



远东福斯特新能源有限公司

FAR EAST FIRST NEW ENERGY CO., LTD

Number: PS-RD-010

Edition: A/04

Internal Number: 22EB

受控文件
分发号: 05-02-01

锂离子电芯规格书

Specification For Lithium-ion Rechargeable Cell

电芯型号 : FST 18650-2200mAh

Cell Type: FST 18650-2200mAh

Document No	PS-RD-010	Version change date	2016-07-16
Version	A/04	Pages	11
Designed	Checked	Approved	
杨广林	刘卫东	刘国良	



Contents 目录

- 1 Preface 前言
- 2 Definition 定义
 - 2.1 Rated capacity and minimum capacity 额定容量与最小容量
 - 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 , Colour 电芯型号, 喷码, 颜色
 - 3.1 Description and model 电芯说明及型号
 - 3.2 Cell bar code and explanation 电芯喷码及说明
 - 3.3 Cell colour explanation 电芯套膜颜色说明
- 4 Characteristics 电池性能
 - 4.1 Cell specification 电芯特性
 - 4.2 Cell dimensions 电芯尺寸
- 5 Technical requirements 技术要求
 - 5.1 Cell storage conditions 电芯存储环境
 - 5.2 Cell testing conditions 电芯测试条件
 - 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
- 6 Warning and cautions in handling the lithium-ion cell 电芯使用时警告事项及注意事项
- 7 The restriction of the use of hazardous substances 有害物质控制要求
- 8 Contact information 联系方式
- 9 Version history 变更纪录



1 Preface 前言

This specification describes the type and dimensions, performance, technical characteristics, warning and caution of the lithium ion rechargeable cell. The specification only applies to 18650 cell supplied by Far East First New 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, 本标准适用于远东福斯特新能源有限公司生产的圆柱型 18650 锂离子电芯。

2 Definition 定义

2.1 Rated capacity and minimum capacity:

额定容量与最小容量:

Rated capacity: $Cap=2200mAh$, minimum capacity: $Cap=2100mAh$. Under $25\pm2^{\circ}C$, It means the capacity value of being discharged by 1-hours rate to end voltage 2.75 V, which is signed Cap, the unit is mAh.

标称容量 $Cap=2200mAh$, 最小容量 $Cap=2100mAh$, 指在 $25\pm2^{\circ}C$ 环境下, 以 1 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 $25\pm2^{\circ}C$, it can be charged to 4.20V with constant current of $0.5I_1(A)$, and then, charged continuously with constant voltage of 4.2V until the charged current is $0.02I_1(A)$.

指在 $25\pm2^{\circ}C$ 环境下, 以 $0.5I_1(A)$ 电流恒流充电至单体电芯电压 4.20 V 后, 转为恒压 4.20 V 充电, 至充电电流降至 $0.02 I_1(A)$ 时, 停止充电。

2.3 Standard discharge method:

标准放电方式:

Under $25\pm2^{\circ}C$, it can be discharged to the voltage of 2.75V with constant current of $1I_1(A)$.

指在 $25\pm2^{\circ}C$ 环境下, 以 $1I_1(A)$ 电流恒流放电至单体电芯电压 2.75 V。

3 Cell type and dimensions 电芯型号、尺寸、颜色

3.1 Description and model

电芯说明及型号

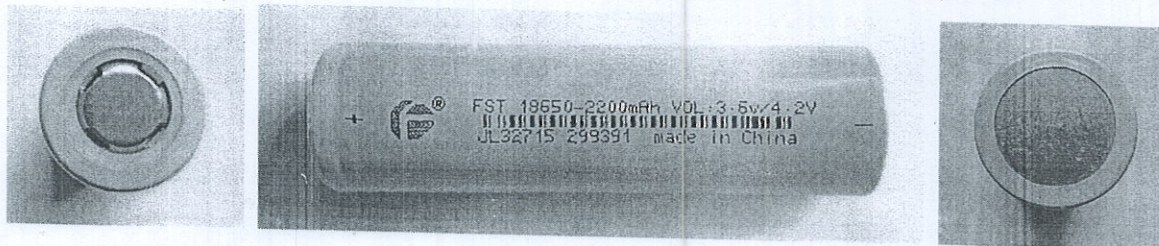
Description: Cylindrical Li-ion rechargeable cell

Model: FST 18650-2200mAh

说明: 圆柱锂离子二次电芯

型号: FST 18650-2200mAh

3.2 Cell bar code and explanation 电芯喷码及说明



Cell bar code includes four parts:

电芯喷码包括四个部分的内容:

Cell type/Rated capacity	+	Normal / Charging voltage	+	Cell batch code	+	Cell ordinal code
电芯型号/额定容量	+	标称/上限电压	+	电芯批号	+	电芯顺序码

For example:

例如: FST 18650-2200mAh	+	VOL:3.6V/4.2V	+	JL32715	+	299391
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**3.3 Cell colour explanation 电芯套膜颜色说明**

Lilac

浅紫色

Color is for reference only, the colour can be adjusted according to customer requirements.

