



## 产品标准

### Product Specification

产品源码 Product source: CC02

产地/产线 Production Place/Line: /

编制 Author: 周浩

审核 Checker: 刘小舟

会签 Countersign: 石炼

批准 Approval: 翟静 2022-01-25

轻型动力电池事业部 部门发布

## 锂离子电芯规格书

### Specification For Lithium-ion Rechargeable Cell

公司名称: \_\_\_\_\_ 蜂巢能源科技有限公司 \_\_\_\_\_

物料名称: \_\_\_\_\_ 21700 圆柱形电芯 \_\_\_\_\_

物料型号: \_\_\_\_\_ 21700-4400mAh \_\_\_\_\_

文件编号: \_\_\_\_\_ DOC-2200864 \_\_\_\_\_

修订日期: \_\_\_\_\_ 2021/8/10 \_\_\_\_\_

版 本: \_\_\_\_\_ A \_\_\_\_\_

|     |     |    |
|-----|-----|----|
| 编制  | 审核  | 批准 |
| 周仁全 | 刘小舟 | 翟静 |

## Contents 目录

- 1 Preface 前言
- 2 Definition 定义
  - 2.1 Nominal capacity 标称容量
  - 2.2 Standard charge method 标准充电方式
  - 2.3 Standard discharge method 标准放电方式
- 3 Cell type and dimension 电芯型号及尺寸
  - 3.1 Description and model 电芯说明及型号
  - 3.2 Cell dimension 电芯尺寸
- 4 Cell characteristics 电芯特性
- 5 Technical requirements 技术要求
  - 5.1 Cell usage conditions 电芯使用环境
  - 5.2 Cell testing conditions 电芯实验环境
  - 5.3 Requirement of the testing equipment 测量仪表要求
  - 5.4 Electrochemical characteristics 电化学特性
  - 5.5 Environmental characteristics and safety characteristics 环境适应性能与安全性能
- 6 Shipment 出货
- 7 Warranty 质量保证
- 8 Storage and Shipment Requirement 存储及运输要求
- 9 Cell safety code 电芯安全准则
- 10 The restriction of the use of hazardous substances 有害物质控制要求
- 11 Contact information 联系方式

## 1 preface 前言

This specification describes the type, dimension, performance, technical characteristics, warnings and cautions of the lithium ion rechargeable cell. The specification only applies to 21700-4400mAh cells supplied by SVOLT Energy Co., Ltd.

本标准描述了圆柱型锂离子电芯的外型尺寸、特性、技术要求及注意事项。本标准适用于蜂巢能源科技有限公司生产的圆柱型 21700-4400mAh 型号锂离子电芯。

## 2 Definition 定义

### 2.1 Nominal capacity

#### 标称容量

The nominal capacity is obtained by discharging a cell at 5-hour rate to cut-off voltage 2.75 V under  $25 \pm 2^\circ\text{C}$ . The rated capacity is signed as Cap and uses mAh as unit.

标称容量指在  $25 \pm 2^\circ\text{C}$  环境下，以 5 小时率放电至终止电压 2.75V 时的容量，以 Cap 表示，单位为毫安时 (mAh)。

### 2.2 Standard charge method

#### 标准充电方式

Under  $25 \pm 2^\circ\text{C}$ , the cell is charged to 4.2V at a constant current of 0.5C (2200mA), and then charged constantly under the voltage of 4.2V until the current reaches 0.02C (88mA).

指在  $25 \pm 2^\circ\text{C}$  环境下，以 0.5C (2200mA) 的电流恒流充电至单体电芯电压 4.2V 后，转为恒压 4.2V 充电，至充电电流小于 0.02C (88mA) 时，停止充电。

### 2.3 Standard discharge method

#### 标准放电方式

Under  $25 \pm 2^\circ\text{C}$ , the cell is discharged to 2.75V at a constant current of 1C (4400mA).

指在  $25 \pm 2^\circ\text{C}$  环境下，以 1C (4400mA) 恒流放电至单体电芯电压 2.75 V。

## 3 Cell type and dimension 电芯型号及尺寸

### 3.1 Description and model 电芯说明及型号

**Description:** Cylindrical Li-ion rechargeable cell

**Model:** IXR 21700-4400mAh

IXR21700-4400mAh 型号的圆柱锂离子二次电芯。

### 3.2 Cell dimension 电芯尺寸

Cell physical dimension is listed in Figure 1 (unit: mm).

电芯尺寸示意图如图 1 所示 (单位: mm)。



Figure 1/ 图 1

**4 Cell characteristics** (Unless otherwise specified, the cell is fresh cell and tested under  $25 \pm 2^\circ\text{C}$ ,  $65 \pm 20\% \text{RH}$ .)

