

锂离子电芯规格书

Specification For Lithium-ion Rechargeable Cell

电芯型号 :ND18650-2500mAh数码

Cell Type: ND18650-2500mAh数码

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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、bar code and size 电芯型号、喷码及尺寸**
 - 3.1 Description and model 电芯说明及型号
 - 3.2 Cell size 电芯尺寸
- 4 Cell specification 电芯特性**
- 5 Technical characteristic 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 Electronic performance 电性能
 - 5.5 Safety characteristics 安全性能
 - 5.6 Environmental characteristics 环境适应性能
- 6 Shelf life and product liability 保质期及产品责任**
- 7 Warning and cautions in handling the lithium-ion cell**
电芯使用时警告事项及注意事项

1 Preface 前言

This specification describes the type and size, performance, technical characteristics, warning and caution of the lithium ion rechargeable cell. The specification only applies to ND18650-2500mAh cell supplied by Guangdong Norda Smart Energy Technology 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。本标准适用于广东诺达智慧能源科技有限公司生产的圆柱型 ND18650-2500mAh 锂离子电芯。

2 Definition 定义

2.1 Nominal capacity:

标称容量:

Nominal capacity: Cap=2500mAh. Under $25\pm5^{\circ}\text{C}$, It means the capacity value of being discharged by 2-hours rate to end voltage 2.75 V, which is signed Cap, the unit is mAh.

标称容量 Cap=2500mAh, 指在 $25\pm5^{\circ}\text{C}$ 环境下, 以 2 小时率放电至终止电压 2.75 V 时的容量, 以 Cap 表示, 单位为毫安培时(mAh)。

2.2 Standard charge method:

标准充电方式:

Under $25\pm5^{\circ}\text{C}$, it can be charged to 4.2V with constant current of 0.2C, and then, charged continuously with constant voltage of 4.2V until the charged current is 0.01C.

指在 $25\pm5^{\circ}\text{C}$ 环境下, 以 0.2C 的电流恒流充电至单体电芯电压 4.2 V 后, 转为恒压 4.2 V 充电, 至充电电流小于 0.01C 时, 停止充电。

2.3 Standard discharge method:

标准放电方式:

Under $25\pm5^{\circ}\text{C}$, it can be discharged to the voltage of 2.75V with constant current of 0.5C.

指在 $25\pm5^{\circ}\text{C}$ 环境下, 以 0.5C 的电流恒流放电至单体电芯电压 2.75 V。

3 Cell type and size 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: ND18650-2500mAh

ND18650-2500mAh 型号的圆柱锂离子二次电芯

3.2 Cell size&Spray code identification 电芯尺寸及喷码标识

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

电芯尺寸示意图如图 1 所示（单位：mm）。

The cell spray code identification is listed in Figure 2.