颜色仅供参考, 可依据客户要求进行调整。

4 Characteristics 电池性能**4.1 Cell specification 电芯特性**

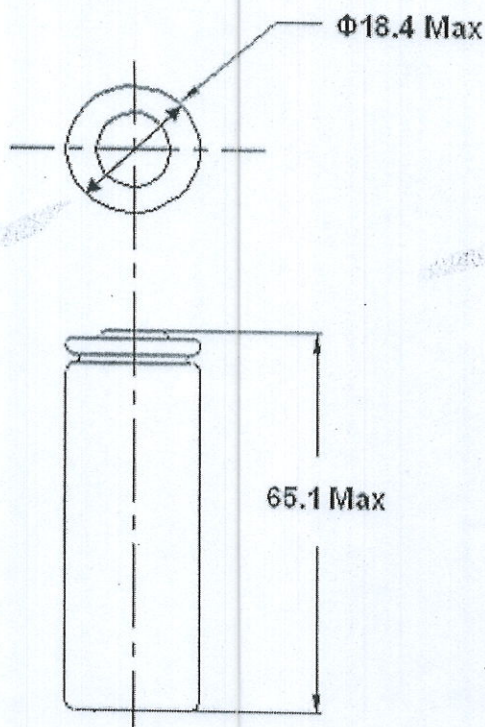
ITEM 项目	SPECIFICATION 特性	
Rated capacity 额定容量	2200	mAh@1C
Minimum capacity 最小容量	2100	mAh@1C
Normal voltage 标称电压	3.60	V
Energy density 能量密度	457	Wh / L
	172	Wh / Kg
Charging voltage 充电电压	4.20	±0.05V
Discharge ending voltage 放电终止电压	2.75	±0.05 V
Standard charging current 标准充电电流	1100	mA
Standard discharge current 标准放电电流	2200	mA
Max charge current 最大充电电流	1C	T ≥ 10℃
	0.5C	10℃ > T ≥ 0℃
	0.1C	0℃ > T ≥ -10℃
Max discharge current 最大放电电流	4C	T ≥ 0℃
	2C	0℃ > T ≥ -20℃
Max recommended charge and discharge cell body temperature 充放电过程中电芯表面的推荐温度	Charge: 0~45℃ Discharge: -20~60℃ 充电时: 0~45℃ 放电时: -20~60℃	
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: 60℃ Discharge: 75℃ 充电时: 60℃ 放电时: 75℃	
Internal resistance 内阻	≤ 35 mΩ (AC Impedance, 1000 Hz)	
Cell dimensions 电芯尺寸	Height : 65.1mm Max 最大高度: 65.1 mm Diameter : 18.4mm Max 最大直径: 18.4 mm	
Weight 重量	≤ 46g	



4.2 Cell dimensions 电芯尺寸

Cell physical dimensions(unit: mm).

电芯尺寸示意图 (单位: mm)



5 Technical requirements 技术要求

5.1 Cell storage conditions 电芯存储环境

Temperature 温度: 3 个月 3 month $-20\sim 45^{\circ}\text{C}$ 1 年以上 1 year $-20\sim 25^{\circ}\text{C}$

Relative humidity 相对湿度: $0\sim 45\%\text{RH}$

5.2 Cell testing conditions 电芯测试条件

Unless otherwise specified, all tests stated according to following:

除非有特殊说明, 所有测试的条件要求如下:

