



惠州亿纬锂能股份有限公司
EVE Power Co., Ltd.

文件编号
File NO.

RD-MF-0687-D09-01

产品型号
Product Model

MF-0687

版本
Version

1

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File Name

产品规格书 (91031516)
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MF-0687 产品规格书

MF-0687 Product Specification

(91031516)

编制/日期 Edited by/ Date	审核/日期 Reviewed by/ Date	批准/日期 Approved By / Date
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惠州亿纬锂能股份有限公司

EVE Energy Co., Ltd.

受控文件

2024-03-05



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Change History 变更履历


Version 版本	Date 日期	Contents 更改内容	Checked By 确认人
1	2024.02.29	First issue. 新版发行	YongMing Feng 冯勇铭

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Term Definition 术语定义

Term 术语	Definition 定义
Product 产品	Refers to rechargeable Prismatic MB30 (306 Ah) with adapter LFP Cell with aluminum shell manufactured by EVE Power Co., Ltd. (hereinafter referred to as EVE))in this specification. 本规格书中的“产品”是指湖北亿纬动力有限公司(以下简称 EVE)生产的 MB30 (306Ah) 带转接头可充电方形铝壳锂离子电池。
Customer 客户	Refers to the buyer in the product sales contract signed with EVE. 指与 EVE 签署产品销售合同中的买方。
Environment temperature 环境温度	Surrounding environmental temperature where the cell is located. 电池所处的周围环境温度。
Cell temperature 电芯温度	Temperature measure by the temperature sensor installed at the center of cell surface. 由温度传感器测量的电池大面或侧面中心的温度。
Rate 倍率 (C)	The ratio of the charge/discharge current to the rated capacity of the cell is indicated by the letter C. For example, if the cell capacity is 306Ah, when the charging or discharging current is 153A, the charging or discharging rate is 0.5C. 充/放电电流与电池的额定容量值的比率, 用字母 C 表示。例如, 电池容量为 306 Ah, 当充电或放电电流为 153 A 时, 则充电或放电倍率为 0.5 C。
State of charge 荷电状态 (SOC)	Under unloaded conditions, the ratio of the cell capacity state to the rated capacity measured in ampere-hours or watt-hours. The abbreviation is expressed by SOC. For example, if the capacity is 306Ah as 100% SOC, when the capacity is 0Ah, the SOC is 0%. 在无负载的情况下, 以安培小时或者以瓦特小时为单位计量的电池容量状态与额定容量的比值, 缩写用 SOC 表示。如: 若将容量为 306 Ah 的状态视为 100% SOC, 则容量为 0 Ah 时, SOC 为 0%。
Cycle 循环	The cell is charged and discharged in a cycle according to the prescribed charging and discharging standards. The cycle includes short-term normal charging or a combination of regenerative charging and discharging processes. In the charging process, sometimes there is only normal charging and no re-regenerative charging. The discharge can be formed by combining some partial discharges. 电池按规定的充放标准充放一次为一个循环。循环包括短时的正常充电或者再生充电和放电过程的组合, 在充电过程中有时只有正常充电而无再生充电的情况。放电可以由一些部分放电组合在一起形成。
Standard charge 标准充电	The charging mode described in 3.5 of this specification. 本规格书第 3.5 条所述的充电模式

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Standard discharge 标准放电	The discharge mode described in 3.6 of this specification. 本规格书第 3.6 条所述的放电模式。				
Open circuit voltage 开路电压 (OCV)	The voltage of the cell measured when unloaded or circuit is connected. The abbreviation is expressed by OCV. 没有接入任何负载和电路时测得的电池的电压，缩写用 OCV 表示。				
DC resistance 直流电阻 (DCR)	The ratio of the voltage changes of the cell to the corresponding current change under working conditions, the abbreviation is DCR. 工作条件下电池的电压变化与相应的电流变化之比，缩写用 DCR 表示。				
Module 模组	Lithium-ion batteries combined in series and parallel, intermediate products formed between single cell cells and PACK which are integrated with cell monitoring and management devices. 锂离子电芯经串并联方式组合，加装单体电池监控与管理装置后形成的电芯与 pack 的中间产品。				
Pulse current 脉冲电流	The current or voltage pulses that appear periodically are called pulse currents. The pulse currents appear either in the same direction or in alternating positive and negative directions. 以周期重复出现的电流或电压脉冲称为脉冲电流，脉冲电流或是以同一方向出现，或是以正、负交替变换方向出现。				
Compression force 压缩力	When the module is assembled, the battery bears the force perpendicular to the battery stacking direction. 模组组装时，电池可承受压缩力的安全边界。				
The unit of measurement 测量单位	“V” (Volt) 伏特， Voltage 电压单位 “A” (Ampere) 安培， Current 电流单位 “Ah” (Ampere-Hour) 安培-小时， Capacity 负荷单位 “Wh” (Watt-Hour) 瓦特-小时， Energy 能量单位 “Ω” (Ohm) 欧姆， Resistance 电阻单位 “mΩ” (Milliohm) 毫欧姆， Resistance 电阻单位 “°” (degree Celsius) 摄氏度， Temperature 温度单位 “mm” (millimeter) 毫米， length 长度单位 “s” (second) 秒， Time 时间单位 “Hz” (Hertz) 赫兹， Frequency 频率单位				

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1. Law and regulation requirement of product 产品法律法规要求

The customer's hazardous substance control requirements for this project are lower than the company's hazardous substance control standards. To comply with the EVE hazardous substance control requirements, the raw material supplier is required to provide a third-party RoHS test report to complete the product hazardous substance declaration.

该项目客户有害物质管控要求低于公司有害物质管控标准，按照 EVE 有害物质管控要求进行管控，需要要求原材料供应商提供第三方 RoHS 测试报告，完成产品有害物质宣告。

The customer does not have HSF requirements, and the batteries can meet the requirements of the battery directive.

客户无 HSF 要求，电芯满足电池指令要求即可。

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2. Cell Specification 电池规格参数

2.1.Fundamental Parameters 电池基本参数

Items 项目	Standards 标准	Remarks 备注	
Min. Capacity 最小容量	306 Ah	0.5C, 25±2□, 2.5-3.65V	
Min. Energy 最小能量	979.2Wh	0.5C, 25±2□, 2.5-3.65V	
Initial IR 初始内阻	0.18±0.05 mΩ	AC, 1 kHz, Delivery SOC Fresh cell 新鲜电池 出货SOC	
Nominal Voltage 标称电压	3.2 V	0.5C, 2.5~3.65V	
Weight 电池重量	5600 ±300 g	/	
Charging Cut-off Voltage 充电限制电压 (U _{max})	3.65 V	/	
Discharging Cut-off Voltage 放电截止电压 (U _{min})	2.5V (T>0□) 2.0V (T≤0□)	/	
Standard Charging Power 标准充电功率	0.5P	0.5P	
Standard Discharging Power 标准放电功率	0.5P	0.5P	
25□ Standard Cycle 25□标准循环	10000 Cycles	Applying 300±20kgf pre-pressure, 0.5C, 2.5~3.65V, Capacity retention rate ≥70%, 300±20 kgf 夹紧力下, 0.5 C, 2.5~3.65 V, 容量保持率 ≥70%,	
Charging Temperature 充电温度	0~60□	/	
Discharging Temperature 放电温度	-30~60□	/	
Storage Temperature 存储温度	1 year 1 年	Delivery SOC State 出货 SOC 状态	
	1 month 1 个月		
Welding Parameter of Al Busbar 铝巴焊接参数	Laser Welding Depth 激光焊接熔深	≤2 mm	/
	Max Pressure Force on Terminals 极柱承受最大压力	700 N	Max force in longitudinal direction, no deformation 极柱承受最大垂直力, 不发生变形
	Max Torque Force on Terminals 极柱承受最大扭矩	6 N · m	Max torsion, non-loosen 极柱承受最大扭矩, 不松动

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		Max Temperature on Terminals 极柱承受最大温度	130□	The maximum temperature the terminals can withstand, at which the plastic pads will not deform 极柱承受最大温度，塑胶垫不发生变形	

2.2.Product Parameters 产品规格

2.2.1. Dimension and Weight 尺寸、重量指标

No.	Items 项目	Standards 标准	Testing Methods 测试方法
1	Height (H) (including adapter) 高度 (H) (含转接头)	217.5±0.5 mm	3.8.1
	Height (h) (excluding adapter) 高度 (h) (不含转接头)	207.2±0.5 mm	
	Length 宽度 (L)	173.7±0.5 mm	
	Thickness 厚度 (T)	71.7±0.8mm	
2	Weight (Including blue film, can-top film) 重量(含蓝膜, 顶贴片)	5600 ±300 g	3.8.2

2.2.2. Electrical Performance Parameters 电性能指标

Items 项目	Specifications 规格			Testing Methods 测试方法
Rate Charge and Discharge Performance 倍率充放电性能	Items	Discharging energy 放电能量	Energy efficiency 能量效率	3.8.3.1
	Rate	E_1^*	$E_1^*/E_1 \geq 93.5\%$	
	0.5P 1P	$E_2^* \geq 95\% * E_1^*$	$E_3^*/E_3 \geq 87\%$	
High/Low Temperature Charge/Discharge Performance 高/低温充放电性能	Items	Discharging energy 放电能量	Energy efficiency 能量效率	3.8.3.2
	Rate	$E_4^* \geq 98\% * E_0^*$	$E_4^*/E_4 \geq 93\%$	
	45°C 5°C	$E_5^* \geq 80\% * E_0^*$	$E_5^*/E_5 \geq 76\%$	
Capacity Retention and Recovery 荷电保持与恢复 (100%SOC)	Items	Discharging energy retention 能量保持率	Discharging energy recovery 放电能量恢复率	3.8.3.3 3.8.3.4
	Rate	$E_6^* \geq 95\% * E_0^*$	$E_7^* \geq 97\% * E_0^*$	
	25°C & 28days 45°C & 7days	$E_8^* \geq 95\% * E_0^*$	$E_9^* \geq 97\% * E_0^*$	
Storage 存储性能 50%SOC	Items	Discharging energy recovery 放电能量恢复率		3.8.3.6 3.8.3.7
	Rate	$\geq 98\% * E_0^*$		
	25°C & 28days 45°C & 28days	$\geq 97\% * E_0^*$		
Cycle Life	25°C Cycle	10000 cycles, 70% SOH		3.8.3.5

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循环寿命		25□ 循环			

2.2.3. Safety Performance parameters 安全性能指标

No.	Items 项目	Standards 技术标准	Testing Methods 测试方法章节
1	Over Charge 过充电	No fire, No explosion 不爆炸、不起火	3.8.4.1
2	Over Discharge 过放电	No fire, No explosion 不爆炸、不起火	3.8.4.2
3	External Short-circuit 短路	No fire, No explosion 不爆炸、不起火	3.8.4.3
4	Extrusion Test 挤压	No fire, No explosion 不爆炸、不起火	3.8.4.4
5	Drop Test 跌落	No fire, No explosion 不爆炸、不起火	3.8.4.5
6	Low Pressure 低气压	No fire, No explosion, No leakage 不爆炸、不起火、不漏液	3.8.4.6
7	Heating 加热	No fire, No explosion 不爆炸、不起火	3.8.4.7
8	Thermal Runaway 热失控	No fire, No explosion 不爆炸、不起火	3.8.4.8

2.3.Out Appearance 外观

The cell should have none of obvious scratches, cracks, rust stains, discoloration, or electrolyte leakage, which have any defects that affect the commercial value of the cell.

