

Specification Approval Sheet

产品规格书

Battery Type: GRPA495183-25C-44.4V 22000mAh

电池型号: GRPA495183-25C-44.4V 22000mAh

Supplier 供应商	Prepared By 编制	Linli	2019-1-10
	Checked By (RD) 审核 (研发)	Tanxinrong	2019-1-10
	Checked By (QC) 审核 (品质)	Wujintao	2019-1-10
	Approved By 批准	Yinzhenguo	2019-1-10

Customer Approval (客户批准)	Company Name (公司名称)
	Signature/Date (签名/日期)
	Company Stamp (公司印章)

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Appendix

附

Customer's Checking Criterion
(customer required)

客户验收标准（客户必填）：

- By Grepow's Testing Criterion for Lithium Polymer Battery.
按格瑞普电池有限公司电池检验标准
- By Customer's Testing Request and Criterion (Customer must supply the checking criterion)
按客户要求检验（需附验货标准）

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1. Scope 适用范围

This document describes the Product Specification of the Lithium-Polymer (LIP) rechargeable battery cell supplied by SHENZHEN GREPOW BATTERY CO., LTD.

本规格说明书描述了深圳市格瑞普电池有限公司生产的可充电聚合物锂离子电池的产品性能指标

2. Specification 产品规格

Package specification 电池组规格

	NO	Items	Specifications
Package (电池组)	1	Combination method (组合方式)	12 S 1 P (十二串一并)
	2	Nominal capacity 标称容量	22000mAh @ 0.2C Discharge(放电)
	3	Minimum capacity 最小容量	21500mAh @ 0.2C Discharge(放电)
	4	Nominal voltage 标称电压	44.4V
	5	PACK Voltage (As of shipment) 电池电压(出货状态)	45.0~46.2V (cell: 3.75~3.85V)
	6	Internal Impedance(内阻)	≤12mΩ
	7	Dimensions (尺寸)	MAX (T*W*H) : 116*172*235.5mm±1mm
	8	Pack weight (电池重量)	6000±100 g (APPROX)
	9	Standard Charge 标准充电	0.2C CC (constant current) charge to 50.4V, then CV(constant voltage 50.4V) charge till charge current decline to ≤0.05C 0.2C CC (恒流) 充电至 50.4V, 再 CV (恒压 50.4V) 充电直至充电电流 ≤0.05C
	10	Rapid Charge 快速充电	Constant Current 30A, Constant Voltage 50.4V, 0.05C cut-off 持续电流: 30A 持续电压: 50.4V 截止电流: 0.05C
	11	Charging time 充电时间	Standard Charging: 7.5 hours (Ref.) 标准充电: 7.5 小时 (参考值) Rapid charge: 1.0 hours (Ref.) 快速充电: 1.0 小时 (参考值)
	12	Standard discharge 标准放电	Constant current 0.2C end voltage 38.4V 持续电流: 0.2C 截止电压: 38.4V
	13	Maximum discharge current 最大放电持续电流	Constant current 100A end voltage 42.6V 持续电流 100A 截止电压: 42.6V

注: If no otherwise specified, an interval rest time is 30min between charging and discharging.
如果没有特别说明, 电池充放电间隔时间为 30 分钟。

3. Protection Circuit Characteristics (at 25°C) 保护板特性

3.1 BMS Parameters 保护板参数

Type 类别	Item 项目	Parameters 规格 (典型值)	Remark 备注
Charge 充电参数	Max. Charging Voltage 最大充电电压	50.4V	Controlled by charger 充电器管控
	Max. Charging Current 最大充电电流	30.0A	Controlled by charger 充电器管控
	Working Temperature 工作温度 (充电)	+4°C ~ +45°C	
Discharge 放电参数	Constant Working Current 可持续工作电流	100A	
	Peak Current 峰值电流	150A	< 3S 秒
	Working Temperature 工作温度 (放电)	+10°C ~ +85°C	
Data Acquisition 采集误差	Configuration 采集串数	12S	
	Single Cell Voltage 单体电压采集误差	± 5mV	25°C
	Current 电流采集误差	± 5%	25°C
	Temperature 温度采集误差	± 2°C	
Balancing Function 均衡功能	Balancing Type 均衡方式	Integrated Passive Balancing 内置被动均衡	
	Min. Balancing Voltage of single cell 单体电压均衡启动门限	3900mV	
	Balancing Current 均衡电流	30-50mA	
	Max. Voltage Difference of single cells 单体电压差均衡启动门限	> 40mV	
	Min. Voltage Difference of single cells 单体电压差均衡关闭门限	< 20mV	
Capacity Management	SOC Capacity Tolerance SOC 容量统计误差	< 5%	

