

产品规格书

Product Specification

方形锂离子电池
Prismatic lithium Ion Battery

型号：L148N50
Model: L148N50

修订履历

Revision Notes

版次 Version	日期 Data	变更内容 Change Content	备注 Remark
A0	2019.12.10	初始状态 Original state	
A1	2021.07.21	更改部分：4.1、4.3、4.6.3、10。 Change part: 4.1、4.3、4.6.3、10.	
A2	2021.08.30	调整了章节顺序，添加了部分产品参数 Adjusted the chapter order and added some product parameters	
A3	2021.11.17	公司名称变更 Change of company name	

编制 Edited	校对 Checked	审核 Audited	批准 Approved	会签 Countersigned
廖凯 2021.11.17	纪文旭 2021.11.17	单旭意 2021.11.17	孔繁明 2021.11.17	曹虎成 2021.11.17

产品规格书

Product Specification

方形锂离子电池

Prismatic lithium Ion Battery

型号：L148N50

Model: L148N50

中创新航科技股份有限公司
CALB Co.,Ltd.

目录 Content

术语定义 Terms & Definition.....	1
1. 适用范围 Scope of Application.....	2
2. 产品参数 Product Parameter.....	2
2.1 产品信息 Product Information	2
2.2 产品外观 Cell Image	3
2.3 产品部件 Product Component.....	4
2.4 产品图纸 Product Drawing.....	4
3. 产品性能 Product Performance.....	5
3.1 充电性能 Charging Performance.....	5
3.2 放电性能 Discharging Performance.....	6
3.3 脉冲功率 Impulse Power.....	6
3.4 循环性能 Cycle Performance	7
3.5 温度性能 Temperature Performance	7
3.5 安全性能 Safety Performance	8
4. 技术要求 Technical Requirement	9
4.1 电压限制 Voltage Limit	9
4.2 电流限制 Current Limit.....	10
4.3 温度限制 Temperature Limit.....	10
4.4 机械冲击加速度限值 Acceleration limit for mechanical shock.....	11
4.5 安全阀 Safety Vent.....	11
4.6 熔断 Fuse	11
5. 模组设计以及过程注意事项 Parameter for Module Design and Process.....	12
5.1. 可施加在极柱上的最大扭矩 Max Torque which can be applied to terminal.....	12
5.2. 可施加在极柱上的最大力 Max. Force which can be applied to terminal	12
5.3. 模块组装时的压缩参数 Compression parameter during module assembly	12
5.4. 膨胀力 Swelling Force	12
5.5. 模组焊接过程中温度的影响 Effect of Heat for Module Welding	12
6. 运输注意事项 Precautions for Transportation.....	13
7. 贮存注意事项 Precautions for Storage	13
8. 充电注意事项 Precautions for Charging	14

8.1 充电电流 Charging Current.....	14
8.2 充电电压 Charging Voltage	14
8.3 充电温度 Charging Temperature.....	14
8.4 禁止反向充电 Reversal charging.....	14
9. 放电注意事项 Precautions for Discharging.....	14
9.1 放电电流 Discharging Current	14
9.2 放电温度 Discharging Temperature	14
9.3 禁止过放电 Over Discharging	15
10. 电池操作注意事项 Cautions of Battery Operation	15
11. 紧急情况处理 Emergency Treatment	17
12. 其它事项 Others.....	17

术语定义 Terms & Definition

术语 Terms	定义 Definition
中创新航 CALB	中创新航科技有限公司。 China Lithium Battery Technology Co., Ltd.
产 品 Product	本规格书中的“产品”是指中创新航生产的 L148N58A 可充电镍钴锰酸锂电池。 "Product" in this specification refers to L148N58A rechargeable Lithium nickel manganese cobalt oxide battery produced by CALB.
客 户 Customer	“客户”是指购买本规格书所述产品的公司、企业或个人。 "Customer" means the companies, enterprises or individuals who purchase the products described in this specification.
室 温 Room Temperature	表示温度为 25±2℃ 房间或自然环境。 Indicates a room or natural environment with a temperature of 25 ± 2℃.
电池温度 Cell Temperature	电池正积极柱温度。 The temperature of the cell positive terminal.
充、放电倍率 (C-Rate) Charge or Discharge Rate	电池在规定的时间内放出其额定容量时所需要的电流值，它在数据值上等于电池额定容量的倍数，通常以字母 C 表示。 The current value that the battery need to discharge its rated capacity in a stated time, which equal to a multiple of the rated capacity of the battery on the data value, usually expressed with the letter "C".
循环寿命 Cycle life	二次电池在反复充放电的使用下，电池的容量会逐渐下降，通常以该电池的额定容量作为标准，电池容量降到其 80% 的充放电次数，称为循环寿命。 With the repeated charging and discharging, the battery's capacity will gradually decline. Usually the rated capacity of the battery is a standard, the number of charge-discharge cycles a battery can go through before it reaches 80% of its rated capacity called cycle life.
开路电压 (OCV) Open circuit voltage	开路电压是指外电路没有电流流过时电池正负极柱之间的电位差。 Open-circuit voltage is the difference of electrical potential between two terminals of a device when disconnected from any circuit.
工作电压 Operating Voltage	工作电压又称放电电压或负荷电压，是指有电流通过外电路时，电池两极间的电位差。 工作电压总是低于开路电压，因为电流流过电池内部时，必须克服极化电阻和欧姆内阻所造成的阻力。 Operating voltage, also known as the discharge voltage or load voltage, is defined as the potential difference between the battery terminals when the current transmits through the external circuit. Working voltage is always lower than the open circuit voltage, because when the current transmits through the battery internal, the polarization resistance and ohmic resistance must be overcome.
标准充电 Standard Charging	室温下，以 1/3C 恒流持续充电至单体电池电压 4.35V，然后在 4.35V 下恒压持续充电直至电流下限 0.05C At room temperature, charged to 4.35V at a constant current of 1/3C, and then, changed continuously with constant voltage of 4.35V until the current was not more than 0.05C.
阶梯充电 Step-charge	为产品的推荐使用充电方法，不同温度下的充电方法请见技术参数表。 This is the recommended charging method for the product. Please refer to Technical Parameters table for charging methods at different temperatures.
标准放电 Standard Discharging	室温下，以 1C 恒流持续放电至 2.75V At room temperature, discharged to 2.75V at a constant current of 1C.
荷电状态 (SOC) State of charge	电池剩余电量百分比，也是电池一个重要的参数，只有准确估算电池 SOC 才能有效提高电池利用效率、保证电池的使用寿命和安全。 The percentage of remaining energy. Only with estimating the battery SOC accurately can improve the utilization efficiency of the battery, and ensure the battery life and safety.
测量单位 Units of measurement	“V” (Volt) 伏特，电压单位 “V” (Volt) ,Unit of voltage