电池应无明显擦伤、裂痕、锈渍、变色或电解液泄漏这类对电池商用价值有影响的缺陷。

3. Testing Conditions 试验条件

3.1.Environmental Conditions 环境条件

Unless otherwise specified, the test should be carried out in an environment with a temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, a relative humidity of 10%-90% RH, and an atmospheric pressure of 86 kPa to 106 kPa. The ambient temperature mentioned in this specification refers to 25 ± 2 .

除另有规定外，试验应在温度为 25 ± 2 ，相对湿度 10%~90%，大气压力为 86 kPa~106 kPa 的环境中进行。本规格书所提到的室温，是指 25 ± 2 。

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3.2.Measurement Instrument 测量设备

The accuracy of measuring instruments and meters should meet the following requirements:

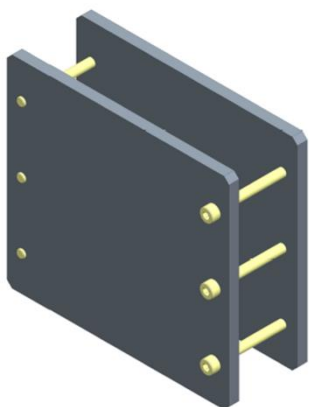
测量仪器、仪表准确度应满足以下要求:

- A. Voltage measuring device 电压测量装置: $\pm 0.05\%FS$;
- B. Current measuring device 电流测量装置: $\pm 0.05\%FS$;
- C. Temperature measuring device 温度测量装置: $\pm 1\%$;
- D. Dimension measuring device 尺寸测量装置: $\pm 0.01mm$;
- E. Weight measuring device 重量测量装置: $\pm 0.1g$.

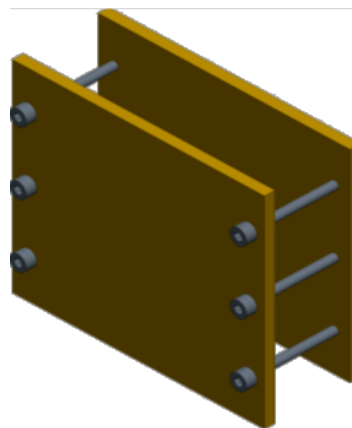
3.3.Testing Clamp Preparation 测试夹具准备

The single cell needs to be clamped with steel splints or aluminum alloy splints (thickness: 12mm). The splints need to cover the large surface of the cell. The splints are fixed with 6 M6 bolts. All sides of the splints need to be covered with insulating film. Fixtures as shown below:

单体电池需采用钢夹板（厚度：12 mm）固定，夹板需要覆盖住电池大面，夹板之间采用 6 个 M6 螺栓固定，夹具工装如下图所示：



Schematic diagram of cell clamp
夹具示意图



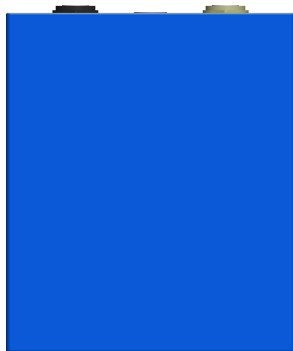
Insulation film of cell clamp
包绝缘膜夹具示意图

3.4.Testing Clamp Installation 测试夹具安装

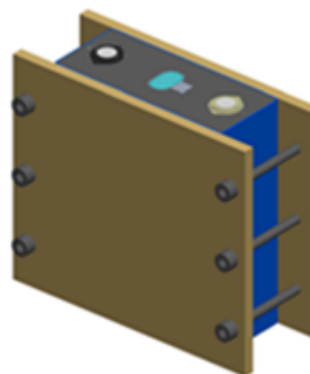
Place the cell (15~40%SOC) covered with blue film (material: PET, thickness 0.1mm) and top film (material: PC, thickness 0.3mm) in the middle of the clamp, and the initial compression force is (300 kgf \pm 20kgf).

将包覆有蓝膜（材质：PET，厚度 0.1 mm）和顶部贴片（材质：PC，厚度 0.3 mm）的电池（15~40%SOC）准备好后，置于夹具中间，每个螺栓初始预紧力为 300 \pm 20 kgf。

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Schematic diagram of cell coating
电池包膜示意图



Side view of cell shaft
电池上夹具图

3.5. Standard Charge 标准充电方式

Charge to 3.65V with a constant power of 489.6 W at an ambient temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
 在环境温度 $25 \pm 2^{\circ}\text{C}$ 的条件下，以 489.6 W 恒功率充电至 3.65V。

3.6. Standard Discharge 标准放电方式

Standard discharge is to Discharge to 2.5V with a constant power of 489.6 W at an ambient temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, discharge until the voltage reaches 2.5V, and rest for 30 minutes.

标准放电是在环境温度 $25 \pm 2^{\circ}\text{C}$ 的条件下，电池以 489.6 W 恒功率放电，放电至电压达到 2.5 V 截止，搁置 30 min。

3.7. Capacity and Energy Calibration 容量标定和能量标定

The capacity and energy calibration is to charge according to the (3.5) standard charge under the condition of an ambient temperature of $25 \pm 2^{\circ}\text{C}$, constant temperature and no convection, and then discharge according to the (3.6) standard discharge, First, repeat the standard charging method and discharge method 3 times making it active, and then repeat the standard charging method and discharge method 5 times. The average discharge capacity of the last 3 times is the 0.5C discharge capacity, the recorded discharge capacity is the calibrated capacity C_0 , and the average discharge energy of the last 3 times is the 0.5C discharge energy. Record the discharge energy as the calibration energy E_0 .

容量标定是在环境温度 $25 \pm 2^{\circ}\text{C}$ ，恒温无对流的条件下，对电池按照（3.5）标准充电方式进行充电，然后按照（3.6）标准放电方式进行放电。将标准充电方式和标准放电方式先进行预处理重复 3 次；再重复 5 次进行容量标定，以后 3 次的平均放电容量为 0.5 C 放电容量，记录放电容量为标定容量 C_0 ，以后 3 次的平均放电能量为 0.5 C 放电能量。记录放电能量为标定能量 E_0 。

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3.8. Testing Methods 测试方法

3.8.1. Dimension 尺寸

Testing Instrument 试验设备: Automatic wrapping machine 自动包膜机

Testing Method 试验方法:

Use the wrapping machine to measure the length, width and height of the battery.

使用自动包膜机测试电池长度、宽度和高度;

Test conditions 测试条件: 300kgf±20kgf 压力。

The thickness of the battery will increase as the SOC increases, and it will increase along with usage. The thickness here indicates the thickness of the battery at the time of shipmen.

电池厚度随着 SOC 增加会有所增加, 随着使用时间增加会有所增加, 此处厚度指出货时电池的厚度。

3.8.2. Weight 重量

Test Instrument 试验设备: electronic scale 电子秤

Test Method 试验方法: use the electronic scale to measure the weight of the battery.

使用电子秤测量电池的重量。

3.8.3. Electrical Performance 电性能

3.8.3.1. 25□ Rate Discharge Performance 25□倍率放电性能

Discharge the cell according to (3.6) at the ambient temperature of 25°C ±2°C;

Charge the cell to 3.65 V at a constant power of 489.6 W and rest for 30 min, note as E₁;

Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note as E₁*;

Charge the cell to 3.65 V at a constant power of 979.2 W and rest for 30 min, note as E₂;

Charge the cell to 3.65 V at a constant power of 489.6 W and rest for 30 min;

Discharge to 2.5 V at a constant power of 979.2 W and rest for 30 min, note as E₂*;

Discharge the cell to 2.5 V at a constant power of 489.6 W and rest for 30 min;

Charge the cell to 3.65 V at a constant power of 979.2 W and rest for 30 min, note as E₃;

Discharge to 2.5 V at a constant power of 979.2 W and rest for 30 min, note as E₃*;

Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min;

1P discharge energy retention rate = E₂ */ E₁*;

0.5P energy efficiency = E₁ */ E₁;

1P energy efficiency = E₃ */ E₃.