**电芯特性** (除非有特殊说明, 否则所有测试要求为: 温度在  $25 \pm 2^\circ\text{C}$ , 湿度  $65 \pm 20\% \text{RH}$  条件下进行, 样品为交货一周内的新电池)

| ITEM<br>项目                          | SPECIFICATION<br>规格  |
|-------------------------------------|--|
| Nominal capacity<br>标称容量            | 4400 mAh@0.2C  |
| Minimum capacity<br>最小容量            | 4200 mAh@0.2C  |
| Nominal voltage<br>标称电压             | 3.6V   |
| Charge voltage<br>充电电压              | 4.20V  |
| Discharge cut-off voltage<br>放电终止电压 | 2.75 V   |
| Max charge current<br>最大充电电流        | $0^\circ\text{C} \leq T \leq 5^\circ\text{C}$ 0.2C (880mA) (not for cycle life)<br>$5^\circ\text{C} < T \leq 15^\circ\text{C}$ 0.5C (2200mA) (not for cycle life)<br>$15^\circ\text{C} < T \leq 45^\circ\text{C}$ 1C (4400mA) (not for cycle life)       |
| Max discharge current<br>最大放电电流     | $-20^\circ\text{C} \leq T \leq 5^\circ\text{C}$ 1.0C (4400mA) (not for cycle life)<br>$5^\circ\text{C} < T \leq 45^\circ\text{C}$ 3.0C (13200mA) (not for cycle life)<br>$45^\circ\text{C} < T \leq 60^\circ\text{C}$ 1.5C (6600mA) (not for cycle life) |

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 3 / 13 |
|-------------|-------------|---------|---|------|--------|

|                             |  |
|-----------------------------|--|
| Storage temperature<br>存储温度 | 1 year: -20~25°C<br>3 months: -20~45°C<br>1 month: -20~60°C              |
| Humidity range<br>湿度范围      | 0~60% RH (non-condensing 不冷凝)  |
| Internal resistance<br>内阻   | ≤ 20 mΩ (AC Impedance, 1000 Hz)  |
| Cell dimension<br>电芯尺寸      | Height: 71.2±0.2mm 高度: 71.2±0.2mm<br>Diameter: 21.6±0.2mm 直径: 21.6±0.2mm |
| Weight<br>重量                | 67.5±2g  |

## 5 Technical requirements 技术要求

### 5.1 Cell usage conditions 电芯使用环境

Temperature of charge 充电温度: 0~45°C

Temperature of discharge 放电温度: -20~60°C

### 5.2 Cell testing conditions 电芯试验环境

Unless otherwise specified, all tests stated should be done under 25 ±2°C, 65 ±20%RH

除非有特殊说明, 所有测试须在25 ±2°C, 65 ±20%RH环境下进行

### 5.3 Requirement of the testing equipment 测量仪表要求

The voltage measurement device: not less than 0.5 grade

电压测量装置: 不低于 0.5 级

The current measurement device: not less than 0.5 grade

电流测量装置: 不低于 0.5 级

AC Impedance: 1000 Hz

交流阻抗测量频率: 1000 Hz

Temperature meter: precision ≤ 0.5°C

温度仪表要求: 测量温度的仪表精度不高于 0.5°C

Time measurement unit: ±0.1%

时间测量装置: ±0.1%

The size measurement device: ±0.1%

尺寸测量装置: ±0.1%

The quality measurement device: ±0.1%

质量测量装置: ±0.1%

### 5.4 Electrochemical Characteristics (Unless otherwise specified, the cell should be fresh cell and tested under 25 ±2°C, 65 ±20%RH.)

**电芯特性** (除非有特殊说明, 否则所有测试要求为: 温度在 25±2°C, 湿度 65±20%RH 条件下进行, 样品为交货一周内的新电池)

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 4 / 13 |
|-------------|-------------|---------|---|------|--------|

