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深圳市海雷新能源有限公司

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VER: A

DATE: 2010/11/5

# LiFePO4 Battery Specification

## 磷酸铁锂电池规格书

**MODEL/型号: IFR14500-600mAh**

Prepared By/Date 编制/日期	Checked By/Date 审核/日期	Approved By/Date 批准/日期

	Signature 确认	Date 日期
Customer Approval 客户批准		
	Company Name: 公司名称:	
	Company Stamp: 客户印章:	

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## 1 Scope (适用范围)

This specification is applied to the reference battery in this Specification and manufactured by Shenzhen Hailei New Energy Co., Ltd.

本说明书适用于本书中所提及的、海雷新能源有限公司制造的电池。

## 2 Product Specification (产品技术规格)

Table 1 (表 1)

No. (序号)	Item (项目)	General Parameter (常规参数)		Remark (备注)
		Typical (标称容量)	600mAh	
1	Rated Capacity (额定容量)	Minimum (最小容量)	580mAh	Standard discharge (0.2C <sub>5</sub> A) after Standard charge (标准充电后 0.2C <sub>5</sub> A 标准放电)
2	Nominal Voltage (正常电压)	3.2V		Mean Operation Voltage (即工作电压)
3	Voltage at end of Discharge (放电终止电压)	2.0V		Discharge Cut-off Voltage (放电截止电压)
4	Charging Voltage (充电电压)	3.65V		
5	Internal Impedance (内阻)	≤120mΩ		Internal resistance measured at AC 1KHz after 50% charge (半电态下用交流法测量内阻) The measure must uses the new batteries that within one week after shipment and cycles less than 5 times (使用出货后不到一个星期及循 环次数少于 5 次的新电池测量)
6	Standard charge (标准充电)	Constant Current 0.2C <sub>5</sub> A Constant Voltage 3.65V 0.01 C <sub>5</sub> A cut-off (持续电流: 0.2C <sub>5</sub> A 持续电压: 3.65V 截止电流: 0.01 C <sub>5</sub> A)		
7	Standard discharge (标准放电)	Constant current 0.2C <sub>5</sub> A end voltage 2.0V (持续电流: 0.2C <sub>5</sub> A 截止电压: 2.0V)		



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Continuous the table 1 (续表 1)

No. (序号)	Item (项目)	General Parameter (常规参数)	Remark (备注)
8	Fast charge (快速充电)	Constant Current 0.5C <sub>5</sub> A Constant Voltage 3.65V 0.01 C <sub>5</sub> A cut-off (持续电流: 0.5C <sub>5</sub> A 持续电压: 3.65V 截止电流: 0.01 C <sub>5</sub> A)	
9	Fast discharge (快速放电)	Constant current 1.0C <sub>5</sub> A end voltage 2.0V (持续电流: 1.0 C <sub>5</sub> A 截止电压: 2.0V)	
10	Maximum Continuous Charge Current (最大充电持续电流)	1.0 C <sub>5</sub> A	
11	Maximum Continuous Discharge Current (最大放电持续电流)	1.5 C <sub>5</sub> A	
12	Operation Temperature Range (工作温度范围)	Charge (充电): 0~45°C	60±25%R.H. Bare Cell (单体电池储存湿度范围)
		Discharge (放电): -10~60°C	
13	Storage Temperature Range (储存温度范围)	Less than 1 year: -20~25°C (小于一年: -20~25°C)	60±25%R.H. at the shipment state (出货状态时的湿度范围)
		less than 3 months: -20~40°C (小于3个月: -20~40°C)	
		Less than 7 day: -20~65°C (小于7天: -20~65°C)	
14	Cell Dimension (电芯尺寸)	High/高度: 50.5±0.3 mm	Initial Dimension (初始尺寸)
		Diameter/直径: 14.0±0.2mm	



### 3 Performance And Test Conditions (电池性能及测试条件)

#### 3.1 Standard Test Conditions (标准测试条件)

Test should be conducted with new batteries within one week after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of  $20 \pm 5^\circ\text{C}$  and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature  $15 \sim 30^\circ\text{C}$  and humidity 25~85%RH.

测试必须使用出厂时间不超过一个星期的新电池，且未进行过五次以上的充放电循环。除非特别说明，否则测试会在温度  $20 \pm 5^\circ\text{C}$ ，相对湿度 45~85%的条件下进行。如果经鉴定测试结果不受上述条件影响，测试也可以在温度  $15 \sim 30^\circ\text{C}$ ，相对湿度 25~85%RH 的条件下进行。

#### 3.2 Measuring Instrument or Apparatus (测量器具及设备)

##### 3.2.1 Dimension Measuring Instrument (尺寸测量器具)

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

尺寸测量器具的精度等级应不小于 0.01 mm。

##### 3.2.2 Voltmeter (伏特计)

Standard class specified in the national standard or more sensitive class having inner impedance more than  $10\text{k}\Omega/V$

按照国家标准指定规格等级或采用灵敏度更高的，测量电压时内阻不应小于  $10\text{k}\Omega/V$ 。

##### 3.2.3 Ammeter (安培计)

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than  $0.01\Omega$ .

