

2020



远东福斯特新能源有限公司
FAR EAST FIRST NEW ENERGY CO., LTD

Number: PS-RD-019
Edition: A/02

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 18650-2000mAh

Cell Type : FST 18650-2000mAh

Document No	PS-RD-019	Version change date	2016-04-19
Version	A/02	Pages	11
Designed	Checked	Approved	
杨广林	刘卫东	刘国保	



Contents 目录



- 1 Preface 前言
- 2 Definition 定义
 - 2.1 Rated capacity and minimum capacity 标称容量与最小容量
 - 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
 - 5.6 Environmental characteristics 环境适应性能
- 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:

标称容量与最小容量:

Rated capacity: Cap=2000mAh, minimum capacity: Cap=1900mAh. Under 25±2°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=2000mAh, 最小容量 Cap=1900mAh, 指在 25±2°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±2°C, it can be charged to 4.2V with constant current of 0.5C, and then, charged continuously with constant voltage of 4.2V until the charged current is 0.02C.

指在 25±2°C 环境下, 以 0.5C 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 0.02C 时, 停止充电。

2.3 Standard discharge method:

标准放电方式:

Under 25±2°C, it can be discharged to the voltage of 2.75V with constant current of 0.5C.

指在 25±2°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 dimensions 电芯型号、尺寸、颜色

3.1 Description and model

电芯说明及型号

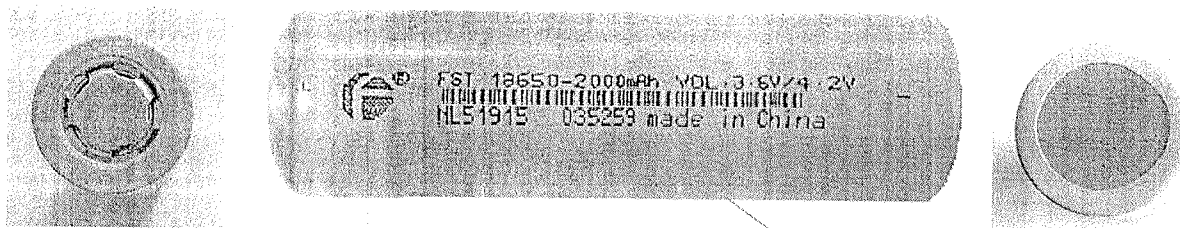
Description: Cylindrical Li-ion rechargeable cell

Model: FST 18650-2000mAh

说明: 圆柱锂离子二次电芯

型号: FST 18650-2000mAh

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



Cell bar code includes two parts:

电芯喷码包括四个部分的内容:

Figure

Part one(Figure):

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

For example:

例如: FST 18650-2000mAh	+	VOL:3.6V/4.2V	+	NL51915	+	035259
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Cell batch code definition as following (N means Number, L means Letter) :
电芯批号如下 (其中, N 代表数字, L 代表字母), 显示如下:

N	L	N	N	N	N	N
↓	↓	↓	↓		↓	
Production capacity 电芯容量 6 means 2000 7 means 2200 8 means 2600 9 means 2800 ...	Manufacture month 排产月份 A means January, B means February.... L means December A 代表 1 月, B 代表 2 月 L 代表 12 月	Factory 工厂 1 means Production I, 2 means Production II 1 代表制造一部 2 代表制造二部....	Manufacture day 排产日期 For example: 1 means date1 1 代表 1 日		Manufacture Year 排产年份 For example: 13 means 2013 13 代表 2013 年	

3.3 Cell colour explanation 电芯套膜颜色说明

Peacock Blue

孔雀蓝

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
Normal capacity 标称容量	2000 mAh@0.5C
Minimum capacity 最小容量	1900 mAh@0.5C
Normal voltage 标称电压	3.6V
Energy density 能量密度	415 Wh / L 156 Wh / Kg
Charging voltage 充电电压	4.20 ±0.05 V
Discharge ending voltage 放电终止电压	2.75 ±0.05 V
Standard charging current 标准充电电流	0.5C(1000 mA)
Standard discharge current 标准放电电流	0.5C(1000 mA)
Max charge current 最大充电电流	1C(T ≥ 10°C) 0.5C(10°C > T ≥ 0°C) 0.1C(0°C > T ≥ -10°C)
Max discharge current 最大放电电流	10A



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分发号: 05-02-0

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°C Discharge: -20~60°C 充电时: 0~45°C 放电时: -20~60°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芯循环寿命很快衰减)	Charge: 60°C Discharge: 75°C 充电时: 60°C 放电时: 75°C
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 listed in Figure 3(unit: mm).