	“A”（Ampere）安培，电流单位 “A”（Ampere）,Unit of current
	“Ah”（Ampere-Hour）安培-小时，电荷单位 “Ah”（Ampere-Hour）,Unit of electric charge
	“Wh”（Watt-Hour）瓦特-小时，能量单位 “Wh”（Watt-Hour）,Unit of energy
	“mΩ”（MilliOhm）毫欧姆，电阻单位 “mΩ”（MilliOhm）,Unit of resistance
	“°C”（degree Celsius）摄氏度，温度单位 “°C”（degree Celsius）,Unit of temperature
	“mm”（millimeter）毫米，长度单位 “mm”（millimeter）,Unit of length
	“s”（second）秒，时间单位 “s”（second）,Unit of time
	“Hz”（Hertz）赫兹，频率单位 “Hz”（Hertz）,Unit of frequency

1. 适用范围 Scope of Application

本产品规格书描述了中创新航生产的 L148N50 可充电镍钴锰酸锂电池的产品参数、产品性能、技术要求及安全注意事项。

This specification covers the performance indexes, technical requirements and safety issue of the L148N58A rechargeable Lithium nickel manganese cobalt oxide battery manufactured by CALB.

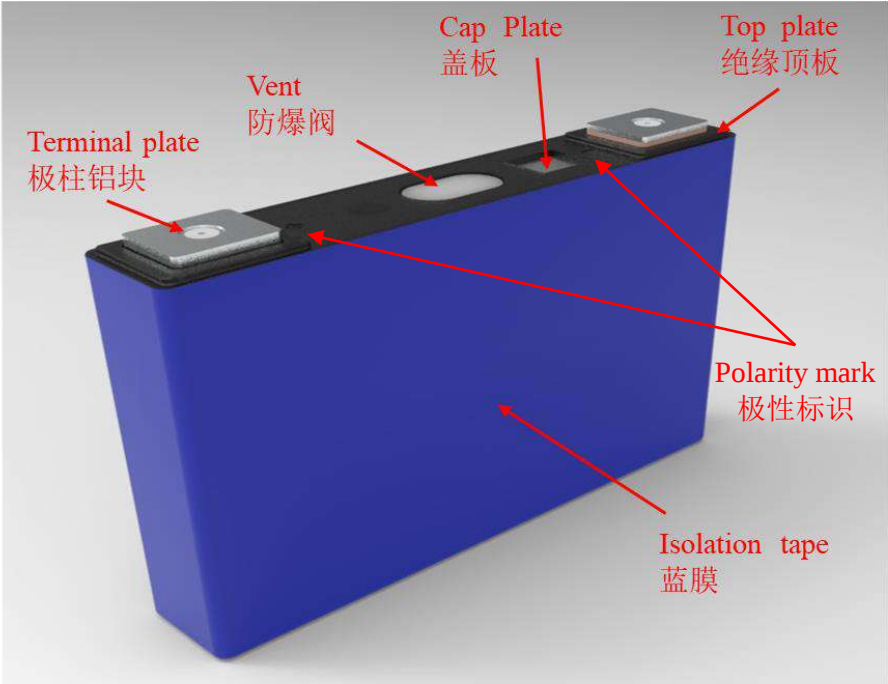
2. 产品参数 Product Parameter

2.1 产品信息 Product Information

序号 NO.	项目 Items	参数说明 Parameter	备注 Remarks
1	额定容量 Rated Capacity	50 Ah	标准放电 Standard Discharge
		51 Ah	1/3C 放电 1/3C Discharge
2	额定电压 Rated Voltage	3.66 V	标准放电 Standard Discharge
		3.71 V	1/3C 放电 1/3C Discharge
3	额定能量 Rated Energy	183 Wh	标准放电 Standard Discharge
		189.21 Wh	1/3C 放电 1/3C Discharge
5	重量 Weight	860 ± 50 g	/
6	体积 Volume	402 cm ³	/
7	质量能量密度 Mass Energy Density	220 Wh/kg	1/3C 放电 1/3C Discharge
8	体积能量密度 Volume Energy Density	470 Wh/L	1/3C 放电 1/3C Discharge
9	内阻（ACR） Alternating Current Resistance	0.55~0.75 mΩ	70%SOC，室温，交流阻抗，1000 Hz 70%SOC, Room Temperature, AC Impedance, 1000 Hz

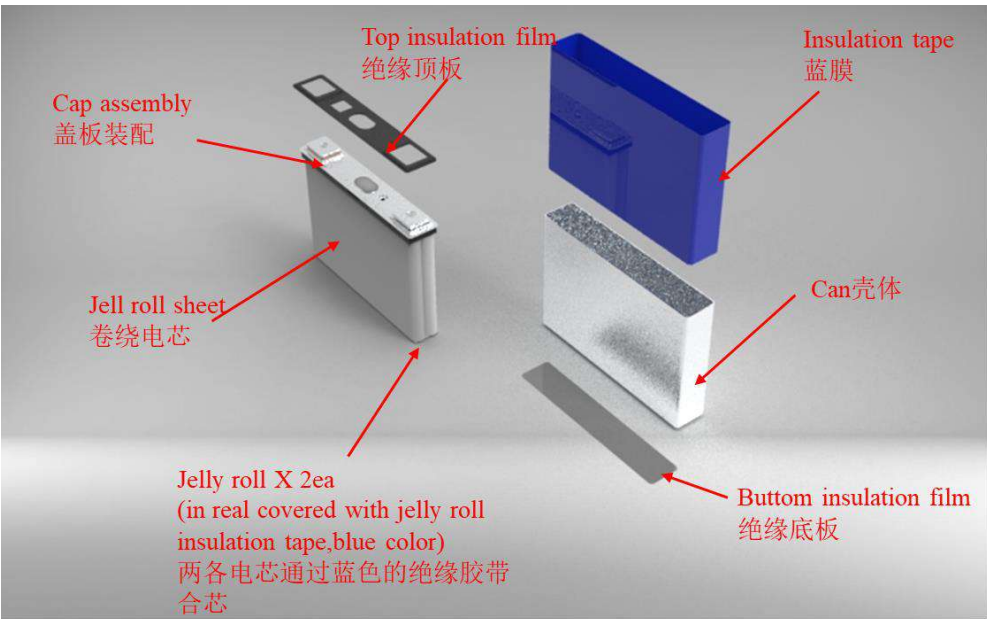
10	内阻（DCR） Direct Current Resistance		1.3~2.1 mΩ	70%SOC, 室温, 1C 充、放电 10s 70%SOC, Room Temperature, 1C Charge/Discharge for 10s
11	温度范围 Temperature Range	充电温度 Charging Temperature	-20~55 ℃	/
		放电温度 Discharging Temperature	-30~55 ℃	/
		存储温度 Storage Temperature	-40~60 ℃	/
12	电压范围 Voltage Range		2.75~4.30 V	0℃≤T≤55℃
			2.50~4.30 V	-20℃≤T<0℃
			2.00~4.30 V	-30℃≤T<-20℃