电量管理	Low SOC Warning SOC 过低告警值	< 5%	
Power consumption parameters 功耗参数	Working Consumption 运行状态功耗	<10mA	
	Sleeping Mode Consumption 休眠静态功耗	< 500uA	
Protection Parameters 保护参数	Overcharge Protection 单体电池过充告警值	> 4.250±0.05V	Red + white LED on 红灯+白灯常亮告警
	Overcharge Protection Latency Time 单体电池过充告警延迟值	2-5S	
	Overcharge Protection Release 单体电池过充告警恢复值	<4.180±0.05V	Red + white LED off 红灯+白灯熄灭
	Overcharge Protection Release 单体电池过放告警值	< 3.30±0.10V	Red + white LED on 红灯+白灯常亮告警
	Over-discharge Protection Latency Time 单体电池过放告警延迟值	2-5S	
	Over-discharge Protection Release 单体电池过放告警恢复值	>3.650±0.1V	Red + white LED off 红灯+白灯熄灭
	High Temperature Warning while discharging 放电高温一级告警值	≥50℃	White LED flashing 白灯闪烁
	Latency Time of High Temperature Warning while discharging 放电高温一级告警延迟值	2-5S	
	Release of High Temperature Warning while discharging 放电高温一级告警恢复值	<45℃	White LED off 白灯熄灭
Protection Parameters 保护参数	High Temperature weighty Warning while discharging 放电高温二级告警值	≥85℃	Red LED flashing 红灯闪烁
	Release of High Temperature weighty Warning while discharging 放电高温二级告警恢复值	≤80℃	Red LED off, white LED flashing 红灯熄灭, 转白灯闪烁
	Low temperature warning while discharging 放电低温警告值	≤10℃	white LED flashing 白灯闪烁

Latency Time of Low temperature warning while discharging 放电低温告警延迟值	2-5S	
Release of low Temperature Warning while discharging 放电低温告警恢复值	$\geq 15^{\circ}\text{C}$	White LED off 白灯熄灭
High Temperature Warning while Charging 充电高温一级告警值	$\geq 50^{\circ}\text{C}$	White LED flashing 白灯闪烁
Latency Time of high temperature warning while charging 充电高温一级告警延迟值	2-5S	
Release of high temperature warning while charging 充电高温一级告警恢复值	$< 45^{\circ}\text{C}$	White LED off 白灯熄灭
High temperature weighty warning while charging 充电高温二级告警值	$\geq 75^{\circ}\text{C}$	Red LED flashing 红灯闪烁
Release of high temperature weighty warning while charging 充电高温二级告警恢复值	$\leq 70^{\circ}\text{C}$	Red LED off, white LED flashing 红灯熄灭, 转白灯闪烁
Low temperature warning while charging 充电低温告警值	$< 4^{\circ}\text{C}$	White LED flashing 白灯闪烁
Latency time of low temperature while charging 充电低温告警延迟值	2-5S	
Release of low temperature warning while charging 充电低温告警恢复值	$\geq 15^{\circ}\text{C}$	White LED off 白灯熄灭
Over current warning while charging 充电一级过流告警值	$\geq 50\text{A}$	White LED on 白灯常亮
Latency time of over current warning while charging 充电一级过流告警延迟值	2-5S	
Release of over current warning while charging 充电一级过流告警解除	Current $< 50\text{A}$, or release by cutting electricity 电流 $<50\text{A}$, 或者断开电源自动解除	White LED off 白灯熄灭