Temperature 温度: $25\pm 2^{\circ}\text{C}$

Use standard charge and standard discharge method 使用标准充电与标准放电方式

5.3 Requirement of the testing equipment 测量仪表要求

Voltage meter: The precision is ≥ 0.5

电压仪表要求: 测量电压的仪表精度不小于 0.5 级

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

温度仪表要求: 测量温度的仪表精度 $\pm 0.5^{\circ}\text{C}$



5.4 Characteristics 电池性能

NO. 序号	Item 项目	Standard 标准	Test Method 测试方法
1	Discharge Characteristics (Room Temperature) 室温倍率放电	Discharge capacity / Initial capacity *100% A) $0.5C_1A \geq 100\%$ B) $1C_1A \geq 95\%$ C) $2C_1A \geq 90\%$ D) $3C_1A \geq 90\%$ 放电容量/初始容量 $\times 100\%$ A) $0.5C_1A \geq 100\%$ B) $1C_1A \geq 95\%$ C) $2C_1A \geq 90\%$ D) $3C_1A \geq 90\%$	Under the room temperature, after $0.5I_1(A)$ standard charged, rest for 15min and then discharge at $0.5I_1(A)$, $1I_1(A)$, $2I_1(A)$ and $3I_1(A)$ to the discharge cut-off voltage 2.75V respectively. Discharge capacity of different rate accord with testing standard. 在室温下, 电池以标准充电方式充电后, 搁置 15min, 分别以 $0.5I_1(A)$ 、 $1I_1(A)$ 、 $2I_1(A)$ 、 $3I_1(A)$ 电流放电至 2.75V, 不同倍率放电容量符合测试标准。
2	Charge Characteristics (Room Temperature) 室温倍率充电	Discharge capacity / Initial capacity *100% $2C_1A \geq 80\%$ 放电容量/初始容量 $\times 100\%$ $2C_1A \geq 80\%$	Under the room temperature, Then discharge at $1I_1(A)$ to the discharge cut-off voltage 2.75V, After 15 min to charge at $2I_1(A)$ to the charge cut-off voltage 4.2V, Then discharge at $1I_1(A)$ to the discharge cut-off voltage 2.75V, 在室温下, 电池以 $1I_1(A)$ 电流标准放电至 2.75V, 搁置 15min, 以 $2I_1(A)$ 电流充电至上限电压 4.2V, 搁置 15min, 再次以 $1I_1(A)$ 电流放电至 2.75V, 符合测试标准。
3	Cycle Life 循环寿命	The 500th discharge capacity \geq Initial capacity *90% or The 1000th discharge capacity \geq Initial capacity *80% 第 500 次放电容量 \geq 初始容量 *90% 或 第 1000 次放电容量 \geq 初始容量 *80%	Measured the initial capacity of battery. Then conduct 0.5C/1C cycle measured the final condition of battery. 测量电池的初始状态, 室温下进行 $0.5C_1A / 1C_1A$ 循环, 循环后测量电池的最终状态。