2.2 产品外观 Cell Image



产品外观
Cell Image

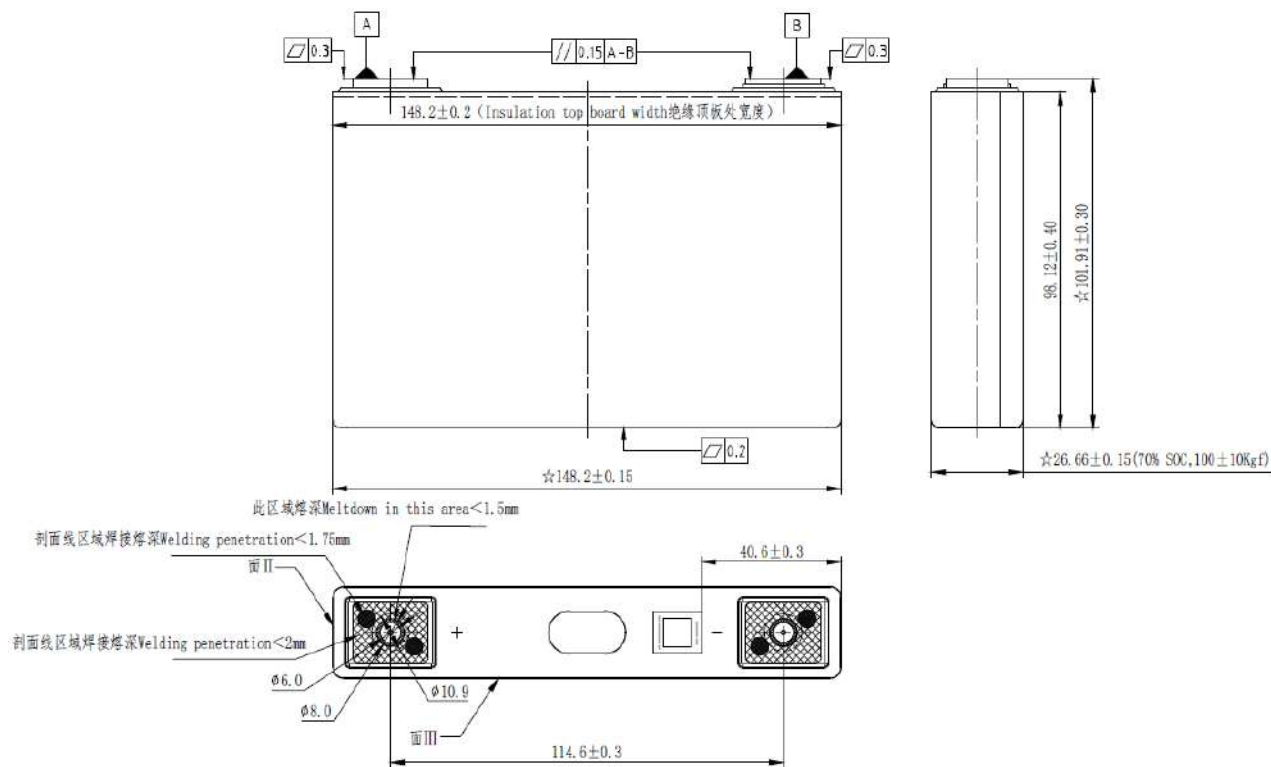
2.3 产品部件 Product Component



爆炸图
Exploded Diagram

零部件 Parts	功能 Function	材质 Material
蓝膜 Insulation tape	侧面电绝缘 Side insulation	PET 颜色：蓝色 厚度：0.08 mm Color: Blue Thickness: 0.08 mm
绝缘顶板 Top insulation film	顶面电绝缘 Top surface insulation	材料：ABS，厚度：1.2 mm Material: ABS, Thickness: 1.2 mm
绝缘底板 Outer bottom insulation film	底面电绝缘 Bottom surface insulation	材料：PET，厚度：0.175mm Material : PET, Thickness : 0.175mm (Transparent)
壳体 Can	隔绝电池内外部环境 Insulate the internal and external environment of the battery	Al 3003 H14
正积极柱 Positive Column	能量交换接口 Energy exchange interface	Al 1060 H14
负积极柱 Negative Column	能量交换接口 Energy exchange interface	Al 1060 H112 & Cu T2

2.4 产品图纸 Product Drawing



二维图纸

2D Drawing

项目 Items	描述 Description	尺寸 (mm) Dimensions (mm)
W	宽度 Width	148.2 ± 0.15
T	厚度 Thickness	26.66 ± 0.15 (70%SOC, 100 ± 10 Kgf)
H	高度 Height	101.91 ± 0.3

3. 产品性能 Product Performance

3.1 充电性能 Charging Performance

序号 NO.	充电温度 Charging Temperature	充电方式 Charging Mode	描述方式 Descriptive Mode	充电时间 Charging Time
1	室温 Room Temperature	标准充电 Standard Charge	0~100%SOC	约 4h About 4h
2	室温 Room Temperature	阶梯充电 Step-charge	0~80%SOC 0~95%SOC	约 55min About 55min 约 90min About 90min
3	45℃	阶梯充电 Step-charge	0~80%SOC 0~95%SOC	约 55min About 55min 约 90min

				About 90min
4	0℃	阶梯充电 Step-charge	0~95%SOC	约11.5h About 11.5h
5	-20℃	阶梯充电 Step-charge	0~95%SOC	约22h About 22h

3.2 放电性能 Discharging Performance

在室温下，用标准充电方法充满电，在不同温度下放电至截止电压，放电电流与容量关系如下表：

Charge the battery fully by standard charging method at room temperature, and discharge the battery to cut-off voltage at different temperatures. The relationship between discharge current and capacity is shown in the following table:

放电温度 Discharging Temperature	放电倍率 Discharging Rate	放电容量 Discharging Capacity	放电说明 Discharging Description
室温 Room Temperature	1/3C	≥51 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
45℃		≥51 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
0℃		≥44 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
-20℃		≥40 Ah	放电截止电压为2.5V The discharging cut-off voltage is 2.5V
室温	1C	≥50 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
45℃		≥50 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
0℃		≥43 Ah	放电截止电压为2.75V The discharging cut-off voltage is 2.75V
-20℃		≥42 Ah	放电截止电压为2.5V The discharging cut-off voltage is 2.5V