电芯喷码标识如图 2 所示。

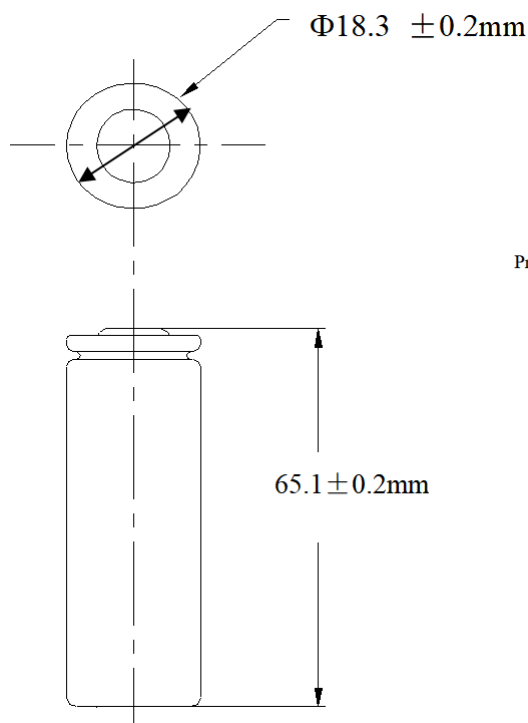


Figure 1/ 图 1

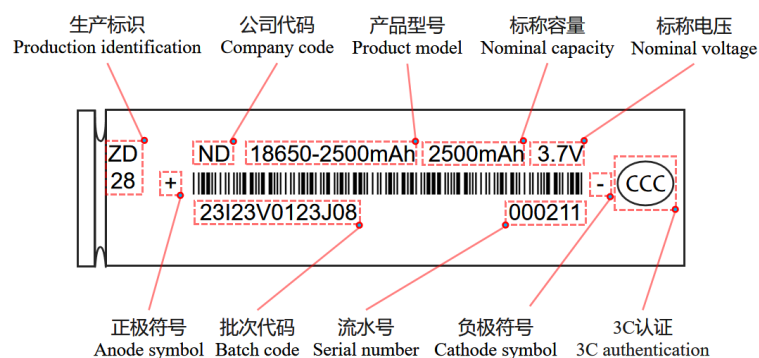


Figure 2/ 图 2

4 Cell specification 电芯特性

ITEM 项目	SPECIFICATION 特性
Nominal capacity 标称容量	2500 mAh (0.5C)
Minimum capacity 最小容量	2450 mAh (0.5C) (Discharge the cell from 4.2V to 2.75V by 0.5C current) (电芯以 0.5C 从 4.2V 放电至 2.75V)
Nominal voltage 标称电压	3.7V
Charging upper limit voltage 充电截止电压	4.2 V
Discharge ending voltage 放电截止电压	2.75 V
Standard charging current 标准充电电流	0.2C(500 mA)
Standard discharge current 标准放电电流	0.5C(1250mA)

Max charge current 最大充电电流	1C($T \geq 10^{\circ}\text{C}$) 0.2C($10^{\circ}\text{C} > T \geq 0^{\circ}\text{C}$)
Max continuous discharge current 最大持续放电电流	1C($T \geq 0^{\circ}\text{C}$) 0.5C($0^{\circ}\text{C} > T \geq -10^{\circ}\text{C}$) 0.2C($-10^{\circ}\text{C} > T \geq -20^{\circ}\text{C}$)
Max instantaneous discharge current 最大瞬间放电电流	2C
Max recommended charge and discharge cell body temperature 充放电过程中电芯表面的最大推荐温度	Charge: $0 \sim 45^{\circ}\text{C}$ Discharge: $-20 \sim 55^{\circ}\text{C}$ 充电时: $0 \sim 45^{\circ}\text{C}$ 放电时: $-20 \sim 55^{\circ}\text{C}$
Maximum short term allowable charge and discharge cell body temperature. Charging and discharging at these conditions will shorten cell cycle life. 充放电过程中电芯表面的短时间最大温度(在这些情况下充放电将会导致电池循环寿命很快衰减)	Charge: 45°C Discharge: 55°C 充电时: 45°C 放电时: 55°C
Humidity range 湿度范围	$0 \sim 90\% \text{RH}$ (non-condensing 不冷凝)
Internal resistance 内阻	$\leq 52\text{m}\Omega$ (AC Impedance, 1000 Hz)
Cell dimension 电芯尺寸	Height : $65.1 \pm 0.2\text{mm}$ 高度: $65.1 \pm 0.2\text{mm}$ Diameter : $18.3 \pm 0.2\text{mm}$ 直径: $18.3 \pm 0.2\text{mm}$
Weight 重量	$\approx 45.7\text{g}$

5 Technical characteristics 技术要求

5.1 Cell usage conditions 电芯使用环境

Temperature of charge 充电温度: $0 \sim 45^{\circ}\text{C}$

Temperature of discharge 放电温度: $-20 \sim 55^{\circ}\text{C}$

5.2 Cell testing conditions 电芯试验环境

Unless otherwise specified, all tests stated according to following:

除非有特殊说明, 所有测试的环境条件要求如下:

Temperature 温度: $25 \pm 5^{\circ}\text{C}$

5.3 Requirement of the testing equipment 测量仪表要求

Voltage meter: The voltage tester internal resistance is $\geq 10 \text{ K}\Omega/\text{V}$

