# 锂离子电池规格书

# Specification for Lithium-ion Rechargeable Cell

型号 Type：FE100

容量 Capacity：100Ah

客户名称：

**Customer Name:**

客户型号：

**Customer model:**

客户意见：

**Comments:**

客户确认：

**Approved by:**

**Customer Approval /Date:**

升版记录 **UPDATE RECORDS**

| 版本 **Version** | 修订日期**Date** | 修订人 **Originator** | 修订原因 **Reason for Revision** 初版发行 **Original Release** |
|---|---|---|---|
| **01** | **2022-3-3** | 王盈来 **Wang Yinglai** | |
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# 目 录

## 术语定义 **Definitions**

| 术语 **Terms** | 定义 **Definition** |
|---|---|
| 产品<br>Product | 本技术协议中的“产品”是指 NARADA 生产的 100 Ah 3.2V 磷酸铁锂电池。<br>Means the 100 Ah 3.2V rechargeable lithium ion cells produced by NARADA. |
| 客户<br>Customer | 指《NARADA 产品销售合同》中的买方。<br>Means the customer in the 《NARADA product sales contract》. |
| NARADA | 浙江南都电源动力股份有限公司 Zhejiang NARADA Power Source Co., Ltd. |
| 周围环境温度<br>Ambient Temperature | 电池所处的周围环境温度。<br>Means the ambient temperature of the environment which the products are exposed to. |
| 电池管理系统<br>Battery Management System(BMS） | 客户用于监测和记录产品在整个服务期限内的运行参数的一种有效的追踪和控制系统。其追踪和记录的参数包括但不限于电压、电流、温度等，以控制产品的运行并确保产品运行环境及运行条件符合本技术协议的规定。<br>Means an active tracking and control system to be developed and implemented by NARADA to monitor and record the operating parameters, including but not limited to voltage, current and temperature, of each product in its entire service life, and to control the operation of each product to ensure a safe operation of product. |
| 电芯温度<br>Cell Temperature | 由接入电池的温度传感器测量的电芯顶盖温度，可通过采集温度（如极柱温度）修正为顶盖温度。<br>Means the temperature of the cell measured by the temperature sensor connected to the main part of cell. The temperature can be calculated from the collected temperature. |
| 新电池状态<br>Fresh State | 是指客户收货的 7 天以内的状态（仅限国内运输）。<br>Means the state within 7 days after customer received the product （domestic only）. |
| 充电倍率<br>C-Rate | 充电倍率与电池管理系统多次测量的电池的容量值的比率。例如：电池容量为 100 Ah，充电电流为 50 A 时， 则充电倍率为 0.5 C；当电池容量衰减为 80 Ah，充电电流为 40 A 时，则充电倍率为 0.5 C。<br>The ratio of charging current to the capacity of battery measured repeatedly by BMS. For example, when the battery capacity is 100Ah and the charging current is 50 A, the charging rate is 0.5 C; when the battery capacity fades to 80 Ah and the charging current is 40 A, the charging rate is 0.5 C. |
| 放电倍率<br>D-Rate | 放电倍率与电池管理系统多次测量的电池的容量值的比率。例如：电池容量为 100 Ah，放电电流为 50 A 时，则放电倍率为 0.5 C；<br>The ratio of discharging current to the energy of battery measured repeatedly by BMS. For example, when the battery capacity is 100 Ah and the discharging current is 50 A, the discharging rate is 0.5 C. |
| 循环<br>Cycle | 电池按规定的充放标准充放一次为一个循环。充电可以由一些部分充电组合在一起形成。放电可以由一些部分放电组合在一起形成。<br>Means a state when a total of charge and discharge according to rules from a cell as recorded by BMS and it may consist of a summation of a few segments of partial charge and discharges. |
| 生产日期<br>Production date | 电池的制造日期，每个相关的电池的顶端刻码上标示的明确的日期代码为制造日期。<br>Means the production date of the cell marking on the top of the cell by date code. |

## 1. 范围 Scope

本产品规格书适用于浙江南都电源动力股份有限公司生产的锂离子电芯，描述了该产品的主要特性。对于超出产品使用环境和条件的情况，不在本规格书范围内。

This product specification defines the requirements of the rechargeable lithium ion battery cell to be supplied to the Customer by NARADA Power Source. It is not included in this specification for situations that beyond the use environment and conditions of the product.

## 2. 产品分类 Product Classification

可充电锂离子电池。

Rechargeable Lithium-ion cell.