	Over current weighty warning while charging 充电二级过流告警值	$\geq 60A$	Red + white LED on 红灯+白灯常亮
	Release of over current weighty warning while charging 充电二级过流告警解除	Current < 60A, or release by cutting electricity 电流<60A, 或者断开电源自动解除	Current: 50<I<60A, red LED off, white on. I<50A, red and white LED off 电流: 50<I<60A时, 红灯熄灭, 白灯亮起; I<50A时, 红+白灯熄灭
	Short circuit warning while charging 充电短路告警	Charging current $\geq 70A$ 充电电流 $\geq 70A$	Red LED + white LED on 红灯+白灯常亮
	Release of short circuit warning 充电短路解除	Cut off electricity or man-made 断开电源或者手动解除	Red LED + white LED off 红+白灯熄灭
	Short circuit protection while discharging 放电短路保护	no 无	
	Reverse charging protection 电池组反充电保护	no 无	
Connection protocol 通讯方式	CAN	Supported 支持	Can be customized 外部定义可选

Remarks: Parameters as above are for references, which could be slightly changeable in the future.
注: 以上参数为推荐参考值, 如有细微修订, 恕不另行通知

3.2 Statement for working status 工作状态说明

3.2.1 Normal status 通常状态

After BMS is connected, the battery can only be charged or discharged without abnormal status warning, such as the warning of over voltage, under voltage, over current, short circuit or high temperature and so on.

保护板正确连接上电后, 在没有过压、欠压、过流、短路以及过温等告警状态发生时, 可以进行正常充放电。

3.2.2 Over charge warning and release 过充告警和恢复

When the voltages of single cells are beyond over charge limit and its lasting time is longer than the latency time, the BMS will define it as over charged, which means the white LED and the red LED will be on for warning. Until cell voltages are back to normal status, the white and red LEDs will be off and the warning will be released.

当任意单电芯电压大于过充电告警电压且持续时间超过延时时间, BMS判定为过充, 白色状态灯与红色状态灯会同时亮起发出告警, 当电芯电压恢复到过充电恢复电压时, 状态解除。

3.2.3 Over discharge warning and release 过放电告警和恢复

When the single cell voltage is lower than over discharge limit and its lasting time longer than the latency time, the BMS will define it as over discharged, which means the white LED and the red LED will be on for warning. Until the cell voltages are back to normal status, the white and red LED will be off and the warning will be released.

当任意一电芯电压VCELL小于过放电告警电压且持续时间超过延时时间, BMS判定为过放, 白色状态灯与红色状态灯会同时亮起发出告警。当电芯电压恢复到过放电恢复电压时, 状态解除。

3.2.4 High temperature alarm and release 过温告警和恢复

When the battery temperature is higher or lower than the limit, the BMS will define it as abnormal temperature. At abnormal temperature warning, the white LED will be flashing, and red LED will be flashing on abnormal temperature for warning. Until the battery temperature to be normal, the white and red LED will be off and the warning will be released.

当BMS监测到温度上升和下降到告警值且持续时间超过延时时间时, 将触发过温告警。进入一级过温状态时, 白色状态灯会闪烁发出告警, 当进入二级过温状态时, 红色状态灯会闪烁发出告警。当温度下降或者上升到温度恢复值时, 告警解除。

3.2.5 Over current protection and release 过流和恢复

When charging or discharging current is over the limit and its lasting time longer than the latency time, the BMS will define it as over current. Until the current is back to normal status, the warning will be released.

当充电或者放电电流超过充电/放电电流值且持续时间超过延迟时间, 保护板过流告警, 达到恢复时间时, 状态解除。

3.2.6 Drift warning and release 压差告警和恢复

It will be warning while the drift between cells are more than 40mV. The white LED will be on in normal for normal warning, and the red LED will be on in weighty warning. Until the drift is under 40mV, the white and red LED will be off and the warning will be released.