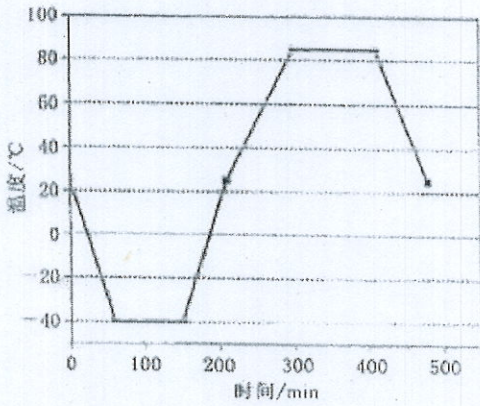


4	Normal Storage 室温荷电保持能力	Residual capacity \geq Initial capacity *85% Recovery capacity \geq Initial capacity *90% 剩余容量 \geq 初始容量*85% 恢复容量 \geq 初始容量*90%	<p>Tested the initial condition and initial capacity of battery. Store for 28 days after standard charged, tested the final condition of battery. Then discharge at $1I_1$(A) to the discharge cut-off voltage 2.75V, tested the residual capacity of battery. Then conduct 0.5C₁A/ 1C₁A cycle for 3 times to tested the recovery capacity of battery.</p> <p>测量电池的初始状态和初始容量, 电池按标准充电方式充电后, 开路放置 28 天, 测量电池最终状态; 以 $1I_1$(A) 电流放电至 2.75V, 测量电池的剩余容量, 以 0.5C₁A/ 1C₁A 循环 3 次测量电池恢复容量。</p>
5	High Temperature Storage 高温荷电保持能力 (55℃)	Residual capacity \geq Initial capacity *85% Recovery capacity \geq Initial capacity *90% 剩余容量 \geq 初始容量*85% 恢复容量 \geq 初始容量*90%	<p>Standard charge. Tested the initial condition of battery. Put the battery into a 55℃\pm2℃ for 7d, Then discharge at $1I_1$(A) to the discharge cut-off voltage 2.75V, tested the residual capacity of battery. Then conduct 0.5C₁A/ 1C₁A cycle for 3 times to tested the recovery capacity of battery.</p> <p>测量电池的初始状态, 电池标准充电后, 在 55\pm2℃ 条件下存储 7d 后、再在室温下以 $1I_1$(A) 电流放电至 2.75V, 测量电池的剩余容量, 以 0.5C₁A/ 1C₁A 循环 3 次测量电池恢复容量。</p>
6	Long Time Storage 储存 (45℃)	Recovery capacity \geq Initial capacity *90% 恢复容量 \geq 初始容量*90%	<p>Standard charge. Then discharge at $1I_1$(A) to 30 min . Tested the initial condition of battery. Store for 28 days at 45\pm2℃ temperature, measured the final condition of battery. Then conduct 0.5C₁A/ 1C₁A cycle for 3 times to record the discharge capacity.</p> <p>电池标准充电后, 在室温下以 $1I_1$(A) 电流放电 30 分钟, 测量电池的初始状态, 然后电池在 45\pm2℃ 下储存 28d 后, 测量电池的最终状态, 然后以 0.5C₁A/ 1C₁A 循环 3 次记录电池的恢复容量。</p>
7	High And Low Temperature Discharge Characteristics 高低温放电	Discharge capacity / Initial capacity *100% A) 55℃ \geq 100% B) -20℃ \geq 70% 放电容量/初始容量 \times 100% A) 55℃ 时 \geq 100% B) -20℃ 时 \geq 70%	<p>Tested the initial condition and initial capacity of battery. Standard charge. Put the battery into a 55℃\pm2℃ for 5h, discharge at $1I_1$(A) to the cut-off voltage 2.75V, then standard charge at room temperature. In turn put the battery into -20℃\pm2℃ for 24h, discharge at $1I_1$(A) to 2.50V, then test the final capacity of the battery.</p> <p>测量电池的初始容量和初始状态, 电池标准充电后, 在 55\pm2℃ 条件下恒温搁置 5h、以 $1I_1$(A) 电流放电至 2.75V, 然后在室温条件下标准充电, 在 -20\pm2℃ 的恒温条件下搁置 24h, 以 $1I_1$(A) 电流放电至 2.50V, 分别记录不同温度下放电容量。</p>

**5.5 Safety Performance 安全性能**

NO. 序号	Item 项目	Standard 标准	Test Method 测试方法
1	Overcharge 过充	No explosion、No fire 不爆炸、不起火	Standard charge. Charge at $1I_1$ (A) to 10V. 电池标准充电后, 测量电池的初始状态, 以 $1I_1$ (A) 电流充电至 10V, 测试完成后测量电池的最终状态。
2	Over Discharge 过放	No explosion、No fire、 No leakage 不爆炸、不起火、不漏液	Standard charge. Discharge at $1I_1$ (A) to 90 minutes . 电池标准充电后, 测量电池的初始状态, 以 $1I_1$ (A) 电流进行放电 90 分钟, 测试完成后测量电池的最终状态。
3	Short Circuit 短路	No explosion、No fire 不爆炸、不起火	Standard charge. Keep the battery into a explosion-proof tank and short-circuit the positive and negative terminals directly (general resistance shall be less than $5m\Omega$). Short circuit time 10 minutes. 电池标准充电后, 测量电池的初始状态, 置于防爆箱中直接短路其正负极 (线路总电阻小于 $5m\Omega$), 短路时间 10 分钟, 测试完成后测量电池的最终状态。
4	Drop 跌落	No explosion、No fire、 No leakage 不爆炸、不起火、不漏液	Standard charge. Then let it fall off from a height of 1.5m(the lowest height) to the cement floor. 电池标准充电后, 测量电池的初始状态, 由高度 (最低点高度) 为 1.5m 的位置电池正负极端子向下自由跌落到水泥地面上, 测试完成后测量电池的最终状态。
5	Crush 挤压	No explosion、No fire 不爆炸、不起火	Standard charge. perpendicular to the battery. The speed at $5 \pm 1mm/s$. Untill the voltage is 0V or deformation is 30% or the pressure of 200kN. 电池标准充电后, 测量电池的初始状态, 垂直于电池极板方向以 $5 \pm 1mm/s$ 的速度进行挤压, 直至电压达到 0V 或形变量达到 30%或压力达到 200kN, 测试完成后测量电池的最终状态。
6	Hot Oven 热冲击	No explosion、No fire 不爆炸、不起火	Standard charge. Keep the battery connected with a thermocouple and put it into a gravity convection or circulating air oven. Temperature is raised at a rate of $5 \pm 2 \text{ } ^\circ\text{C}$ per minute to a temperature of $130 \text{ } ^\circ\text{C} \pm 2 \text{ } ^\circ\text{C}$ and remained for 30min at this temperature. Observe the variation of the battery's appearance. 电池标准充电后, 测量电池的初始状态, 放置于热箱中, 并与热电偶相连, 温度以 $(5 \text{ } ^\circ\text{C} \pm 2 \text{ } ^\circ\text{C}) / \text{min}$ 的速率升至 $130 \text{ } ^\circ\text{C} \pm 2 \text{ } ^\circ\text{C}$ 并保温 30min, 测试完成后测量电池的最终状态。



