产 品 规 格 书

磷酸铁锂蓄电池 LP71173207-280Ah

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 LP71173207-280Ah 磷酸铁锂蓄电池。

2 常规指标

2.1 符号与缩略语说明

C_1 —— 1h 率额定容量(Ah);

I_1 —— 1h 率放电电流，其数值等于 C_1(A);

本规格书中 1 I_1 = 280A，0.5 I_1 =140A，0.2 I_1 =56A。

SOC——荷电状态；

DOD——放电深度。

2.2 该产品常规指标

表 1

序 号	项 目	规 格
1	电池种类	磷酸铁锂蓄电池
2	电池型号	LP71173207
3	标称容量☆	280Ah（25℃, 0.2 I_1）
4	标称电压☆	3.22V（25℃, 0.2 I_1）
5	交流内阻☆	≤0.2mΩ（1 kHz）
6	重量	5255±100g
7	最大充电电流	I_1（连续）
8	充电电压	3.65 V
9	最大放电电流	I_1（连续）
10	放电终止电压	2.5V（＞0℃）、2.0V（≤0℃）
11	最大工作温度范围：	
	充电	0℃～60℃
	放电	-20℃～60℃
12	最佳工作温度范围：	

	充电	20℃～35℃
	放电	15℃～35℃
13	储藏温度：	
	1 个月内	-30℃～45 ℃
	6 个月内	-20℃～35 ℃

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。除非有其他说明，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，本规格书中所提到的室温，是指（25±2）℃。

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

d） 天平 精度 0.001g

4.3 测试过程及其标准

4.3.1 充电制式

在室温下，以 0.2I_1(A)电流恒流充电至终止电压 3.65V 时转恒压充电，恒压电压为 3.65V，至充电终止电流降至 0.05 I_1(A)时停止充电，充电后静置 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	无明显人为划痕、无变形、无漏液，尺寸见图纸

2	重 量	电子天平	5255±100g
3	标称放电容量☆	按 4.3.1 充电后 1 小时内以 0.2 I_1 (A)电流放电到放电终止电压 2.5V， 并计量容量。	0.2 I_1 (A)容量≥标称容量
4	循环寿命☆	充电：以 0.5 I_1(A)电流恒流充电至终止电压 3.65V 时转恒压充电，恒压电压为 3.65V， 至充电终止电流降至 0.05 I_1(A)时停止充电，充电后静置30min。 放电：0.5I_1 (A)电流恒流放电至 2.5V，100%DOD，循环充放电 5000 次以上，计量放电容量。循环测试需在电池夹紧的状态下进行。	循环 5000 次，放电容量≥80%初始容量。
5	室温荷电保持与容量恢复能力☆	按 4.3.1 充电后，在环境温度（25±2）℃条件下开路搁置 28 天，再以 0.2I_1 (A)电流恒流放电到终止电压 2.5V，并计量荷电保持容量。按 4.3.1 充电，室温下以 0.2I_1 (A)电流恒流放电至 2.5V 截止，计量恢复容量。	荷电保持容量≥95%初始容量 恢复容量≥96%初始容量
6	高温荷电保持与容量恢复能力☆	按 4.3.1 充电后，在温度（60±2）℃的高温箱中放置 7 天，电池在室温搁置5h，然后室温下以 0.2I_1 (A)电流恒流放电至 2.5V，并计量荷电保持容量。按 4.3.1 充电，室温下以 0.2I_1 (A)电流恒流放电至 2.5V 截止，计量恢复容量。	荷电保持容量≥90%初始容量 恢复容量≥94%初始容量
7	高温性能	按 4.3.1 充电后，在温度（55±2）℃的高温箱中放置 5h，然后以 0.2 I_1 (A)电流恒流放电至 2.5V，计量放电容量。	容量≥95%初始容量
8	低温性能	按 4.3.1 充电后，在温度（-20±2）℃的低温箱中放置 24h，然后以 0.2I_1 (A)电流恒流放电至2.0V，计量放电容量。	容量≥70%初始容量
9	低气压★	按 4.3.1 充电后，将电池放入低气压箱中，调节试验箱中气压为 11.6kPa，温度为室温，静置 6h；观察 1h。	电池不起火，不爆炸，不漏液
10	短路试验★	按 4.3.1 充电后，将单体蓄电池正、负极经外部短路 10min，外部线路电阻应小于 5mΩ；观察 1h。	电池不起火，不爆炸
11	过充试验★	按 4.3.1 充电，以 1 I_1 (A)电流恒流充电，到电池电压达到充电终止电压的 1.5 倍或者充电时间到达 1h 后停止充电，观察 1h。	电池不起火，不爆炸

