Specification for Lithium-ion Rechargeable Cell

锂离子电芯规格书

Cell Type（电芯型号）: C40

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Amendment Records
文件修订履历

Rev No. (版本)	Description 修订内容	Amendment pages 修订页次	Amendment Date 修订日期
A	初版发行	无	2021.06.23
B	文件编号更新，增加温度梯度充电方案，修改电芯包膜尺寸，低温放电搁置时间延长，增加45℃放电标准	5, 6, 8, 13	2021.07.21
C	更改端子为圆形端子	4	2021.08.05

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 HuiZhou EVE Energy Co., LTD.

本标准规定了由惠州亿纬锂能股份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： C40

2.3 Designation 名称：

EVE—— C 40

① ② ③

① The letter "EVE" defines Huizhou EVE Energy Co., LTD.
"EVE"代表惠州亿纬锂能股份有限公司。

② The letter "C" defines Aluminous Cylindrical Li-ion rechargeable cell.
" C "代表铝壳圆柱锂离子二次电芯。

③ The letter "40" defines the diameter of the cell.
"40"代表电芯直径为 40 mm。

3. Cell Size（电芯尺寸）

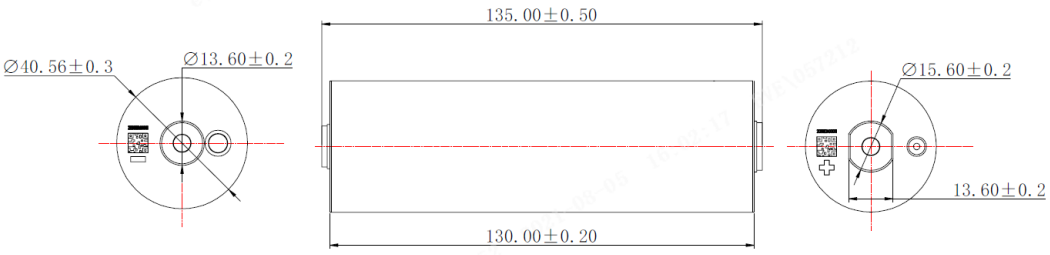

Figure A （图 A）

4. Construction （电芯结构）

A cell is made of cathode, anode, separator, aluminum can, cathode plate and anode plate etc.

电芯由正极、负极、隔膜、铝壳、正极盖板和负极盖板等组成。

5. Specification （标准）

Item 项目		Specification 标准			Remarks 备注
5.1	Capacity@3.65~2.5V 容量@3.65~2.5V	Nominal Capacity 标称容量	20000	mAh	0.33C discharge 0.33C放电
		Minimum 最小容量	19500	mAh	0.33C discharge 0.33C放电
5.2	AC-IR 交流内阻		≤3	mΩ	AC 1 kHz, 出货状态50%SOC
5.3	Cell Weight 电芯重量		364±10	g	
5.4	End-of-charge Voltage 充电限制电压		3.65	V	
5.5	End-of-charge Current 充电截止电流		1000	mA	0.05C
5.6	End-of-discharge Voltage 放电截止电压		2.5 2.0	V	T＞0℃ T≤0℃
5.7	Standard Charging current 标准充电电流		10000	mA	Temperature gradient charging scheme 温度梯度 充电方案
5.8	Fast charge 快速充电电流		20000	mA	1C
5.9	Standard Discharge current 标准放电电流		10000	mA	0.5C
5.10	Max Continuous Discharge current 最大连续放电电流		60000	mA	3C

Item 项目		Specification 标准			Remarks 备注
5.11	Operating Temperature Range（surface temperature of cell） 操作温度范围 （电芯表面温度）	Charging Temp. 充电温度	0~5	℃	≤5000mA
			5~10	℃	≤6000mA
			10~15	℃	≤8000mA
			15~45	℃	≤10000mA
			45~55	℃	≤10000mA
		Discharging Temp. 放电温度	-20~60	℃	
		Storage Temp. 存储温度	-20~50	℃	≤1 month ≤1个月
			-20~45	℃	≤3 months ≤3个月
			0~20	℃	≤1 year ≤1年
		Storage Humidity 存储湿度	≤70	% RH	
5.12	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			
5.13	Cell Dimension 电芯尺寸	Diameter: Φ40.56 ± 0.3 mm（coated） 直径：Φ40.56± 0.3 mm（包膜） Height : 135.0 ± 0.5 mm（pole contained） 高度：135.0 ± 0.5 mm（含极柱）			