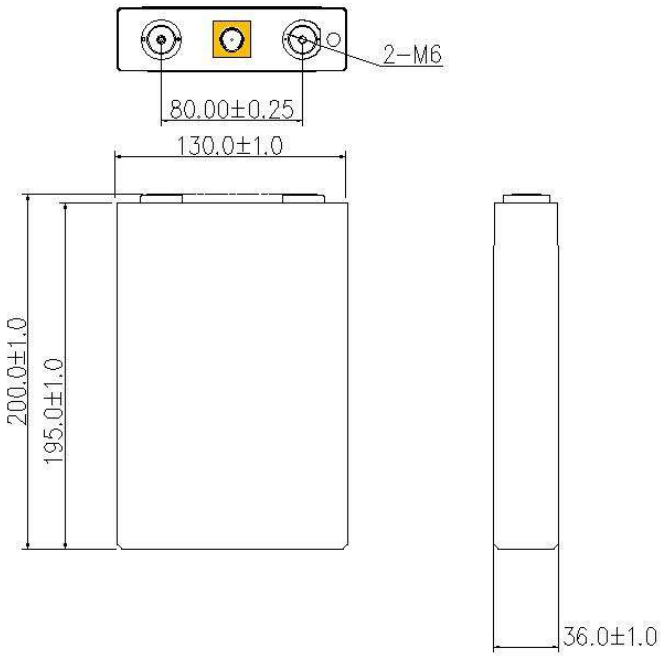
## 3. 电池结构数据 Cell Mechanical Data

### 3.1 外观 Appearance

电芯外观应不存在影响其商业价值的明显划痕、破裂、腐蚀、污染物、漏液等缺陷。

There shall be no such defects as deep scratch, crack, rust, discoloration or leakage, which may adversely affect the commercial value of the cell.

### 3.2 尺寸与重量 Dimensions and Weight



| 项目 **Items** | 尺寸(mm)与重量(kg) **Dimensions (mm) and Weight (kg)** |
|---|---|
| 厚*宽 Thickness*Width | (36.00±1.00) *(130.00±1.00) |
| 高度（不含极柱）Height without terminals | 195.00±1.00 |
| 高度（含极柱） Height with terminals | 200.00±1.00 |
| 极柱中心间距 Center distance of the terminals | 80.00±0.25 |
| 极柱位置 Terminal position | 对称 Symmetrical |
| 极柱尺寸 Terminal Diameter | Φ16.00±0.05 |
| 重量 Weight | Approx.1.98 kg |

备注Remarks：

1、以上尺寸指未进行任何包装下电芯的尺寸。 The above size refers to the size of the cell without any packing.

2、厚度测试压力： 1400 N±200 N。 Thickness measurement shall be carried out under the pretightening force of tooling (Recommend: 1400 N±200 N).

## 4. 电池规格 Cell Specification

| 序号<br>No. | 项目<br>Item | 规格<br>Specification | 测试条件<br>Test condition |
|---|---|---|---|
| 1 | 标称容量<br>Nominal Capacity | 100 Ah@ 0.5 C（新电池状态）<br>(Fresh State) | 标准充电/放电方法(5.4.1 &5.4.2)<br>Standard charge/discharge method (5.4.1 &5.4.2) |
| 2 | 交流内阻<br>AC Impedance | ≤0.8 mΩ | AC 1 KHz 测试（50% SOC）<br>AC 1 KHz measured（50% SOC） |
| 3 | 充电截止电压<br>Charge Cut-off Voltage | 3.65 V | |
| 4 | | 2.5 V | 电芯温度 T＞0℃<br>Cell temperature T＞0℃ |
| | | | 电芯温度 T≤0℃<br>Cell temperature T≤0℃ |
| 5 | 充电电流(1)<br>Charge Current(1) | 标准充电: 50 A<br>Standard charge: 50 A | 25 ℃ |
| | | 快速充电: 50 A<br>Rapid charge: 50 A | 25 ℃ |
| 6 | 放电电流(1)<br>Discharge Current(1) | 标准放电: 50 A<br>Standard charge: 50 A | 25 ℃ |
| | | 最大持续放电: 100 A | 25 ℃ |

| | | | |
|---|---|---|---|
| | | Max continuous Discharging: 100 A | |
| 7 | 工作环境(2) Operating Environment(2) | 充电：温度 0 ℃~45 ℃，湿度≤85%<br>Charging: temperature 0 ℃~45 ℃, humidity less than 85%RH<br>放电：温度-20 ℃~60 ℃，湿度≤85%<br>Discharging: temperature -20 ℃~60 ℃, humidity less than 85%RH | |
| 8 | 储存环境(2) Storage Environment(2) | 温度：-10 ℃~30 ℃，湿度≤85%<br>Temperature: -10 ℃~ 30 ℃, Humidity less than 85%RH | |

备注 Remarks：

（1）充电电流和放电电流仅用于测试，实际使用工况需与南都商议。

Charge current and discharge current are only used for testing, the actual operating conditions need to be discussed with NARADA.

（2）工作温度和存储温度为使用建议值，超出该值将不利于电芯长期使用。

The Operating Temperature and Storage Temperature is the using advise for this cell. Exceeding the temperature will affect the long uselife.

## 5. 产品测试要求及标准 Test Requirement and Standard

测试电池为新电池状态（客户收货的 7 天以内的状态（仅限国内运输）），且电池未进行过五次以上充放电循环，除非另有规定。

Unless specific requirements, all tested cells should be kept within 7 days after customer received the Product (domestic only) and have no more than 5 cycles before the tests.

### 5.1 环境要求 The Requirement of Environment

本规格书中各项测试均应在标准大气条件下进行：温度 25 ℃±2 ℃；相对湿度：25%～85%，特殊说明除外。

All tests stated in this specification are conducted under standard atmospheric conditions, temperature of 25 ℃ ±2 ℃ and humidity between 25% from 85%, except for special instruction.