3.3 脉冲功率 Impulse Power

温度 Temperature		功率 Power [W]					
		持续时间 Duration time	90% SOC	50% SOC	30% SOC	20% SOC	10% SOC
25℃	放电 Discharge	10sec	931.5	882.1	872.0	843.8	556.0
		30sec	922.7	820.0	764.9	737.4	417.0
	充电 Charge	10sec	262.0	646.0	681.4	686.0	755.2
		30sec	189.6	434.8	481.9	487.5	496.8
0℃	放电 Discharge	10sec	756.9	625.7	416.7	211.6	155.0

		30sec	681.2	483.0	364.0	206.0	116.3
	充电 Charge	10sec	63.2	140.0	145.0	152.0	167.2
		30sec	41.9	91.0	102.4	110.9	127.3
-20℃	放电 Discharge	10sec	480.6	224.7	141.1	98.0	60.5
		30sec	360.5	216.0	105.8	68.6	42.4
	充电 Charge	10sec	12.3	55.0	73.0	76.2	87.4
		30sec	8.4	28.5	53.0	67.0	83.0

3.4 循环性能 Cycle Performance

测试温度 Test Temperature	测试条件 Test Condition	结果 Result
室温 Room Temperature	Charge: 1.2C-3.83V, 1.0C-3.89V, 0.85C-3.95V, 0.75C-4.08V, 0.6C-4.11V, 0.5C-4.19V, 0.33C-4.22V, 0.15C-4.25V Discharge: 1.0C-2.75V	>2000 cycles
45℃		>800 cycles

3.5 温度性能 Temperature Performance

环境温度 Environment Temperature	时间限制 Time Limit
$T > 60^{\circ}\text{C}$	不允许电池处于超过60℃环境 The temperature to keep the battery is not allow higher than 60 °C
$50^{\circ}\text{C} < T \leq 60^{\circ}\text{C}$	质保期期内累计时间不超过180天，连续时间不超过8h The cumulative time of the warranty period should not exceed 180 days, and the continuous time should not exceed 8h
$40^{\circ}\text{C} < T \leq 50^{\circ}\text{C}$	质保期期内累计时间不超过540天，连续时间不超过12h The cumulative time of the warranty period should not exceed 540 days, and the continuous time should not exceed 12h
$20^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	推荐使用温度区间 Recommended Temperature Range
$-40^{\circ}\text{C} < T \leq 20^{\circ}\text{C}$	长期存放，启用时应采取必要措施使产品温度升高到推荐使用温度区间 Necessary measures should be taken to raise the temperature of the product to the recommended temperature range, after a long-term storage
$T \leq -40^{\circ}\text{C}$	不允许电池处于低于-40℃环境 The temperature to keep the battery is not allow lower than -40 °C

3.5 安全性能 Safety Performance

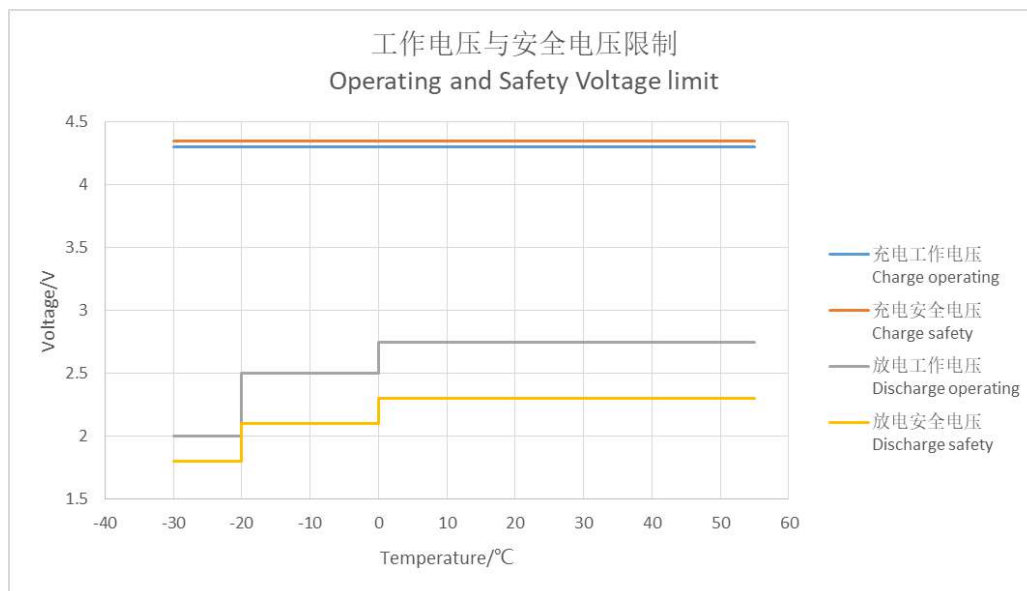
项目 Item		测试条件 Test condition	EUCAR Level	备注 Remark
机械滥用 Mechanical Abuse	挤压 Crush	1) 挤压力达到 100 kN 或电池形变量达到 15%或电压为 0 V; 1) 100 kN of extrusion or 15% of cell deformation or 0 V of cell voltage; 2) 挤压方向:垂直于电池极片方向施压; 2) Crush Direction: Crush vertically in the direction of the plate; 3) 挤压速度:5±1 mm/s。 3) Crush Speed: 5±1 mm/s.	Level 2	<EUCAR safety level > Level 0:无影响 Level 0: No effect Level 1: 保护措施被激活 Level 1: Passive protection activated Level 2: 被损坏 Level 2: Defect/Damage Level 3: 泄漏, 质量损失<50% Level 3: Leakage, Δ mass < 50% Level 4: 漏气, 质量损失>50% Level 4: Venting, Δ mass > 50% Level 5:着火 Level 5: Fire or Flame Level 6: 破裂 Level 6: Rupture Level 7: 爆炸 Level 7: Explosion
	振动 Vibration Test	1) 将测试对象安装在振动台上; 1) Install the test object on the vibration table; 2) 对 XYZ 三个方向每个方向施加振动 8 h, 振动测试参数按照 1 进行, 振动曲线如图 2, 同时叠加一个温度工况, 温度参数见图 3; 2) Vibration is applied to each of the three directions of XYZ for 8 h. Vibration test parameters are carried out in accordance with Table 1. The vibration curve is shown in Figure 2, a temperature condition is superimposed, and the temperature parameters are shown in Figure 3. 3) 振动结束后静置 1h; 3) Stand for 1h after the vibration is over; 4) 以标准电流对电池进行标准循环 3 次, 确定振动后容量; 4) Conduct standard cycle for the cell for 3 times with standard current to determine the capacity after vibration; 5) 按照标准测试方法测试电池内阻值。 5) Test the cell resistance according to the standard test method.	Level 2	
热滥用 Thermal Abuse	热稳定性 Thermal Stability	1) 100% SOC, 5°C/min 的升温速率从 25°C加热到 130°C, 然后保持 30 分钟。 1) 100% SOC, heat from 25°C to 130°C at a heat rate of 5°C/min and stay 30 min.	Level 2	
电滥用 Electrical Abuse	过充 Overcharge	1C 恒流充电至 140%SOC CC mode, 1C, SOC140% cutoff	Level 4	
	过放 Over Discharge	1C 恒流放电, 90min CC discharge, 1C, 90min	Level 2	
	外短路 External Short Circuit	1) 100% SOC, 电池外短路 10 min, 短路电阻小于 5 mΩ, 观察 1 小时。 1) 100% SOC, 10 min of cell external short circuit and the external short circuit resistance is less than 5 mΩ, observe 1 h.	Level 2	
环境测试 Environmental Test	跌落测试 Drop Test	1) 100% SOC, 电池正负端子向下从 1.5 m 高度处自由跌落到水泥地面上, 观察 1 小时。 1) 100% SOC, two terminals of cell faces down from a height of 1.5 m onto the cement floor and observe 1 h.	Level 2	
	温度循环 Temperature Cycle	1) 100% SOC, 单体电池放入温度箱中, 温度箱温度按照表 4 和图 5 进行调节, 循环次数 5 次, 观察 1 小时。 1) 100% SOC, cell was put into the temperature box, and temperature of the temperature box was adjusted according to table 4 and figure 5 for 5 cycles, and observe 1 h.	Level 2	