在环境温度 25□±2□的条件下, 对电池 (3.6) 初始化放电。

以 489.6 W 恒功率充电至 3.65V, 搁置 30 min, 记为 E₁;

以 489.6 W 恒功率放电至 2.5V, 搁置 30 min, 记为 E₁*;

以 979.2W 恒功率充电至 3.65V, 搁置 30 min, 记为 E₂;


以 489.6 W 恒功率充电至 3.65V, 搁置 30 min;

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<p>以 979.2W 恒功率放电至 2.5V，搁置 30 min，记为 E₂*；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min；</p> <p>以 979.2W 恒功率充电至 3.65V，搁置 30 min，记为 E₃；</p> <p>以 979.2W 恒功率放电至 2.5V，搁置 30 min，记为 E₃*；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min；</p> <p>1P 放电能量保持率= $E_2^*/E_1^* \times 100\%$；</p> <p>0.5P 能量效率= $E_1^*/E_1^* \times 100\%$；</p> <p>1P 能量效率= $E_3^*/E_3^* \times 100\%$；</p> <p>3.8.3.2. High/Low Temperature Discharge Performance 高/低温放电性能</p> <p>45□ Charge/discharge Performance 45□ 充放电性能</p> <p>Discharge the cell at the ambient temperature of 25°C ±2°C；</p> <p>Rest the cell for 5 h under the ambient temperature of 45°C ±2°C；</p> <p>Charge to 3.65 V at a constant power of 489.6 W and then rest for 30 min, note the energy as E₄；</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E₄*；</p> <p>Discharge energy retention rate = E_4^*/E_0^*, energy efficiency = E_4^*/E_4.</p> <p>在环境温度 25□ ± 2□ 的条件下，对电池初始化放电；</p> <p>在 45□ ± 2□ 条件下搁置 5h；</p> <p>以 489.6 W 恒功率充电至 3.65V，搁置 30 min，记为 E₄；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E₄*；</p> <p>放电能量保持率= $E_4^*/E_0^* \times 100\%$，能量效率= $E_4^*/E_4 \times 100\%$。</p> <p>5□ Charge-discharge Performance 5□ 充放电性能</p> <p>Discharge the cell at the ambient temperature of 25°C ±2°C；</p> <p>Rest the cell for 5 h at the ambient temperature of 5°C ±2°C；</p> <p>Charge to 3.65 V at a constant power of 489.6 W and then rest for 30 min, note the energy as E₅；</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E₅*；</p> <p>Discharge energy retention rate = E_5^*/E_0^*, energy efficiency = E_5^*/E_5.</p> <p>在环境温度 25□ ± 2□ 的条件下，对电池初始化放电；</p> <p>在 5□ ± 2□ 条件下搁置 5h；</p> <p>以 489.6 W 恒功率充电至 3.65V，搁置 30 min，记为 E₅；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E₅*；</p> <p>放电能量保持率= $E_5^*/E_0^* \times 100\%$，能量效率= $E_5^*/E_5 \times 100\%$。</p> <p>3.8.3.3. 25□ Capacity Retention and Capacity Recovery 25□ 荷电保持与恢复</p> <p>Charge the cell at the ambient temperature of 25°C ±2°C；</p> <p>Store the cell for 28 days at the ambient temperature of 25°C ±2°C；</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E₆*；</p> <p>Charge to 3.65 V at a constant power of 489.6 W and rest for 30 min, note as E₆；</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E₇*；</p>					
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Discharge energy retention rate = E_6^*/E_0^* ; Discharge energy recovery rate = E_7^*/E_0^* .

在环境温度 25 ± 2 的条件下，对电池初始化充电；

电池在 $25^\circ\text{C} \pm 2^\circ\text{C}$ 条件下储存 28 天；

以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E_6^* ；

以 489.6 W 恒功率充电至 3.65V，搁置 30 min，记为 E_6 ；

以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E_7^* ；

放电能量保持率 = $E_6^*/E_0^* \times 100\%$ ；放电能量恢复率 = $E_7^*/E_0^* \times 100\%$ 。

3.8.3.4. 45℃ Capacity Retention and Capacity Recovery 45℃ 荷电保持与恢复

Charge the cell at the ambient temperature of $25^\circ\text{C} \pm 2^\circ\text{C}$;

Store the cell for 7 days at $45^\circ\text{C} \pm 2^\circ\text{C}$ and rest for 5 h at $25^\circ\text{C} \pm 2^\circ\text{C}$;

Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_8^* ;

Charge to 3.65 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_7 ;

Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_9^* ;

Discharge energy retention rate = E_8^*/E_0^* ; Discharge energy recovery rate = E_9^*/E_0^* .

在环境温度 25 ± 2 的条件下，对电池初始化充电；

电池在 $45^\circ\text{C} \pm 2^\circ\text{C}$ 条件下储存 7 天，在 $25^\circ\text{C} \pm 2^\circ\text{C}$ 条件下搁置 5h；

以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E_8^* ；

以 489.6 W 恒功率充电至 3.65V，搁置 30 min，记为 E_7 ；

以 489.6 W 恒功率放电至 2.5V，搁置 30 min，记为 E_9^* ；

放电能量保持率 = $E_8^*/E_0^* \times 100\%$ ；放电能量恢复率 = $E_9^*/E_0^* \times 100\%$ 。

3.8.3.5. 25℃ Cycle life 25℃ 循环寿命

Before the test, prepare the fixture according to (3.3) When the SOC is 30%~40% at room temperature, install the test fixture according to the method of (3.4).

测试前按照 (3.3) 进行夹具准备，在常温下 30~40%SOC 时，按照 (3.4) 的方法安装测试夹具。


Capacity calibration is to discharge the cell according to at the ambient temperature of 25 ± 2 . Charge the cell at a constant power of 489.6 W to 3.65 V and rest for 30 min. Discharge the cell at a constant power of 489.6 W to 2.5V and rest for 30 min. Repeat 5 times and record the average of the last three charging energy as E_0 , the average of the last three discharging energy as E_0^* and the average of the last three discharging capacity as C_0^* .


容量标定是在 25 ± 2 的环境温度下，对电池初始化放电。以 489.6 W 恒功率充电至 3.65V，搁置 30min；以 489.6 W 恒功率放电至 2.5V，搁置 30min。重复 5 此，记录后 3 次充电能量平均值为 E_0 ，后 3 次放电能量平均值为 E_0^* ，后 3 次放电容量平均值为 C_0^* 。

Cycle test: ambient temperature 25 ± 2 ;

循环测试：环境温度 25 ± 2 ；

a. Discharge the cell in accordance with;

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<p>b. Charge the cell to 3.65 V at a constant power of 489.6 W and rest for 30 minutes;</p> <p>c. Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 minutes;</p> <p>d. Repeat steps b~c 10000 cycles.</p> <p>a. 对电池初始化放电;</p> <p>b. 以 489.6 W 恒功率充电至 3.65V, 搁置 30 min;</p> <p>c. 以 489.6 W 恒功率放电至 2.5V, 搁置 30 min;</p> <p>d. 重复 b~c 循环 10000 圈。</p> <p>Capacity test after cycling at ambient temperature of 25 ± 2:</p> <p>Charge the cell to 3.65 V at a constant power of 0.5P, rest for 30 min; Discharge to 2.5 V at a constant power of 0.5P, rest for 30 min; Charge the cell to 3.65 V at a constant power of 0.5P, rest for 30 min; Discharge to 2.5 V at a constant power of 0.5P, record the discharge capacity C_{11}^*. rest for 30 min; The capacity retention rate $= C_{11}^* / 306Ah \times 100\%$.</p> <p>在 25 ± 2 的环境温度下循环后容量测试: 以 489.6 W 恒功率充电至 3.65V, 搁置 30 min; 以 489.6 W 恒功率放电至 2.5V, 搁置 30 min; 以 489.6 W 恒功率充电至 3.65V, 搁置 30 min; 以 489.6 W 恒功率放电至 2.5V, 记录电池容量为 C_{11}^*, 搁置 30 min; 放电容量保持率 $= C_{11}^* / 306Ah \times 100\%$。</p> <p>When the cell is at 80% SOH and 70% SOH, modify the charging and discharging power according to the capacity of the cell: 100%~ 80% SOH, 489.6 W; 80%~70% SOH; 391.68W; 70%~ 60% SOH, 342.72W.</p> <p>电池在 80% SOH、70% SOH, 需按照电池容量, 修正充放电功率: 100%~ 80% SOH, 489.6 W; 80%~70% SOH; 391.68W; 70%~ 60% SOH, 342.72W。</p> <p>3.8.3.6.Storage at 25°C 25 存储</p> <p>Charge the cell at 25 ± 2°C;</p> <p>Discharge for 60 min at a constant power of 489.6 W and rest for 30 min;</p> <p>Store the cell for 28 days at 25 ± 2°C and rest for 5h at 25 ± 2°C;</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min;</p> <p>Charge to 3.65 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_8;</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_{10}^*;</p> <p>Charge energy recovery rate $= E_8 / E_0$, discharge energy recovery rate $= E_{10}^* / E_0^*$.</p> <p>在环境温度 25 ± 2 的条件下, 对电池初始化充电;</p> <p>以 489.6 W 恒功率放电 60min, 搁置 30 min;</p> <p>电池在 25 ± 2°C 条件下储存 28 天, 在 25 ± 2°C 条件下搁置 5h;</p> <p>以 489.6 W 恒功率放电至 2.5V, 搁置 30 min;</p> <p>以 489.6 W 恒功率充电至 3.65V, 搁置 30 min, 记为 E_8;</p> <p>以 489.6 W 恒功率放电至 2.5V, 搁置 30 min 记为 E_{10}^*;</p>					
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<p>充电能量恢复率= $E_8 / E_0 * 100\%$，放电能量恢复率= $E_{10} / E_0 * 100\%$。</p> <p>3.8.3.7.Storage at 45°C 45□存储</p> <p>Charge the cell at the ambient temperature of 25°C ±2°C;</p> <p>Discharge for 60 min at a constant power of 489.6 W and rest for 30 min;</p> <p>Store the cell for 28 days at the ambient temperature of 45°C ±2°C and rest for 5 h at the ambient temperature of 25°C ±2°C;</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min;</p> <p>Charge to 3.65 V at a constant power of 489.6 W and rest for 30 min;</p> <p>Discharge to 2.5 V at a constant power of 489.6 W and rest for 30 min, note the energy as E_{10}^*;</p> <p>Discharge energy recovery rate = E_{10}^* / E_0^*.</p> <p>在环境温度 25□±2□的条件下，对电池初始化充电；</p> <p>以 489.6 W 恒功率放电 60min，搁置 30 min；</p> <p>电池在 45°C ±2°C 条件下储存 28 天，在 25°C ±2°C 条件下搁置 5h；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min；</p> <p>以 489.6 W 恒功率充电至 3.65V，搁置 30 min；</p> <p>以 489.6 W 恒功率放电至 2.5V，搁置 30 min 记为 E_{11}^*；</p> <p>放电能量恢复率= $E_{11}^* / E_0^* * 100\%$。</p> <p>3.8.4. Safety Performance 安全性能</p> <p>3.8.4.1.Over Charge Test 过充电试验</p> <p>Charge the cell according to (3.5) at the ambient temperature of 2°C, and install the test clamp according to the methods in (3.4). Charge the cell to 5.475 V at a constant current of 306 A or for 1 hour, and then stop charging. Observe for 1 hour. (Refer to GB/T 36276 2018 Lithium Ion Battery for Electrical Energy Storage)</p> <p>在环境温度 25±2□的条件下，对电池按照标准充电方式（3.5）充满电，然后按照（3.4）的方法安装测试夹具。在安全试验环境温度 25±5□下电池以 306A 的电流恒流充电至 5.475 V 或充电时间达到 1 h，停止充电。观察 1 h。（参考 GB/T 36276-2018 《电力储能用锂离子电池》）</p> <p>3.8.4.2.Over Discharge Test 过放电试验</p> <p>Under the condition of an ambient temperature of 25□±2□, the cell is charged to 100%SOC according to (3.5) standard, and then install the test fixture according to (3.4). Under the condition of a safety test temperature of 25□±5□, the battery is discharging in constant current mode until the time reaches 90min or the voltage reaches 0V, and the discharge current is 1C. Observe for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)</p> <p>在环境温度 25±2□的条件下，对电池按照标准充电方式（3.5）充满电，然后按照（3.4）的方法安装测试夹具。在安全试验环境温度 25±5□下电池以 306 A 的电流恒流放电 90 min 或电压达到 0 V 时停止放电。观察 1 h。（参考 GB/T 36276-2018 《电力储能用锂离子电池》）</p>					
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3.8.4.3.External Short-circuit Test 外短路试验