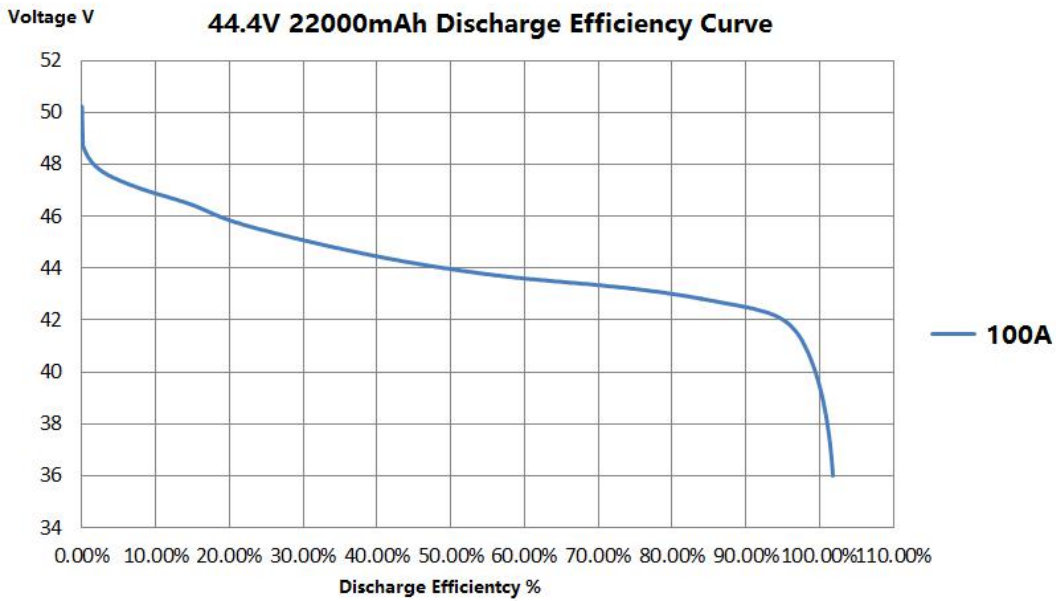
当电池组中电芯压差大于预设值时, 将触发压差告警。进入一级压差告警时, 白色状态灯会亮起, 进入二级压差告警时, 红色状态灯会亮起。当压差恢复到预设值范围内, 白灯或者红等将会熄灭, 解除告警。