| NO.<br>序号 | ITEM<br>测试项目  | CRITERION<br>性能标准   |
|-----------|---|---|
| 5.4.1     | Discharge rate capability<br>倍率放电性能                   | Test conditions:<br>Temperature: 25 ± 2°C<br>Charge: standard charge<br>Discharge: CC discharge at variable values with cut-off voltage 2.75 V<br><br>$\frac{\text{discharge capacity at 3C}}{\text{discharge capacity at 1C}} \geq 95\% ; \frac{\text{3C放电容量}}{\text{1C放电容量}} \geq 95\%$   |
| 5.4.2     | Cycling life<br>循环寿命                                  | Test conditions:<br>Temperature : 25 ± 2°C<br>Charge: the cell is charged to 4.2V at a constant current of 0.5C (2200mA), and then charged constantly under the voltage of 4.2V until the current reaches 0.05C (220mA) .<br>Discharge: standard discharge<br><br>$\frac{\text{Discharge capacity of 401th cycle}}{\text{Original discharge capacity}} \geq 90\% ; \frac{\text{第401次循环的放电容量}}{\text{初始放电容量}} \geq 90\%$<br><br>$\frac{\text{Discharge capacity of 801th cycle}}{\text{Original discharge capacity}} \geq 80\% ; \frac{\text{第801次循环的放电容量}}{\text{初始放电容量}} \geq 80\%$          |
| 5.4.3     | High-Low temperature discharge performance<br>高低温放电性能 | Test conditions:<br>Charge: standard charge<br>Discharge: CC discharge at 1C (4400 mA) under various temperatures with cut-off voltage 2.75V (2.5 V at -20°C)<br><br>$\frac{\text{discharge capacity at } -20^{\circ}\text{C}}{\text{discharge capacity at } 25^{\circ}\text{C}} \geq 75\% ; \frac{\text{-20}^{\circ}\text{C 放电容量}}{\text{25}^{\circ}\text{C 放电容量}} \geq 75\%$<br><br>$\frac{\text{discharge capacity at } 60^{\circ}\text{C}}{\text{discharge capacity at } 25^{\circ}\text{C}} \geq 95\% ; \frac{\text{60}^{\circ}\text{C 放电容量}}{\text{25}^{\circ}\text{C 放电容量}} \geq 95\%$ |
| 5.4.4     | Storage performance<br>存储性能                           | 5.4.4.1 RT Storage Performance (100% SOC)<br>Test conditions:<br>Charge: standard charge<br>Stored at 25°C for 28 days<br>Discharge: standard discharge<br><br>$\frac{\text{Residual capacity after 28days storage}}{\text{Original discharge capacity}} \geq 90\% ; \frac{\text{存储28天残余容量}}{\text{初始容量}} \geq 90\%$  |

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 5 / 13 |
|-------------|-------------|---------|---|------|--------|

|  |  |  |
|--|--|--|
|  |  | <p> <math display="block">\frac{\text{Recovery capacity after 28days storage}}{\text{Original discharge capacity}} \geq 95\% ; \frac{\text{存储28天恢复容量}}{\text{初始容量}} \geq 95\%</math> </p> <p>5.4.4.2 High Temperature Storage Performance ( 100% SOC)</p> <p>Test conditions:</p> <p>Charge: standard charge</p> <p>Stored at 60°C for 7 days</p> <p>Discharge: standard discharge after kept for 5 h at 25°C</p> <p> <math display="block">\frac{\text{Residual capacity after 7days storage}}{\text{Original discharge capacity}} \geq 90\% ; \frac{\text{存储7天残余容量}}{\text{初始容量}} \geq 90\%</math> </p> <p> <math display="block">\frac{\text{Recovery capacity after 7days storage}}{\text{Original discharge capacity}} \geq 95\% ; \frac{\text{存储7天恢复容量}}{\text{初始容量}} \geq 95\%</math> </p> <p>5.4.4.3 High Temperature Storage Performance ( 50%SOC)</p> <p>Test conditions:</p> <p>Charge: standard charge</p> <p>Discharge: standard discharge , 初始容量 Co</p> <p>Stored at 45°C for 28 days</p> <p>Charge: standard charge after kept for 5 h at RT</p> <p>Discharge: standard discharge</p> <p> <math display="block">\frac{\text{Recovery capacity after 28days storage}}{\text{Original discharge capacity}} \geq 95\% ; \frac{\text{存储28天恢复容量}}{\text{初始容量}} \geq 95\%</math> </p> |
|--|--|--|

## 5.5 Environmental characteristics and safety characteristics 环境适应性能和安全性能

| NO.<br>序号 | ITEM<br>测试项目            | CRITERION<br>性能标准                                     | TESTING METHOD<br>测试条件与方法  |
|-----------|-------------------------|---|--|
| 5.5.1     | Overcharge test<br>过充测试 | No leak, no flame, no fire, no explosion<br>电芯不起火、不爆炸 | After fully charged according to the standard charge method, the cell is charged at 1C till the ending conditions: the cell voltage reaches 1.5 times of the cut-off voltage of standard charge or the 1C charge time reaches 60 min. The cell is observed for 1 h afterwards.<br>电芯以标准充电方式充满电, 然后以 1C 充电至电压达到充电终止电压的 1.5 倍或充电时间达 1h 后停止充电, 观察 1h。 |