Under the condition of an ambient temperature of $25 \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard, and then install the test fixture according to (3.4). Under the condition of a safety test temperature of $25 \pm 5^\circ\text{C}$, the positive and negative terminals of the cell are short-circuited externally for 10 minutes, and the resistance of the external circuit should be less than $5\text{m}\Omega$. Observe for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)

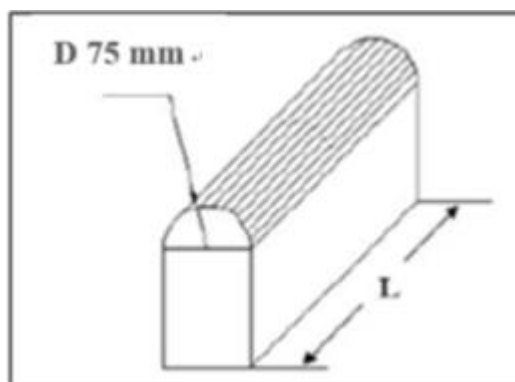
在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下, 对电池按照标准充电方式 (3.5) 充满电。在安全试验环境温度 $25 \pm 5^\circ\text{C}$ 下将电池正、负极经外部短路 10 min, 外部线路电阻值应小于 $5\text{m}\Omega$ 。观察 1 h。(参考 GB/T 36276-2018 《电力储能用锂离子电池》)

3.8.4.4.Extrusion Test 挤压试验

Under the condition of an ambient temperature of $25 \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard. Experiment according to the following conditions.

在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下, 对电池按照标准充电方式 (3.5) 充满电。按照如下条件进行试验:

- Extrusion direction: apply pressure perpendicular to the direction of the battery cell plate;
 - The form of the extruded plate: a semi-cylinder with a radius of 75mm, the length (L) of the semi-cylinder is greater than the size of the cell being extruded (refer to the figure below);
 - Extrusion speed: $(5 \pm 1)\text{mm/s}$;
 - Extrusion degree: stop extruding when the voltage reaches 0V or the deformation reaches 30% or the extruding force reaches $(13 \pm 0.78)\text{kN}$; Keep it for 10 minutes.
 - Observe it for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)
- 挤压方向: 垂直于电池极板方向施压;
 - 挤压板形式: 半径 75 mm 的半圆柱体, 半圆柱体的长度 (L) 大于被挤压电池单体的尺寸;
 - 挤压速度: $5 \pm 1\text{mm/s}$;
 - 挤压程度: 电压达到 0 V 或变形量达到 30% 或挤压力达到 $(13 \pm 0.78)\text{kN}$ 时停止挤压; 保持 10 min。
 - 观察 1 h。(参考 GB/T 36276-2018 电力储能用锂离子电池)



3.8.4.5.Drop Test 跌落试验

Under the condition of an ambient temperature of $25 \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard.

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Drop the positive or negative terminal of the battery cell from a height of 1.5m to the concrete floor once. Then observe it for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)

在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下，对电池按照标准充电方式（3.5）充满电。将电池正负极柱向下从 1.5 m 高度处自由跌落至水泥地面上。观察 1 h。（参考 GB/T 36276-2018 《电力储能用锂离子电池》）

3.8.4.6.Low Pressure Test 低气压试验

Under the condition of an ambient temperature of $25^\circ\text{C} \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard, and then install the test fixture according to (3.4). Then put the cell into the low-pressure box, adjust the pressure to 11.6kPa, make the temperature $(25 \pm 2)^\circ\text{C}$, stand for 6h, and then observe it for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)

在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下，对电池按照标准充电方式（3.5）充满电，然后按照（3.4）的方法安装测试夹具。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 1 h。（参考 GB/T 36276-2018 《电力储能用锂离子电池》）

3.8.4.7.Heating Test (130°C) 加热试验 (130°C)

Under the condition of an ambient temperature of $25^\circ\text{C} \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard. And put the battery into the temperature chamber, and the temperature chamber will rise from room temperature to $130^\circ\text{C} \pm 2^\circ\text{C}$ at a rate of $5^\circ\text{C}/\text{min}$, and keep this temperature for 30 minutes before stopping heating, then observe it for 1h. (Refer to GB/T 36276-2018 Lithium ion battery for electrical energy storage)

在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下，对电池按照标准充电方式（3.5）充满电。将电池放入温度箱，温度箱按照 $5^\circ\text{C}/\text{min}$ 的速率由室温升至 $130 \pm 2^\circ\text{C}$ ，并保持此温度 30 min 后停止加热。观察 1 h。（参考 GB/T 36276-2018 《电力储能用锂离子电池》）

3.8.4.8.Thermal Runaway Test 热失控试验

- (1) Under the condition of an ambient temperature of $25^\circ\text{C} \pm 2^\circ\text{C}$, the cell is charged to 100%SOC according to (3.5) standard.

在环境温度 $25 \pm 2^\circ\text{C}$ 的条件下，对电池按照标准充电方式（3.5）充满电。

- (2) Use a flat or rod-shaped heating device, and its surface should be covered with ceramic, metal or insulating layer. The heating power of the heating device should be in the range of 300-1000W. Complete the assembly of the battery cell and the heating device, the heating device should be in direct contact with the battery, and the size of the heating device should not be larger than the heated surface of the battery cell; Install a temperature monitor, and the detection point temperature sensor is arranged on the side of the principle heat conduction. That is installed on the opposite side of the heating device, the temperature data sampling interval should not be greater than 1s, the accuracy should be $\pm 2^\circ\text{C}$, and the diameter of the temperature sensor tip should be less than 1mm.

使用平面状或者棒状加热装置，并且其表面应覆盖陶瓷，金属或绝缘层，加热装置的功率要求为 300~1000W。完成电池单体与加热装置的装配，加热装置与电池应直接接触，加热装置的尺寸规格应不大于电池单体的被加热面；安装温度监测器，监测点温度传感器布置在远离热传导的一侧，即安装在加热装置的对侧(如下图)。温度数据的采

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样间隔应小于 1s，准确度要求为 $\pm 2\%$ ，温度传感器尖端的直径应小于 1 mm。

(3) After the battery is fully charged, continue to charge for 12 minutes at a constant current of 1C.

对电池单体用 1 C 电流继续充电 12 min。

(4) Start the heating device and continue to heat the test object with its maximum power. When thermal runaway occurs or the temperature of the monitoring point reaches 300°C, stop triggering and turn off the heating device.

立刻启动加热装置，并以其最大功率对电池单体进行持续加热，当发生热失控或者监测点温度达到 300°C 时，停止触发，关闭加热装置。

(5) Observe it for 1h, and whether thermal runaway occurs is determined according to the following conditions:

加热过程中及加热结束 1 h 内，如果发生起火、爆炸现象，则试验终止。

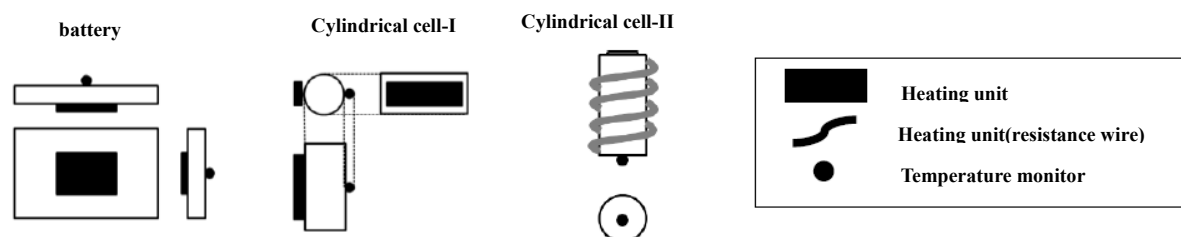
- a) The test object generates a pressure drop;
- b) The temperature of the monitoring point reaches the protection temperature of the battery;
- c) Temperature rise rate of monitoring points $\geq 1\text{ }^\circ\text{C/s}$;

- a) 测试对象产生电压降；
- b) 监测点温度达到电池的保护温度；
- c) 监测点的温升速率 $dT/dt \geq 1\text{ }^\circ\text{C/s}$

When a)&c) or b)&c) occurs, it is determined that the battery is thermally out of control. (Refer to GB/T 36276-2018

Lithium ion battery for electrical energy storage)

当 a)&c) 或者 b)&c) 发生时，判定发生热失控。（参考 GB/T 36276-2018 电力储能用锂离子电池）



Schematic diagram of thermal runaway experiment

热失控试验加热示意图

4. Charge and Discharge Parameters 充放电参数

4.1. Charge Mode 充电模式

Parameters 参数	Product Specifications 产品规格	Condition 条件
Standard charging current 标准充电电流	0.5C	$25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$
Maximum continuous	1C	$25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$

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charging current 最大可持续放电电流		
Standard charging voltage 标准充电电压	Single battery ≤ 3.65 V 单体电池 ≤ 3.65 V	
Standard charging mode 标准充电模式	Charge to 3.65V with a constant power of 489.6 W 以 489.6 W 恒功率充电至 3.65V	
Standard charging temperature 标准充电温度	25□ ± 2□	
Absolute charging temperature (battery temperature) 极限充电温度 (电池温度)	0□ ~ 60□	No matter what charging mode the battery is in, once the battery temperature exceeds the absolute charging temperature range, charging will stop 无论电池处于何种充电模式, 电池温度一旦超过极限充电温度范围, 即停止充电
Absolute charging voltage 极限充电电压	Max 3.8V 最大 3.8 V	No matter what charging mode the battery is in, once the battery voltage exceeds the absolute charging voltage, the charging will stop 无论电池处于何种充电模式, 电池电压一旦超过极限充电电压, 即停止充电

Note: In order to ensure the safe use of the whole life cycle and maximize the service life of the battery, the charging current (rate) must be adjusted according to the SOH (capacity attenuation) of the battery. The BMS should ensure this function, monitor the actual charging current (and allowable charging current limit), and trigger fault and protection functions when necessary.