4. Pack Drawing 组装示意图

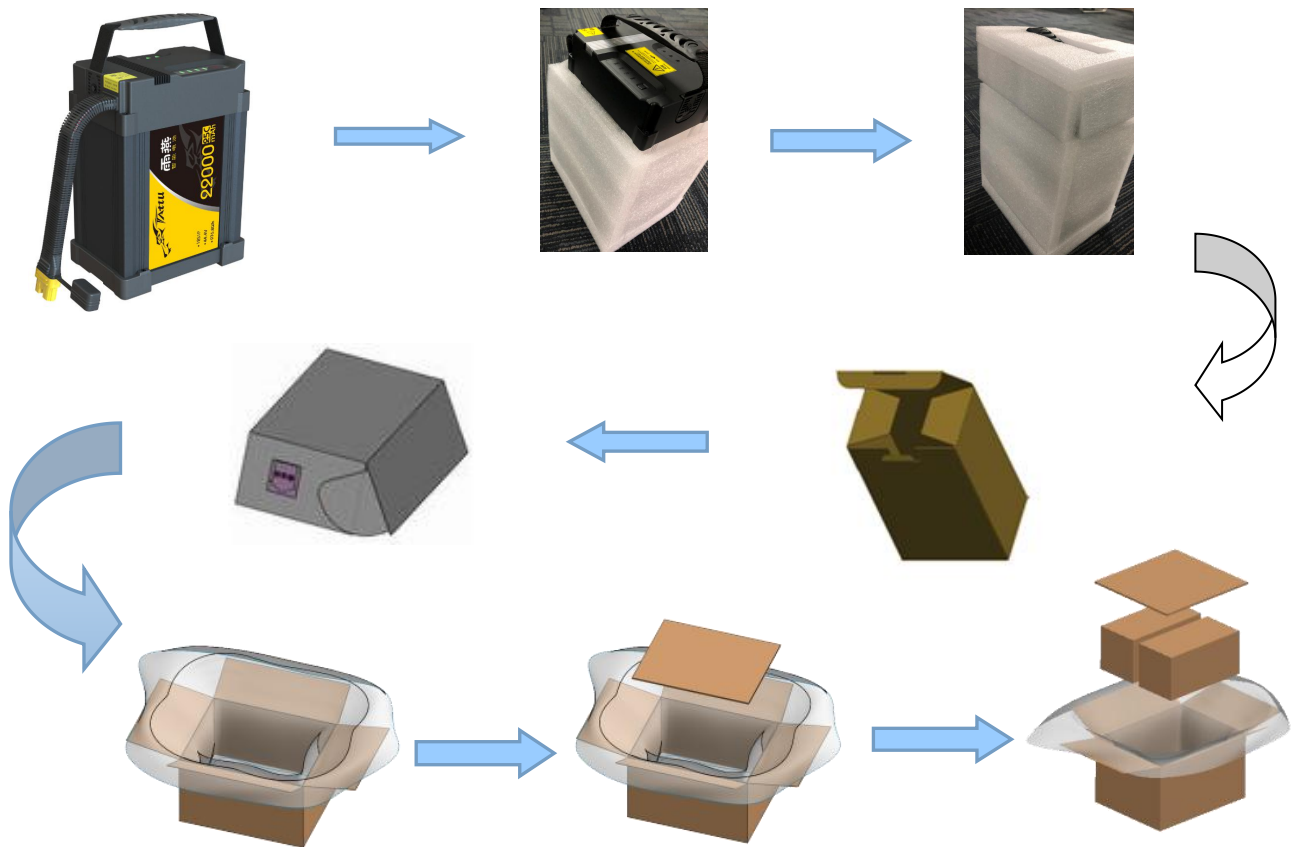


05	Appearance	Black plastic Case and Aluminum Frame	/
04	BMS	Smart BMS	1
03	Charge/ Discharge wire	AS150-U	1
02	Balancing port	Molex-430251600	1
01	Cell Type	22000mAh-25C	12
NO	Item	Type	Quantity
标记	处数	变更内容	
设计	许勇创	样品确认	
绘图	许勇创	复核	
审核	谭欣荣	批准	
版本		日期	
		12S1P-25C-22000mAh	图纸号
		深圳市格瑞普电池有限公司	客户名称
		SHENZHEN GREPOW BATTERY CO., LTD	比例
			A4
			共 页 第 页
			 

5. Discharge curve 放电曲线

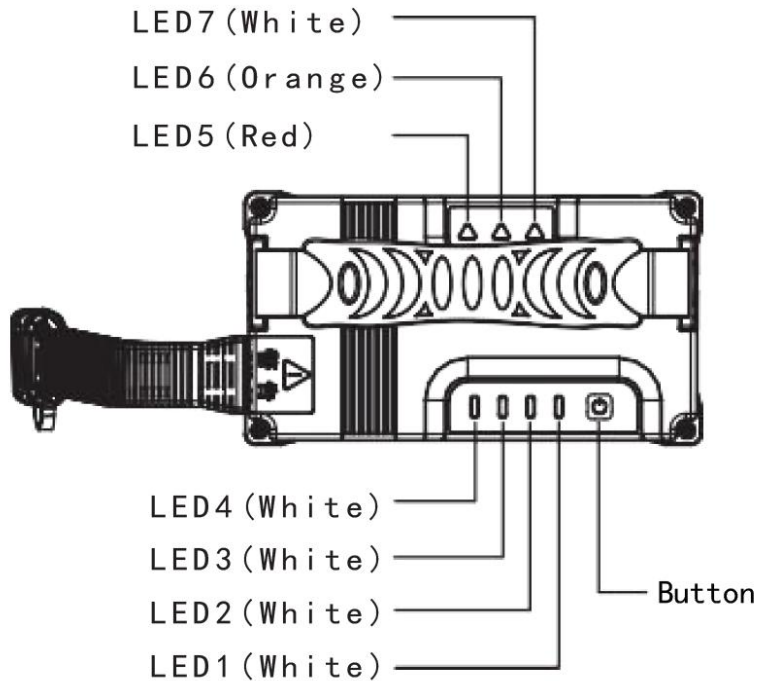


6. Package Schemes 包装示意



7. Operating Instruction 使用说明

7.1 Control panel, LED indicators 控制面板、指示灯说明



7.2 Button definitions 按键功能

7.2.1 Short-Check 查看

When the battery is powered off, by shortly pressing the button, the LED will light up successively to show SOC. After 2 seconds, all LED lights will be off.