Note：Temperature gradient charging scheme

注释：温度梯度充电方案

	SOC	Temperature Gradient 温度梯度				
		0℃~5℃	5℃~10℃	10℃~15℃	15℃~45℃	45℃~55℃
Charge Current 充电电流	100%	0.05C	0.05C	0.05C	0.05C	0.05C
	90%	0.15C	0.3C	0.4C	0.5C	0.5C
	80%	0.25C	0.3C	0.4C	0.5C	0.5C
	70%	0.25C	0.3C	0.4C	0.5C	0.5C
	60%	0.25C	0.3C	0.4C	0.5C	0.5C
	50%	0.25C	0.3C	0.4C	0.5C	0.5C
	40%	0.25C	0.3C	0.4C	0.5C	0.5C
	30%	0.25C	0.3C	0.4C	0.5C	0.5C
	20%	0.25C	0.3C	0.4C	0.5C	0.5C
	10%	0.25C	0.3C	0.4C	0.5C	0.5C
	0%	0.25C	0.3C	0.4C	0.5C	0.5C

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℃±2℃ 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℃±2℃；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 0.05C. For test purpose, charging shall be performed at 25℃±2℃

“标准充电”即在环境温度为 25℃±2℃ 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 0.05C。

6.3 Standard discharge method 标准放电方式

The "Standard Discharge" means discharging the cell at a constant current of 0.5C until the voltage is 2.5V. For test purpose, discharging shall be performed at 25℃±2℃

“标准放电”即在环境温度为 25℃±2℃ 的条件下，以恒定电流 0.5C 放电到 2.5V。

7. Electrical Characteristics （电性能）

<table>
<tr><th></th><th>Test Item
测试项目</th><th>Test Method
测试方法</th><th colspan="6">Criteria
检验标准</th></tr>
<tr><td rowspan="3">7.1</td><td rowspan="3">Discharge Rate Capabilities
倍率放电性能</td><td rowspan="3">The cell is measured with the various discharge currents in right table to the cut-off voltage after the standard charge.（2.5V）
电芯按照右表不同电流放电至截止电压（2.5V）</td><td colspan="6">Discharge Condition
放电条件</td></tr>
<tr><td>Discharge Current
放电电流</td><td colspan="2">1C</td><td colspan="3">2C</td></tr>
<tr><td>Relative Capacity Rate of 0.33C
相对 0.33C 放电容量比</td><td colspan="2">≥95%</td><td colspan="3">≥90%</td></tr>
<tr><td rowspan="3">7.2</td><td rowspan="3">Temperature Dependence of Discharge Capacity
不同温度放电性能</td><td rowspan="3">The cell is measured with discharge constant current of 1C to 2.5V with follow discharge temperature and rest for 6h after the standard charging.
电芯按右表不同温度搁置 6h，以 1C 电流放电至 2.5V (≤0℃时搁置 12h，1C 放电至 2.0V)</td><td>Discharge Temperature
放电温度</td><td>-20℃</td><td>-10℃</td><td>0℃</td><td>25℃/ 45℃</td><td>60℃</td></tr>
<tr><td>Standing Time
搁置时间</td><td>12h</td><td>12h</td><td>12h</td><td>6h</td><td>6h</td></tr>
<tr><td>Relative Capacity
相对容量</td><td>⩾ 70%</td><td>⩾ 85%</td><td>⩾ 90%</td><td>⩾ 100%</td><td>⩾ 95%</td></tr>
<tr><td rowspan="4">7.3</td><td rowspan="4">100% SOC Temperature Charge Retention and Regain
100% SOC 荷电保持与恢复能力</td><td rowspan="4">Capacity after storage at certain time and temperature after the standard charged measured with discharge current of 0.5C to cut-off voltage.Then capacity after 0.5C charge and 0.5C dischage for 3 cycles.
电芯按规定充电，以不同温度和时间存储后，以 0.5C 电流放电至截止电压测试容量保持容量，电芯以 0.5C 充电，再以 0.5C 放电循环 3 次，第三次为恢复容量</td><td>Storage Condition
存储条件</td><td colspan="2">Retention
保持率</td><td colspan="3">Regain
恢复率</td></tr>
<tr><td>30d，25℃</td><td colspan="2">⩾95%</td><td colspan="3">⩾97%</td></tr>
<tr><td>28d，45℃</td><td colspan="2">⩾90%</td><td colspan="3">⩾95%</td></tr>
<tr><td>28d，60℃</td><td colspan="2">⩾85%</td><td colspan="3">⩾90%</td></tr>
</table>