注: 为确保全生命周期的使用安全并最大限度延长电芯使用寿命, 充电电流 (倍率) 必须要根据电芯的 SOH (容量衰减) 来进行调整。BMS 应确保具有该功能, 并对实际的充电电流 (和允许充电电流限制) 做监测, 并在必要的时候触发故障和保护功能。

4.2. Other charging modes 其它充电模式

4.2.1. Constant power charging 恒功率充电

Cell temperature / □ 电芯温度 / □	0	5	10	15	20	25	45	50	55	60
Max charging power 最大充电功率 (P) 0%~100% SOC	0.05	0.12	0.3	0.5	0.5	0.5	0.8	0.5	0.5	0

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4.3. Discharge Mode 放电模式

Parameters 参数	Product specifications 产品规格	Condition 条件
Standard discharge current 标准放电电流	0.5C	25□±2□
Maximum continuous discharge current 最大放电可持续电流	1C	25□±2□
Discharge cut-off voltage 放电截止电压	2.5 V	Temperature T > 0□ 温度 T > 0□
	2.0 V	Temperature T ≤ 0□ 温度 T ≤ 0□
Standard discharge mode 标准放电模式	Discharge to 2.5V with a constant power of 489.6 W 以 489.6 W 恒功率放电至 2.5V	
Standard discharge temperature 标准放电温度	25□±2□	
Absolute discharge temperature (battery temperature) 极限放电温度 (电池温度)	-35□~65□	No matter what discharge mode the battery is in, once the battery temperature exceeds the absolute discharge temperature range, the discharge should stop 无论电池处于何种放电模式, 电池温度一旦超出极限放电温度范围, 即停止放电
Absolute discharge voltage 极限放电电压	Min 1.8 V 最小 1.8 V	No matter what kind of discharge mode the battery is in, once the battery voltage is less than the absolute discharge voltage, the discharge should stop 无论电池处于何种放电模式, 电池电压一旦小于极限放电电压, 即停止放电

4.4. Other discharge modes 其它放电模式

Cell temperature /□ 电芯温度/□		-30	-20	-10	-5	0	5	45	50	55	60
Max discharging power 最大放电功率 (P)	0%~100% SOC	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0

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5. Safety Limits 安全限制

5.1. Voltage Limits 电压限制

Items 项目	Category 类别	Parameters 参数	Protective Action 保护动作
Charging Voltage 充电电压	Charging Ends 充电终止	3.65 V	When the cell voltage reaches 3.65 V, stop charging. 当电池电压达到 3.65V 终止充电。
	Third 三级	3.7V	BMS alarm BMS 系统报警
	Second 二级	3.75 V	Reduce battery charging current or power 降低电池充电电流或者功率
	First 一级	3.8V	Cut off the current, force the cell to stop working and lock the BMS until the technician solves the problem. 切断电流，强制使电池停止工作，并锁定电池管理系统，直至技术人员解决问题。
Discharging Voltage 放电电压	Discharging Ends 放电终止	2.5 V ($> 0^{\circ}\text{C}$) 2.0 V ($\leq 0^{\circ}\text{C}$)	When the cell voltage reaches 2.5 V (0°C) or 2.0 V ($\leq 0^{\circ}\text{C}$), stop charging. 当电池电压达到 2.5 V ($> 0^{\circ}\text{C}$) 或者 2.0 V ($\leq 0^{\circ}\text{C}$) 时终止充电。
	Third 三级	2.0 V ($> 0^{\circ}\text{C}$) 1.9 V ($\leq 0^{\circ}\text{C}$)	BMS alarm BMS 系统报警
	Second 二级	1.9 V ($> 0^{\circ}\text{C}$) 1.8 V ($\leq 0^{\circ}\text{C}$)	Reduce battery Discharging current or power 降低电池放电电流或者功率
	First 一级	1.85 V ($> 0^{\circ}\text{C}$) 1.75 V ($\leq 0^{\circ}\text{C}$)	Cut off the current, force the cell to stop working and lock the BMS until the technician solves the problem. 切断电流，强制使电池停止工作，并锁定电池管理系统，直至技术人员解决问题。

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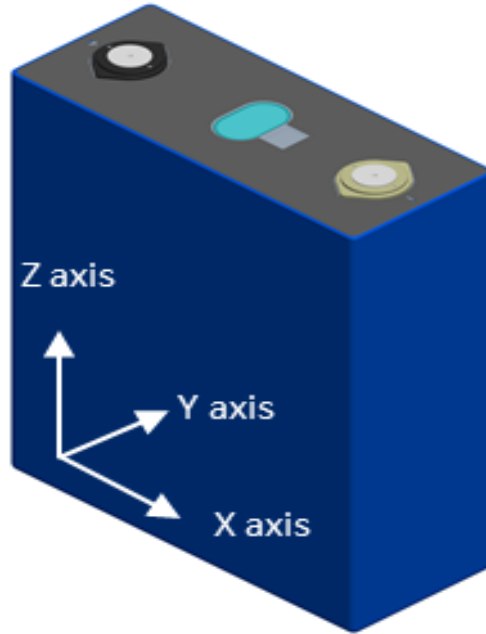
5.2. Temperature Limits 温度限制

Items 项目	Value 参数	Remarks 备注
Recommended Operating Temperature Range 推荐工作温度范围	10℃~45℃	Recommended battery usage temperature range. 推荐使用电池的温度范围
Maximum operating temperature 最高工作温度	60℃	If the battery temperature exceeds the maximum operating temperature, the power needs to be reduced to 0. 如果电池使用温度超过最高工作温度，功率需要降为0
Minimum operating temperature 最低工作温度	-30℃	If the battery temperature exceeds the minimum operating temperature, the power needs to be reduced to 0. 如果电池使用温度超过最低工作温度，功率需要降为0
Maximum safe temperature 最高安全温度	65℃	If the battery temperature exceeds the maximum safe temperature, it will cause irreversible and permanent damage to the battery, and the user should not use it higher than the maximum safe temperature. 如果电池使用温度超过最高安全温度，将会造成电池不可逆的永久性损坏，用户使用时不得高于最高安全温度
Minimum safe temperature 最低安全温度	-35℃	If the battery temperature exceeds the minimum safe temperature, it will cause irreversible and permanent damage to the battery, and the user should not lower the minimum safe temperature when using it. 如果电池使用温度超过最低安全温度，将会造成电池不可逆的永久性损坏，用户使用时不得低于最低安全温度

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6. Parameters Recommendation for Module Design 模组设计参数建议

6.1. Battery Directions 电池方向



6.2. Battery Compression Force 电池压缩力

When the module is assembled, the safety margin of the compressive force that battery can withstand. The test conditions are as follows:

模组组装时，电池可承受压缩力的安全边界。测试条件如下：

-Compression area 压缩面积：

173.7mm×204.4mm(L×H)

-Compression speed 压缩速度：0.02 mm/s

-Compression direction 压缩方向：Y direction

-Battery 电池 SOC：15 %~40 %

Items 项目	Compression Force 压缩力
Recommended compression force 推荐压缩力	3000 N ~7000 N
Instantaneous maximum compression force 瞬时最大压缩力	≤ 10000 N

The compression force of the cell shall be no larger than 10000 N, otherwise the cell may be damaged.

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电池承受的压缩力不能超过 10000 N，否则可能电池会受到损害。

6.3. Battery Expansion Force 电池膨胀力

6.3.1. Testing Conditions 测试条件

Before the test, prepare the fixture according to 3.3. When the SOC is 30%~40%, install the expansion force test fixture according to the method of 3.4.

测试前按照 3.3 进行夹具准备，在 30%~40%SOC 时，按照 3.4 的方法安装膨胀力测试夹具。

At ambient temperature

室温条件下

-Charge: 153 A constant current charge to 3.65 V, then constant voltage charge to cut-off current 15.3 A (0.05C), rest for 30 minutes.

-充电：153A 恒流恒压充电至 3.65 V，截止电流 15.3A (0.05C)，搁置 30min。

-Discharge: discharge at 153 A constant current to 2.5 V, and rest for 30 min.

-放电：153A 恒流放电至 2.5 V，搁置 30 min。

According to the charging and discharging conditions, cycle to 60% of the initial capacity, and record the battery expansion force before and after the cycles.

按照充电&放电条件，循环至初始容量的 60%，记录循环前后的电池膨胀力。

Customer shall fully consider the influence of the cell swelling force when designing the module. The product generates expansion force during use, and the expansion force is about 60000N when the cell capacity attenuates to 60% under the test conditions of 15mm steel plate+0.0mm GAP (the space for cells to expand). Customers shall consider the reliability of structural strength in the product design process, and it is suggested to reserve 2.0mm ~ 2.5mm expansion space while grouping the cells.

客户在设计模组时，应充分考虑电池膨胀力的影响。产品在使用过程中会产生膨胀力，电芯在 15mm 钢板+0.0mmGAP（可供电芯膨胀的空间）测试条件下衰减至 60%时膨胀力约为 60000N，客户在产品过程中需要考虑结构强度可靠性，建议电芯成组预留 2.0mm-2.5mm 的膨胀空间。

6.4. Recommended Temperature Control 温度管理建议

The recommended temperature collection points are the poles and the code when collecting temperature of the cell surface. The cell thermodynamic parameters needed in the thermal management system are shown in the following table.

