



HIGHSKY POWER INDUSTRY PRIVATE LIMITED

3nd Floor Plot:B-117,Sector-88,Noida 201306,(U.P.) India

WELSON POWER TECHNOLOGY (WUXI) CO.,LTD

B2-7 No.82 Dicui Road Binhu District Wuxi Jiangsu,China

SPECIFICATION FOR APPROVED

客户名称 Customer Name:

交付日期 Released Date:

产品名称 Product Name: Rechargeable Lithium-ion Cell

产品规格描述 Product Description: WSP-32700-6.0Ah(EV)

版本号 Version: Rev 1.1

发行日期 Date of Issue:

页数 Page: Page13

产品编码 Product Code:

证书 Certificate: ☒ BIS

抑制 Prepared by

技术审核 Reviewed by

批准确认 Approved by

Customer Approved



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1 基本信息 General Information

1.1 适用范围 Scope

This specification describes the technical requirements of Cylindrical Lithium-ion Cell supplied by Jiangsu Highsky/Welson Battery manufacturing Co.,Ltd If any other technical information is needed, please contact us.

1.2 产品分类 Product Classification

圆柱型可充电磷酸铁锂离子电池

Cylindrical Rechargeable Lithium-ion Cell

1.3 型号名称 Model Name

WSP-32700-6.0Ah (EV)

2 定义 Definition

2.1 标称容量 Rated capacity

指在 $25\pm 2^{\circ}\text{C}$ 环境下, 以 1.0C 放电至终止电压 2.0V 时的容量, 以 Cap 表示, 单位为毫安培时(mAh)。

Under $25\pm 2^{\circ}\text{C}$, It means the capacity value of discharging to end voltage 2.0V with constant current of 1.0C, which is signed Cap, the unit is mAh.

2.2 标准充电方式 Standard charge method

指在 $25\pm 2^{\circ}\text{C}$ 环境下, 以 0.5C 的电流恒流充电至单体电芯电压 3.65V 后, 转为恒压 3.65V 充电, 至充电电流小于 0.05C 时, 停止充电。

Under $25\pm 2^{\circ}\text{C}$, it can be charged to 3.65V with constant current of 0.5C, and then, charged continuously with constant voltage of 3.65V until the charged current is less than 0.05C.

2.3 标准放电方式 Standard discharge method

指在 $25\pm 2^{\circ}\text{C}$ 环境下, 以 1.0C 的电流恒流放电至单体电芯电压 2.0V。

Under $25\pm 2^{\circ}\text{C}$, it can be discharged to the voltage of 2.0V with constant current of 1.0C



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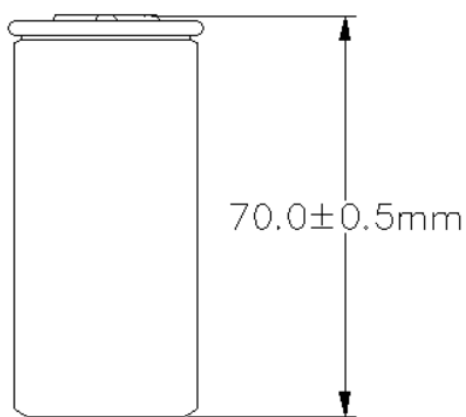
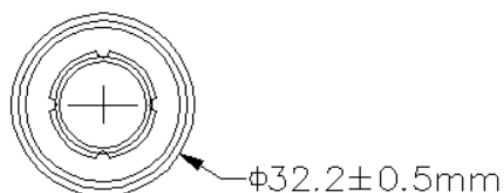
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3 电芯型号、尺寸、颜色 Cell type and dimenstions


3.1 电芯说明及型号 Description and model



Cell physical dimension listed Figure1(unit: mm)