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 6 / 13 |
|-------------|-------------|---------|---|------|--------|

|       |                                     |   |   |
|-------|-------------------------------------|---|---|
| 5.5.2 | 130 °C hot oven test<br>130 °C 热箱测试 | No fire, no explosion<br>电芯不起火、不爆炸              | After fully charged according to the standard charge method, the cell is put in a oven at a heating speed of 5°C per minute until the temperatures of both the cell and the oven reach 130°C. The cell shall be maintained at 130°C for 30 min or until a fire or explosion is obtained.<br>电芯按照标准充电方式充满电后，将电芯放进热箱里，然后将热箱按 5°C/min 升温到 130°C，当电芯的温度也达到 130°C 时，电芯在热箱 130°C 环境下保持 30 min 或者电芯起火爆炸为止。 |
| 5.5.3 | Short circuit test<br>短路测试          | No fire, no explosion<br>电芯不起火、不爆炸              | After fully charged according to the standard charge method, the cell is short-circuited by connecting the positive and negative terminals with a copper wire for 10 min. The wire resistance shall be less than 5 mΩ. The cell is observed for 1 h after test.<br>以标准充电方式充满电后，用内阻小于 5 mΩ 的电线将电芯正、负极外部短路 10min，观察 1h。   |
| 5.5.4 | Over discharge test<br>过放测试         | No fire, no explosion, no leak<br>电芯不起火、不爆炸、不漏液 | After fully charged according to the standard charge method, the cell is discharged at 1 C for 90 min and then observed for 1 h.<br>电芯按标准充电后以 1C 电流放电 90min，观察 1h。  |
| 5.5.5 | Drop test<br>跌落测试                   | No fire, no explosion, no leak<br>电芯不起火、不爆炸、不漏液 | After fully charged according to the standard charge method, the cell is dropped with both ends from a height of 1.5 m onto the cement floor. Afterwards, the cell is observed for 1 h.<br>电芯按标准充电后分别以正负端子两个方向从 1.5m 高度处自由跌落到水泥地面上。   |
| 5.5.6 | Seawater immersion<br>海水浸泡          | No fire, no explosion, no leak<br>电芯不起火、不爆炸     | After fully charged according to the standard charge method, the cell is immersed in sea water (3.5wt% of NaCl) for 2 h. Afterwards, the cell is observed for 1 h.<br>电芯按标准充电后完全浸入 3.5% NaCl 溶液（质量百分比，模拟常温下的海水成分）中 2h，并观察 1h。   |

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 7 / 13 |
|-------------|-------------|---------|---|------|--------|

|                   |  |   |   |
|-------------------|--|---|---|
| 5.5.7             | Thermal cycling<br>温度循环  | No fire, no explosion, no leak<br>电芯不起火、不爆炸、不漏液 | <p>After fully charged according to the standard charge method, the cell is put in an oven. Then</p> <ol style="list-style-type: none"> <li>1. Decrease the chamber temperature from RT to -40°C within 60 min and keep the cell under -40°C for 90 min.</li> <li>2. Raise the chamber temperature from -40°C to 25°C within 60 min.</li> <li>3. Raise the chamber temperature from 25°C to 85°C within 90 min and keep the cell under 85°C for 110 min.</li> <li>4. Decrease the chamber temperature from 85°C to 25°C within 70 min.</li> <li>5. Repeat the sequence for a further 4 cycles.</li> </ol> <p>Afterwards, the cell is observed for 1 h.<br/>电芯首先按标准制式充电，放入温度箱中，温度箱温度调节如下：</p> <ol style="list-style-type: none"> <li>1. 在 60 min 内由 25°C 降温至 -40°C，保持 90 min</li> <li>2. 在 60 min 内温度升至 25°C</li> <li>3. 在 90 min 内温度升至 85°C，保持 110 min</li> <li>4. 在 70 min 内降温至 25°C。</li> <li>5. 循环以上步骤 4 次</li> </ol> <p>结束后观察 1h.</p> |
| 5.5.8             | Low pressure 低气压   | No fire, no explosion, no leak<br>电芯不起火、不爆炸、不漏液 | <p>After fully charged according to the standard charge method, the cell is put at the pressure of 11.6 kPa for 6 h. Afterwards, the cell is observed for 1 h.</p> <p>电芯以标准充电方式充满电后将其放入低气压箱中，调节试验箱中气压为 11.6 kPa，温度为室温，静置 6 h，之后观察 1 h。</p>  |
| <b>Note</b><br>备注 | <p>Unless otherwise specified, all safety tests above shall be conducted in ventilated environment at 25 ± 2°C and under protective equipment.<br/>除特殊说明，以上所有安全测试均应在 25°C ± 2°C 通风橱中，且附带有保护装置的情况下进行。</p> |   |   |

## 6 Shipment 出货

The Cell shall be shipped in voltage range of 3.6~3.9V or in accordance with customers' requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.