	低气压 Low Pressure	1) 100% SOC, 单体电池放入低气压箱中, 调节试验箱中气压为 11.6 kPa, 温度为室温, 静置 6 小时, 观察 1 小时。 1) 100% SOC, cell was put into a low-pressure chamber, air pressure was adjusted to 11.6 kPa in ambient temperature, stand for 6 h and observe 1 h.	Level 2	
	海水浸泡 Seawater Immersion	1) 100% SOC, 将单体电池浸入 3.5% NaCl 溶液 (质量分数) 中 2 小时, 水深应完全没过单体电池, 观察 1 小时。 1) 100% SOC, cell was immersed in 3.5% (mass fraction) NaCl solution for 2 h, water depth should completely exceed height of the cell and observe 1 h.	Level 2	

4. 技术要求 Technical Requirement

4.1 电压限制 Voltage Limit

充放电电压限制 Voltage limit of charge and discharge			
限制 Limit	项目 Item	数值 Value	备注 Remark
安全限制 Safety limit	充电电压 Charging voltage	4.35 V	/
	放电电压 Discharging voltage	2.3 V ($T \geq 0^{\circ}\text{C}$) 2.1 V ($-20^{\circ}\text{C} \leq T < 0^{\circ}\text{C}$) 1.8 V ($-30^{\circ}\text{C} \leq T < -20^{\circ}\text{C}$)	/
工作限制 Operation limit	充电电压 Charging voltage	4.30 V	/
	放电电压 Discharging voltage	2.75 V ($T \geq 0^{\circ}\text{C}$) 2.5 V ($-20^{\circ}\text{C} \leq T < 0^{\circ}\text{C}$) 2.0 V ($-30^{\circ}\text{C} \leq T < -20^{\circ}\text{C}$)	/



4.2 电流限制 Current Limit

温度 Temperature (°C)	峰值电流限制 Peak Current Limit			
	放电电流 (A) Discharging current (A)		充电电流 (A) Charging current (A)	
	10s	30s	10s	30s
55	134	123	51	30
50	284	248	103	61
45	340	309	181	122
40	340	309	186	125
35	340	309	193	130
30	340	309	202	137
25	363	331	206	139
20	344	312	150	99
15	306	292	129	82
10	275	270	107	67
5	253	251	68	47
0	247	231	53	37
-5	206	210	38	32
-10	181	184	34	27
-15	175	156	30	24
-20	170	125	25	20
-25	70	71	0	0
-30	53	46	0	0

电池温度范围 Cell temperature range	T < -20°C	-20°C ≤ T < -10°C	-10°C ≤ T < 0°C	0°C ≤ T < 10°C	10°C ≤ T < 15°C	15°C ≤ T < 20°C	20°C ≤ T < 45°C	45°C ≤ T < 55°C	T > 55°C
允许最大充电电流 Maximum charging current allowed	不允许 Not allowed	0.05C	0.1C	0.2C	0.5C	0.8C	1.2C	0.8C	不允许 Not allowed
最大充电电流的截止电压 The voltage limitation of the maximum charging current		4.10V	4.10V	4.35V	3.95V	3.90V	3.83V	4.10V	

4.3 温度限制 Temperature Limit

安全限制 Safety limit	最高存储温度 Max. storage	60°C	该温度为环境温度 This is to be ensured in an ambient temperature
	最低存储温度 Min. storage	-40°C	该温度为环境温度 This is to be ensured in an ambient temperature
	最高工作温度 Max. operation	60°C	该温度为电芯温度 This is to be ensured in a cell core temperature
	最低工作温度 Min. operation	-35°C	该温度为电芯温度 This is to be ensured in a cell core temperature
工作限制 Operation limit	最高工作温度 Max. operation	55°C	该温度为电芯温度 This is to be ensured in a cell core temperature

	最低工作温度 Min. operation	-30°C	该温度为电芯温度 This is to be ensured in a cell core temperature
--	--------------------------	-------	--

4.4 机械冲击加速度限值 Acceleration limit for mechanical shock

Y 方向 direction : $\pm 60g$;

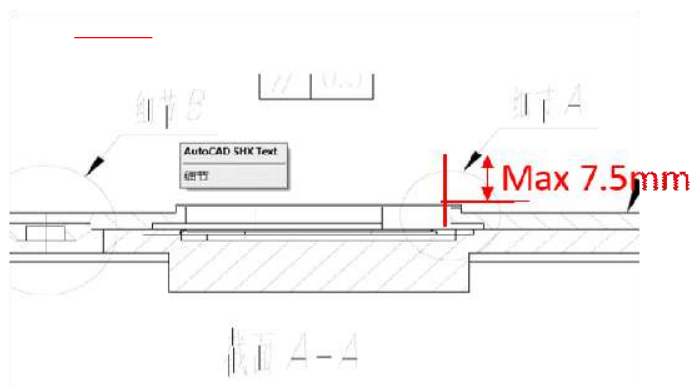
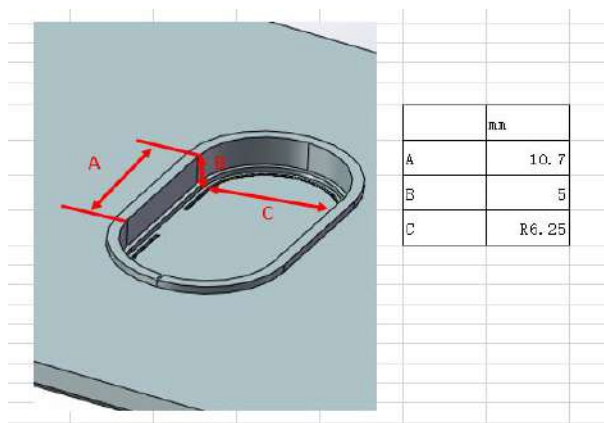
X, Z 方向 direction: $\pm 35g$;

持续时间 Duration: 30ms;

4.5 安全阀 Safety Vent

1)功能 Function: 在安全事故中释放电池内部压力 Degassing during safety event to maintain inner pressure in a cell low.