对电池表面进行温度采集时，建议温度采集点布置在极柱或刻码。对热管理系统中所需要的电芯热力学参数见下表：

Mean thermal conductivity 导热系数均值	Thermal Conductivity (W/mK) 导热系数 W/mK	
	X/Z direction 方向	Y direction 方向
	9~11W/mK	2~3 W/mK
Mean heat capacity	Heat Capacity 热容 (kJ/(kg K))	

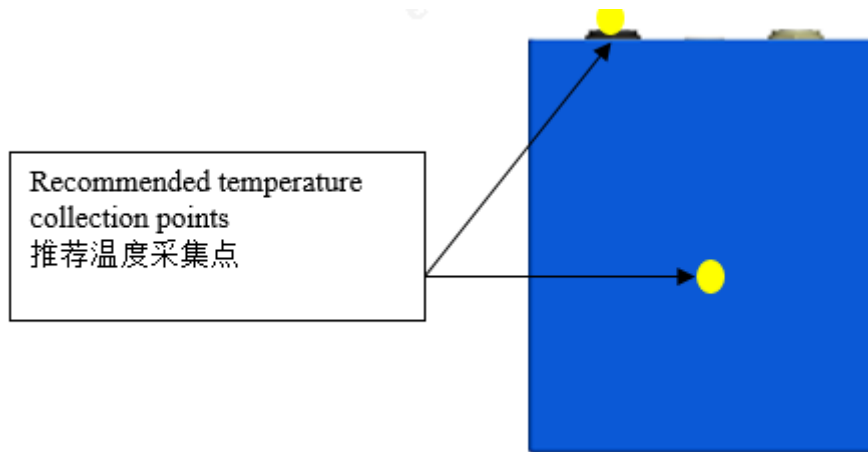
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热容均值			0.9~1.1kJ/(kg K)		

6.5. Recommended Temperature Collection Points 推荐温度采集点

(Battery temperature field distribution 电池温度场分布)

When collecting temperature on the battery surface, it is recommended that the temperature collection points to be arranged at the center of the positive pole and the large surface, as shown in the figure.

对电池表面进行温度采集时，建议温度采集点布置在极柱及大面中心处，如图。



6.6. Battery operation instructions and precautions 电池操作说明及注意事项

6.6.1. Product End-life Management 产品寿命终止管理

The battery life is limited. Customers should establish an effective tracking system to monitor and record the internal resistance and capacity of each battery during its life. The measurement method and calculation method of internal resistance and capacity need to be discussed and agreed between the customer and EVE Power Co., Ltd. When the internal resistance of the battery in use exceeds 150% of the initial internal resistance of the battery or the capacity is less than 60% of the nominal capacity (25□) or the end of battery life which both customer and EVE agree on is coming, the battery should not to be operated. Violation of this requirement will exempt EVE Power Co., Ltd. from its responsibility for product quality assurance in accordance with the product sales agreement and this specification.

电池使用期限是有限的，客户应建立有效的跟踪系统监测并记录每个使用期限内电池的内阻和容量。内阻及容量的测量方法和计算方法需要客户和 EVE 共同讨论和双方同意。当使用中电池的内阻超过这个电池最初内阻的 150% 或容量小于标称容量的 60% (25□) 或与客户达成一致的电池寿命末期，应停止使用电池。违反该项要求，免除 EVE 依据产品销售协议以及本规格书所应承担的产品质量保证责任。

6.6.2. Long-term Storage 长期存储

After the battery is charged, it should be used as soon as possible to avoid loss of usable capacity due to self-discharge. If storage is required, the battery needs to be stored in a low SOC state. The recommended storage conditions are 30%~40%SOC, 0~25□, ≤60%RH.

电池进行充电后，需尽快使用，以免因自放电而造成可用容量损失。若需要存储，则电池需要在低 SOC 态下进行存储。推荐的存储条件为：30%~40% SOC, 0~25□, ≤60% RH。

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6.6.3. Transportation 运输

Battery for shipping should be packed in boxes with the SOC of 30%~40%. The severe vibration, impact, extrusion, sun and rain should be prevented during shipping. Applicable methods of transportation include truck, train, ship, airplane, etc.


产品的运输应在 30%~40% SOC 下包装成箱进行。在运输过程中应防止剧烈振动、冲击或挤压、避免日晒雨淋。适用于汽车、火车、轮船、飞机等交通工具运输。

6.6.4. Instructions for 操作说明

- It is forbidden to inversely charge. Correctly connect the positive and negative poles of the battery, and reverse charging is strictly prohibited.
- 禁止反向充电，正确连接电池的正负极，严禁反向充电。
- It is forbidden to over-discharge. During the normal use of the battery, in order to prevent over-discharge, the battery should be charged regularly to maintain the voltage above 2.8 V.
- 禁止过放电，在电池正常使用过程中，为防止过放电，电池应定期充电，将电压维持在 2.8 V 以上。
- It is strictly forbidden to immerse the battery in water. When it is not in use, it should be placed in a cool and dry environment.

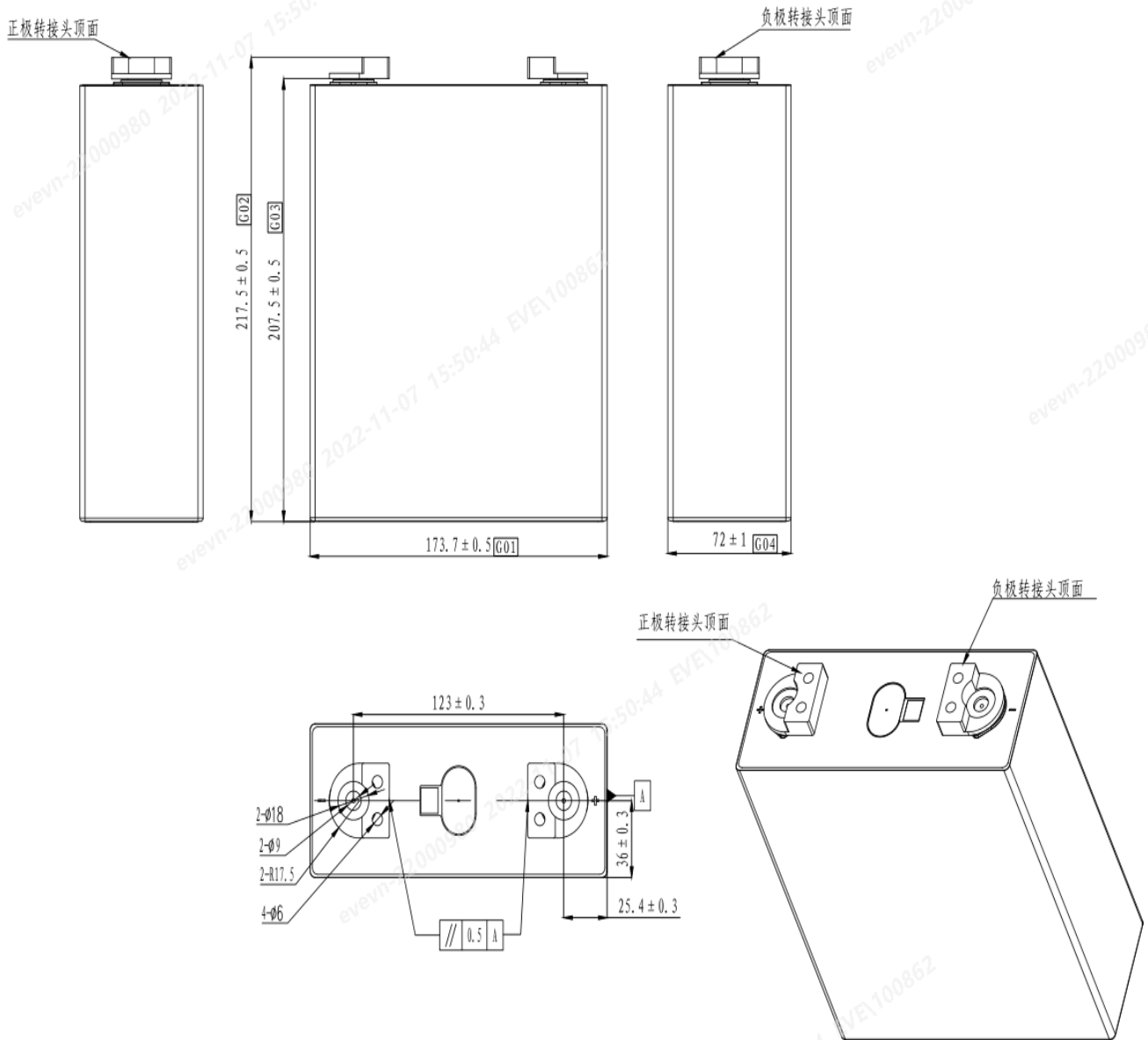
严禁将电池浸入水中，保存不用时，应放置于阴凉干燥的环境中。

- It is forbidden to use and leave the battery next to heat and high temperature sources, such as fire, heater, etc. 禁止将电池放在热高温源旁边，如火、加热器等使用和留置。
- Please use a special charger for lithium-ion batteries when charging. 充电时请选用锂离子电池专用充电器。
- During usage, it is strictly prohibited to reverse the positive and negative terminals of the battery. 在使用过程中，严禁将电池正负极颠倒。
- Do not throw the battery in the fire or heater. 禁止将电池丢于火或给电池加热。
- It is forbidden to use metal to directly connect the positive and negative terminals of the battery to short-circuit. 禁止用金属直接导通电池正负极。
- It is forbidden to transport or store the battery with metal, such as hairpins, necklaces, etc. 禁止将电池与金属，如发夹、项链等一起运输或贮存。
- It is forbidden to knock or throw, step on, or bend the battery. 禁止敲击或抛掷、踩踏和弯折电池等。
- It is forbidden to directly solder the battery. 禁止直接焊接电池。
- It is forbidden to directly pierce the battery with nails or other sharp objects. 禁止用钉子或其它利器刺穿电池。
- It is forbidden to use or place the battery under high temperature (under hot sunlight), such as in a car under direct sunlight or in a hot day.

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<p>不要使用处于极热环境中的电池，如阳光直射或热天的车内。</p> <ul style="list-style-type: none"> ● It is forbidden to use it in places with strong static electricity and strong magnetic fields. 禁止在强静电和强磁场的地方使用。 ● If the battery leaks and the electrolyte splashes on the skin, clothes, eyes, mouth, nose, etc., immediately wash the affected area with running water and send to a doctor for treatment immediately, otherwise it will cause serious harm to the human body. 如果电池漏液，电解液溅入到皮肤、眼睛、口、鼻等部位，应立即用大量清水冲洗，并马上送医治疗，否则会对人体造成严重伤害。 ● If the battery emits peculiar smell, heat, discoloration, deformation, or any abnormality during use, storage, or charging, stop using it. 如果电池出现异味、发热、变色、变形或使用、贮存、充电过程中出现任何异常时不得使用。 					
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7. Product size chart 产品尺寸图



Product size drawing

产品尺寸图

Appearance is smooth and beautiful、no deformation, surface without burr, dry, no trauma, no dirt;

外观光滑美观、不得变形、表面无毛刺、干燥、无外伤、无污物；

The polarity of terminal should be correct and clear;

端子极性标识应正确、清晰；

Support after welding tension is greater than (80±20kg.f) ;

支架焊接后拉力要求大于 (80±20kg.f) ；

After the support is welded, the position direction must be consistent with the direction shown.