### 5.2 产品执行标准 The Standard Performed

公司企标、GB38031-2020、GB/T 31484-2015、GB/T 31486-2015 相关标准。

Company's standard, GB 38031-2020, GB/T 31484-2015 and GB/T 31486-2015 relative standard.

### 5.3 测试设备要求 Measuring Instrument or Apparatus

5.3.1 测量尺寸的仪器精度±0.01 mm。

The precision of dimension measurement apparatus should be ±0.01 mm.

5.3.2 万用表测量电压及电流的准确度应不低于 0.5 级；测电压时内阻应不小于 10 kΩ/V。

The accuracy level of multi-meter should not be lower than 0.5; and internal resistance should be not

less than 10 kΩ/V.

5.3.3 电池测试系统的电流/功率精度±0.1%，电压精度±0.5%，计时精度±0.1%。

The current/power precision should be ±0.1%, the voltage precision should be ±0.5% and the timing precision should be ±0.1%.

5.3.4 温度测量的仪表准确度±0.5 ℃。

Accuracy of temperature accuracy should be ±0.5 ℃.

### 5.4 测试条件 Test Conditions

除非特殊规定外，充电和放电之间的应包含静置时间，且应不低于 30min。本规格书提到的静置时间为 30 min。

Unless otherwise specified, Rest Time should exist between charge and discharge and be not less than 30min. Rest Time in this specification is 30 min.

5.4.1 标准充电 Standard Charge：

除非特殊规定外，标准充电为：25 ℃±2 ℃条件下，电芯以50 A恒流充电到3.65 V，而后转为恒压充电，充电电流降低至5 A时停止充电。

Unless otherwise specified, Standard charge: 50 A constant current charge (CC) to 3.65 V then constant voltage charge (CV) until current to 5 A under 25 ℃±2 ℃.

5.4.2 标准放电 Standard Discharge：

除非特殊规定外，标准放电为：25 ℃±2 ℃条件下，电芯以50 A恒流放电到2.5 V。。

Unless otherwise specified, Standard discharge: 50 A constant current discharge (DC) to 2.5 V under 25 ℃±2 ℃.

5.4.3 初始化Initiating charge and discharge

初始化放电：25 ℃±2 ℃条件下搁置5 h，电芯以50 A恒流放电至放电终止电压，静置30 min。

除非特殊规定外，电芯测试前应±进行初始化放电。

Initiating discharge: stored at 25 ℃±2 ℃ for 5 h, 50 A constant current discharge (DC) to 2.5 V and set for 30 min.

Unless otherwise specified, the cell shall be initially discharged prior to testing.

5.4.4 25 ℃储存特性测试

Storage characteristics test at 25 ℃

第一步：初始化放电(5.4.3)； 第

二步：标准充电(5.4.1)；

第三步：25 ℃±2 ℃环境温度下开路搁置28天； 第四步：

标准放电(5.4.2)（取此步放电容量为容量保持量）； 第五步

：标准充电(5.4.1)； 第六步：标准放电(5.4.2)（取此步容量

为容量恢复量）。

Step 1: Initiating discharge (5.4.3);

Step 2: Standard charge (5.4.1);

Step 3: The cell is stored at 25 ℃±2 ℃ for 28 days;

Step 4: Standard discharge (5.4.2) (capacity retention);

Step 5: Standard charge (5.4.1);

Step 6: Standard discharge (5.4.2) (capacity recovery).

5.4.5 60℃储存特性测试

Storage characteristics test at 60℃

第一步：初始化放电(5.4.3)； 第二步：标准充电(5.4.1)；

第三步：60 ℃±2 ℃环境温度下开路搁置7天； 第四步：标准放电(5.4.2)（取此步放电容量为容量保持量）； 第五步：标准充电(5.4.1)； 第六步：标准放电(5.4.2)（取此步容量为容量恢复量）。

Step 1: Initiating discharge (5.4.3);

Step 2: Standard charge (5.4.1);

Step 3: The cell is stored at 60 ℃±2 ℃ for 7 days;

Step 4: Standard discharge (5.4.2) (capacity retention);

Step 5: Standard charge (5.4.1);

Step 6: Standard discharge (5.4.2) (capacity recovery).

5.4.6 T ℃容量测试

T ℃ capacity test 第一步：初始化放电(5.4.3)； 第二步：标准充电(5.4.1)；

第三步：T ℃±2 ℃下搁置n小时；参照标准充电(5.4.1)，静置30 min（注：-20 ℃下搁置24 h，60 ℃下搁置5 h）；

第四步：50 A恒流放电至2.5 V（T＞0 ℃）或2.0 V（T≤0 ℃）（此步放电容量记为T ℃容量）。

Step 1: Initiating discharge (5.4.3);

Step 2: Standard charge (5.4.1);

Step 3: Stored for n hours at T ℃±2 ℃; Refer to standard charge (5.4.1), rest for 30 min (Marks：n=24 h if stored under -20 ℃, n=5 h if stored under 60 ℃);

Step 4: 50 A constant current discharge (DC) to 2.5 V (T＞0℃) or 2.0 V (T≤0 ℃) (capacity for T ℃).