7	Seawater Immersion 海水浸泡	No explosion、No fire 不爆炸、不起火	Standard charge. Keep the battery to 3.5% NaCl solution 2 hours. 电池标准充电后, 测量电池的初始状态, 浸入 3.5% 的 NaCl 溶液中 2h, 测试完成后测量电池的最终状态。																																
8	Low Pressure 低气压	No explosion、No fire、 No leakage 不爆炸、不起火、不漏液	Standard charge. Keep the battery to the altitude chamber of 11.6Kpa 6 hours. 电池标准充电后, 测量电池的初始状态, 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, 测试完成后测量电池的最终状态。																																
9	Heat Cycle Properties 温度循环	No explosion、No fire、 No leakage 不爆炸、不起火、不漏液	<p>Standard charge. Put the battery into a temperature controlled tank, then according to the parameter to test, A total of five times.</p> <p>电池标准充电后, 放入温度箱中, 温度箱的温度按照以下参数进行调节, 循环 5 次。</p> <p>1) 一个循环的温度和时间:</p> <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> <p>2) 示意图:</p> 	温度 ℃	时间增量 min	累计时间 min	温度变化率 ℃/min	25	0	0	0	-40	60	60	13/12	-40	90	150	0	25	60	210	13/12	85	90	300	2/3	85	110	410	0	25	70	480	6/7
温度 ℃	时间增量 min	累计时间 min	温度变化率 ℃/min																																
25	0	0	0																																
-40	60	60	13/12																																
-40	90	150	0																																
25	60	210	13/12																																
85	90	300	2/3																																
85	110	410	0																																
25	70	480	6/7																																



Comments: the definitions of some nomenclatures of this specification

备注: 以上标准中的一些术语的定义:

- (1) Initial State: The initial appearance, open-circuit voltage and internal resistance of battery.
初始状态: 电池的初始外观、开路电压、交流内阻。
- (2) Final State: The final appearance, open-circuit voltage and internal resistance of battery.
最终状态: 电池的最终外观、开路电压、交流内阻。
- (3) Residual Capacity: After a specific testing program, the first discharge capacity of battery.
剩余容量: 电池经过特定的检测程序后的首次放电容量。
- (4) Recovery capacity: After a specific testing program, and through the repeatedly charging and discharging to the recovery state, then the discharge capacity of battery.
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。
- (5) $0.5 C_1 A / 1 C_1 A$: Charge at $0.5 I_1 (A)$ to limit charge voltage $4.20V$, then change to charge with constant voltage until the current less than or equal to $0.02 I_1 (A)$, rest for 5 min, then discharge at $1 I_1 (A)$ to $2.75V$ cut-off.
 $0.5 C_1 A / 1 C_1 A$: 以 $0.5 I_1 (A)$ 充电, 当电池端电压达到充电限制电压 $4.20V$ 时, 转为恒压充电, 直到充电电流小于或等于 $0.02 I_1 (A)$ 停止充电, 充电完成后, 搁置 5min, 再以 $1 I_1 (A)$ 恒流放电至终止电压 $2.75V$ 。
- (6) I_1 : 1 小时率放电电流; C_1 : 1 小时率额定容量;
- (7) Initial Capacity: Standard charge method and standard discharge method at the room temperature, the discharge capacity is initial capacity.
初始容量: 在室温下, 电池按照标准充电和标准放电方式进行充放电测试的放电容量。

6 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.
禁止将电芯在热高温源旁, 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。
- » When disposing of secondary cells, keep cells of different electrochemical systems separate from each other.
二次电池处理时, 请将电池和其他电化学体系的产品分开。



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。

7 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 "environmental substances control standard".

本型号锂离子电芯符合本公司“环境物质控制标准”要求！

8 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: Firstbattery industrial park.No.39, Yichun Economic Development Zone Jiangxi Province. (336000)

厂址：江西宜春经济技术开发区经发大道 39 号(福斯特工业园)

Tel : 0795-3666188

Fax : 0795-3666118

电话： 0795-3666188

传真： 0795-3666118



Page: 11/11

分发号: 65-02-01