支架焊接后，位置方向严格按照图示方向执行。

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8. Packaging guidelines 包装准则

8.1. Overall packaging requirements 整体包装要求

Product packaging should be well-protected, compact and reliable, economical, reasonable, and beautiful, to ensure that the product is not damaged or reduced product quality due to packaging during loading, unloading, transportation, and storage.

产品包装应作到防护周密、包装紧凑可靠，经济合理和美观大方，确保产品在装卸、运输过程中和存储有效期内，不因包装原因发生损坏和降低产品质量。

8.2. Packaging requirements of sample 包装基本要求

a. In order to protect the product's plastic, metal and other fundamentals from damage, the use of carton packaging products.

a. 为了保护产品之塑料、金属等基本而免受破坏，对产品使用纸箱包装。

b. In order to cushion the impact of the product during transportation, it is necessary to strengthen the protection of the product, and padded packaging is required.

b. 为了缓冲产品在运输过程中产生的冲力，要对产品加强保护，需加衬垫包装。

8.3. Packaging material specifications 包装材料规范

8.3.1. List of packing materials 包装材料清单

The list of module packing materials is shown in Table 1.

模组包材清单如表 1。

Table 1 List of packing materials

表 1 包装材料清单

No. 序号	Name of the packaging material 包装材料的名称	Composition of packaging materials 包装材料的材质	Quantity and unit of packaging materials 包装材料的数量及单位	Remark 备注
1	10134161- Corrugated cartons 10134161-瓦楞纸箱	X7X7X	0.25EA	
2	10134160- Anti-static pearl cotton 10134160-防静电珍珠棉	EPE anti-static EPE 防静电	0.25EA	
3	10134158- Anti-static pearl cotton 10134158-防静电珍珠棉	EPE anti-static EPE 防静电	0.25EA	
4	10056350 - desiccant 10056350-干燥剂	Silica gel particles 硅胶颗粒	0.25EA	
5	10034475 - carbon belt 10034475-碳带	Quan Shu Jiao 全树胶	0.001EA	
6	10029934- Blank label 10029934-空白标贴	PET	0.25 EA	
7	10090372- Box label 10090372-箱唛标签	PET	0.001ROL	
8	10040217- Category Nine labels 10040217-九类标签	Coated paper 铜版纸	0.278EA	

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No. 序号	Name of the packaging material 包装材料的名称	Composition of packaging materials 包装材料的材质	Quantity and unit of packaging materials 包装材料的数量及单位	Remark 备注		
9	10042981 - label paper 10042981-标签纸	PET	0.008EA			
10	10003977- Sealing tape 10003977-封箱胶带	PET	0.008 ROL			
11	10029882- Paper corner guard 1 10029882-纸护角 1	Kraft paper 牛皮纸	0.067EA			
12	10033322- Paper corner guard 2 10033322-纸护角 2	Kraft paper 牛皮纸	0.033EA			
13	10042232 - packing tape 10042232-打包带	PET	0.001ROL			
14	10023972 - wrap film 10023972-缠绕膜	PE	0.001ROL			
15	10055278- Self-sealing plastic bag 10055278-自封口胶袋	PE	0.25EA			
16	10034887 - pallet 10034887-栈板	plywood 胶合板	0.008EA			

8.3.2. The tray 托盘

Refer to QHZYW 2002-2019 Lithium Battery Packaging Specification (hereinafter referred to as the enterprise standard); Pallet technical standard refer to enterprise standard 3.1 Technical requirements for wooden cases and pallets, pallet inspection standard refer to GB/T4996-1996, pallet size tolerance refer to GB/T2934-1994.

Tray size 1300×1100×123mm, material; Plywood, as shown in Figure 1.

参考《Q HZYW 2002-2019 锂电池包装规范》(以下简称企标)规定; 托盘技术标准参考企标 3.1 木箱、托盘技术要求, 托盘检验标准参考 GB/T4996-1996, 托盘尺寸公差参照 GB/T2934-1994。

托盘尺寸 1300×1100×123mm, 材料: 胶合板, 如示图 1。

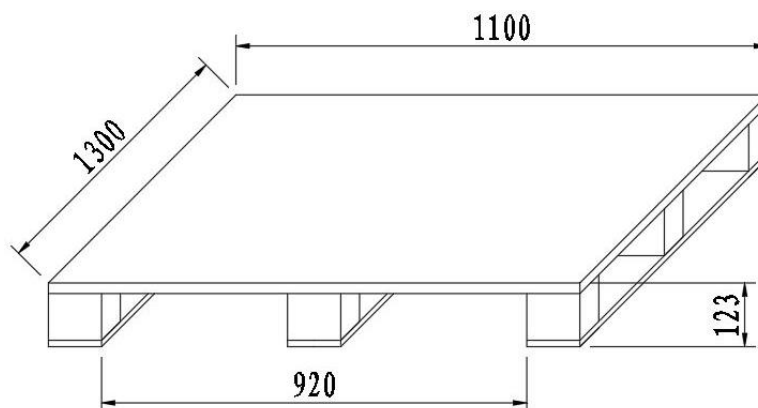


Figure 1 Schematic diagram of the card board

图 1 卡板示意图

8.3.3. Corrugated carton 瓦楞纸箱

According to the requirements of the enterprise standard, corrugated boxes using X7X7X double pit corrugated paper (230/140/230/140/230) g/m², gram weight 970±20g. Size: Outer size 520×254×275mm. Technical standards, quality and

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structure, test methods and testing rules of corrugated carton refer to the relevant requirements of enterprise standards 4.3, 4.4, 4.5 and 4.6. The carton storage and transportation drawings are printed in strict accordance with GB/T191-2008.

根据企标要求, 瓦楞纸箱采用 X7X7X 双坑瓦楞纸 (230/140/230/140/230) g/m², 克重 970±20g。尺寸规格: 外尺寸 520×254×275mm, 瓦楞纸箱的技术标准、质量与结构、试验方法及检测规则参考企标 4.3、4.4、4.5、4.6 的相关要求。纸箱储运图示标识严格按照国标 GB/T191-2008 印刷。

8.3.4. Anti-static pearl cotton 1, 2 防静电珍珠棉 1、2

Anti-static pearl cotton pad 1 size 505×239×15mm, anti-static pearl cotton pad 2 size 505×239×240mm, density 18kg/m³, anti-static coefficient 10⁹-10¹¹Ω, For the technical standards, quality and structure, test methods and testing rules of anti-static pearl-cotton, refer to the relevant requirements of enterprise Standards 8.2, 8.3 and 8.4.

防静电珍珠棉垫块 1 尺寸 505×239×15mm, 防静电珍珠棉垫块 2 尺寸 505×239×240mm, 密度 18kg/m³, 防静电系数 10⁹-10¹¹Ω, 防静电珍珠棉的技术标准、质量与结构、试验方法及检测规则参考企标 8.2、8.3、8.4 的相关要求。

8.3.5. You pack 打包带

Packing with material PET, fracture tension ≥6400N, fracture tensile rate ≤20%, skew ≤30mm/1.2m; Selection of specifications: width 16mm±2mm, thickness 1mm±0.5mm. When the pallet collection height h<1m, transverse packing belt is made for 2 channels, h>1m, hit 3; Make two vertical packing belts. Test enterprise standards with Packaging and detection Rules 11.5 Detection Rules.

打包带材质 PET, 断裂拉力≥6400N, 断裂拉伸率≤20%, 偏斜度≤30mm/1.2m; 选用规格: 宽度 16mm±2mm, 厚度 1mm±0.5mm。当托盘集合高度 h<1m 时, 横向打包带打 2 道, h>1m 时, 打 3 道; 纵向打包带打 2 道。打包带检测规则检测企标 11.5 检测规则。

8.3.6. Paper Angle protector 纸护角

Paper Angle guard specification: 45×45×5×L(unit: mm, 50mm is the section size, deviation ±2mm; 5mm section thickness, deviation ±0.5mm; L length), Angle 90° ±3°, vertical pressure ≥5000N(sample length 1m), horizontal pressure ≥830N(sample length 1m).

纸护角规格: 45×45×5×L(单位: mm, 50mm 为截面尺寸, 偏差±2mm; 5mm 截面厚度, 偏差±0.5mm; L 长度), 角度 90° ±3°, 垂直压力≥5000N(试样长度 1m), 水平压力≥830N(试样长度 1m)。

8.3.7. Wrap film 缠绕膜

Wrap film, also known as stretch film, elastic film or wrapping package film, self-adhesive, is a kind of single or double sided sticky can stretch wrapped by plastic film packaging items, and since the glue won't be attached on the surface of packaged goods, there is only on the surface of the membrane and membrane, cosmetic requirements is an important content in the product standard, The incoming material shall not have broken head, bubble, perforation, rupture, stiff block, fisheye, etc.

缠绕膜也称为拉伸膜, 弹性薄膜或裹包薄膜, 具有自粘性, 是一种单面或双面有粘性可拉伸并裹紧被包装物品的塑料薄膜, 并且自粘胶不会附着在被包装物品的表面, 只存在于膜与膜的表面, 外观要求是产品标准中的一项重要内容, 来料不能有断头、气泡、穿孔、破裂、僵块、鱼眼等。

8.4. Product carton specification 产品装纸箱规范

8.4.1. Assemble the packing carton 组装装箱纸箱

(1). Put the cell into the pearl cotton, and put the parts (1 Carton:4 connecting pieces and 16 bolts) in the middle. The parts shall be packed into PE bags, the PE bag material number: 10055278, and put on the pearl cotton cover, and seal the box with adhesive paper, as shown in Figure 2.