5.4.7 室温倍率性能测试

Rate performance test at room temperature

5.4.7.1 倍率放电性能

Rate discharge performance

第一步：初始化放电(5.4.3)；
第二步：标准充电(5.4.1)，静置30 min；
第三步：100 A 恒流放电至 2.5 V。

Step 1: Initiating discharge (5.4.3);
Step 2: Standard charge (5.4.1)，set for 30 min;
Step 3: 100 A constant current discharge to 2.5 V.

5.4.7.2 倍率充电性能

Rate charge performance

第一步：初始化放电(5.4.3)；
第二步：100 A恒流充电至3.65 V，静置1 h；
第三步：标准放电(5.4.2)。

Step 1: Initiating discharge (5.4.3);
Step 2: 100 A constant current charge to 3.65 V，set for 1 h;
Step 3: Standard charge (5.4.2).

5.4.8 循环寿命测试

Cycle life test

循环寿命测试应在 25 ℃±2 ℃及 1400 N±200 N 预紧力条件下按以下工步测试：
第一步：初始化放电(5.4.3)；
第二步：标准充电(5.4.1)；
第三步：静置 30 分钟； 第
四步：标准放电(5.4.2)；
第五步：静置 30 分钟；
第五步 重复第二步、第三步、第四步和第五步至循环结束。

The cycle life test should be test at 25 ℃±2 ℃ and 1400 N±200 N pretightening according to the following steps:

Step 1: Initiating discharge (5.4.3);
Step 2: Standard charge (5.4.1);
Step 3: Set for 30 minutes;
Step 4: Standard discharge (5.4.2);
Step 5: Set for 30 minutes;
Step 6: Repeat Step 2、Step 3、Step 4 and Step 5 until the cycle test ends.

## 6. 电芯性能 Cell Performance

### 6.1 电性能 Electricity performance

| 测试项目 | 技术要求 | 条件 |
|---|---|---|

| Test Item | Specification | Condition |
|---|---|---|
| 倍率放电<br>Rate Discharge Capacity | 不低于标称容量的 95%。<br>Not less than 95% of nominal capacity. | 参考 5.4.7.1<br>Refer to 5.4.7.1 |
| 倍率充电<br>Rate Charge Capacity | 不低于标称容量的 95%。<br>Not less than 95% of nominal capacity. | 参考 5.4.7.2<br>Refer to 5.4.7.2 |
| -20 ℃放电容量<br>Discharge Capacity at -20 ℃ | 不低于标称容量的 70%。<br>Not less than 70% of nominal capacity. | 参考 5.4.6，T= -20 ℃<br>Refer to 5.4.6, T= -20 ℃ |
| 60℃放电容量<br>Discharge Capacity at 60℃ | 不低于标称容量的 90%。<br>Not less than 90% of nominal capacity. | 参考 5.4.6，T= 60 ℃<br>Refer to 5.4.6, T= 60 ℃ |
| 25℃储存特性<br>Storage Characteristics at 25℃ | 容量保持率≥90%<br>容量恢复率≥97%<br>Capacity retention≥90%;<br>Capacity recovery ≥97% | 参考 5.4.4<br>Refer to 5.4.4 |
| 60℃储存特性<br>Storage Characteristics at 60℃ | 容量保持率≥85%<br>容量恢复率≥90%<br>Capacity retention≥85%;<br>Capacity recovery ≥90% | 参考 5.4.5<br>Refer to 5.4.5 |
| 循环寿命 Cycle Life | 循环圈数≥1200<br>Cycle life≥1200 | 参考 5.4.8，容量保持(SOH)= 80%，预紧力 1400 N±200 N。<br>Refer to 5.4.6, Capacity retention (SOH) = 80%，under the 1400 N±200 N pretightening |

## 6.2 安全性能 Safety

| 测试项目<br>Test | 技术要求<br>Specification | 条件<br>Condition |
|---|---|---|
| 过充电<br>Over Charge | 不爆炸、不起火<br>No explosion and no fire | 标准充电后，以 1 C 恒流充电至电压达到 5.475 V 或充电时间达 1 h 后停止充电，观察 1 h。<br>After standard charge, the cell is charged at a constant current of 1 C until voltage up to 5.475 V or the charge time up to 1 h, observe 1 h. |
| 外部短路 | 不爆炸、不起火 | 标准充电后，用内阻小于 5mΩ的线路短路电池 10 min，观察 |