关机状态，短按按键，LED指示电量，2S后熄灭。

7.2.2 Power-on 开机

Keep pressing the button more than 2 seconds till all LED lights are successively turned on. The LED lights indicate the SOC.

关机状态下，短按按键，LED指示电量，在灯没有熄灭状态下，再长按按键2秒以上，电量指示灯从LED1到LED4依次全亮，开机完成，随后LED指示当前电量。

7.2.3 Power-off 关机

Pressing the button till all 4 LEDs are flashing, then press the button again more than 2 seconds, LEDs will light off successively, the battery will be powered off.

电池开机状态下，短按按键，4个LED全闪，再长按按键2秒以上，LED指示灯从LED4到LED1依次全灭，电池进入关机状态。

7.2.4 Battery lifespan indicator 健康指示

While the battery is powered off, keep pressing the button more than 5 seconds, LEDs will show the lifespan of battery

关闭状态下，长按键5S以上，电量指示灯显示电池的寿命；

7.3 智能电量指示 Smart SOC indicator

The 4 LED indicators show the SOC of battery at eight different levels.

BMS设计了4个LED，分8等级指示电池电量；

Note: “●” on. “○” off. “⊙” flash.

说明: ● 表示常亮; ○ 表示熄灭; ⊙ 表示闪烁;

7.3.1 SOC indication in standby mode and discharging mode 待机与放电状态下的电量指示

SOC capacity 当前容量	LED1	LED2	LED3	LED4
0%~12%	⊙	○	○	○
13%~24%	●	○	○	○
25%~37%	●	⊙	○	○
38%~49%	●	●	○	○
50%~62%	●	●	⊙	○
63%~74%	●	●	●	○
75%~94%	●	●	●	⊙
95%~100%	●	●	●	●

7.3.2 SOC indication in charging mode 充电状态的电量指示

SOC capacity 当前容量	LED1	LED2	LED3	LED4
0%~12%	⊙	⊙	⊙	⊙
13%~37%	●	⊙	⊙	⊙
38%~62%	●	●	⊙	⊙
63~94%	●	●	●	⊙
95%~100%	●	●	●	●

- ① If charging after battery on, all LED indicators will be off after 10 minutes when full charging.
如果是开机后充电，电池充满电后电量指示灯10分钟后全熄灭。
- ② If charging in standby mode, all LED indicators will be off within 10 seconds after full charging.
如果是自动唤醒充电，电池充满电后电量指示灯10秒内全熄灭。

7.3.3 Residual lifespan indicator 剩余使用寿命指示灯

When the battery is powered off, keep pressing the button for 5 seconds, then the LED indicator will show the lifespan of battery.

电池关闭状态长按按键5S，LED显示电池当前剩余使用寿命。

Residual lifespan 剩余寿命	LED1	LED2	LED3	LED4
88%~100%	●	●	●	●
75%~87%	●	●	●	⊙
63%~74%	●	●	●	○
50%~62%	●	●	⊙	○
38%~49%	●	●	○	○
25%~37%	●	⊙	○	○
13%~24%	●	○	○	○
12%以下	⊙	○	○	○

7.4 Residual lifespan 状态LED指示

①. Red LED: Battery can not be used on weighty warning status.

