Specification for Lithium-ion Rechargeable Cell

锂离子电芯规格书

Cell Type（电芯型号）: IFR18650P-1500mAh 3.2V

Approved 批准	Checked 审核	Designed 设计制作

Customers Name 客户名称	
Customer Approval 客户回签	

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Catalogue 目　录

1. Preface（前言）

This Product Specification describes the technique requirements, test procedure and precaution notes of prismatic type Lithium-ion Rechargeable cell to be supplied to customer by Shandong Tianhan New Energy Technology Co. ,LTD.

本标准规定了由山东天瀚新能源科技有限公司生产的锂离子电芯技术要求，测试方法及注意事项。

2. Description（说明）

2.1 Product 产品： Lithium-ion Rechargeable cell 锂离子可充性电芯

2.2 Model (Type) 电芯型号： IFR18650P-1500mAh 3.2V

2.3 喷码内容：

IFR 18 650 P —1500mAh 3.2V THLB 18 I 15 000001
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

①The letter "IFR" defines Cylindrical Li-ion rechargeable cell
IFR "代表圆柱磷酸铁锂电池
②Indicates the diameter of the cell
代表电芯直径 18=18mm
③Indicates the overall height of the cell
代表电芯高度 650=65mm
④The letter "P" Power battery
"P"代表动力电池
⑤Indicates the capacity of the cell
代表电芯容量 1500mAh
⑥Indicates the voltage of the cell
代表电芯电压 3.2V
⑥The letter"THLB"difines ShandongTianhanNewEnergyTechnologyCo.,LTD
"THLB"代表 山东天瀚新能源科技有限公司
⑦Year of production
表示生产年份 18＝2018 年
⑧Month of production
表示生产月份 I＝9 月份
⑨Date of production
表示生产日期 15＝15 日
⑩Represents the production sequence code
表示生产顺序码

3.Cell Size(电芯尺寸)

H=65.3mm±0.2
Φ=18.3mm±0.2

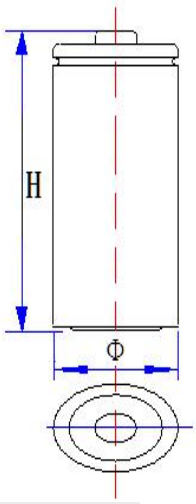

Figure A (图 A)

4. Construction （电芯结构）

A cell is made of cathode, anode, separator, steel can and header etc..

电芯由正极、负极、隔膜、钢壳和盖帽等组成。

5. Specification （标准）

序号	Item 项目	Specification 标准			Remarks 备注
5.1	Capacity 容量	Nomina 标称容量	1500	mAh	0.5C discharge
		Minimum 最小容量	1450	mAh	
5.2	AC-IR 交流内阻	max	40	mΩ	AC 1 kHZ
5.3	Nominal Voltage 标称电压		3.2	V	
5.4	Cell Weight 电芯重量	max.	44	g	
5.5	End-of-charge Voltage 充电限制电压		3.65±0.05	V	
5.6	End-of-charge Current 充电截止电流		30	mA	0.02C
5.7	End-of-discharge Voltage		2.5±0.05	**V**	

	放电截止电压				
5.8	Charging Time 充电时间		6	h	0.2C
			3	h	0.5C
5.9	Charge Method 充电方式	Standard 标准充电方式	750	mA	0.5C
		Maximum Charge Current 最大充电电流	1500	mA	1C
5.10	Standard Discharge Metho 标准放电方式		750	mA	0.5C
5.11	Max Continuous Discharge current 最大连续放电电流		4500	mA	3C
5.12	Cycle Life 循环性能	0.5C/1C	1500cycle （80%）		25±2°C
5.13	Operating Temperatur Range 操作温度范围	Charging Temp 充电温度	0～15	°C	≤0.2C
			15~2	°C	≤0.5C
			25~45	°C	≤1C
		Discharging Temp 放电温度	-20~60	°C	≤1 month ≤1 个月
		Storage Temp. 存储温度	-20~45	°C	≤3 months ≤3 个月
			0~25	°C	≤1 year ≤1 年
5.14	Shelf Life 保质期		1	year	
5.15	Appearance 外观	Without break, scratch, distortion, contamination, leakage and so on 无破裂、划痕、变形、污迹、电解液泄露等			
5.16	Cell Dimension 电芯尺寸	Diameter (max.): 直径（最大）：	18.50	mm	
		Height (max.) 高度（最大）	65.50	mm	

6. Test Conditions （测试条件）

6.1 Standard Test Conditions 标准测试条件

Unless otherwise specified, all tests stated in this Product Specification should be conducted at temperature 25°C±2°C and humidity 65%±20% RH.