按照国家标准指定规格等级或采用灵敏度更高的，包括电流表及电线在内的总外阻应小于  $0.01\Omega$ 。

##### 3.2.4 Impedance Meter (电阻计)

Impedance shall be measured by a sinusoidal alternating current method(1kHz LCR meter).

内阻测试仪测量原理应为交流阻抗法 (1kHz LCR)。

#### 3.3 Standard Charge\Discharge (标准充放电)

##### 3.3.1 Standard Charge : Test procedure and its criteria are referred as follows:

标准充电：测试过程及标准如下：

$0.2C_5A = 120\text{mA}$

Charging shall consist of charging at a  $0.2C_5A$  constant current rate until the cell 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  $0.01 C_5A$ . Charge time: Approx 5.5h, The cell shall demonstrate no permanent degradation when charged between  $0^\circ\text{C}$  and  $45^\circ\text{C}$ .

电池先  $0.2C_5A$  恒流充至 3.65V，当充电电流逐渐减小时再以 3.65V 恒压充至电流减小到  $0.01 C_5A$ ，充电时间大约为 5.5 个小时。在  $0^\circ\text{C} \sim 45^\circ\text{C}$  内充电电池应没有永久损害。

##### 3.3.2 Standard Discharge (标准放电)

$0.2C_5A = 120\text{mA}$

Cells shall be discharged at a constant current of  $0.2 C_5A$  to 2.0 volts @  $20^\circ \pm 5\text{C}$

电池以  $0.2 C_5A$  恒流放电至 2.0V @  $20^\circ \pm 5\text{C}$

##### 3.3.3 If no otherwise specified, the rest time between Chare and Discharge amount to 30min.

如果没有特别说明，电池充放电间隔时间为 30 分。



3.4 Appearance (外观)

There shall be no such defect as flaw, crack, rust, leakage, which may adversely affect commercial value of battery.

电池外观应没有划伤、破裂、污渍、生锈、漏液等影响市场价值的缺陷存在。

3.5 Initial Performance Test (初始性能测试)

Table 2 (表 2)

Item (项目)	Test Method and Condition (测试方法及条件)	Requirements (要求)
(1) Open-Circuit Voltage (开路电压)	The open-circuit voltage shall be measured within 24 hours after standard charge. (标准充电后 24 小时内测量开路电压)	$\geq 3.35V$
(2) Internal impedance (初始内阻)	Internal resistance measured at AC 1KHz after 50% charge. (半充电状态下, 测量其 AC 1KHz 下的交流阻抗)	$\leq 120m\Omega$
(3) Minimal Rated Capacity (最小额定容量)	The capacity on 0.2C <sub>5</sub> A discharge till the voltage tapered to 2.0V shall be measured after rested for 30min then finish standard charge. (标准充电后, 搁置 30min, 测量 0.2C 放电至 2.0V 截止电压所放出的容量)	Discharge Capacity (放电容量) $\geq 580mAh$

3.6 Temperature Dependence of discharge capacity (放电温度特性)

Cells shall be charged per 3.3.1 and discharged @0.2 C<sub>5</sub>A to 2.0 volts. Except to be discharged at temperatures per Table 3. Cells 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 23 °C and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 3.

电池按 3.3.1 规定充电。按表 3 的温度中放电, 电池必须先在该试验温度中放置 3 个小时。在每一个温度中的放电容量应不小于表 3 的要求。

Table 3 (表 3)

Discharge Temperature (放电温度)	-10°C	0°C	23°C	60°C
Discharge Capacity (0.2 C <sub>5</sub> A) (放电容量/0.2 C <sub>5</sub> A)	50%	75%	100%	95%



3.7 Cycle Life and Leakage-Proof (循环寿命及漏液试验)

Table 4 (表 4)

