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SPECIFICATION

规格书

Rechargeable Nickel Metal Hydride Cell

可充电镍氢电芯

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Revision History 修订履历

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1. Preface 序言

This product specification covers the requirements for the following sealed cylindrical rechargeable Nickel Metal Hydride cell type manufactured and delivered by **JYH Technology Co., Ltd.**

该文件标准包含了下述由江门市锦业华科技有限公司制造和交付的密闭圆柱可充电镍氢电芯型号的性能要求。

2. Product Description 产品描述

2.1	Product Name 产品名称	Sealed cylindrical rechargeable Nickel Metal Hydride cell 密闭圆柱可充电镍氢电芯
2.2	Model 型号	H2/3AAA400, correspond to IEC designation HRM 11/29 H2/3AAA400, 对应 IEC 标准名称 HRM 11/29
2.3	Description 描述	Flat top 2/3AAA 400mAh 1.2V NiMH cell 平帽 2/3AAA 400mAh 1.2V 镍氢电池

3. Ratings 额定参数

3.1	Nominal Voltage 标称电压	1.2V
3.2	Nominal Capacity 标称容量	400mAh
3.3	Typical Capacity 典型容量	420mAh after standard charge and standard discharge. 420mAh 标准充电和放电条件下.
3.4	Standard charge 标准充电	40mA for 16hrs. 40mA 充电 16 小时.
3.5	Fast Charge 快速充电	200mA for 2.2 hours. 200mA 充电 2.2 小时 -delta V cut-off controlled: 5mV. 压降切除控制: 5mV dT/dt controlled: 1°C per min. 温升速率控制: 1°C/分钟
3.6	Trickle charge 涓流充电	8mA to 16mA. 8mA 至 16mA.
3.7	Standard Discharge 标准放电	80mA to 1.0V. 80mA 放电到 1.0V.
3.8	Fast Discharge 快速放电	400mA to 1.0V. 400mA 放电到 1.0V.
3.9	Maximum Continuous Discharge Current 最大连续放电电流	1200mA
3.10	Operating Temperature 操作温度	Standard charge 标准充电 0°C to 40°C Fast charge 快速充电 10°C to 35°C Trickle charge 涓流充电 0°C to 40°C Discharge 放电 -20°C to 50°C
3.11	Storage Temperature 储存温度	< 1 year 小于 1 年 -20°C to 40°C < 3 months 小于 3 个月 -20°C to 40°C
3.12	Dimensions 尺寸	Diameter 直径 $10.5^{+0}_{-0.7}$ mm Height 高度 $29.0^{+0}_{-1.5}$ mm
3.13	Typical Weight 典型重量	7g

4. Performance 性能

Unless otherwise stated, tests should be conducted under the following conditions:

除非另作说明，测试应在下列条件下进行：

Time frame 时间期限	Within one month after delivery 交货后一个月内
Ambient temperature 环境温度	20°C ± 5°C
Relative Humidity 相对湿度	65% ± 20%

4.1 Initial Capacity 初始容量

Initial capacity is measured with a discharging current of 0.2C and a discharge final voltage of 1.0V within 1-4 hours after the standard charge. Up to five cycles are permitted for this test.

初始容量是指电芯在标准充电后 1-4 小时内，以 0.2C 电流放电至截止电压 1.0V 的放电容量。允许连续测试 5 次，任意一次达到要求即可停止测试。

Criteria: Discharge capacity ≥ nominal capacity.

标准：放电容量 ≥ 标称容量。

4.2 Open Circuit Voltage 开路电压

The open circuit voltage is measured within 1-4 hours after standard charge.

在标准充电后 1-4 小时内测量电芯的开路电压。

Criteria: Open circuit voltage ≥ 1.25V

标准：开路电压 ≥ 1.25V

4.3 Initial Internal Impedance 初始内阻

The initial internal impedance is measured at 1KHz within 1-4 hours after standard charge.

在标准充电后 1-4 小时内，用 1KHz 的频率测量电芯的初始内阻。

Criteria: Initial internal impedance ≤ 65mΩ

标准：初始内阻 ≤ 65mΩ

4.4 Fast Discharge Capacity 快速放电容量

Fast discharge capacity is measured with a discharging current of 0.5C to a discharge final voltage of 1.0V within one hour after standard charge.