电芯尺寸示意图如图 3 所示 (单位: mm)。

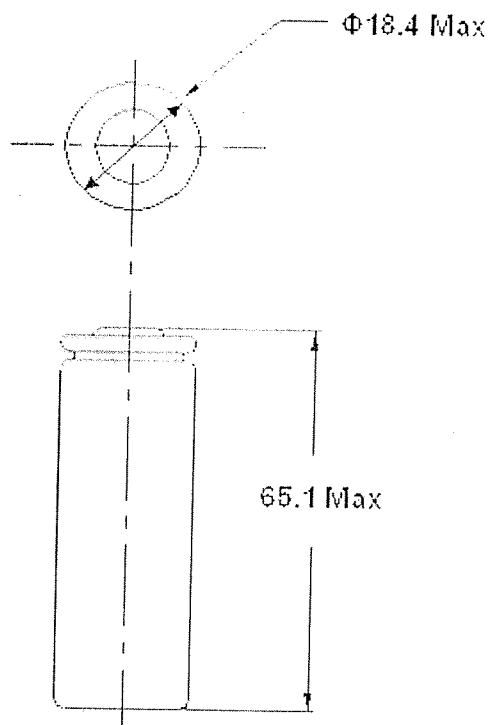


Figure 3/ 图

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 -20~45°C 1年以上 1 year -20~25°C
Relative humidity 相对湿度: 0~45%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±2°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 voltage tester internal resistance is ≥ 10 KΩ/V

电压仪表要求: 测量电压的仪表内阻不小于 10KΩ/V

Temperature meter: The precision is ≤0.5°C

温度仪表要求: 测量温度的仪表精度不低于 0.5°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) 倍率放电	Discharge capacity / Nominal capacity *100% A) 0.5C ₅ A ≥100% B) 1C ₅ A ≥95% C) 2C ₅ A ≥90% D) 3C ₅ A ≥90% The charging and discharging curves must be smooth 放电容量/标称容量×100% A) 0.5C ₅ A ≥100% B) 1C ₅ A ≥95% C) 2C ₅ A ≥90% D) 3C ₅ A ≥90% 充放电曲线应平稳光滑	At standard atmospheric pressure, ambient temperature 25°C±2°C, relative humidity 45%~80% (The following if no specific instructions are all in these conditions, according to this charging ways), at 0.5 C ₅ A standard charged, rest for 15min and then discharge at 0.5C ₅ A, 1C ₅ A, 2C ₅ A and 3C ₅ A to the discharge cut-off voltage 2.75V respectively. Charge/discharge cycle can be conducted for 3 times before meeting the Standards (the same below). 在 1 标准大气压, 环境温度 25°C±2°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 15min, 分别以 0.5C ₅ A、1C ₅ A、2C ₅ A、3C ₅ A 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)。
2	Normal Storage 常温荷电保持能力	Residual capacity ≥ Nominal capacity *85% Recovery capacity ≥ Nominal capacity *90% 剩余容量 ≥ 标称容量*85% 恢复容量 ≥ 标称容量*90%	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 0.5C ₅ A to the discharge cut-off voltage 2.75V, tested the residual capacity of battery. 0.5C ₅ A /0.5 C ₅ A tested the recovery capacity of battery. Charge/discharge cycle can be conducted for 3 times before meeting the Standards. 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 ₅ A 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。