No. (序号)	Item (项目)	Criteria (标准)	Test Conditions (测试条件)
1	Cycle Life (循环寿命)	Higher than 70% of the Initial Capacities of the Cells (初始容量的 70%)	Carry out 1000cycle Charging/Discharging in the below condition. ◆Charge: Standard Charge, per 3.3.1 ◆Discharge: 0.2 C <sub>5</sub> A to 2.0V ◆Rest Time between charge/discharge:30min. ◆Temperature:20±5℃ 循环 1000 次 充放电按以下条件: ◆充电: 标准充电, 按 3.3.1 规定 ◆放电: 0.2 C <sub>5</sub> A 放至 2.0V ◆搁置:30min. ◆温度:20±5℃
2	Leakage-Proof (漏液试验)	No leakage (visual inspection) (没有漏液/目测)	After full charge with standard charge, store at 60±3℃, 60±10%RH for 1 month. 标准充电条件下充满电后在温度 60±3℃, 湿度 60±10%RH 下储存一个月

4. Mechanical characteristics and Safety Test (安全测试及机械特性)

Table 5 (表 5)

(Mechanical characteristics)

No. (序号)	Items (项目)	Test Method and Condition (测试方法及条件)	Criteria (标准)
1	Vibration Test 振动测试	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz an 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes. 将标准充电后的电芯固定在振动台上, 沿 X、Y、Z 三个方向各振动 30 分钟, 振幅 1.6mm, 振动频率为 10Hz~55Hz, 每分钟变化 1Hz。	No leakage 无泄漏 No fire 不起火
2	Drop Test 跌落测试	The cell is to be dropped from a height of 1 meter twice onto concrete ground. 将标准充电后的电芯从 1 米高度跌落至混凝土地面 2 次	No explosion, No fire, no leakage. 无爆炸、无起火、无泄漏



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Table 6 (表 6)

(Safety Test)

Item (项目)	Battery Condition (电池要求)	Test Method (测试方法)	Requirements (要求)
Crush (挤压试验)	Fresh, Fully charged (充满电的新电池)	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min. (电池放置在两块平面金属板间, 施加 13KN (1.72Mpa) 的作用力, 且持续保持 30 分钟)	No explosion, No fire (无起火无爆炸)
Short Circuit (短路试验 20°C)	Fresh, Fully charged (充满电的新电池)	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1 Ω .Tests are to be conducted at room temperature(20±2°C ). (在常温下约 20±2°C 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω )	No explosion, No fire The Temperature of the surface of the Cells are lower than 150°C (无起火无爆炸 电池表面温度应低于 150°C)
Short Circuit (短路试验 60°C)	Fresh, Fully charged (充满电的新电池)	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1 Ω .Tests are to be conducted at temperature(60±2°C ). (在常温下约 60±2°C 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω )	No explosion, No fire The Temperature of the surface of the Cells are lower than 150°C (无起火无爆炸 电池表面温度应低于 150°C)
Impact (冲击试验)	Fresh, Fully charged (充满电的新电池)	A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample. (用一条直径为 56mm 的圆棒放置在电池中央, 将一 10Kg 的重锤从 1m 的高度垂直落下在电池的中心位置)	No explosion, No fire (无起火无爆炸)
Forced Discharge (过放试验)	Fresh, Fully charged (充满电的新电池)	Discharge at a current of 1 C <sub>5</sub> A for 2.5h. (以 1C <sub>5</sub> A 的电流放电 2.5 小时)	No explosion, No fire (无起火无爆炸)





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## 5. CAUTIONS IN USE(谨慎使用)

To ensure proper use of the battery please read the manual carefully before using it.  
(为确保正确使用电池, 使用前请仔细阅读本细则)

### . Handling (电池操作)

- Do not expose to, dispose of the battery in fire. (不要靠近和放置电池于火中)
- Do not put the battery in a charger or equipment with wrong terminals connected.  
(在充电器或设备仪器中不要把电池接错电极)
- Avoid shorting the battery (避免电池短路)
- Avoid excessive physical shock or vibration. (避免电池过多的物理撞击和震动)
- Do not disassemble or deform the battery. (不要解剖和使电池变形)
- Do not immerse in water. (不要把电池浸泡在水中)
- Do not use the battery mixed with other different make, type, or model batteries.  
(不要和其它不同类型的电池混和使用)
- Keep out of the reach of children. (放置电池于儿童不易接触的地方)

### . charge and discharge (充电和放电)

- Battery must be charged in appropriate charger only.  
(电池必须用适当的充电器充电)
- Never use a modified or damaged charger. (不要使用改装或损坏的充电器)
- Do not leave battery in charger over 24 hours.  
(不要把电池放置于充电器超过 24h)

### . storage(储存)

- Store the battery in a cool, dry and well-ventilated area.  
(应把电池置于凉爽、干燥及通风良好的区域)

### . disposal (电池处理)

- Regulations vary for different countries. Dispose of in accordance with local regulations. (电池处理要符合当地的规定)

## 6 Battery operation instruction (电池工作指南)

### 6.1 Charging (充电)

Charging current: Cannot surpass the biggest charging current which in this specification book stipulated.