电芯尺寸示意图 图 1（单位：mm）

NO	Items	Units: mm
1	Diameter/直径(D)	32.2±0.5
2	Height/高度(H)	70.0±0.5

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4 电芯特性 Cell specification

项目 Item Description	规格描述 Specification
标称容量 Rated Capacity	6000mAh@1.0C
最小容量 Minimum Capacity	6000mAh@1.0C
标称电压 Nominal Voltage	3.20V
充电方式 Charging Method	CC/CV
充电电压 Charging Voltage	3.65V
充电截止电流 End-of-Charge Current	CV Mode:0.05C (300mA)
放电终止电压 Discharge Ending Voltage	2.0V
标准充电电流 Standard Charge Current	0.5C(3000mA)
最大持续充电电流 Maximum Continuous Charge Current	3.0C(18000mA)
标准放电电流 Standard Discharge Current	1.0C(6000mA)
最大持续放电电流 Maximum Continuous Discharge Current	3.0C(18000mA)
最大脉冲放电电流 Maximum Pulse Discharge Current	6.0C(30s)
存储电压 Storage Voltage	3.20~3.30V
建议充放电SOC区间 Recommend SOC Window	10%~90%
操作温度范围 Operating Temperature Range	充电温度 Charging Temperature:0~60°C
	放电温度 Discharging Temperature:-20~60°C
	存储温度 (1年) Storage Temperature (1 year) :-20~45°C
交流内阻 AC Impedance	6~8mΩ (AC Impedance, 1000Hz)
重量 Weight	Approx 140g

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5 技术要求 Technical characteristics

5.1 电芯使用环境 Cell usage conditions

充电温度 Temperature of charge: 0~60℃

放电温度 Temperature of discharge: -20~60℃

5.2 电芯试验环境 Cell testing conditions

除非有特殊说明，所有测试的环境条件要求如下：

Unless otherwise specified, all tests stated according to following:

需在进货一个月测试 Cells should be tested within a month after purchase

测试前电芯循环次数不大于 5 次 Charge-discharge times of the testcells should be less than 5

温度 Temperature: 25±2℃

相对湿度 Relative Humidity: 15%~90%RH

大气压力 Atmospheric Pressure: 86 kPa~106 kPa

5.3 测量仪表要求 Requirement of the testing equipment

电压仪表要求：测量电压的仪表内阻不小于 10KΩ/V

Voltage meter: The voltage tester internal resistance is $\geq 10K\Omega/V$

温度仪表要求：测量温度的仪表精度不低于 0.5℃

Temperature meter: The precision is $\leq 0.5^\circ C$



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5.4 电性能 Electronic performance


No	Item	Standard	Test Condition
1	交流内阻 AC Impedance	$\leq 8\text{m}\Omega$	电芯按 2.2 规定充电后在 1000 Hz 下测量。 Cell shall be measured at 1000 Hz after charged per 2.2.
2	初始容量 (Cini) Initial Capacity	初始容量 $\geq 6000\text{mAh}$ Cini $\geq 6000\text{mAh}$	电芯按 2.2 规定充电后, 按 2.3 规定完全电。 Cell shall be charged per 2.2 and discharged per 2.3 after full discharge.
3	倍率放电能力 High-rated Discharging Performance	放电容量: Discharge Capacity $\geq 90\%$ Cini	电芯按 2.2 规定充电后, 在 $25\pm 2^\circ\text{C}$ 下以 3C 电流放电至终止电压。 Cell shall be charged per 2.2 and discharged at 3C to ending voltage at RT.
4	低温放电能力 Discharge ability at different temperature	Discharge capacity / Nominal capacity $\times 100\%$ $-10^\circ\text{C} \geq 70\%$	电芯按 2.2 标准充电后, 放置在 $-10\pm 2^\circ\text{C}$ 的温箱中 4 小时, 然后以 1.0C 恒流放电至 2.0V。 After standard charged per 2.2, the cell undergo a rest for 4h at $(-10\pm 2)^\circ\text{C}$, then is discharged by current 1.0C to cut-off voltage 2.0V.
5	常温循环寿命 Cycle Life at Room Temperature	2500 次容量保持率 $\geq 80\%$ Capacity retention @2500 $\geq 80\%$	电芯在 $25\pm 2^\circ\text{C}$ 下 0.5C 充电至 3.65V 后恒压充电至电流 $\leq 0.05\text{C}$, 然后搁置 30 分钟, 然后以 1.0C 恒流放电至 2.0V, 搁置 30 分钟, 再进行下一次循环, 连续 2500 次。 Cell shall be charged by current 0.5C to 3.65V, then kept at this voltage until the current is less than 0.05C at $25\pm 2^\circ\text{C}$; stored 30 minutes, then cell shall be discharged by current 1.0C to cut-off voltage 2.0V; After stored for 30 minutes, tests shall be continued for 2500 times.
6	常温存储容量保持和容量恢复测试 Capacity Retention and Capacity Recovery at Room Temperature Test	容量保持率 $\geq 90\%$ 容量恢复率 $\geq 95\%$ Capacity Retention $\geq 90\%$ Capacity Recovery $\geq 95\%$	电芯按 2.2 规定充电后, 在 $25^\circ\text{C} \pm 2^\circ\text{C}$ 下搁置 28 天后, 再以 1.0C 放电至 2.0V, 测试容量保持率。再按 2.2 规定充电后, 静置 30 分钟, 然后以 1.0C 放电至 2.0V, 测试容量恢复率。 Cell shall be charged per 2.2, then stored at $25\pm 2^\circ\text{C}$ for 28 days. Discharged to 2.0V at 1.0C, test capacity retention. then charged per 2.2, stored 30 minutes, Discharged to 2.0V at 1.0C, test capacity recovery.