电压仪表要求: 测量电压的仪表内阻不小于 $10 \text{ K}\Omega/\text{V}$

Temperature meter: The precision is $\leq 0.5^{\circ}\text{C}$

温度仪表要求: 测量温度的仪表精度不低于 0.5°C

5.4 Electronic performance 电性能

NO. 序号	ITEM 测试项目	CRITERION 性能标准	TESTING METHOD 测试条件与方法
5.4.1	Discharge performance at normal temperature 常温放电性能	Discharge capacity/nominal capacity $\times 100\%$ 放电容量/标称容量 $\times 100\%$ A) $0.2C \geq 100\%$ B) $0.5C \geq 97\%$ C) $1C \geq 95\%$	Under the conditions of 1 standard atmosphere, ambient temperature of $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, relative humidity of 45% ~ 80%, battery 0.5C standard charge (if there is no special instructions below, all placed under this condition, all according to this charging method), rest for 10min, Discharge 0.2C, 0.5C, and 1C to the lower limit voltage of 2.75V respectively, cycle for three times, when one reaches the standard, it meets the standard requirements (the same below). 在1 标准大气压, 环境温度 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 相对湿度为 45%~80%的条件下, 电池 0.5C 标准充电后(以下若没有特别说明, 均在此条件下放置, 皆按此充电方式) 搁置10min, 分别以0.2C、0.5C、1C 进行放电至下限电压 2.75V, 循环三次, 当有一次达到标准, 即达到标准要求(下同)
5.4.2	Charge retention capacity at room temperature 常温荷电保持能力	Residual capacity \geq nominal capacity $\times 96\%$ recovery capacity \geq nominal capacity $\times 96\%$ open-circuit voltage reduction rate $\leq 3\%$ Internal resistance increase rate $\leq 10\%$ 剩余容量 \geq 标称容量 $\times 96\%$ 恢复容量 \geq 标称容量 $\times 96\%$ 开路电压减小率 $\leq 3\%$ 内阻增加率 $\leq 10\%$	Measure the initial state and capacity of the battery. After standard charging, the battery is placed in an open circuit for 30 days to measure the final state of the battery. Discharge at 0.5C to 2.75V to measure the remaining capacity of the battery; 0.5C/0.5C measures the recovery capacity of the battery. Can cycle three times, when there is a standard, that is to meet the standard requirements. 测量电池的初始状态和初始容量, 电池标准充电后, 开路放置 30 天, 测量电池最终状态; 以 0.5C 放电至2.75V, 测量电池的剩余容量; 0.5C/0.5C 测量电池的恢复容量。可循环三次, 当有一次达到标准, 即达到标准要求。
5.4.3	Cycle life 循环寿命	Capacity $\geq 80\%$ of nominal capacity 容量 \geq 标称容量 80%	Measure the initial state and initial capacity of the battery, charge at an ambient temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 0.5C and discharge for 0.5C, and measure the final state of the battery after 500 cycles. 测量电池的初始状态和初始容量, 在环境温度 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 进行 0.5C充0.5C放, 循环500次后测量电池的最终状态。
5.4.4	Storage performance 存储性能	0.5C5A discharge time Store the battery for 1 month $\geq 118\text{min}$; Battery stored for 2 months \geq	The initial capacity of the battery was measured. After the battery was charged to $3.80 \pm 0.02\text{V}$, the initial state of the battery was measured before storage. After the battery was stored at room

		116min; Storage of batteries for 3 months $\geq 112\text{min}$. 0.5C 放电时间 贮存1个月的电池 $\geq 118\text{min}$; 贮存2个月的电池 $\geq 116\text{min}$; 贮存3个月的电池 $\geq 112\text{min}$.	temperature for 1 month, 2 months, and 3 months, the final state of the battery was measured. 测量电池的初始容量, 电池充电至 $3.80 \pm 0.02\text{V}$ 后, 测量电池存储前的初始状态, 分别室温贮存 1 个月、2 个月、3 个月, 测量电池的最终状态, 然后以 0.5C 循环3次记录电池的放电时间。
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5.5 Safety characteristics 安全性能