| | | |
|---|---|---|
| External Short Circuit | No explosion and no fire | 1 h。<br>After standard charge, the cell is short-circuited with a conductor (external resistance resistance less than 5 mΩ) for 10 min，observe 1 h. |
| 过放电<br>Over Discharge | 不爆炸、不起火、不漏液<br>No explosion、no fire and no leakage | 标准充电后，以 1 C 放电 90 min，观察 1 h。<br>After standard charge, discharge for 90 min at a constant current of 1 C，observe 1 h. |
| 加热<br>Heating | 不爆炸、不起火<br>No explosion and no fire | 标准充电后，以 5 ℃/min±2 ℃/min 升温至 130 ℃±2 ℃，此温度下保持 30 min。<br>After standard charge, increase the temperature to 130 ℃±2 ℃ at a rate of 5 ℃/min±2 ℃/min and keep 30min, observe 1 h. |
| 挤压测试<br>Crush Test | 不爆炸、不起火<br>No explosion and no fire | 标准充电后，用 R 75 mm 半圆柱体垂直于极板方向挤压电池，挤压速度 5 mm/s±1 mm/s ，直至电压达到 0 V 或形变量达 30%或挤压力达 100 kN 后停止，观察 1 h。<br>After standard charge, extruding the cell with semi cylinder(R 75 mm) perpendicular to the direction of plate until the voltage to 0 V or the deformation degree to 30% or increasing the pressure to 100 kN, observe 1 h. |
| 海水浸泡<br>Seawater Immersion | 不爆炸、不起火<br>No explosion and no fire | 标准充电后，将电池浸入 3.5% NaCl 溶液（质量分数，模拟常温下的海水成分）中 2 h，水深应完全没过电池。 After standard charge, immerse the cell in 3.5% NaCl solution (mass percent, simulated ambient water composition) for 2 h, water depth should be completely above cell. |
| 自由跌落测试<br>Free Falling(Drop) | 不爆炸、不起火、不漏液<br>No explosion, no fire and no leakage | 标准充电后，正负端子向下，电池从 1.5 m 高度自由跌落到水泥板面，观察 1 h。<br>After standard charge, the cell is freely dropped from the height of 1.5 m onto the concrete floor by the positive and negative terminals down, observe 1 h. |
| 低气压<br>Low Pressure | 不爆炸、不起火、不漏液<br>No explosion, no fire and no leakage | 标准充电后，将电池放入低气压箱中，调节试验箱气压为 11.6 kPa，温度为室温，静置 6 h，观察 1 h。<br>After standard charge, the cell is put into the low pressure box, then adjust the air pressure inner the box to 11.6 kPa, the temperature is room temperature, and let it stand for 6 h; observe 1h |

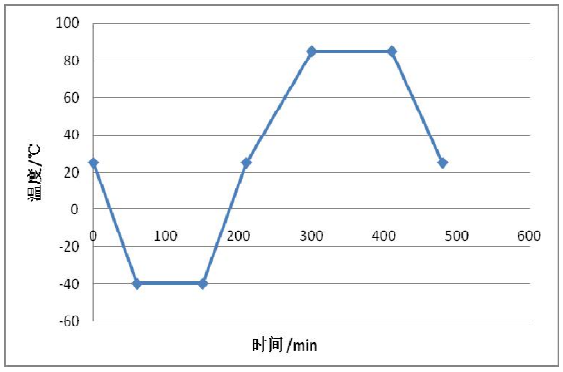
<table>
<tr>
<td>温度循环<br>Temperature Cycling Test</td>
<td>不爆炸，不起火<br>No explosion and no fire.</td>
<td>电池按照标准充电方式结束后，放入温度箱中，温度箱温度按下表和图 2 进行调节，循环 5 次后，观察 1 h。 After standard charge, the cell is put into the hot box. The temperature of box is adjusted according to the following table and figure 2, and repeat 5 times, observe 1 h. 温度实验一个循环的温度和时间<br>Temperature experiment a cycle of temperature and time.
<table>
<tr><th>温度℃</th><th>时间增量 min</th><th>累计时间 min</th><th>温度变化率 ℃/min</th></tr>
<tr><td>25</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>-40</td><td>60</td><td>60</td><td>13/12</td></tr>
<tr><td>-40</td><td>90</td><td>150</td><td>0</td></tr>
<tr><td>25</td><td>60</td><td>210</td><td>13/12</td></tr>
<tr><td>85</td><td>90</td><td>300</td><td>2/3</td></tr>
<tr><td>85</td><td>110</td><td>410</td><td>0</td></tr>
<tr><td>25</td><td>70</td><td>480</td><td>6/7</td></tr>
</table>


图 2 温度循环实验示意图<br>Fig 2 Schematic diagram of temperature cycling experiment</td>
</tr>
<tr>
<td colspan="3">备注Remarks：<br>（3） 安全测试（含热失控测试） 需在测试工装固定辅助下进行测试。<br>Safety test (including Thermal runaway test) shall be carried out with the aid of test fixture fixing</td>
</tr>
</table>

## 7. 应用条件及寿命管理 Application Conditions and Product Life Management

用户应当严格遵守以下电池应用条件。

The user shall strictly observe the following application conditions of the cell.

7.1 电池初次使用必须按照标准充电模式(5.4.1)和标准放电模式(5.4.2)激活，以保证后续使用中容量的充分发挥。

The cell must be charged and discharged according the standard charge/discharge method (5.4.1 and 5.4.2) to activate it for the first use.