单体电芯按 3.6~3.9V 的充电电压或客户要求出货,电芯出货后充电前的剩余容量取决于储存时间和条件。

## 7 Warranty 质量保证

The Warranty period of cell is made according to business contract. However, even though the problem occurs within this period, SVOLT Energy won't replace a new cell for free as long as the problem is not due to the failure of SVOLT Energy manufacturing process or is due to customers' 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，如果非蜂巢能源科技的制程原因，而是客户的误用造成的电芯质量问题，蜂巢能源科技不承诺免费更换。

SVOLT Energy will not be responsible for the trouble caused by handling in violation of cautions in instructions.

蜂巢能源科技对违反安全守则操作所产生的问题不承担任何责任。

SVOLT Energy will not be responsible for the trouble caused by matching electric circuit, cell pack and

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 8 / 13 |
|-------------|-------------|---------|---|------|--------|

charger.

蜂巢能源科技对与电路、电池组、充电器搭配使用所产生的问题不承担任何责任。

SVOLT Energy will not be responsible for any defect of cells caused 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蜂巢能源科技质量保证的范围之列。

## 8 Storage and Shipment Requirement 存储及运输要求

| Item<br>项目   |   | Requirement<br>要求        |
|--|---|--------------------------|
| Storage<br>environment<br>储存环境   | Short period less than 1 month<br>短期少于 1 个月 | -20°C ~ 60°C, 60% RH Max |
|  | Long period more than 3 month<br>长期超过 3 个月  | -20°C ~ 45°C, 60% RH Max |
|  | Recommend storage<br>推荐存储                   | -20°C ~ 25°C, 60% RH Max |
| Long time storage :<br>If the cell is stored for a long time, the cell's storage voltage should be 3.6~3.9 V. Also, it is recommended to charge the cell every six months. |   |                          |

## 9 Cell safety code 电芯安全准则

### Design and usage of chargers and battery packs

#### 9.1 充电器和电池组设计及使用注意事项

##### 9.1.1 Charge 充电

The cell should be charged by constant current charge - constant voltage charge. The charging voltage of a single cell should not exceed 4.20 V, and the cut-off current of charging should be greater than or equal to 1/50C. Considering the control deviation of the charger, the charging voltage of the cell must be lower than 4.20 V. Even in exceptional circumstances, the charging voltage shall not exceed 4.25 V to avoid overcharging. Charging voltage higher than 4.20 V will shorten the cell cycle life.

电芯应该使用恒流充电-恒压充电的方式进行充电。单体电芯的充电电压不能超过 4.20 V，充电截止电流大于等于 1/50C。考虑到充电器的控制偏差，必须保证电芯充电电压低于 4.20 V。即使在异常情况下，充电电压不可超过 4.25V 以避免过充电。充电电压高于 4.20 V 会导致电芯循环寿命缩短；

The charger should have a pre-charging system and the pre-charging function should be used to prevent abnormal high power charging after deep discharge. After long-term storage, When the cell voltage is lower than 2.75V (0%SOC), the cell must be pre-charged with a current lower than 0.1C until the cell voltage is higher than 2.75V, then charge in standard mode. If the cell voltage cannot be charged to 2.75V within 30 minutes, the charger shall stop charging;

充电器应该带有预充电系统，预充电功能应该应用于阻止深度放电后不正常的大倍率充电。当长期存储电芯电压低于 2.75V (0%SOC) 时，必须使用低于 0.1C 电流对电芯进行预充电，直到电芯电压高于 2.75V 再进行标准方式充电。如果电芯电压在 30 分钟内无法充至 2.75V，充电器需停止充电；

Chargers should be equipped with a complete charge detection device. The charging detection device can be checked by timer, current detection or open circuit voltage detection to detect the charging state. When the charging detection device detects that the cell is fully charged, the charging circuit should be completely cut

off to avoid trickling charge. The cell charge should be carried out at the temperature of 0 °C ~ +45 °C. When the cell temperature exceeds this range, it should be placed until the cell temperature reaches the above range.