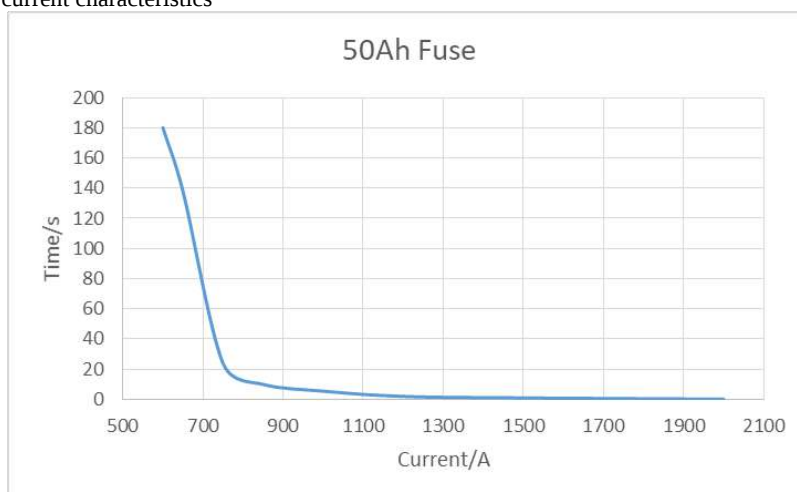
2)排气面积 Degassing area: 1282mm²



4.6 熔断 Fuse

1)电池熔断时间 vs 电流特性曲线

Cell fuse melting time vs. current characteristics



5. 模组设计以及过程注意事项 Parameter for Module Design and Process

5.1. 可施加在极柱上的最大扭矩 Max Torque which can be applied to terminal

扭矩强度：相切于极柱圆柱面 XY 方向最大 6 Nm（2 小时）

Torque strength: tangent to the cylindrical surface of the pole, the maximum is 6 Nm in the XY direction (2 h)

5.2. 可施加在极柱上的最大力 Max. Force which can be applied to terminal

极柱可承受力：≤800 N（x,y 方向），≤800（z 方向）。

Static force at terminal: Max. 800 N in x, y axis (2h), Max. 800 N in z axis (2h).

5.3. 模块组装时的压缩参数 Compression parameter during module assembly

压缩区域：148mm * 102 mm

Compression area: 148 mm * 102 mm

压缩速度：0.02 mm/sec (对电池) / 1mm/s (对模组)

Compression speed: 0.02 mm/sec (for cell) / 1mm/s (for module)

目标厚度：27.0mm（带缓冲材料）

Target thickness: 27.0mm（with Cushioning material）

保持时间：5 min

Duration: 5 min

电池 SOC：70%

Cell SOC: 70%

5.4. 膨胀力 Swelling Force

1) 测试条件 Test condition

电池夹具：钢板, 电池压缩至 27.0mm（加缓冲材质）；

The battery clamp: steel plate, the battery is compressed to 27.0mm (with buffer material)

充放电条件 Charge/discharge condition

充电: Step-charge, 静置 20 min

Charge: Step-charge, rest 20 min

放电: 1C, CD, 2.75 V, 静置 20 min

Discharge: 1C, CD, 2.75 V cut off, rest 20 min

2) 测试结果 Test result

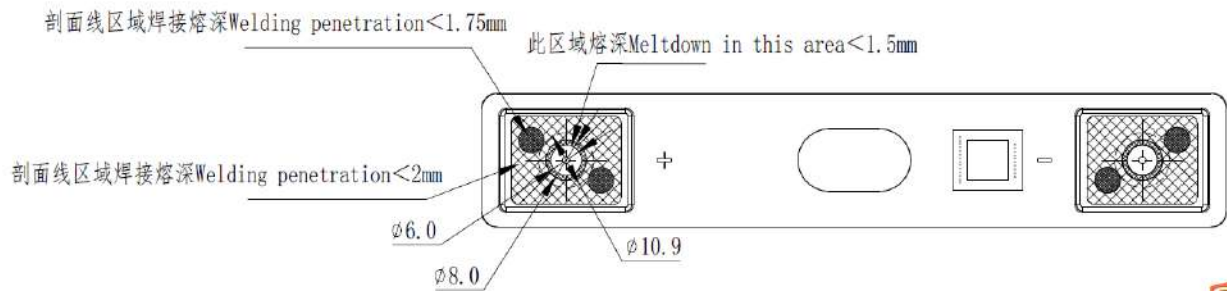
单体电池膨胀力 Cell swelling force	BOL	< 4,000 N
	EOL	< 20,000 N

5.5. 模组焊接过程中温度的影响 Effect of Heat for Module Welding

4.5.1 允许焊接区域 Allowable welding area

允许焊接区域：铆接空以外的其他极柱区域

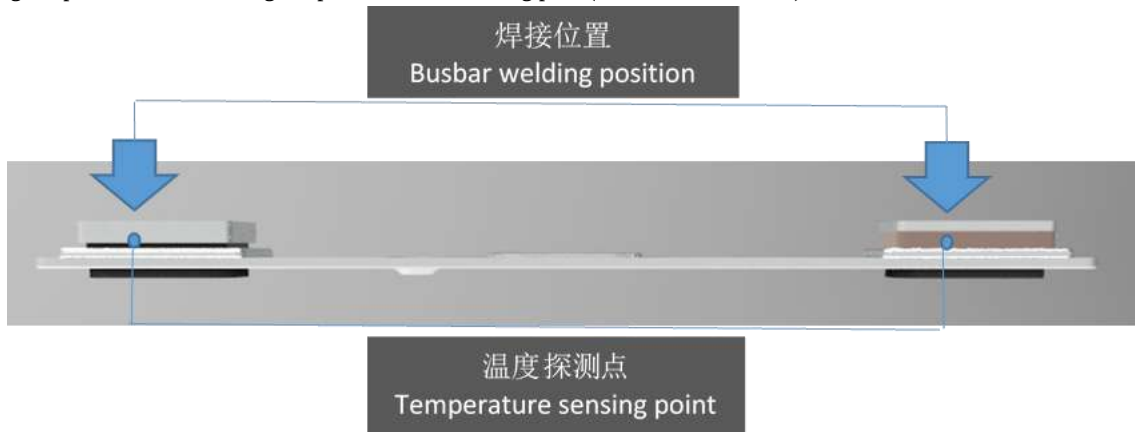
Allowed welding area: On terminal area without rivet, module welding is allowed.