红色LED: 电池处于二级告警状态，此状态下电池不能继续使用。

②. Orange LED: indicates low voltage, battery needs to be charged

橙色LED: 低电压提示指示灯，显示电池当前状态需要充电。

③. White LED: Battery is not suitable for using at normal warning status

白色LED: 电池处于一级告警状态，此状态下电池不适合使用。

④. False indication: red and white LED on

错误指示: 红灯与白灯同时亮起。

Red LED5 红色 (LED5)	Orange LED6 橙色 (LED6)	White LED7 白色 (LED7)	Remarks 说明
⊙	○	○	Over temperature weighty warning 过温二级告警
●	○	○	Voltage drift weighty warning 压差二级告警
○	●	○	Low SOC 电池处于低电状态
○	○	⊙	Over temperature warning 过温一级告警
○	○	●	Voltage drift warning 压差一级告警
●	○	●	False battery warning

7.5 Sleep mode 休眠功能

① Without any action after battery power-on more than 10mins, BMS will enter into sleeping mode to reduce power consumption. The BMS can be activated by charging or discharging.

当电池开机10分钟后, BMS进入系统休眠, 降低自耗, 充电或放电可以激活到正常工作状态。

② When single cell voltage is lower than 3.65V, BMS will enter into low power consumption status and battery can be stored safely within 4 months. If beyond 4 months, the battery is not allowed to be used and should resend to manufacturer for checking

当任意一节电池电压将低于3.65V后, 为了保证电池安全, BMS将进入二级节能模式, 在此模式下电池组可安全待机3~4个月, 如果超出此事件, 用户必须将电池报废或者返回原厂进行安全检查!

③ Battery will enter into deep sleeping mode if battery under extremely low voltage. In this mode, please manually starting up battery and charge at once.

如因电池电量严重不足且闲置事件过长, 电池将进入深度休眠模式, 此模式下, 电池需要手动开机换新, 并立即充电。

7.6 Self-balancing 自均衡功能

When voltage difference touches the setting threshold after 6 hours standby, self-balance function will be triggered.

当电池静置时间>6小时后, 如果BMS检测到各单元电芯的电压差值达到预设值, 均衡功能被触发。

7.7 Smart storage mode 智能存储功能

If battery will not be used in several days, store the battery at 40-70%SOC. If store at full SOC, the battery will trigger smart storage function (self-discharging to 40-70% SOC. Battery temperature will go up during self-discharging). The battery should be put into safety box for long-term storage. Never store the battery at fully discharged status, otherwise cell will be damaged and cannot be used anymore.

超过5天不使用电池, 请将电池放电至40~70%电量存放, 可延长电池的使用寿命。如将电池满电状态存储, 电池会自动开启智能存储功能(由满电放电至合适存储的电量, 放电过程电池温度可能会升高, 这属正常现象)。建议将电池存放在专用电池箱内。切勿将电池彻底放完后长时间存储, 以避免电池进入过放状态, 造成电芯损坏, 将无法恢复使用。

7.8 Software update 软件升级功能

The software can be updated. Directly turn the CAN port to USB port, then connect to computer to realize software update.

BMS具有软件升级功能, 可通过专用的升级通讯转换模块, 将CAN口转为USB口连接电脑后通过上位机进行软件升级, 更新电池软件。

7.9 Battery data log 电池日志记录功能(该功能需用户自定义开放)

BMS can record all using data of battery, including voltage, current, temperature, cycle times and Error status times etc. (This customized function needs to be opened by user)

BMS设计有日志记录功能, 能够对电池整个生命过程的数据记录存储。电池日志信息包含单体电压, 电流, 电池温度, 循环次数, 异常状态次数等, 用户可以通过专用的上位机连接电池进行查看。

8. Performance And Test Conditions 电池性能测试条件

8.1 Standard test condition (标准测试条件)

Before proceed the following tests, the battery should be discharged at 0.2C to 38.4V cutoff. Unless otherwise stated, tests should be done within one month of delivery under the following conditions:

Ambient temperature: $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Relative Humidity: $\leq 75\%RH$

Note Standard Charge/Discharge Conditions:

Charge: The battery will be charged to 50.4V with 0.2C from constant current to constant voltage, when the current is 0.05C, stop to charge.