电芯放入珍珠棉里, 中间放入零部件 (1 纸箱: 4 个连接片、16 颗螺栓), 零部件需用 PE 袋装好放入, PE 袋料号: 10055278, 套上珍珠棉上盖, 胶纸封箱, 如示图 2。

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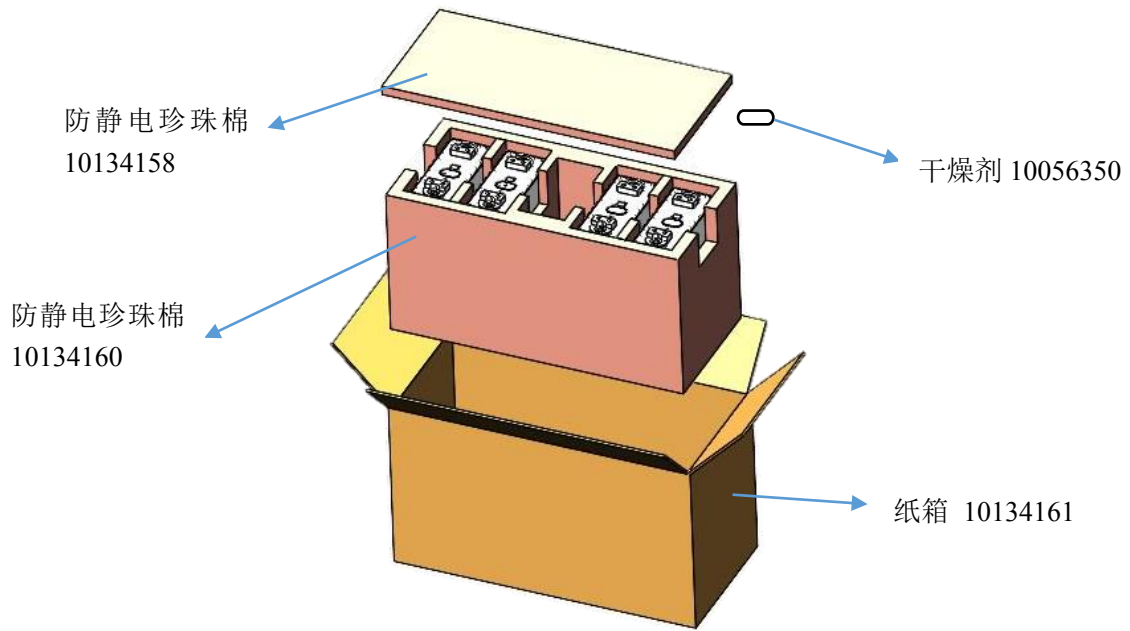


Figure. 2 Schematic diagram of packing cells into cartons

图 2 电芯装纸箱示意图

(2). The board is placed in the designated packing area, and the packed carton is placed on the board. Each layer is placed with 10 (2×5) box modules, with a total of 3 layers of 30 boxes per support, as shown in Figure 3.

卡板放置在指定包装区域，打包好的纸箱放在卡板上，每层放 10 (2×5) 箱模组，共 3 层 30 箱每托，如图 3 所示。

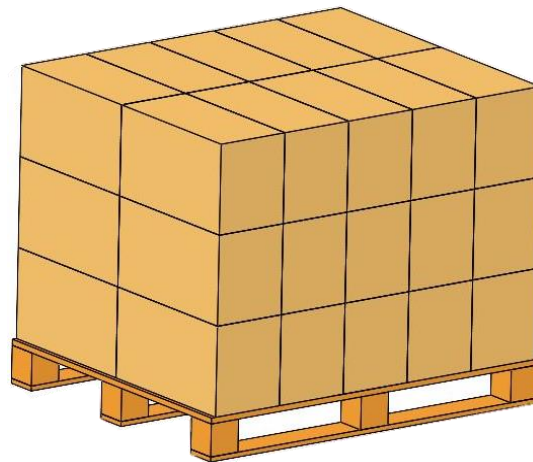


Figure 3 Card stacking diagram

图 3 卡板堆叠示意图

(3).The carton is stacked with 3 layers, and the four sides of the package are coated with corner guards, wrapped with film and wrapped with film on the top. There are 6 packing belts on the whole board, and 2 belts on the front, side and lateral respectively, to leave room for water vapor discharge. The size of A4 paper is pasted with labels to distinguish each pallet, as shown in Figure 4.

纸箱堆叠 3 层，包装四边打上护角，缠绕膜缠绕,顶部缠绕膜缠绕，整板 6 条打包带，正面、侧面、横向各 2 条，留出水蒸气排出空间 A4 纸大小，贴标识区分每托，如示图 4。

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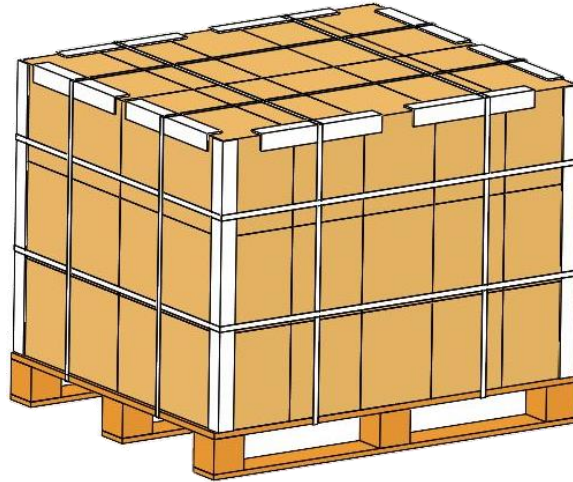


Figure. 4 Schematic diagram of card packing
图 4 卡板打包示意图

8.5. Shipping label specification 出货标识规范

8.5.1. 九类危险品标识

贴于纸箱正唛及打板后卡板正面纸，如示图 5。



Figure. 5 Schematic diagram of nine types of dangerous goods
图 5 九类危险品标识示意图

8.5.4. Side mark logo 侧唛标识

After printing, paste it on the carton sidemark. Fill in the net weight and gross weight according to the actual name of the production line. The material number is 10090372, as shown in Figure 6.

打印后贴于纸箱侧唛，净重、毛重需产线实称填写，料号：10090372，如示图 6。

Lithium Ion Batteries			
Model Name	MB30	No.	91031516


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Rated Capacity		306Ah		Rated Voltage		3.2V	
Description		MB30					
Net Weight		kg		Gross Weight		kg	
Manufacturer		EVE Power Co., Ltd.					

Figure 6 Side mark mark

图 6 侧唛标识

8.5.5. Shipment identification paste diagram 出货标识粘贴示意图

The labels of the nine types of dangerous goods are affixed to the front of the carton, and the labels face outward after the plate is made, as shown in Figure 7.

九类危险品标识贴于纸箱正面，且打板后标识朝外，如示图 7。

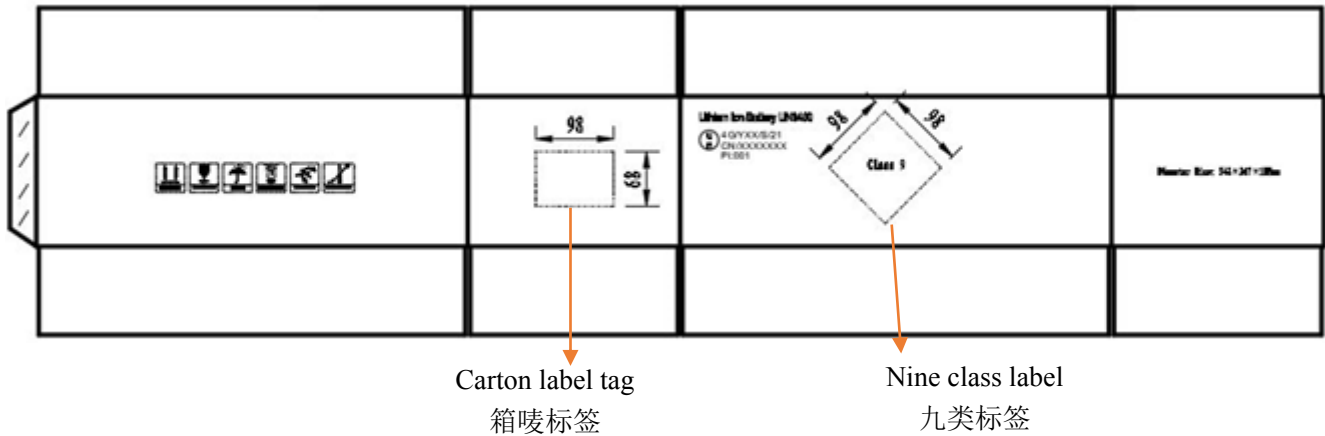


Figure7 Schematic diagram of attaching labels to cartons

图 7 纸箱标签粘贴示意图

8.5.6. The packaging logo 包装标识

There are three types of universal packaging marks in our company:

The first type of card labels should be affixed to the front of each card at the place where the labels are attached. The size of the labels is A4 paper, and the label style is shown in Figure 8.

我司包装标识通用标识有三类标识：

第一类卡板标签，需要在每个卡板标签粘贴处粘贴，贴于卡板正面，标签尺寸为 A4 纸大小，标签样式如示图 8。

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EVE Power Co.,Ltd.			
Consignee:			
Model No.:			
QTY:		Cell No.:	
Manufacture Date:		Product No.:	
Inspector:		Judgement:	
Address:	NO. 68, JINGNAN AVENUE, JINGMEN HI-TECH ZONE, JINGMEN CITY, HUBEI PROVINCE, CHINA		

Figure 8 Card board identification

图 8 卡板标识

The second type is identification of test report box. The identification of test report box indicates that there is shipment test report attached to the outer box, as shown in Figure 9.

第二类检测报告箱标识，检测报告箱标识表示该外箱内附有出货检测报告，如示图 9。



Figure 9. Outgoing inspection label

图 9 出货检验标识

The third type of packaging list, each pallet needs to have a package, the basic information of the pallet, such as customer, model, product, transport number, quantity, weight and the classification status of pallet cell content, as shown in Figure 10.

第三类包装清单，每一托盘需要有一份包装，明确该托盘的基本信息，如客户、型号、产品、运输单号、数量、重量以及托盘类电芯分级状态等内容，如示图 10 包装清单。

包装清单								
客户:				产品:				
型号:				运输单号:				
数量:		重量:		备注:				
No.	Lot No.	Qty.	Rank.		No.	Lot No.	Qty.	Rank.
1.					11.			
2.					12.			
3.					13.			
4.					14.			
5.					15.			
6.					16.			
7.					17.			
8.					18.			
9.					19.			
10.					20.			

Figure 10 Package list

图 10 包装清单

		惠州亿纬锂能股份有限公司 EVE Power Co., Ltd.		文件编号 File NO.	RD- MF-0687-D09-01
				产品型号 Product Model	MF-0687
版本 Version	1	文件名称 File Name	产品规格书 (91031516) Product Specification	页次 Page	34

9. Group requirements: 成组要求:

Every 120 cells are shipped from the same batch (quantity per box: 4PCS, a total of 30 boxes, 120 products);
每 120 个为同一批次电芯出货 (每箱数量: 4PCS, 共 30 箱, 120 个产品);

10. Shipping report (Example): 出货报告(举例)

The shipment report shall adopt our fixed template (English version of product shipment test report).
出货报告采用我司固定模板 (产品出货检测报告 英文版)。