充电器应该配备一个完整的充电检测装置。充电检测装置能够通过计时器、电流检测或者开路电压检测，检测到电池满充电的状态。当充电检测装置检测到电池充满电后，应该完全切断充电电路。避免产生涓流充电；电芯充电应在温度为 0 °C ~ +45 °C 下进行，当电芯温度超出此范围时，应静置到电池温度达到以上范围后再行充电。

### 9.1.2 Discharge 放电

Single cell discharge current should be less than maximum discharge current.

单体电芯放电电流需小于最大放电电流。

The discharge cutoff voltage of the cell shall be higher than 2.75 V;

电芯放电终止电压需高于 2.75 V；

The discharge temperature of the cell range from -20 °C to +60 °C. During the discharge process, if the surface temperature of the cell exceeds 70 °C, the discharge must be terminated.

电芯放电温度范围为-20 °C ~ +60 °C，放电过程中，如果电芯表面温度超过 70 °C，必须终止放电。

### 9.1.3 Over-discharges 过放电

If the voltage of a single cell is lower than 2.75 V, the cell is considered to be over discharged and cannot be used anymore.

如果单体电池的电压低于 2.75 V, 电池被认为是过放电, 不能继续使用。

### 9.1.4 Considerations for battery pack design 电池组设计的注意事项

#### 9.1.4.1 The shape, mechanism and material of the battery pack 电池组的形状、机理和材料

The battery pack should be designed so that it cannot be charged by an unauthorized charger. The battery pack design should ensure that it does not connect to unauthorized equipment and equipment.

电池组设计应该保证其不能被未授权的充电器进行充电。电池组设计应该保证其不能与未授权的装备和设备进行连接。

The positive and negative ends of the battery pack should be designed to avoid short circuit or reverse connection.

电池组正负极两端应该设计成避免短路或正负极发生反接的结构。

In addition, the battery pack should have an overcurrent protection device to avoid the occurrence of external short circuit.

此外，电池组应该有过电流保护功能的装置，来避免外短路的情况发生。

There should be no overlap between the positive and negative connection wires of the battery pack.

电池正、负极连接导线不应有重叠现象。

The battery pack should be designed to prevent static electricity and dust, liquids, etc.

电池组设计应该具有防静电功能并且能够阻止灰尘、液体等侵入

The battery pack should be designed so that even if the cell leaks, the electrolyte will not reach the protective circuit board.

电池组应该设计成即便电池发生了漏液，电解液也不能到达保护线路板。

The design of the battery pack should ensure that the cells are fixed in the battery pack and not arbitrarily movable. The battery pack shall be structurally designed to prevent the occurrence of dents, deformations or other mechanical stresses on the cells in the event of a predictable fall.

电池组设计上应保证电池固定在电池组内，不能任意移动。电池组在结构上应保证在出现可预见的跌

落后不能使电池出现凹痕，变形和其他机械应力。

The flammability of materials used in the battery pack, such as double-sided tape and rubber, should be verified. 电池组使用的材料例如双面胶带和橡胶应该验证其可燃性。

#### 9.1.4.2 Battery pack structure (Cell number limitation) 电池组结构（电池组限制使用的电池数量）

The number of parallel connections is unlimited, but the battery pack must pass the overcharge test (the charging current of the overcharge test is the product of the maximum charging current of the charger and the number of parallel connections).

并联个数无限制 但是电池组必须通过过充电测试（过充测试的充电电流为充电器的最大充电电流与并联数量的乘积）。

The number of serial connections is unlimited, and series fuses are required.

串联个数无限制，需要保险丝。

The cell should be kept away from heating electronic components to avoid deterioration of cell performance. Insulation should be provided between the PCB'A and the battery pack (e.g. plastic barrier for air isolation or non-thermal conductive insulation).

电池应该远离发热电子元器件以避免电池性能的劣化。PCB'A 线路板和电池组之间应该有绝热材料进行隔绝（例如塑料屏障给予空气隔离或非导热电材料隔离）。

#### 9.1.4.3 Protection circuit 保护电路

The following protection circuit should be installed in the battery pack

下面的保护电路应该安装在电池包内

##### Over charge protection

过充电保护

For safety reasons and in order not to shorten cycle life, the maximum overcharge protection voltage of the single cell in each module should be less than 4.2V.

出于安全的原因和为了不缩短循环寿命，每个模块内的单体电池的最大过充保护电压应该低于 4.2V。

##### Over discharge protection

过放电保护

If the single cell voltage reaches 2.75 V, Svolt suggest that the discharge current should be cut off in the over discharge protection, and the consumption current of the circuit should be as small as possible.

