产 品 规 格 书

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锂离子动力电池 LP2770102AC-12.5Ah

天津力神电池股份有限公司

www.lishen.com.cn

1 适用范围

本规格书适用于天津力神电池股份有限公司生产的 LP2770102AC 锂离子电池。

2 常规指标

2.1 符号说明

C_3——3h 率额定容量(A·h)。

I_3——3h 率放电电流，其数值等于 C_3/3(A)。

本规格书中 $3I_3$(A)=12.5(A)。

2.2 该产品常规指标

表 1

序 号	项 目	规 格
1	电池种类	动力型锂离子电池
2	电池型号	LP2770102AC
3	标称容量☆	12.5Ah（最小容量 12Ah）
4	标称电压☆	3.2 V
5	内阻☆	3~8mΩ
6	重量	353±6g
7	最大充电电流	6 I_3 (连续) 12 I_3 (10s)
8	充电电压	3.65 V±0.05V
9	最大放电电流	12 I_3 (连续) 18 I_3 (30s)
10	放电终止电压	2.0V
11	最大工作温度范围：	
	充电	0℃～45℃
	放电	-20℃～60℃
12	最佳工作温度范围：	
	充电	15℃～35℃
	放电	15℃～35℃
13	储藏温度：	
	1 个月内	-40℃～45 ℃
	6 个月内	-20℃～35 ℃

*电池处于半充满或电压为 3.295～3.320V 状态下保存

3 外观和尺寸

外观和尺寸见图 1。

4 性能

4.1 测试条件

进货一个月内进行测试，测试前循环充放电次数不得超过五次。实验和测量须在标准温度（25±2）℃及标准湿度（65±20）%的条件下进行。

4.2 测量设备

a) 伏特计 内阻>1000 Ω/V

b) 游标卡尺 精度为 0.02 mm

c) 内阻表 在 AC 1kHz 条件下测量

4.3 测试过程及其标准

4.3.1 充电制式

在环境温度（25±2）℃条件下，采用先恒流再恒压方式充电。恒流电流为以 $1I_3$(A)，恒压电压为 3.65V，在恒压过程中电流降到 $0.15I_3$ 即可终止充电，静置 1 小时。

4.3.2 测试项目及标准

具体测试项目及标准见表 2。

表 2

序号	项目	测试程序	标准
1	外观和尺寸	目测及游标卡尺测量	无漏液，无明显异常痕迹 尺寸见图纸
2	重 量	天平	353±6g
3	开路电压☆	按 4.3.1 充电后 1 小时内测量开路电压	≥3.35V
4	放电容量☆	按 4.3.1 充电后 1 小时内以 $1I_3$ (A)电流放电到放电终止电压 2.0V， 并测容量。上述循环可以重复 5 次，当有 1 次循环容量符合要求时，试验即可终止。	$1I_3$ (A)容量≥最小容量
5	3 I_3 (A) 放电	按 4.3.1 充电后，1 小时内放电直到放电终止电压， 放电电	$3I_3$ (A)容量≥95%标称容量