	Test Item 测试项目	Test Method 测试方法	Criteria 检验标准
7.4	Normal Temperature Cycle Life 常温循环寿命	Each cycle is an interval between 0.5C charges to 3.65V with 0.05C cut-off and 0.5C discharge with 2.5V cut-off at 25℃±2℃. Capacity after 2000cycles. 电芯以 0.5C 电流充电至 3.65V，0.05C 电流截止，以 0.5C 电流放电至 2.5V，25℃±2℃连续进行充放电循环 2000 次后，记录常温容量。	After 2000 cycles, Capacity retention≥70% Initial capacity 2000 周后容量保持率≥70%初始容量
7.5	45℃ Cycle Life 45℃循环寿命	Each cycle is an interval between 0.5C charges to 3.65V with 0.05C cut-off and 0.5C discharge with 2.5V cut-off at 45℃±2℃. Capacity after 1000cycles at 25℃. 电芯以 0.5C 电流充电至 3.65V，0.05C 电流截止，以 0.5C 电流放电至 2.5V，45℃±2℃连续进行充放电循环 1000 次，记录常温容量。	After 1000 cycles,Capacity retention≥70% Initial capacity 1000 周后容量保持率≥70%初始容量

8. Safety Test （安全测试）

All below tests are carried out on the equipment 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
8.1	Drop Test 跌落测试	A fully charged cell drop onto the cement floor from 1.5m height t in a vertical direction, then observed for 1h. 电芯从 1.5m 的高度以正负极柱的方向跌落至水泥地面，实验后放置至少 1h 后进行外观检查。	No explosion, no fire 不爆炸、不起火
8.2	Crush Test 挤压测试	A cell is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cells and the crushing is to be continued until an applied force of 13±1 KN is reached. Once the maximum force has been obtained is to be released. 将电芯置于挤压设备的两个挤压平面之间，用液压油缸或类似的力挤压，挤压面与电芯接触，逐渐增加压力至 13±1 KN 后停止。	No explosion, no fire 不爆炸、不起火
8.3	Heating Test 加热测试	A cell is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of 5 ℃±2 ℃ per minute to a temperature of 130 ℃±2 ℃ and remain for 30 min and observed 1h. 将电芯放在电热鼓风干燥箱中加热，温度以 5 ℃±2 ℃ /min 的速率由室温升至 130 ℃±2 ℃ 并保持 30min，观察 1h。	No explosion, no fire 不爆炸、不起火
8.4	Sea Water Immersion Test 海水浸泡	The cell was immersed in 3.5%Nacl solution (mass fraction, simulated seawater composition at normal temperature) for 2h. 将电芯完全浸入 3.5%Nacl 溶液（质量分数，模拟常温下的海水成分）中搁置 2h。	No explosion, no fire 不爆炸、不起火
8.5	Low Pressure Test 低气压	The cell cell was placed in a low pressure box, the pressure in the test box was adjusted to 11.6kPa, the temperature was room temperature, then standing and observed for 1h. 电芯放入低气压箱中，调节试验箱中气压为 11.6kPa，温度为室温，静置 6h，观察 1h。	No explosion, no fire, no leakage 不爆炸、不起火、不漏液

