



浙江天能能源科技股份有限公司

ZHEJIANG TIANNENG ENERGY TECHNOLOGY CO., LTD.

锂离子电芯规格书

Specification for Lithium-ion Rechargeable Cell

电芯型号： ITR 18650-2000F

Cell Type: ITR 18650-2000F

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1. 基本信息 General Information

1.1 适用范围 Scope

本规格书规定了由浙江天能能源科技股份有限公司生产的圆柱型锂离子电芯的技术要求，测试方法及注意事项，如需获取本规格书以外的技术要求，请与浙江天能能源科技股份有限公司联系相关事宜。

This specification describes the technical requirements of Cylindrical Lithium-ion Cell supplied by ZHEJIANG TIANNENG ENERGY TECHNOLOGY CO.,LTD. If any other technical information is needed, please contact ZHEJIANG TIANNENG ENERGY TECHNOLOGY CO.,LTD.

1.2 产品分类 Product Classification

圆柱型可充电锂离子电芯

Cylindrical Rechargeable Lithium-ion Cell

1.3 型号名称 Model Name

圆柱形 ITR 18650-2000F 电池

Cylindrical ITR 18650-2000F Cell

2. 产品测试要求 Test requirement and Standard

2.1 环境要求 The requirement of environment

除非另有规定，本规格书中各项试验应在标准大气条件下进行：温度：23℃~27℃；相对湿度：45%~85%；

Unless having additional statement, All tests in this specification will be done under standard atmosphere conditions: temperature:23℃~27℃； relative humidity: 45%~85%；

大气压力：86 kPa~106 kPa

Atmospheric pressure:86 kPa~106 kPa

2.2 测试设备要求 The requirement of measuring equipment

2.2.1 电流表和电压表 Amp-meter and volt-meter

电流表和电压表的精度需达到 0.5 mA 和 0.5 mV 或者更高。

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

2.2.2 游标卡尺 Slide caliper

游标卡尺精度要求 0.01 mm。

The slide caliper should have 0.01 mm scale.

2.2.3 内阻测试仪 Impedence meter

内阻测试仪使用的频率为 AC 1KHz。

The Impedence meter with AC 1KHz should be used.

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2.3 标准充电 Standard Charging Method

“标准充电”即在标准测试条件下，电芯先以恒定电流 0.2 C 充电至 4.2 V，再以 4.2 V 的恒定电压充电至电流小于 0.02 C，搁置 0.5h。

“Standard Charging” means that in standard test conditions, charge the cell at a constant current of 0.2 C until the voltage reaches 4.2 V, then charge it at a constant voltage of 4.2V until the current decreases less than 0.02 C and placed for 0.5 h.

2.4 标准放电 Standard Discharging Method

“标准放电”即在标准测试条件下，电芯以恒定电流 0.2C 放电至 2.75 V。

“Standard Discharging” means that in standard test conditions, discharge the cell at a constant current of 0.2 C until the voltage reaches 2.75 V.

3. 标准规格 Nominal Specification

项目 Item	规格 Specification	条件 Condition/ Note
3.1 标称容量 Nominal Capacity	Typical:2000 mAh Min:2000mAh	0.2C 放电容量 0.2C discharge capacity
3.2 交流内阻 AC Impedance	≤60 mΩ	在 1000 Hz 下测量 At AC 1000 Hz
3.3 标称电压 Nominal Voltage	3.6V	
3.4 电芯尺寸 Cell Size	18.3±0.2 mm	电芯直径 Cell Diameter
	65.0±0.2 mm	电芯高度 Cell Height
3.5 电芯重量 Cell Weight	45±1.5 g	
3.6 充电截止电压 End-of-charge Voltage	4.2 V 0.02C cut-off	恒流恒压充电 CC +CV Mode
3.8 充电方式 Charging Method	0.2 C at CC/CV	标准充电 Standard Charging
	0.5C at CC/CV	快速充电 Max Continuous Charging
3.9 放电截止电压 End-of-discharge Voltage	2.75 V	恒流放电 CC Mode
3.10 最大持续放电电流 Max continuous Discharging Current	2 A (1C)	
3.11 最大瞬时放电电流 Max Pulse Discharging Current	4 A (2C)	
3.12 使用温度范围 Operation Temperature	0 to 45°C	充电 Charge
	-20°C to 60°C	放电 Discharge