如果单体电芯电压达到 2.75 V，建议过放电保护应该切断放电电流，电路的消耗电流要尽量小。

##### Ovre current protection

过电流保护

If the discharge current of a single cell exceeds about maximum discharge current, the overcurrent protection should cut off the discharge current.

如果单体电池放电电流超过最大持续放电电流，过电流保护应该切断放电电流。

##### Protection circuit power consumption

保护电路功耗

In order to avoid over discharge mode in long-term storage, the current consumption of the battery pack protection circuit should be set as small as possible. When it is not in use for a long time, it is necessary to check the residual state of the cell regularly and ensure that each single cell in the battery pack cannot reach the over-discharge state.

为了避免长期存储出现过放电模式，电池包保护线路的消耗电流应该设置的尽量小。长期未使用时，要定期检查电量剩余状态，要确保电池组内各单体电芯不能达到过放状态。

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 11 /13 |
|-------------|-------------|---------|---|------|--------|

#### 9.1.4.4 Cell connection 电池连接

The cells cannot be connected using soldering process. In order to avoid any damage, resistance welding or laser welding is recommended for cell connection.

电池不能使用锡焊的工艺进行连接。为了避免任何损伤，建议采用电阻焊或者激光焊的方式进行电池连接。

Cells in battery pack should be temperature balanced. When the battery pack is discharging, the internal temperature difference of the battery pack should be less than or equal to 5 °C.

电池组应该尽量热均衡，电池包在放电时，内部电芯温差应小于等于 5 °C。

#### 9.1.4.5 Use mode of cell 电芯使用方式

When the cell is used in tandem, the same grade, the same batch and the same charging state are necessary.

This information can be obtained from the label of the inner and outer box. Before the cell is used, the voltage, internal resistance should be detected and assembled according to its purpose. Svolt suggests that the cell voltage within 20 mV and the internal resistance difference within 6 mΩ should be guaranteed at least.

电芯进行串并使用时，需使用相同档位，相同批次及相同充电状态电芯，可以从内外箱标签上获得此信息。电芯使用前需检测电压内阻，并按照其用途进行组配，建议至少保证组配使用电芯电压 20mV 以内，内阻差 6mΩ 以内。

Check voltage, internal resistance, protection circuit function, thermistor, thermal fuse of battery pack before shipment.

出货前电池包检查电压、内阻、保护线路功能、热敏电阻、热熔断器。

Special attention should be paid to the transfer of the cell to the assembly plant. External damage caused by the transport process is forbidden. Svolt recommends using the same transport packaging, even if the packaging is opened during the process.

电芯中转至组装工厂过程要特别注意禁止运输过程造成外力损伤，转运过程建议使用相同的运输包装，即使过程中存在打开包装的情况。

Do not use damaged or leaking cells caused by transportation damage, drop, short circuit or other reasons.

不要使用由于运输损伤，跌落，短路或其它原因造成破损或漏液电芯。

## 9.2 Warning and cautions in handling the lithium-ion cell

### 电芯使用时警告事项及注意事项

Lithium-ion rechargeable batteries subjected to abuse can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before 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 SVOLT Energy in advance, if and when the customer needs other applications or operating conditions not described in this document.

注释 1. 如果客户需要其它应用程序或本文档中描述之外的操作条件，客户需要提前联系蜂巢能源科技有限公司。

Note 2. SVOLT Energy will take no responsibility for any accident when the cell is used under other conditions not 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，蜂巢能源科技有限公司不承担任何责任。

### Warnings 警告

To prevent the possibility of the battery from leaking, heating, explosion, please observe the following precautions: (It should be indicated especially in manual or instruction for users.)

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 12 /13 |
|-------------|-------------|---------|---|------|--------|