(充电电流: 不能超过规格书上规定的最大充电电流)

Charging voltage: Does not have to surpass the highest amount which in this specification book stipulated to decide the voltage.

(充电电压: 不能超过规格书上规定的最大充电电压)

Charge temperature: The battery must carry on the charge in the ambient temperature scope which this specification book stipulated.

(充电温度: 电池充电必须在规格书规定环境温度范围内)

Uses the constant electric current and the constant voltage way charge, the prohibition reverse charges. If the battery positive electrode and the cathode meet instead, can damage the battery. (使用持续电流和电压方式进行充电, 禁止反向充电, 否则会损害电池)



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### 6.2 Discharging current (放电电流)

The discharging current does not have to surpass this specification book stipulation the biggest discharging current, the oversized electric current electric discharge can cause the battery capacity play to reduce and to cause the battery heat.

(不要超过本规格书上规定的最大放电电流，太大的电流放电会导致容量变小及使电池发热)

### 6.3 Electric discharge temperature (放电温度)

The battery discharge must carry on in the ambient temperature scope which this specification book stipulated.

(电池放电必须在本规格书规定的环境温度范围)

### 6.4 Over-discharges (过放电)

After the short time excessively discharges charges immediately cannot affect the use, but the long time excessively discharges can cause the battery the performance, battery function losing. The battery long-term has not used, has the possibility to be able to be at because of its automatic flashover characteristic certain excessively discharges the condition, for prevented excessively discharges the occurrence, the battery should maintain the certain electric quantity.

(在短时间过放电后立即充电不会影响电池的使用，但如果是长时间过放电会导致电池性能及电池功能丧失。电池长时间不使用，可能会有因它本身自动产生的电弧特性而必然的过放电情形，为防止电池过放电，电池应该保持一定的电量)

### 6.5 Storing the Batteries (储存电池)

The battery should store in the product specification book stipulation temperature range. If has surpasses above for six months the long time storage, suggested you should carry on additional charge to the battery。(电池应该储存在本产品规格书中规定温度范围。如果储存时间超过六个月，建议对电池进行额外充电。)

### 7. Period of Warranty (保质期)

The period of warranty is half a year from the date of shipment. Hailei guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customers abuse and misuse.

(保质期从出货之日起半年。如果是制造过程的缺陷而不是用户错用滥用造成的，本公司确保更换)

### 8. Other The Chemical Reaction (其它的化学反应)

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

(电池是利用化学反应产生电量，电池性能会随时间变差，即使电池长时间储存而不使用。另外，各种各样的使用方法，像充电、放电及环境温度，等等不能在本规格书规定的范围时的情形，会减小电池的期望寿命，或者会使仪器设备由于电池漏液而损坏。即使充电正确，电池长时间不能再充电，那就要更换电池了。)

### 9.Note: Any other items which are not covered in this specification shall be agreed by both parties.

(注意：任何本产品规格书未包含的其它条款，应由双方协议确定。)



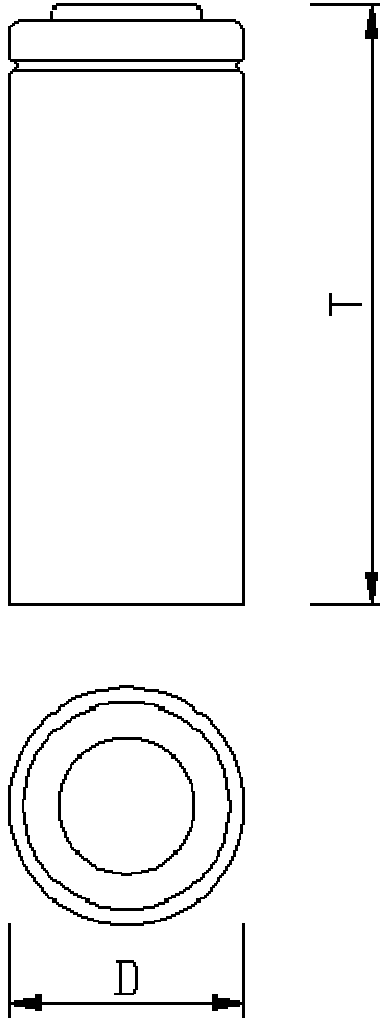
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10. Initial Dimension (初始尺寸):



D	14.0±0.2	H	50.5±0.3	Units/单位	mm
Drawer 绘图		Checked 审核		Approved 批准	Date 日期
			<b>14500 DRAWING</b>		
			Drawing ID/图号		