若无特别要求，此规格书上的产品测试条件均为温度：25°C±2°C，湿度：65%±20% RH。

6.2 Standard Charge Method 标准充电方式

The "Standard Charge" means charging the cell at a constant current of 0.5C until the voltage is 3.65V, then charged at a constant voltage of 3.65V until its current is less than 0.02C.

—标准充电l即在环境温度为 25°C±2°C 的条件下，先以恒定电流 0.5C 充电至 3.65V，再以 3.65V 的恒压充电至电流小于 0.02C。

7. Electrical Characteristics （电性能）

	Test Item 测试项目	Test Method 测试方法	Criteria 检验标准					
7.1	Discharge Rate Capabilities 倍率放电性能	The cell is measured with the various discharge currents in right table to the cut-off voltage after the standard charge 电芯按规定 6.2 标准充电方式充电，按照右表不同电流放电至截止电压。	Discharge Conditio 放电条件					
			Current 放电电流	0. 5C	1C	2C	3C	5C
			Relative Capacity 相对容量	100%	95%	92%	90%	80%
7.2	Temperature Dependence of Discharge Capacity 不同温度放电性能	The cell is measured with discharge constant current 0.2C to the cut-off voltage with follow discharge temperature and rest time after the standard charging. 电芯按规定 6.2 标准充电方式充电，按右表不同温度和不同搁置时间以 0.2C 电流放电至截止电压。	Discharge temperature 放电温度	-20°C	-10°C	0°C	25°C	55°C
			Rest time 搁置时间	20H	10H	10H	2H	5H
			Cut-off voltage 截止电压	2.0V	2.5V	2.5V	2.5V	2.5V
			Relative Capacity 相对容量	40%	50%	70%	100%	95%
7.3	Normal Temperature Charge Retention and	Capacity after storage for 28d at 25°C±2°C after the standard charged measured with discharge current 0.5C			Retention 保持率		Regain 恢复率	

	Regain 常温荷电保持与恢复能力	to cut-off voltage. 电芯按规定 6.2 标准充电方式充电，25°C±2°C 储存 28d 后 0.5C 电流放电至截止电压测试容量保持和恢复。	Relative Capacity 相对容量	≥95%	≥98%
7.4	High Temperature Charge Retention and Regain 高温荷电保持与恢复能力	Capacity after storage for 7d at 60±2°C after the standard charged measured with discharge current 0.5C to cut-off voltage. 电芯按规定 6.2 标准充电方式充电，60±2°C 储存 7d 后 0.5C 电流放电至截止电压测试容量保持和恢复。		Retention 保持率	Regain 恢复率
			Relative Capacity 相对容量	≥90%	≥95%
7.5	Storage 储存	Capacity after storage for 90dat 25±2°C after the standard charged and then discharge for 2h at 0.5C, measured with charge and discharge current 0.5C to cut-off voltage. 电芯按规定 6.2 标准充电方式充电后以 0.5C 电流放电 2h，在 25±2°C 下储存 90d 后以 0.5C 电流充放电至截止电压。	Capacity recovery ≥95% nominal capacity 容量恢复率≥95%标称容量		
7.6	Cycle Life 循环寿命	Each cycle is an interval between 0.5C charge to3.65V with 0.02C cut-off and 1C discharge with 2.5V cut-off at 25±2°C. Capacity after 1500cycles 电芯以 0.5C 电流充电至 3.65V，0.02C 电流截止，以 1C 电流放电至 2.5V，在 25±2°C 下连续进行充放电循环 1500 次。	Capacity retention≥80% nominal capacity 容量保持率≥80%标称容量		