NO. 序号	ITEM 测试项目	CRITERION 性能标准	TESTING METHOD 测试条件与方法
5.5.1	Overcharge test 过充测试	No explosion, no fire, the highest temperature $< 130^{\circ}\text{C}$ 不爆炸、不起火、最高 温度 $< 130^{\circ}\text{C}$	After the battery is discharged to 2.75V at 0.5C and then charged to 4.6V with 1C constant current, and then charged at 4.6V constant voltage, the battery temperature change is monitored during the test, and when one of the following two situations occurs, the test is terminated. 1. The continuous charging time of the battery reaches 7h; 2. The temperature drop value of the battery reaches 20% of the maximum temperature value; 电池 0.5C 放电至 2.75V 后再以 1C 恒流充电至 4.6V, 然后再以 4.6V 恒压充电, 试验过程中监测电池温度变化, 当出现以下两种情形之一时, 试验终止。 1、电池持续充电时间达到 7h; 2、电池温度下降值达到温度最大值的 20%;
5.5.2	Normal temperature short circuit performance 常温短路性能	No explosion, no fire, the highest temperature $< 130^{\circ}\text{C}$ 不爆炸、不起火、最高 温度 $< 130^{\circ}\text{C}$	After standard charging of the battery, measure the initial state of the battery, and place it in the explosion-proof glass cover to short-circuit its positive and negative poles directly (The total line resistance is $80\text{m}\Omega \pm 20\text{m}\Omega$). When the battery temperature drops to about 10°C lower than the peak value, the test ends. Observe the temperature and appearance of the battery. 电池标准充电后, 测量电池的初始状态, 置于防爆玻璃罩中直接短路其正负极(线路总电阻 $80\text{m}\Omega \pm 20\text{m}\Omega$), 当电池温度下降到比峰值约低 10°C 时试验结束。观察电池的温度及外观变化。
5.5.3	High temperature short circuit performance 高温短路性能	No explosion, no fire, the highest temperature $< 130^{\circ}\text{C}$ 不爆炸、不起火、最高 温度 $< 130^{\circ}\text{C}$	After the battery is charged standardly, it is placed in the environment of $57 \pm 4^{\circ}\text{C}$, and after the temperature of the battery surface reaches $57^{\circ}\text{C} \pm 4^{\circ}\text{C}$, it is placed for another 30 minutes, and then at this temperature, the positive and negative extremes of the battery are connected with a wire (the total resistance of the line is $80\text{m}\Omega \pm 20\text{m}\Omega$), and the cell temperature change is monitored during the test, and when one of the following two situations occurs, the test is terminated: 1. The cell temperature drops to 20% lower than the peak value; 2. The short-circuit time reaches 24h; 电池标准充电后, 放置于 $57 \pm 4^{\circ}\text{C}$ 的环境中, 待电池表面温度达到 $57^{\circ}\text{C} \pm 4^{\circ}\text{C}$ 后, 再放置 30min 然后在此温度下用导线(线路 总电阻 $80\text{m}\Omega \pm 20\text{m}\Omega$) 连接电池正负极端, 试验过程中监测电芯温度变化, 当出现以下两种情形

			<p>之一 时，试验终止：</p> <p>1、电芯温度下降到比峰值低 20%；</p> <p>2、短接时间达到 24h；</p>
5.5.4	Impact test 重物冲击测试	No fire, no explosion 不起火、不爆炸	<p>After the battery is charged as standard, the battery is placed horizontally and longitudinally on the surface of the platform, and the metal rod with a diameter of $15.8\text{mm} \pm 0.2\text{mm}$ is placed horizontally on the center surface of the battery, so that the metal rod is perpendicular to the longitudinal axis of the battery, and the weight of $9.1\text{kg} \pm 0.1\text{kg}$ is used to hit the battery surface of the metal rod from a height of $610\text{mm} \pm 25\text{mm}$, and 6h is observed.</p> <p>电池标准充电后， 电池水平纵向放置于平台表面， 将直径为 $15.8\text{mm} \pm 0.2\text{mm}$ 的金属棒横置在电池中心表面，使其金属棒 与电池纵轴向垂直，采用重量 为 $9.1\text{kg} \pm 0.1\text{kg}$ 的重物从 $610\text{mm} \pm 25\text{mm}$ 的高度自由落体状态撞击金属棒的电池表面， 并观察 6h。</p>
5.5.5	Extrusion safety performance 压缩安全性能	No explosion, no fire, the highest temperature $<130^{\circ}\text{C}$ 不爆炸、不起火、最高温度 $<130^{\circ}\text{C}$	<p>After the battery is charged as standard, it is connected with the thermocouple, and the cell is placed in two planes, so that its longitudinal axis is parallel to the two plates, and the extrusion force of $13.0\text{kN} \pm 0.78\text{kN}$ is applied between the two plates, and the speed of extrusion of the battery is 0.1 mm/s.</p> <p>电池标准充电后，与热电偶相连，将电芯置于两个平面内，使 其纵轴向与两平板平行，垂直于极板方向进行挤压，两平板间 施加 $13.0\text{kN} \pm 0.78\text{kN}$ 的挤压力，挤压电池的速度为 0.1 mm/s。</p>
5.5.6	Thermal shock safety performance 热冲击安全性能	不起火、不爆炸	<p>After the battery is charged as standard, it is placed in the test chamber, and the test chamber is heated at a temperature rise rate of $5^{\circ}\text{C} \pm 2^{\circ}\text{C/min}$, and the temperature in the test chamber reaches $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and then the constant temperature lasts for 30min. Observe the changes in the appearance of the battery.</p> <p>电池标准充电后，放置于试验箱中， 试验箱以 $5^{\circ}\text{C} \pm 2^{\circ}\text{C/min}$ 的 温升速率进行升温，当试验箱内温度达到 $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$后恒温并 持续 30min。观察 电池外观变化。</p>
Note 备注	<p>All above safety tests will be conducted at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ except where specified differently. Use proper ventilation with protective equipment.</p> <p>除特殊说明，以上所有安全测试均应在 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$通风橱中，且附带有保护装置的条件下进行。</p>		