Discharge: 0.2C to 38.4V

在进行下列各项测试前电池应用 0.2C 放至 38.4V。如果没有特别规定，测试应在电池交付 1 个月内按以下各项条件进行：

环境温度： $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 相对湿度： $\leq 75\%RH$

注意标准充放电为：

充电：以 0.2C 电流恒流充电至限制电压 50.4V 时，改为恒压充电，直到截止电流为 0.05C 时停止充电；

放电：以 0.2C 电流恒流放电至限制电压 38.4V

8.2 Visual inspection (外观检查)

There shall be no such defect as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the cell.

不允许有任何影响电池性能的外观缺陷，诸如裂纹、裂缝、泄漏等。

8.3 Measuring Instrument or Apparatus (测量器具及设备)

8.3.1 Dimension Measuring Instrument (尺寸测量器具)

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

尺寸测量器具的精度等级应不小于 0.01 mm 。

8.3.2 Voltmeter (伏特计)

Standard class specified in the national standard or more sensitive class having inner impedance more than $10\text{k}\Omega/V$

按照国家标准指定规格等级或采用灵敏度更高的，测量电压时内阻不应小于 $10\text{k}\Omega/V$ 。

8.3.3 Ammeter (安培计)

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω .

按照国家标准指定规格等级或采用灵敏度更高的，包括电流表及电线在内的总外阻应小于 0.01Ω 。

8.3.4 Impedance Meter (电阻计)

Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).

内阻测试仪测量原理应为交流阻抗法 (1kHz LCR) 。

8.4 Routine Inspection And Testing Of Battery Performance 电池常规性能检查及测试

NO	Items	Test Method and Condition	Criteria
1	Discharge Performance at different temperature 不同温度下放电特性	High Temperature: Storage 2 hours at $60\pm 2^{\circ}\text{C}$ after standard charge, 0.2C discharge at $60\pm 2^{\circ}\text{C}$ 高温: 标准充电后储存在 $60\pm 2^{\circ}\text{C}$ 的环境中, 2 小时后用 0.2C 放电	$\geq 90\%$
		Normal Temperature: Standard Charge / Discharge 常温: 标准充放电	$\geq 100\%$
		Low Temperature: Storage 2 hours at $0\pm 2^{\circ}\text{C}$ after standard charge, 0.2C discharge at $0\pm 2^{\circ}\text{C}$ 低温: 标准充电后储存在 $0\pm 2^{\circ}\text{C}$, 2 小时后用 0.2C 放电	$\geq 90\%$
		Low Temperature: Storage 2 hours at $-20\pm 2^{\circ}\text{C}$ after standard charge, 0.2C discharge at $-20\pm 2^{\circ}\text{C}$ 低温: 标准充电后储存在 $-20\pm 2^{\circ}\text{C}$, 2 小时后用 0.2C 放电	$\geq 70\%$
2	Cycle Life 循环寿命	Test condition: Step1: Charge: 25A to 50.4V, end current 0.05C Step2: Rest :30min Step3: Discharge: 100A to 42.6V Step4: cycle from step1 to step 3 More than 80% first capacity at 100A discharging 测试条件: 1) 恒流恒压充电: 25A 充电到 50.4V, 限流 0.05C 2) 静置: 30min 3) 恒流放电: 100A 放电到 42.6V 4) 循环 1) 至 3) 工步 当以 100A 放电容量小于初始容量 80%时, 所完成的循环次数定义为该电芯的循环寿命	≥ 200 Circle
3	Charge retention 荷电保持	Standard charge, storage: 28days at $20\pm 2^{\circ}\text{C}$ 0.2C discharge at $20\pm 2^{\circ}\text{C}$ to test residual capacity 标准充满电后 $20\pm 2^{\circ}\text{C}$ 贮藏 28 天。 然后常温下 0.2C 放电, 所得容量为剩容量	Residual capacity $\geq 90\%$ (First Capacity) 剩余容量 $\geq 90\%$ 初始容量
		Standard charge/discharge for 3 cycles, to test recovery capacity 按标准充放电制式循环 3 次, 取最大值为恢复容量	Recovery Capacity $\geq 95\%$ (First Capacity) 恢复容量 $\geq 95\%$ 初容量

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