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3.13 存储温度 Storage Temperature	-20~60℃ -20~45℃ -20~25℃	一个月 1 month 三个月 3 months 一年 1year
3.14 外观 Appearance	无破裂、变形、电解液泄露等 Without break, distortion, leakage and so on	

4. 电性能 Electrochemical Performance

测试项目 Test Item	测试方法 Test Method	检验标准 Criteria
4.1 循环寿命 Cycle Life	电芯按 0.2 C CC/CV 充电后搁置 30 min, 然后以 0.2 C 恒流放电至 2.75 V 结束, 搁置 30 min, 再进行下一次循环。 Cell shall be charged at CC/CV mode(CC: 0.2 C, CV: 4.2 V, End-of-charge current: 0.02 C); After stored for 30 min, cell shall be discharged at CC mode(0.2 C, End-of-charge voltage: 2.75 V); After stored for 30 min, then go to the next cycle.	≥300 次@80 % ≥ 300times@80 %
4.2 倍率放电性能 High-rated Discharging Performance	电芯按 2.3 规定充电后, 室温下以 1 C 电流放电至终止电压。 Cell shall be charged per 2.3, and discharged at 1C to ending voltage at RT.	放电容量: ≥ 90% C _{ini} Discharge Capacity: ≥ 90% C _{ini}
4.3 低温性能 Low Temperature Performance	电芯按 2.3 规定充电后, 将电芯放入一定温度的低温箱中恒温 24 h, 然后以 0.2 C 电流放电至终止电压。 Cell shall be charged per 2.3 and stored in a temperature-controlled environment for 24h. Then discharged cell at 0.2C to ending voltage.	放电容量: Discharge Capacity: ≥ 65% C _{ini} (-20℃)
4.4 高温性能 High Temperature Performance	电芯按 2.3 规定充电后, 将电芯放入一定温度的高温箱中恒温 5 h, 然后以 0.2 C 电流放电至终止电压。 Cell shall be charged per 2.3 and stored in a temperature-controlled environment for 5h. Then discharged cell at 0.2C to ending voltage.	放电容量: Discharge Capacity: ≥ 95% C _{ini} (55℃)
4.5 常温存储 Room Temperature Storage Test	电芯按 2.3 规定充电后, 在 25℃ ±2℃ 下搁置 28 天, 再以 0.2C 恒流放电至终止电压。 Cell shall be charged per 2.3, then stored at 25℃ ±2℃ for 28 days. Finally discharged cell at 0.2 C to ending voltage.	容量保持率 ≥ 90 % Capacity retention ≥90% 容量恢复率 ≥ 95 % Capacity recovery ≥95%
4.6 高温存储 High Temperature Storage Test	电芯按 2.3 规定充电后, 在 55℃ ±2℃ 下搁置 7 天后, 室温搁置 5h, 再以 0.2 C 恒流放电至终止电压。 Cell shall be charged per 2.3, then stored at 55℃ ±2℃ for 7 days. After standing for 5h, discharged cell at 0.2 C to ending voltage.	容量保持率 ≥ 90 % Capacity retention ≥90% 容量恢复率 ≥ 95 % Capacity recovery ≥95%

注: C_{ini} 表示初始放电容量, 即电池按 2.3 和 2.4 进行充放电后得到的放电容量。

Note: C_{ini} represents the initial discharge capacity, which is obtained after the cell charged and discharged per 2.3 and 2.4.