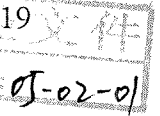
3	Cycle Life 循环寿命	Residual capacity \geq Nominal capacity *80% 容量 \geq 标称容量 *80%	Measured the initial condition and initial capacity of battery. Then conduct 0.5C ₅ A/1C ₅ A 500th cycle measured the final condition of battery. 测量电池的初始状态和初始容量, 进行 0.5C/1C 循环, 500 次后测量电池的最终状态。
4	Long Time Storage 贮存性能	The discharge time of 0.2C ₅ A: Storage 12 months of battery \geq 4h. 0.2C ₅ A 放电时间; 贮存 12 个月的电池 \geq 4h.	Charged to the voltage of 3.80 \pm 0.02V, before storage, measured the initial condition and initial capacity of battery. Store for 12 months at room temperature, measured the final condition of battery. Then conduct 0.5 C ₅ A /0.2 C ₅ A cycle for 3 times to record the discharge time of the battery. 测量电池的初始容量, 电池充电至 3.80 \pm 0.02V 后, 测量电池存储前的初始状态, 室温 12 个月, 测量电池的最终状态, 然后以 0.5C/0.2C 循环 3 次记录电池的放电时间。
5	Discharge Characteristics under Different Temperature 不同温度下的放电性能	Discharge capacity / Nominal capacity *100% A) 55 °C \geq 100% B) -10 °C \geq 60% 放电容量/标称容量 \times 100% A) 55 °C 时 \geq 100%; B) -10 °C \geq 60%;	Tested the initial condition and initial capacity of battery. Standard charge. Put the battery into a 55°C \pm 2°C for 2h, discharge at 0.2C ₅ A to the cut-off voltage 2.75V, then standard charge at room temperature. In turn put the battery into -10°C \pm 2°C for 4h, discharge at 0.2C ₅ A to the cut-off voltage, then test the final capacity of the battery, and then store it for 2h at room temperature. Observe the variation of the battery's appearance. 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°C 条件下恒温搁置 2h、以 0.2C ₅ A 放电至 2.75V, 然后在室温条件下标准充电, 在 -10 \pm 2 °C 的恒温条件下搁置 4h, 以 0.2C ₅ A 放电至 2.75V

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 fire, No explosion, 不爆炸、不起火	Standard charge. Charge at 1 C ₅ A to 10V, then change to charge with constant voltage till the current less than or equal to 0.01 C ₅ A. Observe the variation of the battery's appearance and temperature. 电池标准充电后, 测量电池的初始状态, 保证电池状态正常 (下同), 以 1 C ₅ A 电流充电至 10V, 然后转恒压充电至截至电流 0.01C ₅ A 时终止, 观察电池的温度及外观变化。



2	Forced Discharge 强制放电	No fire, No explosion 不起火、不爆炸	Standard charge. Discharge at 0.2C ₅ A to 2.75V, and then reverse charge the cell at 1 C ₅ A for 90min 电池标准充电后, 电池以 0.2 C ₅ A 进行放电至 2.75V, 然后以 1 C ₅ A 的电流对电池进行反向充电 90min
3	Short Circuit at 55 °C 55°C短路	No fire, No explosion, 不爆炸、不起火	Standard charge. Keep the battery into a ventilation cabinet and short-circuit the positive and negative terminals directly. Stop the test when the temperature falls to 10 °C lower than the peak value. Observe the variation of the battery's appearance and temperature. 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, 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。
4	Impact test 重物冲击	No fire, No explosion 不起火、不爆炸	Standard charge. Placed the battery in a plane, and connected with the thermocouple. Take a diameter of 15.8 mm steel column(9.1kg) in the 610 mm height and middle of battery. Let it freedom to impact the battery. Observe the variation of the battery's appearance and temperature. 电池标准充电后, 测量电池的初始状态, 放在平面上, 并与热电偶相连, 将一直径为 15.8mm 的棒放在电池高度方向中间位置, 让重量 9.1kg 的重物从 610mm 高度自由垂落至冲击台面, 观察电池外观及温度变化。
5	Crush 挤压	No fire, No explosion, 不起火、不爆炸	Standard charge. Placed the battery in two iron plane moulds, and connected with the thermocouple. With the most strongly 13 KN pressure for the moment compression. Observe the variation of the battery's appearance and temperature. 测量电池的初始状态, 电池标准充电后, 与热电偶相连, 放置于两铁制平面模具中, 用 13KN 的最大力压力进行瞬间压缩, 观察电池的温度及外观变化。
6	Hot Oven 热冲击	No fire, No explosion 不起火、不爆炸	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 °C ±2 °C per minute to a temperature of 130 °C±2 °C and remained for 30min at this temperature. Observe the variation of the battery's appearance. 测量电池的初始状态, 电池标准充电后, 放置于热箱中, 并与热电偶相连, 温度以 (5 °C ±2 °C) /min 的速率升至 130 °C ±2 °C 并保温 30Min。观察电池外观变化