	容量	流为 $3I_3$ (A)， 并记下时间或容量。	
6	最大充电电流	按 4.3.1 充电后，以 $1I_3$(A)电流放电到放电终止电压 2.0V，并记录容量。以 3n(n 为整数)倍 I_3(A)恒流充至 3.65V，再以 3.65V 恒压充至 $0.15I_3$ 截止。	$6I_3$(A)(连续); $12I_3$(A)(10s);
7	最大放电电流	按 4.3.1 充电后，以 $1I_3$(A)电流放电到放电终止电压 2.0V，并记录容量。以 $1I_3$(A)充电，以 3n(n 为整数)倍 I_3(A)放电至 2V。	$12I_3$(A)(连续); $18I_3$(A)(30s);
8	充放电循环寿命☆	充电：按 4.3.1 充电 放电: $3I_3$ (A) 电流恒流放电，80%DOD，每第 25 次放电 100%DOD，循环充放电 1500 次以上，记录容量。	剩余容量≥80%标称容量 或循环寿命≥1500 次
9	荷电保持能力☆	按 4.3.1 充电后，在环境温度（25±2）℃条件下开路搁置 30 天，再以 $1I_3$ (A)电流恒流放电到放电终止电压 2.0V。 按 4.3.1 充电后，在温度（60±2）℃的高温箱中放置 7 天，然后以 $1I_3$ (A)电流恒流放电至 2.0V， 并记下容量。	容量≥90%标称容量
10	高温性能	按 4.3.1 充电后，在温度（60±2）℃的高温箱中放置 5h，然后以 $1I_3$ (A)电流恒流放电至 2.0V， 并记下容量。	容量≥95%标称容量
11	低温性能	按 4.3.1 充电后，在温度（-20±2）℃的低温箱中放置 20h，然后以 $1I_3$ (A)电流恒流放电至 2.0V， 并记下容量。	容量≥35%标称容量
12	密封性☆	将电池在进行荷电保持能力试验前和试验后分别用感量为 0.001g 的电子天平称重，计算电池失重量。	失重< 300 mg
13	短路试验★	按 4.3.1 充电后，将接有热电耦的电池放入通风厨中短路，电池经线路电阻小于 5mΩ 的外部电路短路 10min	电池不起火，不爆炸
14	过充试验★	按 4.3.1 充电后，将接有热电偶的电池进行过充电试验，以下面任一种方式充电： a）以 $1I_3$ (A)电流充电，到电池电压达到 5V 或时间达到 90min(其中一个条件优先达到即停止试验) b）以 $9I_3$ (A)电流充电，至电池电压达到 10V 即停止试验。	电池不起火，不爆炸
15	过放试验★	按 4.3.1 充电后，在（25±2）℃下以 $1I_3$ (A)电流放电，直至电池电压达到 0V 结束试验。	电池不起火，不爆炸 不漏液
16	热箱试验★	将接有热电耦的电池放入恒温箱中，关闭箱门后，开启恒温箱加热，监视恒温箱内温度变化（温箱升温速度为 5℃±2℃/min），箱温达到（85±2）℃时保持 120min 后结束试验。	电池不起火，不爆炸

17	针刺试验★	按 4.3.1 充电后，将接有热电耦的电池放入通风厨中，用φ3mm～φ8mm 的耐高温钢针以 10mm/s～40mm/s 的速度，从垂直于电池极组的方向贯穿（钢针停留在电池中）	电池不起火，不爆炸
18	挤压试验★	按 4.3.1 充电后，垂直于电池极组的方向挤压电池至电池电压至 0V。	电池不起火，不爆炸
19	跌落试验	按 4.3.1 充电后，在（25±2）℃下，从 1.5m 高度处自由跌落到厚度为 20mm 的硬木地板上，每个面一次。	电池不起火，不爆炸 不漏液