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5. 环境特性 Environment Characteristic

测试项目 Test Item	测试方法 Test Method	检验标准 Criteria
5.1 恒温恒湿性能 Constant Temperature and Humidity Test	电芯按 2.3 规定充电后, 将电芯放入 $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($90\sim 95\%$ RH) 的恒温恒湿箱中搁置 48h 后取出, 在室温下搁置 2 h, 观察 1h。 Cell shall be charged per 2.3, and stored in $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($90\sim 95\%$ RH) for 48 h. Then be placed in RT for 2h and checked for 1h.	电芯无变形、无锈蚀、不冒烟、不爆炸 No distortion, no rust, no fume and no explosion.
5.2 温度循环测试 Temperature Cycling Test	电芯按 2.3 规定充电后, 放入恒温箱中, $75\text{ }^{\circ}\text{C}$ 下保持 6h, 30 min 内降至 $-40\text{ }^{\circ}\text{C}$, 保持 6h 后, 在 30 min 内升至 $75\text{ }^{\circ}\text{C}$ 。重复上述步骤 10 次。 Cell shall be charged per 2.3, and put into an incubator, remain for 6h at $75\text{ }^{\circ}\text{C}$. Temperature inside the oven will drop to $-40\text{ }^{\circ}\text{C}$ in 30 min and remain for 6h. Then it will rise to $75\text{ }^{\circ}\text{C}$ in 6h. Repeat this process for 10 times.	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.
5.3 低气压测试 Low-pressure Test	电芯按 2.3 规定充电后, 放入低气压箱中, 调节气压为 11.6 kPa, 温度为室温, 静置 6 h 后, 观察 1h。 Cell shall be charged per 2.3, then stored it for 6h at an absolute pressure of 11.6 kPa (RT). Check it for 1h.	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.
5.4 跌落测试 Drop Test	电芯按 2.3 规定充电后, 正负端子向下从 1.5 m 高度自由跌落到水泥地面上, 观察 1h。 Cell shall be charged per 2.3, then dropped from a height of 1.5 m onto the concrete ground. Positive and negative terminals of cells shall be towards the ground. Check it for 1h.	电芯不爆炸、不起火 No explosion, no fire.

6. 安全特性 Safety Characteristic

测试项目 Test Item	测试方法 Test Method	检验标准 Criteria
6.1 常温外部短路测试 Normal Temperature External Short-Circuiting Test	电芯按 2.3 规定充电后, 放置在 $20 \pm 2\text{ }^{\circ}\text{C}$ 的环境中, 待电池表面温度达到 $20 \pm 2\text{ }^{\circ}\text{C}$ 后, 再放置 30min, 将正、负极经外部短路, 外部线路电阻 $80 \pm 20\text{m}\Omega$; 当电池温度下降到比峰值低 20% 或短路时间达到 24h 后停止。 Cell shall be charged per 2.3, placed in an environment of $20 \pm 2\text{ }^{\circ}\text{C}$, remain for 30 min after the surface temperature of the battery reaches $20 \pm 2\text{ }^{\circ}\text{C}$, then short-circuited by connecting the positive and negative terminals with a resistance of $80 \pm 20\text{ m}\Omega$, When met any of the following criteria, stopping test. 1. The temperature drops to 20% lower than the peak value. 2. The time of short-circuiting test reaches 24h.	电芯不爆炸、不起火, 最高温度 $\leq 150\text{ }^{\circ}\text{C}$ No explosion, no fire, the maximum temperature $\leq 150\text{ }^{\circ}\text{C}$