8. Mechanical Characteristic（机械性能）

	Test Item 测试项目	Test Method 测试方法	Criteria 检验标准
8.1	Drop Test 跌落测试	The cell drop onto the cement court from 1.5 m height at positive and negative directions, respectively1 time. And	No leakage, no fire, no explosion 电芯不泄露、不

		drop 2 times at a random direction of the cylindrical surface. 电芯由 1.5m 高的位置自由跌落至水泥地板上，从正\负两个端子方向各跌落 1 次，侧面随机跌落 2 次。	起火、不爆炸
8.2	Vibration Test 振动测试	The cell tested at 1.6mm max. excursion/1hertz/minute between 10hertz to 55hertz to 10hertz/90 to 100min or mutually perpendicular directions. 施加双振幅 1.6mm，频率变化率 1Hz/min，频率范围 10Hz～55Hz，往返振动 90～100min 测试电池分别随相互垂直的三个方向的振动。	No leakage, no fire, no explosion 电芯不泄露、不起火、不爆炸

9. Safety Test （安全测试）

All below tests are carried out on the equipments with forced ventilation and explosion-proof device. Before test, all cells should be charged in accordance with 6.2, and stored 24h prior for testing.

下述试验应在有强制排风条件及防爆措施的装置内进行，在试验前所有的电芯都按 6.2 规定 6.2 标准充电方式充电，并搁置 24h 后，再进行以下试验。

	Test Item 测试项目	Test Method 测试方法	Criteria 检验标准
9.1	Impact Test 重物冲击	A Φ15.8 mm bar is to be placed on the center othe cell and a 9.1kg weight is to be dropped from a height of 610 mm onto the cell, the distortion is allowed. 将 Φ15.8mm 的钢柱置于电池中心，重量 9.1kg 重锤自 610mm 高度自由落下冲击电芯，电芯允许发生变形。	No fire, no explosion 电芯不起火、不爆炸
9.2	Crush Test 挤压测试	The cell is to be crushed between two flat surfaces with 13 ±0.78kN pressure, and hold for 1min. 电芯置于两个挤压平面，增加压力至 13±0.78kN，保持压力 1min。	No fire, no explosion 电芯不起火、不爆炸
9.3	Heating Test 热冲击	Heat the standard charged cell at heating rate of 5°C±2°C per minute up to 130°C±2°C and remain for 30 min. 将电芯放在电热鼓风干燥箱中，温度以 5°C±2°C /min 的速率由室温升至 130°C±2°C 并保持 30min。	No fire, no explosion 电芯不起火、不爆炸
9.4	Overcharge Test（1C/12V） 过充电	Charge the standard charged cell with 1C current and 10V, until that last 7h at the voltage of 12Vor the voltage not increased. 对电芯以 1C 电流充电，直到输出电压不低于 12V，持续充电 7h 或电压不再增大。	No fire, no explosion 电芯不起火、不爆炸
9.5	Short-circuit Test 短路测试	Short-circuit the standard charged cell by connecting positive and negative terminal by less than 80±20mΩ wire	No fire, no explosion 电芯不起火、不爆炸

		until the cell surface temperature has returned to be 20% less then peak temperature. 短接电芯的正负极（线路总电阻 80±20mΩ）至电芯温度降至峰值 20%以下。	

10. Shipment （运输）

The capacity of delivery cell is approximately at 30%~40% of charging. It is not specified more than 30%~40% capacity remain at customer, because of self-discharge. During transportation, keep the cell from acutely vibration, impacting, solarization, drenching.

出货电芯处于 30~40%充电状态，由于电芯存在自耗，运送到客户端的电芯无法完全保证30%~40%荷电量。运输过程应防止剧烈振动、冲击、日晒雨淋。

11. Warranty （质量保证）

The warranty period of cell is made according to business contract. However, even though the problem occurs within this period, Tianhan won't replace a new cell for free as long as the problem is not due to the failure of Tianhan manufacturing process or is due to customer's abuse or misuse.

自出货之日起，电芯的保质期限依合同而定。但是，在此期限内，如果非天瀚公司的制程原因而是客户的误用造成的电芯质量问题，天瀚公司不承诺免费更换。

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

天瀚公司对违反安全守则操作所产生的问题不承担任何责任。

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

天瀚公司对与电路、电池组、充电器搭配使用所产生的问题不承担任何责任。

> Tianhan will be exempt from warrantee any defect cells during assembling after acceptance.