5 注意事项

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5.1 充电

a) 严禁过充，充电电压不得高于 3.80V。

b) 严禁反向充电。

c) 建议最佳充电温度为 15℃-35℃。

5.2 放电

a)严禁短路。

b)放电电压不得低于 2.0 V。

c) 建议最佳放电温度为 15℃-35℃。

5.3 将电芯放置在远离儿童的地方

5.4 储存

短时储存（1 个月内）要将电池放置于清洁、湿度低于 65%RH、温度-40℃ ～45℃的环境及半充满状态。

长期储存（6 个月内）要将电池放置于清洁、湿度低于 65%RH、温度-20℃ ～35℃的环境及半充满状态。

6 警示

6.1 严禁电池过热；严禁改装、拆解电池；这些行为非常危险，可能会引起电池起火、漏液、爆炸。

6.2 严禁将电芯暴露在极热环境或投入火中，不要将电池放置在太阳直射的地方。

6.3 严禁将电池正负极柱用金属或其他导线直接连在一起形成通路，这样将导致电池短路，

可能引起电池起火甚至爆炸。

6.4 严禁将正负极柱颠倒使用。

6.5 严禁将电芯浸入水或其它导电性液体中，或者使其吸湿。

6.6 严禁使电芯承受过重的机械冲击。

6.7 严禁直接焊接电池，过热可能会引起电池零部件（如垫片）变形，这将导致电池鼓胀、漏液、起火甚至爆炸。

6.8 严禁使用运输中发生挤压、跌落、短路、漏液及其他不正常问题的电池。

6.9 在使用过程中严禁各电池之间外壳直接接触或通过导体连接在一起形成通路。

7 运输

运输过程中应防止剧烈振动、冲击、日晒雨淋。

运输过程中应使电池处于半充满状态。

8 其它

如果客户需要将电芯在该文件之外的条件下操作或应用，请先咨询力神公司相关事宜。在该文件说明的条件之外使用该电芯而产生的事故，公司不承担任何责任。

对单体电池与电路，电池组，充电器搭配使用不当所产生的问题公司不承担任何责任。

出货后客户在电芯组装过程中，因加工产生的不良电芯不在质量保证的范围之列。

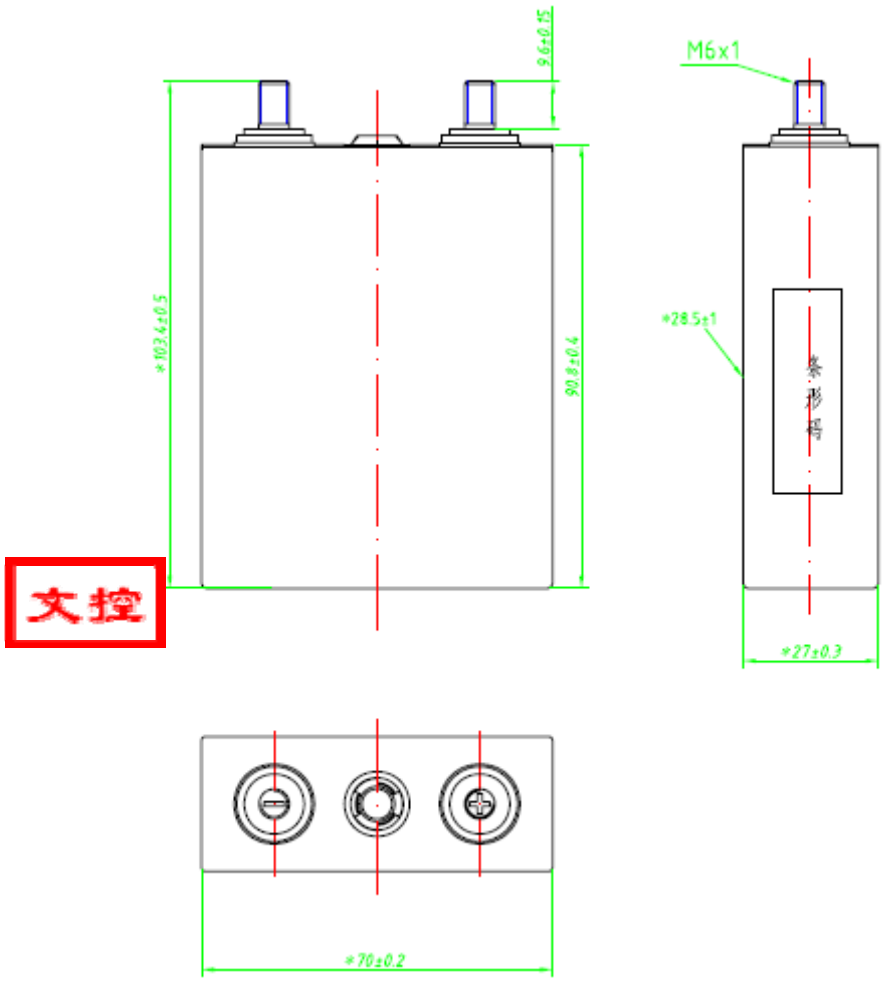

图 1 电池外形图

9 修订记录

修订状态	拟制人	修订原因	修订记录	发布日期
0	荣强	首版发布	------	20100128
1	聂磊	产品图更新	见图纸	2010-06-02
2	聂磊	统一规格书格式	见正文	2010-06-11
3	聂磊	修改内阻、温度限制	正文灰色部分	2010-07-26
4	高飞	修改电池重量、尺寸、循环测试方法	正文灰色部分	2010-09-28
5	王永武	增加特殊特性标示	见正文☆和★部分	2010-12-31

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Product Specification

Lithium-ion Power Cell of LP2770102AC-12.5Ah

Tianjin Lishen Battery Joint-Stock Co.,Ltd

www.lishen.com.cn

History of revision

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LS431.488GS

Revision	Date	Originator	Reason of Revision
0	20100128	Rong Qiang	First Editor
1	20100602	Nie Lei	Renew drawing of the cell
2	20100611	Nie Lei	Spec. Standardization
3	2010-07-26	Nie Lei	Renew IR\temperature conditions
4	2010-09-28	Gao Fei	Renew weight ,dimension & cycle methode
5	2010-12-30	Wang Yongwu	Add characteristic of product

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1. Scope

The product specification describes the requirement of the Prismatic Lithium Ion Power Cell to be supplied to the customer by Tianjin Lishen Battery Joint-Stock Co.,Ltd.. Should there be any additional information required by the customer, customer are advised to contact Tianjin Lishen Battery Joint-Stock Co.,Ltd .