7.2 模组在不同温度和湿度下建议使用的最大电流/功率值

Module Operation Temperature and relative humidity Range (Supplier recommendation)

| Charge 60%±25% R.H. | 0 ℃~10 ℃ | 10 ℃~20 ℃ | 20 ℃~40 ℃ | 40 ℃~45℃ | ≤0 ℃or ≥45 ℃ |
|---|---|---|---|---|---|
| | 0.1 C | 0.3 C | 0.5 C | 0.3C | Not allowed |
| Discharge 60%±25% R.H | -20 ℃~ 0 ℃ | 0 ℃~20 ℃ | 20 ℃~45 ℃ | 45 ℃~50 ℃ | 50 ℃~60 ℃ |
| | 0.1C | 0.3 C | 0.5 C | 0.3C | 0.1C |

7.3 安全与可靠性说明 Safety and Reliability

使用条件说明：安全测试、 循环寿命、系统成组设计需要施加预紧力，新电芯的预紧力范围为1400 N±200 N。

Description of service conditions: safety test、cycle life test and pack design need to add pretightening force, and the recommended pretightening force of fresh cell is 1400 N±200 N.

7.4 客户应配置电池管理系统(BMS)，严密监控、管理与保护每个电池。电池管理系统应该满足以下基本要求。

The user shall configure a battery management system (BMS) to closely monitor, manage and protect each battery, and BMS must meet the following basic requirements.

| No. | 项目 Item | 参数 Parameter | 保护动作 Action |
|---|---|---|---|
| 1 | 充电终止 Stop charge | ≥3.65 V | BMS 发出停止充电指令。 The BMS sends a command to stop charging. |
| 2 | 第一级过充电保护 First overcharge protection | ≥3.70 V | BMS 强制停止充电。 BMS force stop charging. |
| 3 | 第二级过充电保护 Second overcharge protection | ≥3.80 V | BMS 强制停止充电，并锁定，过充电池不能继续使用。 BMS forces stop charging, and BMS should be locked, the overcharged cell cannot continue to be used. |
| 4 | 放电终止 | ≤2.5 V(T＞0 ℃) | BMS 发出停止放电指令。 |

| | | | |
|---|---|---|---|
| Stop discharge | | The BMS sends a command to stop discharge. | |
| 5 | 第一级过放电保护<br>First over discharge protection | ≤2.4 V | BMS 强制停止放电。<br>BMS forces stop discharging. |
| 6 | 第二级过放电保护<br>Second over discharge protection | ≤2.0 V | BMS 强制停止放电，且应立即以 0.1 C 倍率充电至 50% SOC 左右，之后 BMS 锁定，过放电池不能继续使用。 BMS forces stop discharging, and should immediately charge to 50% SOC at 0.1 C, after which the BMS locks and the overdischarged cell cannot continue to be used. |
| 7 | 短路保护<br>Short circuit protection | 不允许短路<br>No short circuit allowed | 发生短路时，由过流保护装置断开电池。<br>When a short circuit occurs, the cell is disconnected by the overcurrent protection device. |
| 8 | 过流保护<br>Over current protection | 参考 4 和 7.2<br>Refer to 4 and 7.2 | 电池管理系统控制充放电电流符合规格。<br>Control discharge current by BMS to values within specification. |
| 9 | 过热保护<br>Over temperature protection | 参考 4.电池规格<br>Refer to 4. Cell specification | 当温度超过本技术协议规定时，终止充电/放电。<br>Stop charging and discharging when temperature exceeds specification. |

备注：以上 2、 3、 5、 6 为警示条款，提醒客户注意： 当电池达到上述任何一项条款描述的指标和参数状态时，意味着电池已超出本技术协议规定的使用条件，客户需依“保护动作”及本技术协议其他相关规定对电池采取保护措施，同时， NARADA 声明对上述使用状态的电池质量不承担任何保证责任，并对因此而导致的客户及第三方的任何损失不予赔偿。

Remarks: The above No. 2, 3, 5, 6 are the warning clause, draw the attention of customers: When the battery reaches any of the terms described in the above, means that the battery has been used beyond the specifications, the customer shall take protective measures on the battery in accordance with the "protection action" and other relevant provisions of this specification. At the same time, NARADA shall not take any responsibility for the damage in connection there with

7.5 电池长期存储时应将荷电状态(SOC)调至 50%左右，并按照以下标准定期进行补电：-10 ℃

~30 ℃存储，每 6 个月； 30~45 ℃，每 3 个月；45℃~60 ℃，每 1 个月。另，实际存储 SOC 不得低于 8%。存储周期仅考虑电池自放电的影响。

When the cell is stored for a long time, the SOC should be adjusted to about 50%, and the cell should be charged periodically according to the following standards: -20 ℃~30 ℃, 6 months; 30 ℃~45 ℃, 3 months; 45 ℃~60 ℃, 1 months. In addition, the actual SOC of cell cannot be less than 8% for storage. The storage considers the self-discharge of cells only.

7.6 电池应避免在本技术协议禁止的低温条件下充电，否则可能出现容量异常降低，并伴有安全风险，南都不承担因此造成的质量保证责任。

The cell shall not be charged under low temperature conditions prohibited by this technical agreement, otherwise, abnormal capacity reduction and security risks may occur, and NARADA shall not undertake the quality assurance responsibility caused thereby.

