline dimensions refer to the following drawing and specification.  
 电芯外形尺寸参见下图及标准。



SN 序号	Items 项目	Units 单位: mm
1	Diameter 直径(D)	18.7 <sup>+0</sup> <sub>-0.7</sub>
2	Height 高度(H)	65.5 <sup>+0</sup> <sub>-1.5</sub>

## 10 Shipment 出货

The cell shall be shipped in voltage range of 3.2-3.4V or in accordance with customers' requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.  
 电芯出厂时电压范围为 3.2-3.4V 或按照客户要求，出货时的剩余容量取决于储存时间和条件。

## 11 Warranty 保质期

As long as the cell is treated in accordance with this product specification, from date of delivery, one year limited warranty against workmanship and material defects is given.  
 依照本产品规格书要求进行操作，自出厂之日起，对于由加工制造和材料造成的缺陷产品给予一年的保质期。



## Precautions and Safety Instructions 安全守则

The cell/battery subject to abusive conditions can cause damage to the cell/battery and/or personal injury. Please read and observe the standard battery precautions below before using utilization.

滥用电芯/电池可能会造成电芯/电池损坏或人身伤害，在使用以前，请仔细阅读以下内容。

Note 1: The customer is required to contact JYH in advance, if and when the customer needs other applications or operating conditions than those described in this document.

特别说明 1: 如果客户需要在该文件描述之外的条件下操作或应用，请向锦业华公司咨询。

Note 2: JYH will take no responsibility for any accident when the cell/battery is used under other conditions than those described in this document.

特别说明 2: 在该文件说明的条件之外使用电芯/电池而产生的事故，锦业华公司不承担任何责任。

### 1. Precaution 预防措施

- a) Do not expose the cell/battery to extreme heat or flame.  
不要将电芯/电池暴露在极热或有火星的环境中。
- b) Do not short circuit, over-charge or over-discharge the battery.  
不要将电芯/电池短路、过充或过放。
- c) Do not subject the cell/battery to strong mechanical shocks.  
不要使电芯/电池承受过重的机械冲击。
- d) Do not immerse the cell/battery in water or sea water, or get it wet..  
不要将电芯/电池浸入海水或水中，或者令其吸湿。
- e) Do not reverse the polarity of the cell/battery for any reason.  
不要颠倒电芯/电池的正负极。
- f) Do not disassemble or modify the cell/battery.  
不要拆卸或修理电芯/电池。
- g) Do not handle or store with metallic like necklaces, coins or hairpins, etc.  
不要和项链、硬币或发夹等金属物品放置在一起。
- h) Do not use the cell/battery with conspicuous damage or deformation.  
不要使电芯/电池受到明显的损坏或变形。
- i) Do not connect cell/battery to the plug socket or car-cigarette-plug.  
不要将电芯/电池与插座或汽车点烟口连接。
- j) Do not make the direct soldering onto a cell/battery.  
不要直接在电芯/电池上焊锡。
- k) Do not touch a leaked cell/battery directly.  
不要直接接触泄漏的电芯/电池。
- l) Do not use for other equipment.  
不要将电芯/电池用于其它设备。
- m) Do not use LiFePO<sub>4</sub> cell/battery in mixture.  
不要将磷酸铁锂电芯/电池混合使用。



- n) Do not use or leave the cell/battery under the blazing sun (or in heated car by sunshine).  
不要将电芯/电池放置在太阳光直射的地方（或阳光暴晒的汽车内）。
- o) Keep cell/battery away from children.  
将电芯/电池放置在远离儿童的地方。
- p) Do not drive a nail into the cell/battery, strike it by hammer or tread it.  
不要针刺、锤打或踩踏电芯/电池。
- q) Do not give cell/battery impact or fling it.  
不要撞击或投掷电芯/电池。

## 2. Cell/Battery Operation Instruction 电芯/电池使用说明

### 2.1. Charging 充电

- a) Charge the cell/battery in a temperature range of 0°C to + 45°C.  
电芯/电池充电温度范围为 0°C ~ +45°C。
- b) Charge the cell/battery at the specified current until 3.65V is attained. Charge rates greater than 1C are NOT recommended.  
按要求的电流将电芯/电池充电至 3.65V，建议不要使用超过 1C 的电流。
- c) Maintain charge voltage at 3.65V for 2.0 hours (recommended for maximum capacity).  
恒压 3.65V 充电 2 小时（建议为得到最大容量测试时使用）。
- d) Use a constant current, constant voltage (CC/CV) lithium-ion cell/battery charge controller.  
使用恒流恒压磷酸铁锂电芯/电池充电器。
- e) Do not continue to charge cell/battery over specified time.  
不要超过标准时间持续充电。

### 2.2. Discharging 放电

- a) Recommended discharge final voltage is 2.0V. Recommended max continuous discharge current is 3C.  
建议放电终止电压为 2.0V，建议最大持续放电电流为 3C。
- b) For maximum performance, discharge the cell/battery in a temperature range of -20°C to +60°C.  
为了达到较好的性能，电芯/电池的放电温度范围为-20°C ~ +60°C。

### 2.3. Storage Recommendations 储存建议

- a) Storage Temperature and Humidity 储存温度和湿度

Store the cell/battery at temperature of -20°C to +35°C, low humidity and no corrosive gas atmosphere.  
电芯/电池应储存在温度范围为-20°C ~ +35°C，低湿度和不含腐蚀性气体的环境中。

- b) Long Period Storage 长期存放

In case of long period storage (more than 3 months), store the cell/battery at temperature range of -10°C to +25°C, low humidity, no corrosive gas atmosphere.  
如需长期存放(超过 3 个月)，电芯/电池应存储在温度为-10°C ~ +25°C、低湿度、不含腐蚀性气体氛围的环境中。

- c) No press on the cell/battery.

不要让电芯/电池承受任何压力。

## **Requirement for Safety Assurance 安全保证要求**

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

为了安全起见,请事先与科恒讨论用电器设计方案、磷酸铁锂电芯/电池的体系及保护电路等。对高倍率放电、快速充电和其它特殊应用,也须向科恒咨询。