5.6 Environmental characteristics 环境适应性能

NO. 序号	Item 项目	Standard 标准	Test Method 测试方法
1	Temperature Cycling test 温度循环	No leakage \ fire \ explosion 电池不漏液、不起火、不爆炸。	Standard charge. Put the battery into a 20 °C ±5 °C chamber: a) raising the chamber temperature to 75 °C ±2 °C for 6h; b) reducing the chamber temperature to -40 °C ±2 °C for 6h; c) change the temperature within 30 minutes; d) repeating the sequence for 10 cycles; 将电池充满电后, 将电池放置在温度为 20 °C ±5 °C 的温控箱体中进行如下步骤: a) 将样品放入温度为 75 °C ±2 °C 的实验箱中保持 6h; b) 将实验箱温度降为 -40 °C ±2 °C, 并保持 6h; c) 温度转换时间不大于 30min; d) 重复步骤 a)~b), 共循环 10 次;
2	Drop 跌落	No smoking \ fire \ explosion Discharge Time ≥ 51min 放电时间不少于 51min; 电池不冒烟、不起火、不爆炸。	Standard charge. Then let it self fall off from a height of 1m (the lowest height) to a smooth hardwood with the thick of 20mm. The drop is implemented totally for 3 times. Discharge at 1C ₅ A to the cut-off voltage, then test the discharge time of the battery. 电池标准充电后, 测量电池的初始状态, 将电池样品由高度 (最低点高度) 为 1.0m 的位置从 XYZ 正负六个方向自由跌落到 20mm 厚木板上。跌落完成后测量电池的最终状态, 然后以 1C ₅ A 放电至 2.75V, 测量电池的放电时间
3	Vibration 振动	Diminishing rate of voltage ≤ 10 % No remarkable damage \ smoking \ explosion \ leakage 电压衰减 ≤ 10 % 电池外观无明显损伤、不冒烟、不爆炸、不漏液	Standard charge. Equip it to the vibration platform, adjust and prepare the test equipment according to following vibration frequency and relevant swing, doing frequency sweeping from X, Y, Z three directions, each from 7Hz to 200Hz for 3 hours of recycling 电池标准充电后, 测量电池初始状态, 安装在振动台面上, 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 3h



Comments: the definitions of some nomenclatures of this specification

备注：以上标准中的一些术语的定义：

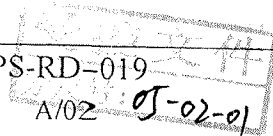
- (1) Initial State: The initial appearance, open-circuit voltage and internal resistance of battery.
初始状态：电池的初始外观、开路电压、交流内阻。
- (2) Final State: The final appearance, open-circuit voltage and internal resistance of battery.
最终状态：电池的最终外观、开路电压、交流内阻。
- (3) Residual Capacity: After a specific testing program, 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) $0.5 C_5A / 1 C_5A$ ($0.5 C_5A / 0.5 C_5A, 0.5 C_5A / 0.2 C_5A$): Charge at $0.5 C_5A$ to limit charge voltage 4.2V, then change to charge with constant voltage until the current less than or equal to $0.01 C_5A$, rest for 5 min, then discharge at $1 C_5A$ ($0.5 C_5A, 0.2 C_5A$) to 2.75V cut-off.
 $0.5C/1C$ ($0.5C/0.5C, 0.5C/0.2C$): 以 $0.5C_5A$ 充电，当电池端电压达到充电限制电压 4.2V 时，转为恒压充电，直到充电电流小于或等于 $0.02C_5A$ 停止充电，充电完成后，搁置 5min，再以 $1C_5A$ ($0.5 C_5A, 0.2C_5A$) 恒流放电至终止电压 2.75V。

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



9 Version change record 修改记录

Serial Number 序列号	Change item 变更项目	修	Change Content 修改内容	修改人 PIC	修改日期 Date
A/00	无		初次发行	杨广林	2015-10-10
A/01	电芯型号及尺寸		套膜颜色PET紫色变更为PET孔雀蓝	杨广林	2015-10-26
A/02	3.3 4 8		1、增加电芯套膜颜色的说明 2、公司LOGO变更; 3、联系方式变更; 4、文件编号变更; 由FST/RD -SPE-019变更为PS-RD-019;	杨广林	2016-04-19