7.7 电箱设计中应充分考虑电池的防水、防尘问题，由于防水、防尘问题而导致的电池的损坏（如腐蚀、生锈等），南都不承担质量保证责任。

The design of the electric box must fully consider the waterproof and dustproof problems of the cells. If the cell is damaged by water or dust, NARADA does not take the responsibility.

7.8 禁止不同批次电池在同一电池系统中混用，否则南都不承担质量保证责任。

It is forbidden to mix different batches of cells in the same battery system, otherwise NARADA shall not undertake the responsibility of quality assurance.

7.9 电池的使用寿命是有限的，用户在电池生命周期内应该建立有效的跟踪系统监测并记录每个电池的容量和内阻数据，当使用中的电池内阻超过这个电池最初内阻的 150%或容量小于等于标称容量 70% (25℃)，应停止使用电池。

Cell is designed to service with a finite life time. The customer shall develop and implement an active tracking system to monitor and record the capacity and impedance of each cell in its entire service life. The user shall stop using any of the cell when its resistance exceeds 150% of its initial internal resistance or capacity fades to 70% of typical capacity at 25 ℃.

7.10 其他化学反应 Other Chemical Reaction

电池中存在化学反应， 长时间不使用电池， 其性能会随着时间的推移而出现衰减。 如果未在规定的充电、放电以及环境和温度下进行使用，电池的使用寿命会缩短或者造成设备损害。即使用正确的充电方式，电池不能长时间充电，请更换电池，由此产生的费用由使用者承担，NARADA 不承担产品质量保证责任。

Since the battery utilizes a chemical reaction, battery performance will deteriorate over time if stored for a long period of time without being used. Inaddition, if the various usage conditions such as charge, discharge, ambient temperature ,etc. are not maintained within the specified ranges, the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery. The resulting costs are borne by the user, and NARADA does not assume

responsibility for product quality assurance.

## 8. 运输 Shipment

8.1 电池应该在 20%左右的荷电状态(SOC)下运输。

Cells shall be shipped at about 20% of SOC.

## 9. 警告 Warning

9.1 不要拆解电池，不要使用尖锐物体刺穿电池。

Do not disassemble the cell, do not damage the cell with sharp objects.

9.2 不要将电池加热或将电池扔进火里、水里或是其它液体中。

Do not heat or dispose the cell into fire, water or other liquids.

9.3 不要使用已损坏的电池。

Do not use a damaged cell.

9.4 不要将正负极直接导通。

Do not connect the positive (+) and negative (-) tabs/terminals.

9.5 不要混用电池。

Do not mixed-using cells.

9.6 不要将不同型号的电池混合一起，避免将新的和旧的、不同规格、不同化学成份的电池配对。

Avoid pairing different type, fresh and old cells, different specification or different chemical systems in the same cell assembly.

## 10. 注意事项 Cautions

10.1 操作温度 Operation Temperature

电池的储存、充电、放电温度应遵照本规格书的相关规定。

The cell shall be operated (stored, charged and discharged) within a proper temperature range specified by this specification

远离热源。不要将电池放置在热源附近或长时间暴露在阳光下，温度的上升会缩短电池的使用寿命。

Keep away from heat. Do not place cell near heating sources; not exposed to direct sunlight for long periods. Elevated temperature can result in reduced cell service life.

10.2 充电 Charge

应使用制造商许可的充电方法；不恰当的充电方式会导致电池过热或损坏；

不要使用高于本规格书规定的最大电流或电压充电；

严禁反充电池（正负极接反），禁止浮充。

The charging method approved by NARADA shall be used; Improper charging method may cause the cell to over-heat or damage.

Do not charge the cell with a current or voltage higher than the specified maximum value in this specification.

Prohibit reverse charging of the cell; No trickle charging shall be applied for the cell.

10.3 放电 Discharge 放电电流应不高于本规格书规定的最大电流放电；

如计划使用高于最大电流的电流放电，请先咨询本司； 避免过

放电，若电池过放电，将导致电池报废并产生安全隐患。

Discharge current should not be higher than the maximum specified in this specification

If you plan to use the higher discharge current, please consult our company.

Do not over-discharge. Once over-discharging happened, the battery will be damaged or safety problem may occur.

10.4 电池短路 Cell Short Circuit

电池短路会使电池发热，严重的会导致起火，发生危险。

A short circuit can result in over-heating, damaging battery, which may cause a fire and danger incurring in serious cases.

10.5 电池操作 Battery Operation

避免电池极耳/极柱接触电池主体。

Avoid the tabs/terminals contacting with the battery body.

避免外力使电池变形，不要将电池弯曲、折叠或抛掷，这样会破坏电池，严重会导致电池鼓涨、漏液、起火或爆炸。

Avoid external force to deform the cell. Do not bend, fold or throw the cell which may cause the cell be damaged and result in the cell swelling, leaking, explosion or ignition.

不要打开或任意地折叠电池的折边。

Do not manipulate the folded cell edge.