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No	Item	Standard	Test Condition
7	高温存储容量保持和 容量恢复测试 Capacity Retention and Capacity Recovery at High TemperatureTest	容量保持率 $\geq 90\%$ 容量恢复率 $\geq 95\%$ Capacity Retention $\geq 90\%$ Capacity Recovery $\geq 95\%$	<p>电芯按 2.2 规定充电后，在 $55^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 下搁置 7 天后，再以 1.0C 放电至 2.0V，测试容量保持率。再按 2.2 规定充电后，静置 30 分钟，然后以 1.0C 放电至 2.0V，测试容量恢复率。</p> <p>Cell shall be charged per 2.2, then stored at $55\pm 2^{\circ}\text{C}$ for 7 days.Discharged to 2.0V at 1.0C,test capacity retention.then charged per 2.2,stored 30 minutes,Discharged to 2.0V at 1.0C,test capacity recovery.</p>

5.5 环境适应性能 Environmental characteristics

No	Item	Standard	Test Condition
1	低气压测试 Low-pressure Test	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.	电芯按 2.2 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 6h 后, 观察 1h。 Cell shall be charged per 2.2, then stored it for 6h at an absolute pressure of 11.6kPa (RT). Check it for 1h.
2	跌落测试 Drop Test	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.	电芯按 2.2 规定充电后, 正负端子向下从 1.5m 高度自由跌落到水泥地面上, 观察 1h。 Cell shall be charged per 2.2, then dropped from a height of 1.5m onto the concrete ground. Positive and negative terminals of cells shall be towards the ground. Check it for 1h.
3	浸泡测试 Soaking Test	电芯不爆炸、不起火 No explosion, no fire.	电芯按 2.2 规定充电后, 完全浸入 3.5 wt% NaCl 溶液中 2h, 观察 1h。 Cell shall be charged per 2.2, then completely soaking into NaCl solution (3.5 wt%) for 2h. Check it for 1h.
4	温度冲击性能测试 Thermal Shock Test	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.	电芯按 2.2 规定充电后, 放入温度箱中, 60min 内降至 -40 °C, 保持 90min 后, 在 60min 内升至 25 °C, 再在 90min 内升至 85 °C, 保持 110min, 然后在 70min 内降至 25 °C。重复上述步骤 5 次, 观察 1h。 Cell shall be charged per 2.2, and put into an oven. Temperature inside the oven will drop to -40°C in 60 minutes and remain for 90 minutes. Then it will rise to 25°C in 60 minutes and keep rising to 85°C in 90 minutes, following by remaining for 110 min. And it will drop to 25°C in 70 minutes. Repeat this process for 5 times, then check it for 1h.