5.6 Environmental characteristics 环境适应性能

NO. 序号	ITEM 测试项目	CRITERION 性能标准	TESTING METHOD 测试条件与方法
5.6.1	Thermal cycling property 热循环性能	The battery does not smoke, catch fire or explode. 电池不冒烟、不起火、不爆炸。	After the battery is charged as standard, the battery cell is placed in the test chamber and tested according to the following steps: 1. The temperature of the test chamber is raised to $72^{\circ}\text{C}\pm 2^{\circ}\text{C}$ and kept for 6 hours; 2. Reduce the temperature of the test chamber to $-40^{\circ}\text{C}\pm 2$ and keep it for 6h; 3. Repeat steps 1~2 for a total of 10 cycles; 4. Store at room temperature $20\pm 5^{\circ}\text{C}$ for 6h to observe the battery; (The transition time between the two temperatures in the test process is not more than 30min) 电池标准充电后, 将电芯放置在试验箱内按照如下步骤 进行试验: 1、将试验箱温度升高为 $72^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 并保持 6h; 2、将试验箱温度降至 $-40^{\circ}\text{C}\pm 2$ 并保持 6h; 3、重复步骤 1~2, 共循环 10 次; 4、在室温 $20\pm 5^{\circ}\text{C}$ 保存 6h 观察电池; (试验过程两个温度之间转换时间不大于 30min)
5.6.2	Drop performance 跌落性能	The battery does not smoke, catch fire or explode. 电池不冒烟、不起火、不爆炸。	After the battery is charged as standard, the battery sample is freely dropped from the position of 1m in the direction of the cylindrical surface of the battery to the concrete slab, and the upper and lower two surfaces are dropped twice each, a total of 4 times. 电池标准充电后, 将电池样品从高度为 1m 的位置 电池 圆柱面方向自由跌落到混凝土板上, 上、下两个面各跌 落2 次, 共4次。
5.6.3	Discharge performance at different temperatures 不同温度下的放电性能	Discharge capacity/nominal capacity $\times 100\%$ A) 55°C , 95% or higher; B) $\geq 90\%$ at 0°C ; C) -10°C at 60% or more; The battery does not smoke, explode or catch fire. 放电容量/标称容量 $\times 100\%$ A) $55^{\circ}\text{C} \geq 95\%$; B) 0°C 时 $\geq 90\%$; C) -10°C 时 $\geq 60\%$; 电池不冒烟、不爆炸、不起火。	Measure the initial capacity and initial state of the battery. After standard charging, the battery is placed under constant temperature for 3h at $55\pm 2^{\circ}\text{C}$, discharged at 0.5C to 2.75V, and then charged at room temperature, and then placed under corresponding constant temperature conditions for 20h in the order of $0\pm 2^{\circ}\text{C}/-10\pm 2^{\circ}\text{C}$. The corresponding termination capacity of the battery was measured at 0.5C, and the final state of the battery was measured at room temperature for 2h, and the appearance of the battery was observed. 测量电池的初始容量和初始状态, 电池标准充电后, 在 $55\pm 2^{\circ}\text{C}$ 条件下恒温搁置 3h、以 0.5C 放电至 2.75V, 然后在室温条件下标准充电, 依此按照 $0\pm 2^{\circ}\text{C}/-10\pm 2^{\circ}\text{C}$ 的顺序在相应的恒温条件下搁置 20h, 以 0.5C 测量电池对应的终止容量, 最后在室温状态下搁置 2h 测量电池的最终状态, 观察电池外观变化。

5.6.4	Adaptability to vibration environment 振动环境适应性	Battery appearance without obvious damage, no smoke, no explosion 电池外观无明显损伤、不冒烟、不爆炸	<p>After the battery is charged as standard, the battery is fastened on the vibration test bench and the vibration frequency and the corresponding amplitude of the press surface to adjust the test equipment, X, Y, Z three directions from 7Hz ~ 200Hz cycle frequency vibration 15min, vibration cycle 12 times.</p> <p>Vibration frequency: 7Hz~200Hz; Displacement amplitude: 0.8mm; After the end, observe the change in the appearance of the battery.</p> <p>电池标准充电后, 电池紧固在振动试验台上按下 面的振 动频率和对应的振幅调整好试验设备,X、 Y、 Z 三个方向 每个方向上从 7Hz~200Hz 循环扫 频振动15min, 振动周期 12次。</p> <p>振动频率: 7Hz~200Hz; 位移幅值: 0.8mm; 结束后观察电池外观变化。</p>
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备注：以上标准中的一些术语的定义：

Initial state: initial appearance of the battery, open circuit voltage, AC internal resistance.