2. Description and Model

Description: Rechargeable Prismatic Lithium Ion Power Cell

Model: LP2770102AC

3. General Specifications

3.1 Abbreviation Definitions

C_3 —— is the rated capacity (in ampere-hours) of the cell for a three-hour discharge.

I_3 —— a current corresponding to the manufacturer's rated capacity (in ampere-hours) for a three-hour discharge.

$I_3 = C_3$ (Ah) / 3h

In below specification 3 I_3 (A) = 12.5(A).

3.2 Specification

	Item	Specification
1	Nominal Capacity☆	12.5Ah (Min capacity:12Ah, Discharge at 1I_3 A)
2	Charging End Voltage	3.65V
3	Average working Voltage☆	3.2V (Discharge at 1I_3 A)
4	AC-impedance☆	3~8mΩ
5	Standard Charge Method	Constant Current and Constant Voltage (CC/CV)
	Current	1I_3 A
	Voltage	3.65V
	End Current	0.15I_3 A
6	Maximum Charge Current	6 I_3（Continuous） 12 I_3(10s)
7	Standard Discharge	Constant Current (CC)
	Current	3I_3 A
	End Voltage	2.0V

8	Maximum Discharge Current	$12I_3$（Continuous） $18I_3$(30s)
9	Cycle Life☆	Capacity≥80% Nominal Capacity @1500th cycles
10	Weight of Bare Cell	353±6g
11	Max Operating Temperature Range	
	Charge	0℃ ~45℃
	Discharge	-20℃ ~60℃
12	Optimal Operating Temperature Range	
	Charge	15℃ ~35℃
	Discharge	15℃ ~35℃
13	Storage Temperature	
	1 month	-40℃~45℃
	6 months	-20℃ ~35℃

4. Outline Dimension (unit:mm)

Dimension: 28.5 ±1.0 (T) ☆×70.0 ±0.2 (W) ×103.4 ±0.3 (L), refer to the attached drawing 1

5. Appearance

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

6. Test Condition and Definitions

6.1 Measuring Equipment

6.1.1. Voltmeter

Inner impedance>1000Ω per volt.

6.1.2. Ampere-meter

Total external resistance(ammeter and wire)<0.01Ω.

6.1.3. Slide caliper

The slide caliper should have a scale of 0.02mm.

6.1.4. Impedance meter

The impedance meter should be operated at AC 1kHz.

6.2 Unless otherwise specified, all tests shall be performed at (25±2)℃and humidity of (65±20)%

RH.

6.3 All tests shall be performed at the same charge voltage, per 7.1.

7. Characteristics

7.1 Charge method:

Charging shall consist of charging at a I_3 A constant current rate until the cell voltage reaches 3.65V. The cell shall then be charged at constant voltage of 3.65 volt while tapering the charge current. Charging shall be terminated when the charging current has tapered to $0.15I_3$A.

7.2 Discharge method:

7.2.1 Cells shall be discharged at a constant current of $3I_3$ A to 2.0 volt @ 25°C±2°C

7.2.2 Cells shall be discharged at a constant current of I_3 A to 2.0 volt @ 25°C±2°C

7.3 Internal Impedance

The impedance shall be measured at AC 1000 Hz initially.

Initial Internal Impedance: 3~8 mohm

7.4 Cycle Life☆

Charge cells per 7.1. Rest for 10 minutes. Cell shall be discharged at a constant current of $3I_3$ A to 80%DOD @ 25°C±2°C. Rest for 10 minutes before recharge. A cycle is defined as one charge and one discharge. Cell shall be discharged at a constant current of $1I_3$ A to 100% DOD @ 25°C±2°C every 25 cycles. Discharge capacity shall be measured after 1500 cycles.