10.6 紧急情况处理 Emergency Treatment

如果电解质发生泄露并进入眼睛，请不要揉擦，应用清水冲洗眼睛，并立即送医治疗，否则会伤害眼睛。

If the leakage of electrolyte happens and enters into eyes, rinsing them out with clear water and get a treatment in the hospital immediately instead of rubbing eyes, or the eyes may get hurt.

如果电池使用以及储存过程中发出异味、发热、变形等异常，应立即切断电源；若电池表面温度较高，待电池冷却后，将电池从装置或充电设备中移离；电池在极端条件下不会发生爆炸，但可能会有冒烟现象发生，遇到该情况可采取将电池隔绝空气的措施，如掩盖沙土，或使用二氧化碳灭火器、干粉灭火器，切忌用水，待烟雾散去后再进行处理。

During the usage and storage process, if any peculiar smell, heat and deformation or any other abnormal occur to the battery, please cut off the power immediately; If the cell surface has got high temperature, please remove it from the device or charging equipment after it gets cool; Explosion will not occur under extreme conditions, but the battery may smoke, for this situation the cell should be isolated from air by any measures except using water, such as covering with sand, or using carbon dioxide fire extinguisher, dry powder fire extinguisher. The cell should be treated after smoke scattering.

电池质保 Cell Warranty

自出货之日起，电池的保质期限依合同而定。但是在此期限内，如果因客户的误用造成的电池质量问题，南都不承担质保责任。

From the date of shipment, the warranty period of the battery is subject to the contract. However, during this period, However, NARADA shall not be liable for any cell quality problems caused by customer misuse during this period.

本司对违反安全守则操作所产生的问题不承担任何责任。

Our company does not accept any responsibility for problems that arise from violating the safety rules.

本司对与电路、电池组、充电器搭配使用所产生的问题不承担任何责任。

Our company does not accept any responsibility for problems arising from the use of circuits, battery packs, and chargers.

出货后客户在电池组装过程中产生的不良电池不在本司质量保证的范围之内。

The defective cells generated by the customer during the assembly process of the cells are not within the scope of the warranty of our company.

## 11. 免责申明 Exclusion of Liability

除了正常损耗，南都电源以及南都电源认可的第三方之外的不适当维修、操作、储存、错误维修等造成的缺陷，没有遵守产品规格书中的规定或者错误的使用安装等是不在质量保护范畴之内的，以下免责项目包括但不限于：

The warranty shall not cover defects caused by normal wear and tear, inadequate maintenance, handling, storage, faulty repair, modification to the battery or pack by a third party other than NARADA

Power Source or NARADA Power Source's agent approved by NARADA Power Source, failure to observe the product specification provided herein or improper use of installation, including but not limited to, the following:

运输或者储存时的损坏；

Damage during transport or storage;

电芯组装 Pack 或者维修时操作不当；

Incorrect installation of battery into pack or maintenance;

在不适宜的环境下使用电芯或电池；

Use of battery cell or battery pack in inappropriate environment;

不恰当的或者不正确的充放电、或者规定之外的保护电路；

Improper, or incorrect charge / discharge, or protection of circuits other than stipulated herein;

错误使用或者不适当的使用；

Incorrect use or inappropriate use;

通风不良；

Insufficient ventilation;

忽视适用的安全警告和指示；

Ignoring applicable safety warnings and instructions;

未经授权的人员随意更改和维修；

Any attempt to alter or repair by unauthorized personnel;

遇到不可抗外力（例如：闪电、暴雨、洪水、大火、地震等）；

In case of force majeure (Ex. Lightening, Storm, Flood, Fire, Earthquake, etc.).

如果由于产品需求单位不按照本说明书中的规定进行使用，造成社会性影响，并对 NARADA 的声誉造成影响的， NARADA 将会追究产品需求单位的责任。根据对 NARADA 造成的影响程度，产品需求单位需向 NARADA 提供赔偿。

If the product demand unit does not use the product according to the provisions of this specification, causing social impact and affecting the reputation of NARADA, NARADA will investigate the responsibility of the product demand unit. According to the degree of impact on NARADA, the product demander should provide compensation to NARADA.

NARADA 保留对产品的规格及性能参数修改的权利。买方在订购 NARADA 产品前，需要与 NARADA 提前确认产品的最新状态。

NARADA reserves the right to modify the specifications and performance parameters of the product.

Before ordering NARADA products, the buyer needs to confirm the latest status of the products in advance with NARAD.

本规格书未涵盖的任何其他项目应由双方商定。

Any other items which are not covered in this specification shall be agreed by both parties.

对于本产品规格书规定外的任何保证（不论默认的还是明示的），南都电源不承担与之相关的任何直接或者间接的赔偿责任。

NARADA does not assume any direct or indirect liability for any warranty (whether default or express) outside the provisions of this product specification.

如果针对此规格书有异议，双方可协商解决。南都有最终解释权。其他事项如不按以上规定操作导致发生意外，与本司无关。

If any matters with this specification arise, it shall be revised by mutual agreements. NARADA has the right of final interpretation. It should make no liability for problems that occur when the above specifications are not followed.

## 12. 备注 Remarks

任何本规格书中未提及的事项，请咨询本公司。

If there are any items not mentioned in this specification, please contact our company.