快速放电容量是指在标准充电后 1 小时内，将电芯以 0.5C 电流放电至截止电压 1.0V 的放电容量。

Criteria: Discharge capacity ≥ 90% of nominal capacity

标准：放电容量 ≥ 标称容量的 90%

4.5 Charge Retention 荷电保持能力

After standard charge and storage time of 28 days at an ambient temperature of 20°C ± 2°C, the capacity is measured with a discharging current of 0.2C and a discharge final voltage of 1.0V.

荷电保持能力是指电芯完成标准充电后，先在 20°C ± 2°C 的环境中存放 28 天，然后以 0.2C 电流放电到 1.0V 终止电压的放电容量。

Criteria: Discharge capacity ≥ 60% of nominal capacity

标准：放电容量 ≥ 标称容量的 60%

4.6 Discharge Capacity at Low Temperature 低温放电容量

After the standard charge, the cell is stored at an ambient temperature of $0^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for not less than 16h and not more than 24h. The capacity is measured with a discharging current of 0.2C and a discharge final voltage of 1.0V.

经过标准充电后，电芯在 $0^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 的环境中存放 16-24 小时，再以 0.2C 电流放至截止电压 1.0V。

Criteria: Discharge capacity $\geq 80\%$ of nominal capacity

标准：放电容量 $\geq$ 标称容量的 80%

4.7 Leakage 泄漏性能

After standard charging and storage for 14 days at specified ambient temperature. Check cell appearance after storage.

电芯标准充电后，在规定的环境温度中存放 14 天。检查存放后的电芯外观。

Criteria: no leakage nor deformation.

标准：无泄漏或变形。

4.8 Cycle Life 循环寿命

According IEC 61951-2 edition 3.0 (2011-05), the test should be carried out in accordance with the conditions below:

基于 IEC 61951-2 3.0 版 (2011-05) 标准，循环寿命测试按照下述条件进行：

Cycle number 循环次数	Charge 充电	Stand in charged condition 充电态搁置时间	Discharge 放电
1	0.1C for 16h 0.1C 充电 16 小时	None 无	0.25C for 140mins* 0.25C 放电 140 分钟*
2-48	0.25C for 140mins 0.25C 充电 140 分钟	None 无	0.25C for 140mins* 0.25C 放电 140 分钟*
49	0.25C for 140mins 0.25C 充电 140 分钟	None 无	0.25C to 1.0V 0.25C 放电到 1.0V
50	0.1C for 16h 0.1C 充电 16 小时	1h to 4h 1-4 小时	0.2C to 1.0V 0.2C 放电到 1.0V

*: If the cell voltage drops below 1.0 V, the discharge may be discontinued.

如果电芯电压降到 1.0V 以下，放电可以中止。

** : It is permissible to allow sufficient open-circuit rest time after the completion of discharge at cycle 50, so as to start cycle 51 at a convenient time. A similar procedure may be adopted at cycles 100, 150, 200, 250, 400, 350, 400, 450. The test would be ended until the discharge time of any 50th cycle is less than 3 hours.

在第 50 次放电完毕后，允许有充足的开路搁置时间，以便在方便的时间启动第 51 次循环。在第 100、150、200、250、400、350、400 和 450 次循环可以采用相似的方法。任意一个第 50 次循环的放电时间少于 3 小时时测试结束。

Criteria: Cycle life is not less than 500 cycles.

标准：循环寿命不小于 500 次。

4.9 Overcharge 过充电

The overcharge test is measured with a discharge current of 0.2C and a discharge final voltage of 1.0V within 1-4 hours after charging for 48 hours at a current of 0.1C. Check cell appearance after overcharge.

过充电测试是以 0.1C 充电 48 小时，搁置 1-4 小时后以 0.2C 电流放电至截止电压 1.0V。检查过充电后的电芯外观。

Criteria: Discharge capacity $\geq 100\%$ of nominal capacity. And no leakage.
标准: 放电容量 $\geq$ 标称容量的 100%, 无泄漏。

4.10 Safety Device Operation 安全阀开启性能

This means the safety device of the cell will operate to allow the escape of gas if the internal pressure exceeds a critical value.