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<p>6.2 高温外部短路测试 High Temperature External Short-Circuiting Test</p>	<p>电芯按 2.3 规定充电后，放置在 55 ± 2 °C 的环境中，待电池表面温度达到 55 ± 2 °C 后，再放置 30min，将正、负极经外部短路，外部线路电阻 $80 \pm 20\text{m}\Omega$；当电池温度下降到比峰值低 20% 或短路时间达到 24h 后停止。 Cell shall be charged per 2.3, placed in an environment of 55 ± 2 °C, remain for 30 min after the surface temperature of the battery reaches 55 ± 2 °C, then short-circuited by connecting the positive and negative terminals with a resistance of 80 ± 20 mΩ. When met any of the following criteria, stopping test. 1. The temperature drops to 20% lower than the peak value. 2. The time of short-circuiting test reaches 24h.</p>	<p>电芯不爆炸、不起火，最高温度 ≤ 150 °C No explosion, no fire, the maximum temperature ≤ 150 °C</p>
<p>6.3 过充电 Over-charge Test</p>	<p>电芯按 2.3 规定充电后，以 3C 电流充电至 4.6 V，当充电时间达到 7h 或电池温度下降到比峰值低 20% 后停止。 Cell shall be charged per 2.3, then charged at 3C to ending voltage of 4.6 V. When met any of the following criteria, stopping test. 1. The charging time reaches 7h. 2. The temperature drops to 20% lower than the peak value.</p>	<p>电芯不爆炸、不起火 No explosion, no fire.</p>
<p>6.4 强制放电测试 Mandatory Discharge Test</p>	<p>电芯按 2.4 规定放电后，以 1C 电流反向充电 90min。 Cell shall be discharged per 2.4, then reversed charging at 1C for 90 min.</p>	<p>电芯不爆炸、不起火 No explosion, no fire.</p>
<p>6.5 挤压测试 Crush Test</p>	<p>电芯按 2.3 规定充电后置于两个平面内，垂直于极板方向进行挤压，两平板间施加 13.0 ± 0.78 kN 的挤压力，一旦压力达到最大值即可停止挤压实验，实验过程中电池不能发生外部短路。 Cell shall be charged per 2.3 and placed in two planes, then crush the cell perpendicularly to the cell plate. When the pressure reaches 13.0 ± 0.78 kN, stopping crushing and check it for 1h.</p>	<p>电芯不爆炸、不起火 No explosion, no fire.</p>
<p>6.6 重物冲击测试 Impact Test</p>	<p>电芯按 2.3 规定充电后置于一平面上，并将一个直径为 $15.8 \pm 0.2\text{mm}$ 的钢柱横置在电池几何中心上表面，采用质量为 $9.1 \pm 0.1\text{kg}$ 的重物从 $610 \pm 25\text{mm}$ 的高处自由落体状态撞击放有钢柱的电池表面，观察 6h。 Cell shall be charged per 2.3 and placed on the plane, put the steel with diameter of 15.8 ± 0.2 mm on the geometric center of the cell, then using an object with a weight of $9.1 \pm 0.1\text{kg}$ to impact the cell with the steel on its surface from the height of 610 ± 25 mm. Check it for 6h.</p>	<p>电芯不爆炸、不起火 No explosion, no fire.</p>
<p>6.5 加热测试 (130 °C) Heating Test</p>	<p>电芯按 2.3 规定充电后，放置入温度箱，以 5 °C/min 的速率由室温升至 130 °C ± 2 °C，并保持 30 min 后停止加热，观察 1h。 Cell shall be charged per 2.3, then heated in an oven. Temperature will rise to 130 °C ± 2 °C at a rate of</p>	<p>电芯不起火，不爆炸 No explosion, no fire.</p>

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5 °C/min and remain for 30 min. Check it for 1h.

7. 存储与运输 Storage and Transportation

7.1 由于电芯的特性，需要对电芯进行合适的包装来保护。

Based on the character of cell, proper environment for transportation of pack need to be created to protect the battery.

7.2 运输过程应采取谨慎的预防措施以避免电芯在运输过程中损坏。

During transportation, careful precautions should be taken to avoid damage of cell.

7.3 电芯需在 0 °C-45 °C 的干燥、清洁、通风的环境下存储。

Cell should be kept at 0 °C-45°C in warehouse where it's dry, clean and well-ventilated.