.Discharge capacity (1500th Cycle) ≥80% of Nominal Capacity

7.5 Storage Characteristics

7.5.1 Storage Characteristics at room temperature

After charge as per 7.1.1, store the testing cells at 25℃±2℃ for 30 days. Then discharge at $1I_3$ A to 2.0V.

Discharge capacity≥90% of Nominal Capacity

7.5.2 Storage Characteristics at high temperature

After charge as per 7.1.1, store the testing cells at 60℃±2℃ for 7 days. Then discharge at $1I_3$ A to 2.0V.

Discharge capacity≥90% of Nominal Capacity

7.6 Temperature Characteristics

Cells shall be charged per 7.1. and discharged per 7.2.2. except to be discharged at temperatures per Table 1. Cells, full charged, shall be stored for 4 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 25℃ and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 1.

Table 1

-20℃ @ $1I_3$ A	25℃ @ $1I_3$ A	60℃ @ $1I_3$ A
≥35% Nominal Capacity	≥100% Nominal Capacity	≥95% Nominal Capacity

8. Safety★

8.1 External Short-circuiting Test

Cell, charged per 7.1, is to be short circuited by connecting the positive and negative terminals of the cell with copper wire having a maximum resistance≤5 mohm. Stop the test when the battery temperature decays to room temperature.

Criteria: No Explosion, No Fire

8.2 Overcharge Test

The testing cell is discharged at $1I_3$ A to 2.0V. Then it is to be subjected to CC/CV power by connecting its positive & negative terminal, then set the current as $3I_3$ A, the voltage as 10V, after that, Charge the cell up to 10V at CC of $3I_3$ A, until that the voltage is no more increased or the cell temperature decreases to the room temperature.

Criteria: No Explosion, No Fire

8.3. Nail penetration Test

A cell is to be penetrated completely the center of the largest side at the speed of 10-40mm per second by a Φ3.0-Φ8.0mm stainless steel nail.

Criteria: No Explosion, No Fire

9. Environment Characteristic Test

9.1 Constant Temperature and Humidity

A cell is charged in accordance with 7.1. and stored in an ambient temperature of 60±2℃(～95%RH) for 16h,then placed in room temperature for 2h. After that, check its appearance prior to being discharged to cut-off voltage at a constant current of $1I_3$ A.

Criteria: No Explosion, No Fire, No distortion, No rust,

The discharging time is not less than 144min

9.2. Vibration Test

A cell is charged in accordance with 7.1., then firmly installed onto the vibration desk and discharge at a constant current of $1I_3$ A. Equipment parameters of frequency and amplitude are as follows: the vibration direction is only up and down, the frequency is to be varied at the rate of 30m/s2 between 10 and 55 herts, sweep cycle for 10 times, and repeat vibration for 2h.

Criteria: No exceptional phenomenon during the discharge process

9.3 Drop Test

A cell is charged in accordance with 7.1., and then dropped from a height of 1500mm to a wooden board (20mm thick) which is placed on the concrete ground. Cells shall be dropped in each of three mutually perpendicular directions.

Criteria: No Fire, No explosion

10. Shipping

The capacity of delivery battery is approximately at 50% of charging. During transportation, keep the battery from acutely vibration, impacting, solarization, drenching.

11. Others

Manufacturer will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.

Manufacturer will be exempt from warrantee any defect cells during assembling after acceptance.

The customer is required to contact Lishen Company in advance, if and when the customer needs other applications or operating conditions than those described in this document, manufacturer will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

Any matter not included in this specification shall be conferred between both parties.