Test Item 测试项目		Test Method 测试方法	Criteria 检验标准
8.6	Over-discharge Test 过放电	Constant discharge with 1C current for 90min ，then observed for 1h. 以 1C 电流恒流放电 90min，观察 1h。	No explosion, no fire, no leakage 不爆炸、不起火、不漏液
8.7	Over-charge Test 过充电	Stop charging after charging with constant 1C current until reaching 1.5 times of the charging termination voltage stipulated by the enterprise or charging time reaching 1.5h. 以 1C 电流恒流充电至达到企业规定的充电终止电压的 1.5 倍，或充电时间达到 1.5h 后停止充电。	No explosion, no fire 不爆炸、不起火
8.8	Short-circuit Test 短路测试	Short-circuit the standard charged cell by connecting positive and negative terminal by less 5 mΩ wire, until the cell case temperature has returned to be 20% less then peak temperature. 短接电芯的正负极，外部线路总电阻＜5 mΩ，当电芯温度下降到比峰值低约 20%，结束实验	No explosion, no fire 不爆炸、不起火

9. Shipment （运输）

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

出货电芯处 50%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 50%荷电量。运输过程应防止剧烈振动、冲击、日晒雨淋。

10. Warranty （质量保证）

The warranty period of cell is made according to business contract. However, even though the problemoccurs within this period, EVE won't replace a new cell for free as long as the problem is not due to the failure of EVE 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，如果非亿纬公司的制程原因而是客户的误用造成的电芯质量问题，亿纬公司不承诺免费更换。

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

亿纬公司对违反安全守则操作所产生的问题不承担任何责任。

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

亿纬公司对与电路、电芯组、充电器搭配使用所产生的问题不承担任何责任。

> EVE 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亿纬公司质量保证的范围之列。

11. 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 EVE 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，请先咨询亿纬公司相关事宜。

Note 2. EVE 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，亿纬公司不承担任何责任。

11.1 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。

11.2 Cell Operation Instruction 电芯使用说明

11.2.1. Charging 充电

a. Charge the cell in an ambient temperature range of 0℃ to 55℃.

电芯充电环境温度范围为 0℃~55℃。

b. Charge the cell at a constant current of 10000mA until 3.65V is attained. Charge rates greater than 10000mA are not recommended.

以 10000mA 的电流恒流充电至 3.65V，超过 10000mA 的电流建议不要使用。

c. Maintain charge voltage at 3.65V for 1hour (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。

11.2.2. Discharging 放电

a. Recommended cut-off voltage to 2.5V. Recommended max continuous discharge current is 60000mA.

建议放电终止电压为 2.5V，建议最大持续恒流放电电流为 60000mA。

b. For maximum performance, discharge the cell in an ambient temperature range of -20℃ to 60℃.

为了达到较好的性能，电芯的放电环境温度范围为-20℃~60℃。

11.2.3. Storage Recommendations 储存建议

a. Short Period Storage 短期存放

- Storage the cell at temperature of -20℃ ~ 45℃（less than 3 months）, low humidity and no corrosive gas atmosphere.
  电芯短期存放（不超过 3 个月）应储存在-20℃~45℃温度范围，低湿度和不含腐蚀性气体的环境中。
- No press on the cell
  不要让电芯承受任何压力。

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℃, low humidity, no corrosive gas atmosphere.
  电芯长期存放（超过 3 个月）应存储在 0℃~25℃温度范围，低湿度和不含腐蚀性气体的环境中。
- No press on the cell

  不要让电芯承受任何压力。

12. Consultation （技术咨询）

As to the obscurity, contact the following:

Address: HuiZhou EVE Energy Co., Ltd.—EVE Industrial Park on No.38,Huifeng 7th Road, Zhongkai Hi-Tech Zone, Huizhou

Tel No.: 86-755-3270571

Fax No.: 86-752-2606033

Website: http://www.evebattery.com.cn

如有疑问，请按以下方式咨询：

厂址：惠州市亿纬锂能股份有限公司－惠州市仲恺高新区惠风七路 38 号

电话：86-755-3270571

传真：86-752-2606033

网址：http://www.evebattery.com.cn

13. 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 EVE 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，锂离子电池系统保护电路或高电流，快速充电和其它方面的特殊应用，请先咨询亿纬公司相关事宜。