The cell shall be forced discharged at an ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ at a constant current of 0.2C to a final voltage of 0 V. The current shall then be increased to 1C and maintained in direction at the same ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 40 min.

该性能是指在内部气压超过临界值后, 电芯安全阀开启以允许气体外泄的性能。

电芯应在 $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 的环境中以 0.2C 电流强制放电至 0V, 然后将电流增加到 1C 继续放电 1 小时。

Criteria: Leakage and deformation may occur, however, no explosion is allowed.
标准: 允许泄漏和变形, 但不允许爆炸。

4.11 Vibration Test 振动测试

This means the endurance of the cell against vibrations. Charge the cell at standard charge mode and then store for 24hrs, check the voltage and impedance of cell before and after the vibration as the following conditions.

该性能是指电芯对机械振动的承受能力。电芯在标准充电后存放 24 小时, 然后按如下振动条件进行测试, 振动前后检查电芯电压和内阻性能。

Frequency 频率	10Hz - 55Hz
Vibration amplitude 振幅	1.5mm
Axes of vibration 轴向	3 mutually perpendicular axes 三个相互垂直的方向
Traversed time 时间	40minutes 40 分钟

Criteria: No fire, no explosion and no leakage.

Change of voltage $< 0.02\text{V}/\text{cell}$, change of internal impedance $< 5\text{m}\Omega/\text{cell}$.

标准: 无起火、爆炸、泄漏现象。

单只电芯电压变化 $< 0.02\text{V}$, 单只电芯内阻变化 $< 5\text{m}\Omega$

4.12 Drop Test 跌落测试

This means the endurance of the cell against drop. Charge the cell at standard charge mode and then store for 24hrs, check cell before and after the drop as the following conditions.

该性能是指电芯对跌落冲击的承受能力。电芯在标准充电后存放 24 小时, 然后按如下跌落条件进行测试, 跌落前后检查电芯电压和内阻。

Height 高度	100cm
Direction 方向	Not specified 无要求
Surface 基面	Wooden board with 3cm thickness 厚度 3cm 的木板
Drop times 跌落次数	3 times 3 次

Criteria: No fire, no explosion and no leakage.

Change of voltage $< 0.02\text{V}/\text{cell}$, change of internal impedance $< 5\text{m}\Omega/\text{cell}$.

标准: 无起火、爆炸、泄漏现象。

单只电芯电压变化 $< 0.02\text{V}$, 单只电芯内阻变化 $< 5\text{m}\Omega$

4.13 Short Circuit Test 短路测试

This means the endurance of the cell against external short circuit. Charge the cell at standard charge mode and then store for 1hr, short circuit the cell at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ until the cell temperature returns to ambient temperature. The resistance of leading wire for connecting shall not exceed 0.1Ω .

该性能是指电芯对外部短路的承受能力。电芯在标准充电后存放 1 小时，在 $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 环境中将电芯短路连接直到电芯表面温度恢复到室温。连接导线的电阻应不超过 0.1Ω 。

Criteria: Leakage and deformation may occur, however, no explosion is allowed.

标准: 允许泄漏和变形，但不允许爆炸。

5. 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、生锈和泄漏现象。

6. 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，对于因加工制造和材料原因导致的缺陷产品给予一年的保质期。

Storage 储存

- In order to ensure to maintain the capacity level, we suggest NiMH cells/batteries should be stored under the condition of the -20℃ ~ 40℃, low humidity, no corrosive gases.
为确保能维持容量水平, 建议镍氢电芯/电池储存在-20℃ ~ 40℃、低湿度、无腐蚀性气体的环境中。
- NiMH cells/batteries should avoid the high temperature or high humidity storage, otherwise it would lead to the cell/battery leakage, rust, and the lower capacity.
镍氢电芯/电池应避免高温高湿存放, 否则将导致电芯/电池漏液、生锈和低容。
- For NiMH cells/batteries after a long term storage, please charge and discharge for 1-3 cycles to recover its performance.
经过长期储存的镍氢电芯/电池, 需要经过 1-3 个充放电循环来恢复性能。
- During long term storage, periodic charging is needed when voltage of the battery fall to 1.05V or below. Every three months, discharge NiMH cells and batteries to 1.0V firstly and then charge to 40-50% of SOC. Recommend the charge and discharge current is at 0.2C or below.
长期存放期间, 当电池电压降低到 1.05V 或以下时需要对电池进行定期充电, 每三个月将镍氢电池先放电到 1.0V 后再充电到 40-50% 的荷电态。建议充放电电流为 0.2C 或以下。