危险警告：（应在使用说明手册或说明书中，特别注明）为防止电池可能发生泄漏，发热，爆炸，请注意以下预防措施：

|    |   |
|----|---|
| 1  | Do not use and leave the cell near a heat source such as fire or heater.<br>禁止将电芯在热高温源旁，如火，加热器等旁边使用和留置。   |
| 2  | Do not use or leave the cell under the blazing sun (or in heated car by sunshine).<br>不要将电芯放置在太阳光直射的地方。   |
| 3  | Do not use or leave the battery at very high temperature conditions (e.g., strong direct sunlight or a vehicle in extremely hot conditions). Otherwise, it can overheat or catch fire or its performance will be degenerate and its service life will be decreased.<br>禁止在高温下（直热的阳光下或很热的汽车中）使用或放置电池，否则可能会引起电池过热，起火或功能失效，寿命减短。 |
| 4  | Do not short circuit, over-charge or over-discharge the cell.<br>不要将电芯短路,过充或过放。   |
| 5  | Don't immerse the battery in water and seawater. Please put it in cool and dry environment if no using.<br>严禁将电池浸入海水或水中，保存不用时，应放置在阴凉干燥的环境中。   |
| 6  | Don't reverse the positive and negative terminals<br>严禁颠倒正负极使用电池。   |
| 7  | Do not disassemble or modify the cell.<br>不要拆卸或修整电芯。  |
| 8  | Do not transport or store the battery together with metal objects such as necklaces, hairpins, coins, etc.<br>禁止将电池与金属，如发夹，项链等一起运输或贮存。  |
| 9  | Make sure the cell is not with conspicuous damage or deformation.<br>不要使电芯受到明显的损害或变形。   |
| 10 | Don't connect the cell to an electrical outlet directly.<br>严禁将电芯直接插入电源插座。  |
| 11 | If the cell leaks and the electrolyte splashes into the eyes, rinse the eyes with clean running water immediately for at least 15 minutes, and go to hospital for treatment if necessary.<br>如果电芯发生泄露，电解液进入眼睛，请立即用清水冲洗眼睛至少 15 min，必要时请立即前往医院接受治疗。   |
| 12 | Mixed use of batteries of different types is not allowed.<br>禁止与液态锂离子或不同型号的锂电池混合使用。   |
| 13 | Keep the battery away from babies.<br>电池应远离小孩。  |
| 14 | Do not directly solder the battery and pierce the battery with a nail or other sharp object<br>禁止直接焊接电池和用钉子或其它利器刺穿电池。   |
| 15 | Do not strike, throw or trample the battery.<br>禁止敲击或抛掷，踩踏电池等。  |
| 16 | Use the battery charger specifically for that purpose when charging.<br>充电时请选用锂离子电池专用充电器。   |
| 17 | Please separate cells of different electrochemical systems from one another when disposing of secondary cells.  |

|             |             |         |   |      |        |
|-------------|-------------|---------|---|------|--------|
| Document No | DOC-2200864 | Version | A | Page | 13 /13 |
|-------------|-------------|---------|---|------|--------|

|    |  |
|----|--|
|    | 二次电池处理时，请将电池和其他电化学体系的产品分开。   |
| 18 | Clean the terminals with a dry cloth before use if the battery terminals are dirty. Otherwise power failure or charge failure may occur due to the poor connection with the instrument.<br>如果电池弄脏，使用前应用干布抹净，否则可能会导致接触不良功能失效。   |
| 19 | Batteries should be removed from the device or charger immediately and not used again if they are over heat, give off odor, discolor or deform, or appear abnormally in any way during use, charging and storage.<br>如果电池发出异味，发热，变色，变形或使用，贮存，充电过程中出现任何异常现象，立即将电池从装置或充电器中移离并停用。 |
| 20 | The battery replacement shall be done only by either cell supplier or device supplier instead of the user.<br>更换电芯应由电芯供应商或设备供应商完成，用户不得自行更换。  |
| 21 | Please tape the terminals to insulate batteries before discarding them in case of fire and explosion.<br>废弃电池之前应用绝缘纸包住电极，以防起火、爆炸。  |
| 22 | Do not use cells in strong electrostatic and magnetic occasions, otherwise, it can cause safety problems easily.<br>禁止在强静电和强磁场的地方使用，否则易带来不安全的隐患。   |
| 23 | Use of damaged cells is not permitted.<br>禁止使用已损坏的电芯。  |
| 24 | Make sure package designing will not cause battery damages.<br>电池外壳设计和包装禁止损伤电池。  |
| 25 | Battery packing should be conducted strictly according to level range, any misuse of different levels should not be permitted.<br>电池配组时需严格按等级执行，不能跨等级成组。   |
| 26 | Disassembling cells from pack or module is not permitted unless under the guidance of professional technicians.<br>严禁将电池从电池包或电池模组中拆卸，除非在专业技术人员的指导下进行。  |

## 10 The restriction of the use of hazardous substances 有害物质控制要求

This model of lithium-ion cell is in accordance with our company's request of

“The hazardous substances and material management standard” or customer's requirements!

本型号锂离子电芯符合本公司《有害物质与材料管理规范》要求或参照客户要求执行！

## 11 Contact information 联系方式

If you have any questions regarding the cell, please contact the following address:

如有疑问，请按以下地址联系：

Headquarter: 50m east of the intersection of Jiangdong Avenue and Zhengwei Road, Yushan Economic Development Zone, City

厂址：马鞍山市雨山经济开发区江东大道与正威路交叉口向东 50 米

Post Code:243000

邮编：243000