初始状态：电池的初始外观、开路电压、交流内阻。

Final state: the final appearance of the battery, open circuit voltage, AC internal resistance.

最终状态：电池的最终外观、开路电压、交流内阻。

Remaining capacity: the first discharge capacity of the battery after a specific testing procedure.

剩余容量：电池经过特定的检测程序后的首次放电容量。

Recovery capacity: the discharge capacity of the battery after repeated charging and discharging to restore the state after a specific detection procedure.

恢复容量：电池经过特定的检测程序后，通过反复充放电使状态恢复后的放电容量。

6 Shelf life and product liability

保质期及产品责任

Shelf life is from the factory date (inkjet) 12 months from the start (every 3 months need to charge and discharge once, no-load battery needs to be in a semi-electric state).

Guangdong Norda Smart Energy Technology Co., Ltd shall not be responsible for the accidents caused by the failure to operate according to the specifications. When there are some changes in the specifications, Guangdong Norda Smart Energy Technology Co., Ltd shall notify the purchaser.

保质期是从出厂日期（喷码）开始起 12个月（每3个月需充放电一次，空载搁置电池需处于半电状态）

广东诺达智慧能源科技有限公司对因没有按本规格书规定操作而导致的意外不负责任，当本规格书有一些变动时，广东诺达智慧能源科技有限公司通知购买方。

7 Warning and cautions in handling the lithium-ion cell

电芯使用时警告事项及注意事项

To prevent the possibility of the cell from leaking, heating, explosion, please observe the following precautions:

为防止电芯可能发生泄露，发热，爆炸，请注意以下预防措施：

- » Don't immerse the cell in water.
- » 严禁将电芯浸入水中，保存不用时，应放置在阴凉干燥的环境中。
- » Don't use and leave the cell near a heat source such as fire or heater.

- » 禁止将电芯在高温源旁，如火，加热器等旁边使用和留置。
- » When charging, use a cell charger specifically for that purpose.
- » 充电时请选用锂离子电芯专用充电器。
- » Don't reverse the positive and negative terminals.
- » 严禁颠倒正负极后使用电芯。
- » Don't connect the cell to an electrical outlet directly.
- » 严禁将电芯直接插入电源插座。
- » Don't discard the cell in fire or heater.
- » 禁止将电芯丢入火或加热器中。
- » Don't connect the positive and negative terminal directly with metal objects.
- » 禁止用金属直接连接电芯正负极，造成短路。
- » Don't transport and store the cell together with metal objects such as necklaces, hairpins.
- » 禁止将电芯与金属，如发卡、项链等一起运输或存储。
- » Don't strike, throw or trample the cell.
- » 禁止敲击，抛掷或踩踏电芯等。
- » Don't directly solder the cell.
- » 禁止直接焊接电芯。
- » Don't pierce the cell with a nail or other sharp object.
- » 禁止用钉子或其它利器刺穿电芯。

Caution 小心

- » Don't use or leave the cell at very high temperature conditions (for example, strong direct sunlight or a vehicle in extremely hot conditions).
- » 禁止在高温下（直热的阳光下或很热的汽车中）使用或放置电芯，否则可能会引起电芯过热，起火或功能失效，寿命减短。
- » If the cell leaks and the electrolyte get into your eyes, don't wipe eyes, instead, thoroughly rinse the eyes with clean running water for at least 15 minutes, and immediately seek medical attention. Otherwise, eyes injury can result.
- » 如果电芯发生泄露，电解液进入眼睛，请不要搓揉，应用清水冲洗眼睛，必要时请立即前往医院接受治疗，否则会伤害眼睛。
- » If the cell gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during usage, recharging or storage, immediately remove it from the device or cell charger and stop using it.
- » 如果电芯发出异味，发热，变色，变形或使用、存储、充电过程中出现任何异常现象，立即将电芯从装置或充电器中移开并停用。
- » In case the cell terminals get dirty, clean the terminals with a dry cloth before use.
- » 如果电芯弄脏，使用前应用干布抹净。