4.5.2 焊接对极柱高度的影响 Influence of welding on pole height

焊接温度：焊接过程中，探测点温度（极柱底部）不能超过 150℃；

Welding temperature: The welding temperature at the sensing point (terminal bottom side) should be below 150℃



6. 运输注意事项 Precautions for Transportation

电池应在 20%~70% 荷电状态下包装成箱进行运输，在运输过程中应防止剧烈振动、冲击或挤压、防止日晒雨淋，不得倒置。适用于汽车、火车、轮船等交通工具运输。航空运输请参照 MH/T 1020-2013 《锂电池航空运输规范》。

The batteries, which should be kept between 20% and 70% SOC must be packed in boxes for transportation. They are also should be prevented from vibration, shock, extrusion, sun-scorched and rain-drenched. It could be delivered by the transportation like a car, a train or a boat. If it will be delivered by air, please refer to MH/T 1020-2013 *Standards for transport of lithium batteries by air*.

7. 贮存注意事项 Precautions for Storage

电池贮存（超过 6 个月）在环境温度为 -20℃~25℃ 的清洁、干燥通风的室内，避免与腐蚀性物质接触，远离火源及热源。在存放过程中，禁止将电池倒置，并避免机械冲击和重压。

The batteries should be stored (more than 6 month) in a clear, dry and ventilated room under ambient temperature of -20℃~25℃, and it should be kept away from caustic material, combustion source and heat source. Do not turn over battery during storage; mechanical shock and stress should be avoided.

长期不用时，每六个月对电池进行一次标准充放电维护，电池在 20~50% SOC 状态下贮存。

If the batteries kept unused for a long time, it should be charged and discharged at the standard model every six months. Store the battery in the state of 20~50% SOC.

8. 充电注意事项 Precautions for Charging

8.1 充电电流 Charging Current

充电电流不得超过本规格书中规定的允许最大充电电流。使用高于推荐值电流充电将可能引起电池的充放电性能、机械性能和安全性能的问题，并可能会导致发热或漏液。

The charging current should not be higher than the maximum value described in this specification. If the current is higher than the recommended one, it could bring about a series of problems, such as charging and discharging performance, mechanical property and safety, or even leads to overheat and leakage.

8.2 充电电压 Charging Voltage

充电电压不得超过本规格书中规定的绝对充电电压。电池电压高于绝对充电电压值时，将可能引起电池的充放电性能、机械性能和安全性能的问题，并可能会导致发热或漏液。

The charging voltage should not be higher than the maximum value described in this specification. If the voltage is higher than the maximum value, it could bring about a series of problems, such as charging and discharging performance, mechanical property and safety, or even leads to overheat and leakage.

8.3 充电温度 Charging Temperature

电池必须在绝对充电温度：-20°C~55°C的范围内进行充电(详见技术参数表)。

The battery should be charged under the absolute charging temperature of -20°C~55°C (As shown in the technical parameters table).

8.4 禁止反向充电 Reversal charging

正确连接电池的正负极，严禁反向充电。若电池正负极接反，将导致电池报废并产生安全隐患。

Properly connect the terminals of positive and negative of the batteries. The reversal charging is forbidden. If the polarity is reversed, the battery will be damaged and safety problem may occur.

9. 放电注意事项 Precautions for Discharging

9.1 放电电流 Discharging Current

放电电流不得超过本规格书规定的最大放电电流，大电流放电会导致电池容量快速衰减并可能导致过热，甚至会出现电池冒烟并喷出黑色物质等极端情况。

The discharging current should not be higher than the maximum value described in this specification. Discharging with a higher current may result in the capacity fade and over-heat, even smoke or black material ejected from the case.

9.2 放电温度 Discharging Temperature

电池必须在绝对放电温度：-30°C~55°C的范围内进行放电(详见技术参数表)。

The battery should be discharged under the absolute discharging temperature of -30°C~55°C (As shown in the Technical Parameters table).

9.3 禁止过放电 Over Discharging

在电池正常使用过程中，应安装电池管理系统防止电池过放电的发生，若电池过放电，将导致电池报废并产生安全隐患。

During normal usage, the battery management system should be applied to avoid over discharging. Once over discharging happens, the battery will be damaged or safety problem may occur.

需要注意的是，在电池长期未使用期间，它可能会由于其自放电特性而处于某种过放电状态。为防止过放电的发生，电池应定期充电，让电池处于 20~50%荷电状态。

What should be paid attention to is that the battery can be in the state of over discharging because of self-discharging during the long time storage. To avoid over discharging, the battery should be charged according to a fixed schedule, keep the battery within the 20~50% SOC.

10. 电池操作注意事项 Cautions of Battery Operation

1. 使用电池前，请仔细阅读本规格书和注意电池表面标识。

Please read the instructions carefully and pay attention to the marks on the surface of battery before use.

2. 在使用过程中，应远离热源、火源，切勿摔打电池，禁止坠落、冲击电池。

During operation, please keep the cell away from heat source, fire source. Never beat, drop or shock the cell.

3. 禁止直接焊接电池和用钉子或其它利器刺穿电池。

Do not directly solder the cell or pierce it with a nail or other sharp object.

4. 禁止将电池倒置，并避免敲击、抛掷、踩踏和弯折电池等。

Do not turn over battery. Keep it from strike, throw, tread or bending.

5. 禁止短路电池，以免发生危险，电池严重损坏。

Do not make battery short-circuited, in order to avoid from danger incurring or battery damage.

6. 废弃电池请安全妥当处理，不要投入火中或水中。

Discarded battery should be well disposed. Do not throw it into the fire or water.

7. 本电池只能使用锂离子电池专用充电器充电。

This battery only can be used with the specified charger for lithium-ion battery.

8. 电池箱设计注意事项。

Precautions for the Design of Battery Box.