Caution 注意事项

- The cells/batteries are delivered in half charged state or less, charge before use.
电芯/电池交付时带电量仅为二分之一或更低, 使用前请先充电。
- If cell/battery terminals become dirty, clean up them with a soft dry cloth prior to use.
若电芯/电池端子上有灰尘或脏污, 使用前请用柔软干燥的抹布擦净。
- Charge and discharge under specified ambient temperature in JYH specification.
在 JYH 产品规格书规定的环境温度下进行充放电。
- Turn off the equipment after use.
使用后应关闭设备的电源。
- Always discharge cells/batteries to a SOC of below 50% before bulk storage or shipment.
集中存放或运输电池时需要将电芯/电池放电至 50% 以下的荷电态。
- When the operating time of a battery becomes much shorter than its initial operating time even after recharged, it should be replaced to a new battery as its cell/battery life has ended.
电芯/电池的工作时间较初始工作时间明显缩短时, 说明寿命基本终结, 需要用新电芯/电池替换。

Warning 警告

- Never solder onto cells/batteries directly.
切勿直接在电芯/电池上焊锡。
- Short circuit leading to cell/battery terminals must be avoided.
应避免出现电芯/电池正负极端子之间的短路。
- Do not dispose of cells/batteries into fire or dismantled under any condition.
不得将电芯/电池投入火中或进行拆解。
- Cells/batteries reversal is not permitted.

禁止将电芯/电池反极使用。

- Store cells/batteries out of the reach of babies and children.
电芯/电池应储存在婴幼儿及儿童接触不到的安全地方。
- Use cells/batteries in extreme condition may affect the service life. such as: deep cycle, overcharge and over-discharge.
深度循环、过充和过放电等极限条件下使用电芯/电池会影响使用寿命。
- If cells/batteries leak fluid, change color, change shape, or change in any other way, stop using Immediately.
若出现漏液、变色、变形或其它形式的变化，须立即停用 电芯/电池。
- Do not mix different cell types and capacities in the same battery assembly.
切勿将不同型号和容量的电芯进行装配或混合使用。
- Never deform the positive terminal of cells or cover or obstruct its gas release structure.
切勿将电芯正极帽弄变形、覆盖或阻塞其气体泄放结构。
- Do not remove the outer tube from a cell/battery or damage it. Doing so will expose the battery to the risk of a short circuit, and may cause leakage of battery fluid, heat generation, explosion and fire.
切勿拆除或损坏电芯/电池外部绝缘管，否则将面临短路风险，可能导致电芯/电池出现漏液、发热、爆炸和起火等现象。
- Do not apply water, seawater or other oxidizing reagents onto cells/batteries, as this can cause rust and heat generation. If a cell/battery becomes rusted, the gas release vent may no longer operate, and can result in explosion.
切勿将水、海水或其它氧化剂泼到电芯/电池上，否则将导致电芯/电池生锈和发热。如果已经出现生锈，气体泄放安全阀可能已无法正常工作，可能导致爆炸的情况的出现。

First Aid Measure 应急措施

- Cells/batteries contain a strong colorless alkaline solution. The alkaline solution is extremely corrosive and will cause skin and eyes damage. If the skin or clothing comes in contact with fluid from battery, thoroughly wash the area immediately with clean water. If any fluid from a battery comes in contact with user's eyes, they should immediately flush their eyes and wash them thoroughly with clean water and consult a doctor urgently.
电芯/电池含有无色的强碱性溶液，具有很强的腐蚀性，会对皮肤和眼睛造成伤害。如果皮肤或衣服接触到了电芯/电池内泄漏出来的液体，需立即用清水进行彻底清洗。如果泄漏出来的液体接触到了用户的眼睛，需要立即用大量水进行冲洗，然后用清水进行彻底清洗并立即就医。