出货后客户在电芯组装过程中产生的不良电芯不在天瀚公司质量保证的范围之列。

12. Precautions and Safety Instructions （安全守则）

Lithium-Ion rechargeable batteries subject to abusive conditions 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。在使用锂离子充电电芯以前，请仔细阅读以下的安全守则：

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

注释 1.如果客户需要将电芯在该文件之外的条件下操作或应用，请先咨询天瀚公司相关事宜。

Note 2. Tianhan will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

注释 2.在该文件说明的条件之外使用该电芯而产生的事故，天瀚公司不承担任何责任。

12.1 Standard cell Precaution 电芯防范措施

a. Do not expose the cell to extreme heat or flame.
不要将电芯暴露在极热或有火星的环境中。

b. Do not short circuit, over-charge or over-discharge the cell.
不要将电芯短路，过充或过放。

c. Do not subject the cell to strong mechanical shocks.
不要使电芯承受过重的机械冲击。

d. Do not immerse the cell in water or sea water, or get it wet.
不要将电芯浸入海水或水中，或者使其吸湿。

e. Do not reverse the polarity of the cell for any reason.
不要颠倒电芯的正负极。

f. Do not disassemble or modify the cell.
不要拆卸或修整电芯。

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 with conspicuous damage or deformation.
不要使电芯受到明显的损害或变形。

i. Do not connect cell to the plug socket or car-cigarette-plug.
不要将电芯与插座连接。

j. Do not make the direct soldering onto a cell.
不要直接焊接电芯。

k. Do not touch a leaked cell directly.
不要直接接触泄漏的电芯。

l. Do not use for other equipment.

不要将电芯用于其它设备。

m. Do not use Lithium-ion cell in mixture.

不要将锂离子电芯混合使用。

n. Do not use or leave the cell under the blazing sun (or in heated car by sunshine).

不要将电芯放置在太阳光直射的地方。

o. Keep cell away from children.

将电芯放置在远离儿童的地方。

p. Do not drive a nail into the cell, strike it by hammer or tread it.

不要针刺、锤打或践踏电芯。

q. Do not give cell impact or fling it.

不要撞击或投掷电芯。

12.2 Cell Operation Instruction 电芯使用说明

12.2.1. Charging 充电

a. Charge the cell in a temperature range of 0°C to 45°C.

电芯充电温度范围为 0°C～45°C。

b. Charge the cell at a constant current of 0.5C until3.65V 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）。

c. Maintain charge voltage at 3.65V for 1 hour (recommended for maximum capacity).

保持恒压 3.65V 充电 1 小时（最大容量）。

* Cell must be charged with constant current-constant voltage method.

必须使用恒流恒压方式对电芯进行充电。

* Do not continue to charge cell over specified time.

不要超过标准时间持续充电。

12.2.2. Discharging 放电

a. Recommended cut-off voltage to 2.5V. Recommended max continuous discharge current is 5C. 建议放电终止电压为 2.5V，建议最大持续恒流放电电流为 5C 。

b. For maximum performance, discharge the cell in a temperature range of -20 °C to 60°C.

为了达到较好的性能，电芯的放电温度范围为-20°C ～ 60°C。

12.2.3. Storage Recommendations 储存建议

a. Short Period Storage 短期存放

•Storage the cell at temperature of –20 ~ 45°C（less than 3 months）, low humidity and no corrosive gas atmosphere.

如果短期存放（不超过 3 个月）电芯应储存在温度范围为–20 ～45°C，低湿度和不含腐蚀性气体的环境中。

•No press on the cell

不要让电芯承担任何压力。

b. Long Period Storage 长期存放

•In case of long period storage (more than 3 months), storage the cell at temperature range of 0 ~ 25°C,

low humidity, no corrosive gas atmosphere.

如果长期存放（超过 3 个月），电芯应存储在温度范围为 0～25°C，低湿度和不含腐蚀性气体的环境中。

•No press on the cell

不要让电芯承担任何压力。

13. Consultation （技术咨询）

As to the obscurity, contact the following:

Addrss: **No.1866,WuYiShan Road Hi-tech District ,ZaoZhuang, Shandong, China**

Tel No.: 86-632-8015263/8059888

Website: Http://www.thbattery.com

如有疑问，请按以下方式咨询：

厂址：中国山东省枣庄市高新区武夷山路 1866 号

电话：86-632-8015263/8059888

网址：Http://www.thbattery.com

14. 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 with Tianhan 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，请先咨询天瀚公司相关事宜。