7.4 装卸电池时需注意避免跌落、翻转和堆积。

During loading of battery, attention must be paid against dropping, turning over and serious stacking.

8. 安全守则 Precautions and Safety Instructions

为避免电芯泄露，过热和爆炸，请注意以下事项：

In order to prevent the battery leakage, getting hot and explosion, please pay attention to preventing measures as following:

警告！Warning!

- 请勿将电池投入水中。非使用时，电池需在干燥阴凉处存放。
Never throw the battery into water. Store it under dry, shady circumstance when not use.
- 请勿颠倒正负极使用。
Never misidentify the positive and negative terminals.
- 请勿直接用金属接通正负极，避免短路。
Never connect the positive and negative terminals of battery with metal to prevent short-circuiting.
- 请勿将电池与金属一起储存或运输。
Never ship or store the battery together with metal.
- 请勿敲击、投掷或踩踏电池。
Never knock, throw or trample the battery.
- 请勿用钉子或其它利器破坏电池。
Never cut through the battery with nail or other edge tool.

使用建议！Tips!

- 请勿在过高的温度下使用或储存电池，否则会引起电池过热，致使寿命减短和性能降低，甚至起火。

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Never use or store the battery under the over-high temperature. Otherwise it will lead to battery over-heating, which might lose some function and reduce life, even getting fire.

- 请勿将电池投入火中或其它热源中，避免起火、爆炸和环境污染。废电池需回收至供应商处，移交回收站处理。

Never throw the battery into fire or heating machine to avoid fire, explosion and environment pollution; scrap battery should be returned to the supplier and handled by the recycle station.

- 请勿将电池置于强静电场或强磁场中，否则会破坏保护设备。

Never use the battery under strong static electronic and magnetic field, otherwise it will destroy the protecting device.

- 若电解液泄露并进入眼睛，请勿揉捏，经水洗后尽快就医。

Never knead eyes if leakage electrolyte gets into eyes. Wash eyes by water and seek medical advice ASAP.

- 若电池在使用、储存、充电过程中发出异味，过热，形变或其他非常规情况，请停止使用并移除设备。

If battery emit peculiar smell, over-heating, distortion or appear any unconventionality during using, storage or charging process, please stop using and take it out of the device.

- 请勿在充电中直接插拔电池，并使用规定充电设备进行充电。

Never cut the battery in socket directly, please use the stated charger when charging.

- 使用前请检查电池电压和相关连接器；若有异常请勿使用。

Check the voltage of battery and relevant connectors before using. Do not use until everything turns out to be normal.

- 在充电前请检查相关设备绝缘性、物理状态和老化情况。电池电压需高于截止电压，如有异常，需标记并勿更改现状，然后通知我们售后服务部门，待我们工作人员到场维修。

Prior to charging, fully check the insulativity, physical condition and ageing status. The pack voltage must not be less than the cut-off voltage, if not, it needs to be labeled. The user should contact our Customer Service Department. It can't be charged until repaired by our staff.

- 电池需在 50 %SOC 下储存，若半年未使用，需重新充电。

The battery should be stored in 50% SOC. It needs to be charged once again if out of use for as long as half a year.

- 若电极端子污染，需用干净、干燥的棉布擦拭，否则会导致接触和操作不良。

Clean the dirty electrode with a clean dry cloth if any contamination appears, otherwise poor contact or operation failure may occur.

9. 公司地址 Company Address

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浙江天能能源科技股份有限公司

ZHEJIANG TIANNENG ENERGY TECHNOLOGY CO., LTD.

ZHEJIANG TIANNENG ENERGY TECHNOLOGY CO.,LTD.

地址：中国浙江省长兴县画溪工业园包桥路 18 号

Address: 18 Baoqiao Road ,Huaxi Industrial Zone, Zhicheng Industrial Zone,Changxing County,Zhejiang,China.

<http://www.tn-ny.com>

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