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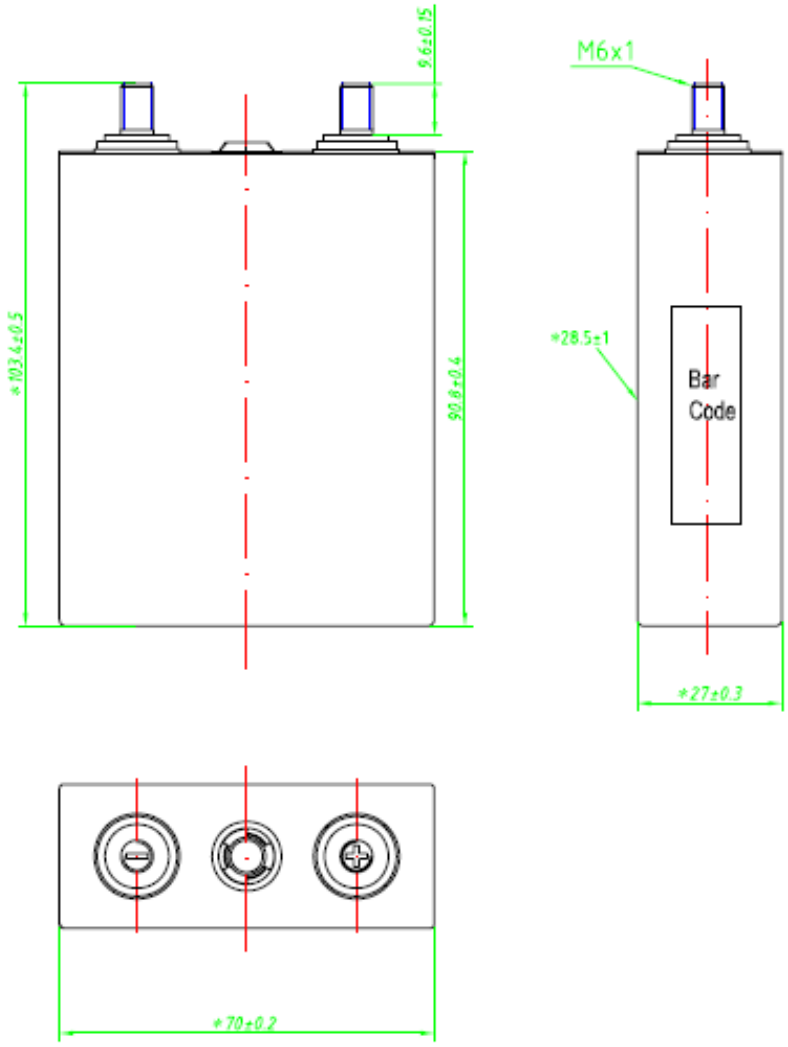
Attached drawing 1



HANDLING INSTRUCTIONS

FOR LITHIUM ION RECHARGEABLE BATTERY

The following caution and warning should appear in manuals and/or instructions for users, especially at the point of use.

1.Caution

1.1 Charging

a) Avoid over-charging voltage of charging not over 3.80V.

b) No reverse charging

c) Charger should start charging at temperature range 0℃ ~ 45℃.

d) Optimal charging temperature range is 15℃ ~ 35℃.

1.2 Discharging

a) Discharge current must be below 18 I_3 A (75A) /cell.

b) Discharge end voltage must be over 2.0V.

c) Discharge temperature range should be -20°C ~ 60°C.

d) Optimal discharging temperature range is 15 ℃~ 35℃.

1.3 Environmental using conditions:

When the battery is charged: 0°C ~+45°C

When the battery is discharged: -20°C ~+60°C

When stored within 1 month: -20°C ~+45°C

When stored within 6 months: -20°C ~+35°C

1.4 Storage

a) For any short time storage (in one month), cell should be in a dry area（humidity ≤65% RH） and at -40℃ ~+45℃ at half charged stage.

b) For any long time storage (in 6 month), cell should be in a dry area（humidity ≤65% RH） and at -20℃ ~+35℃ at half charged stage.

c) Don't unscrew the nuts of electrode poles and the nuts of vent during storage and maintenance.

1.5 Battery position in equipment and charger.

To avoid degradation of battery performance by heat, a battery should set the place apart from heat generating electronic parts inside equipment and charger.

2. Warning

2.1 Avoid overheat in any circumstances. Don't disposed in fire or water .Don't modify or disassemble the battery. It will be dangerous, and may cause ignition, heating, leakage or explosion.

2.2 Don't short-circuit positive(+) and negative(-) terminals. Keep away from metal or other conductive materials. Jumbling the batteries of direct contact with positive(+) and negative(-) terminals or other conductive materials may cause short-circuit.

2.3 Don't reverse the positive (+) and negative (-) terminals.

2.4 If the battery gives off an odor, generates heat, becomes discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it from the device or battery charger and stop using it.

2.5 Don't solder the battery directly. Excessive heating may cause deformation of the battery components such as the gasket, which may lead to the battery swelling,leakage, explosion,or ignition.

2.6 Don't use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.