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5.6 安全性能 Safety characteristics

No	Item	Standard	Test Condition
1	短路测试 External Short-Circuiting Test	电芯不爆炸、不起火。 No explosion, no fire.	电芯按 2.2 规定充电后，将正、负极经外部短路 10min，外部线路电阻应小于 50mΩ；静置 1h。 Cell shall be charged per 2.2, then short-circuited by connecting the positive and negative terminals with a resistance of <50mΩ for 10 min. Check it for 1h.
2	过充电测试 Over-charge Test	电芯不爆炸、不起火 No explosion, no fire.	电芯按 2.2 规定充电后，以 1.0C 电流充电至 5.5V 或充电达 1h 后停止充电，观察 1h。 Cell shall be charged per 2.2, then charged at 1.0C to ending voltage of 5.5 V or charged at 1.0C for 1h. Check it for 1h.
3	过放电测试 Over-discharge Test	电芯不爆炸、不起火、不漏液 No explosion, no fire, no leakage.	电芯按 2.2 规定充电后，以 1.0C 电流放电 90 分钟，观察 1h。 Cell shall be charged per 2.2, then discharged at 1.0C for 90minutes. Check it for 1h.
4	挤压测试 Crush Test	电芯不爆炸、不起火 No explosion, no fire.	电芯按 2.2 规定充电后，以半径为 75 mm 半圆柱体垂直电芯极板方向，以(5±1) mm/s 速度挤压，当电压为 0V 或变形量达到 30%或挤压力达到 13kN 后停止挤压，观察 1h。 Cell shall be charged per 2.2, then crush the cell perpendicularly to the cell plate at a rate of (5±1) mm/s with a semi-cylinder (radius of 75 mm). When met any of the following criteria, stopping crushing and check it for 1h. 1. Voltage reaches 0V; 2. Deformation reaches 30%; 3. Pressure reaches 13 kN.



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6 存储与运输 Storage and Transportation

- 6.1 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.
- 6.2 运输过程中需保证电芯带电量为 10%~50% SOC，以确保不受短路和液体的损伤。
During transportation, 10%~50% SOC must be kept to ensure that short circuit, appearance of liquid in the battery or immersion of battery in liquid never occur.
- 6.3 电芯需在-20°C-45°C 的干燥、清洁、通风的环境下存储。
Cell should be kept at -20°C-45°C in warehouse where it's dry, clean and well-ventilated.
- 6.4 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.

7 安全守则 Precautions and Safety Instructions

- 7.1 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:
- 7.2 **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.
 - 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。
长时间储存的温度范围建议是 10~45 °C。
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. The proposed temperature for long-term storage is 10~45°C.
 - 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



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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.

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8 有限责任和保证 Limited Warranty and Liabilities

8.1 保质期 Warranty Period

自电芯标识显示的制造日期之日起1年内（“保证期限”），电芯应符合本规格书的规定。在此保证期限内，Highsky/Welshon免费为客户更换不符合本规格书规定的电芯。

The cells shall comply with this specification within 1 year from the manufacture date as stipulated on cell marking (“Warranty Period”). In the Warranty Period, Highsky/Welshon will replace cells which fail to conform to this specification at no cost to Customer.

8.2 免责 Exclusion of Liability

在以下条件下，Highsky/Welshon 对客户因使用电芯而引起的任何损失不承担赔偿责任：

Under the following conditions, Highsky/Welshon will not take any responsibility incurred in any losses resulting from the use of cells:

a. 误用、滥用电芯或违反本规格书的规定使用电芯。

The cells are misused, abused or are used in any manner deviated or in breach of conditions as set out in this specification.

b. 非 Highsky/Welshon 原因导致的或 Highsky/Welshon 不能控制的原因导致的电芯不符合本规格书的规定。

The cells are rendered to be nonconforming to this specification for reasons caused by parties other than Highsky/Welshon or by circumstances beyond the control of Highsky/Welshon.


c. 出货后客户在电芯组装过程中，因加工产生的不良电芯不在质量保证的范围之列。

Manufacturer will be exempt from warranty any defect cells during assembling after acceptance.

8.3 有限保证 Limited Warranty

推荐客户完全按照此产品规格书上所描述的要求进行操作，或采用经过客户与Highsky/Welshon双方确认的其他条件。如果客户采用的操作方法既没有按照此规格书的要求，也没有经Highsky/Welshon同意，将导致产品质量保证不适用于此保质期期限。

Recommend to follow this specification to use. Or Customer can use an alternative operation method mutually agreed by Customer and Highsky/Welshon. Using a operation method neither according to this specification nor agreed by Highsky/Welshon in written will cause voiding of Limited Warranty.

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产品变更履历/ Product Modified Record List		
日期/ Date	变更点描述/ Problem and Solution	责任人/ Principal