- 电池箱应有足够的机械强度以保证其内部电池免受机械撞击；

Battery box should have enough mechanical strength to make sure that the battery inside would avoid mechanical shock;

- 电池箱内安装电池的部位不应有锋利的边角；

Places inside of the box which are used to fix batteries should not have sharp edges;

- 电池箱的设计应充分考虑单体电池的散热问题，由于电池箱散热设计问题导致的电芯或电池过热损坏，中创新航不承担质量保证责任；

The cooling issue of the battery box should be fully considered. Overheating damages to cells or batteries caused by battery box thermal design problem, CALB will not assume responsibility for such quality assurance;

- 电池箱设计中应充分考虑电池的防水、防尘问题，电池箱必须满足国家有关标准规定的防水、防尘等级。由于防水、防尘问题而导致的电芯或电池的损坏（如腐蚀、生锈等），中创新航不承担质量保证责任。

Battery box design should be fully considered about the battery waterproof and dustproof problem, battery box must meet the relevant national standards for water and dust levels. Cell or battery damage due to water, dust problems caused (such as corrosion, rust, etc.), CALB will not assume responsibility for such quality assurance.

- 金属壳表面上粘贴的蓝色绝缘膜仅能满足单体电池运输情况下的绝缘，不能满足电池成组后的绝缘要求。金属壳电池在成组为模块时，须根据实际使用工况在单体电池外增加额外绝缘防护措施。若未按照以上要求进行绝缘防护，可能造成着火危险。使用的绝缘材质可选择塑料板、PC板、PET膜、橡胶垫或发泡PU等进行加强绝缘性，具体绝缘方案请联系我公司。

The blue insulating films, which wrapped over the metal shell batteries, can only provide insulation for the cell transportation. The films can't provide the stable insulation protections for battery modules. The additional insulation protection measures should be added to the surface of cells according to the usage conditions, when the cells are used as modules or systems. Otherwise fire may occur. We suggest to use plastic, PC, PET, Rubber and foaming PU, etc to be the insulation protection material. Please contact our company for more information.

9. 电池的连接 Connection of the Cells

- 使用前应用细砂纸打磨极柱和连接片，确保金属表面没有氧化层，否则可能会导致接触不良，功能失效。

Rub the terminals and bus bar with sandpaper before usage to make sure that there isn't oxide layer; otherwise poor contact may incur which may leads to improper function.

- 建议使用铝连接片来连接电池。电池在 1C 放电电流时，导电条与极柱之间的保证压降 $<3\text{mV}$ ，可保障不因连接电阻过大导致的异常发热。

Aluminum material is suggested to connect the terminals. When the battery was discharged at 1C, the voltage between the terminals and bus bar should not reduce more than 3mV . It ensured that exceptional heat did not occur to the battery because of the augment of contacting resistance.

10. 电池管理系统的应用 Applications of Battery Management System (BMS)

- 客户应配置电池管理系统，严密监控、管理与保护每个电池。

Customers should configure a BMS which is used for strictly monitoring, management and protection.

- 客户应具有电池管理系统详细的设计方案，并对系统特点、框架，系统数据、格式等相关信息进行评估，建立电池管理档案。

Customers should have a detailed design of BMS, assess system features, frameworks, system data, format and other related information, and establish battery management file.

- 客户不可擅自修改或者改变电池管理系统的设计和框架，以免影响电池的使用性能。

The design or framework of BMS must be changed with permission, so as not to affect the performance of battery.

- 客户应保存完整的电池运转的监测数据，用作产品质量责任划分的参考。不具备完整的电池系统使用期限内的监测数据的，中创新航不承担产品质量保证责任。

Customers should keep a complete battery operation monitoring data as the reference of responsibility division for product quality. Without complete battery operation monitoring data within system usage period, CALB will not assume responsibility for such quality assurance.

- 避免电池达到过放状态。电池电压低于 1.8V 时，电池内部可能会遭到永久性的破坏，此时中创新航的产品质量保证责任失效。当放电截止电压低于 2.75V($T \geq 0^{\circ}\text{C}$)或 2.5V($-20^{\circ}\text{C} \leq T < 0^{\circ}\text{C}$)或 2.0V($T < -20^{\circ}\text{C}$)时，系统内部能耗降低到最小，并在重新充电之前延长休眠时间。客户需要培训使用者在最短的时间内重新充电，防止电池进入过放状态。

Avoid over-discharge state. When the battery voltage is lower than 1.8V, the internal battery may suffer permanent damage, now the quality assurance responsibilities of the product of CALB failure. When the discharge cut-off voltage is lower than 2.75V($T \geq 0^{\circ}\text{C}$) or 2.5V($-20^{\circ}\text{C} \leq T < 0^{\circ}\text{C}$) or 2.0V($T < 0^{\circ}\text{C}$), the energy consumption in the internal system minimize and prolong sleep time before recharging. Customers need to train users to re-charge in the shortest time, to prevent the battery into the over-discharge state.

- 电池避免在本规格书禁止的低温条件下充电（包括标准充电，快充，紧急情况充电和再生充电），否则可能出现意外的容量降低现象。电池管理系统应依照最小的充电和再生充电温度进行控制。禁止在低于本规格书规定的温度条件下充电，否则中创新航不承担质量保证责任。

Charging at low temperature is forbidden in this specification (including standard charge, fast charge, emergency charge and regenerative charge), or it may reduce the capacity. Battery management system should ensure the cell operating according to the temperature protocol; otherwise the CALB does not assume responsibility for quality assurance.

11. 维护保养请参见《中创新航锂离子动力电池安装操作和使用保养手册》

Refer to *CALB Lithium-ion Battery Installation and Maintenance Manual* for maintenance.

11. 紧急情况处理 Emergency Treatment

如果电池发生泄露，电解液进入眼睛，请不要揉擦，应用清水冲洗眼睛，并立即送医治疗，否则会伤害眼睛；

If the leakage of electrolyte happens, and the electrolyte enters into eyes, rinsing them out with clear water and get a treatment in the hospital immediately instead of rubbing eyes, or the eyes may get hurt;

如果电池使用以及贮存过程中发出异味、发热、变色、变形等异常，应立即切断电源，若电池表面温度较高，待电池冷却后，将电池从装置或充电器中移离；

During the usage and storage process, if any peculiar smell, heat, color changing and deformation or any other abnormal occur to the battery, please cut off the power immediately. If the cell surface has got high temperature, please remove it from the device or charger after it gets cool;

电池在极端条件下不会发生爆炸，但可能会有冒烟现象发生，遇到该情况可采取将电池隔绝空气的措施，如掩盖沙土，或使用二氧化碳灭火器、干粉灭火器，切忌用水，待烟雾散去后再进行处理。

Explosion will not occur under extreme conditions, but the battery may smoke, for this situation the cell should be isolated from air by any measures except using water, such as covering with sand, or using carbon dioxide fire extinguisher, dry powder fire extinguisher. The cell should be treated after smoke dispersing.

12. 其它事项 Others

任何本规格书中未提及的事项，请咨询本公司。当本规格书版本更新时，本公司不做另行通知。

If there are any items not mentioned in this specification, please contact our company. When the version of the specification is updated, the Company will not issue a separate notice.