<table>
<tr><td>12</td><td>过放试验★</td><td>按 4.3.1 充电后，以 1 I_1 (A)电流放电 90min；观察 1h。</td><td>电池不起火，不爆炸，不漏液</td></tr>
<tr><td>13</td><td>热箱试验★</td><td>按 4.3.1 充电，将单体蓄电池放入温箱中，温箱按照 5℃/min 的速率由室温升至 (130±2) ℃，并保持此温度 30min 后停止加热；观察 1h。</td><td>电池不起火，不爆炸</td></tr>
<tr><td>14</td><td>针刺试验★</td><td>按 4.3.1 充电后，用 Φ5.0~Φ8.0mm 的耐高温钢针（针尖的圆锥角度为 45～60°，针的表面光洁、无锈蚀、氧化层及油污），以(25±5) mm/s 的速度，从垂直于电池极板的方向贯穿，贯穿位置宜靠近所刺面的几何中心，钢针停留在电池中；观察 1h。</td><td>电池不起火，不爆炸</td></tr>
<tr><td>15</td><td>挤压试验★</td><td>按 4.3.1 充电后，垂直于电池极板的方向以(5±1) mm/s 的速度挤压电池，挤压板形式为半圆柱体（半径 75mm，长度大于被挤压电池的尺寸），电池电压到达0V 或变形量达到30%或挤压力达到200kN 后停止挤压；观察 1h。</td><td>电池不起火，不爆炸</td></tr>
<tr><td>16</td><td>跌落试验★</td><td>按 4.3.1 充电后，将电池的正负极端子向下从 1.5m 高度处自由跌落到水泥地面上；观察 1h。</td><td>电池不起火，不爆炸
不漏液</td></tr>
<tr><td>17</td><td>海水浸泡★</td><td>按 4.3.1 充电后，将电池浸入 3.5% NaCl 溶液（质量分数，模拟常温下的海水成分）中 2h，水深应完全没过单体电池。</td><td>电池不起火，不爆炸</td></tr>
<tr><td>18</td><td>温度循环★</td><td>按 4.3.1 充电后，电池放入温度箱中，温度箱温度按照附表进行调节，循环次数 5 次；观察 1h。
<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></td><td>电池不起火，不爆炸
不漏液</td></tr>
</table>

5 注意事项

5.1 充电

a) 严禁过充，充电电压不得高于 3.65V。

b) 严禁反向充电。

c) 建议最佳充电温度为 20℃~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-30℃-45℃环境及荷电20%~40%SOC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℃环境及荷电20%~40%SOC状态。

6 警示

6.1 在使用之前，应详细阅读规格书并对其中警示内容和注意事项有足够深刻的理解。

6.2 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。

6.3 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。

6.4 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。

6.5 严禁将正负极柱颠倒使用。

6.6 严禁将电芯浸入水中或者其它导电性液体中，或者使其吸湿。

6.7 严禁使电芯承受过重的机械冲击。

6.8 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。

6.9 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。

6.10 电池应该在远离静电的场所进行储存、使用。

6.11 禁止把电池同其他一次电池或二次电池一起使用，也不要同不同包装、不同型号或其他品牌的电池一起使用。

6.12 在使用、充放电或者存储过程中发现电池急剧变热、散发气味、变色、变形或者其他反应，应立即停止使用，并进行相应的处理。

6.13 如电池漏液到皮肤或衣物上，请立即用清水冲洗，以免造成皮肤不适等。

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20~40%SOC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。

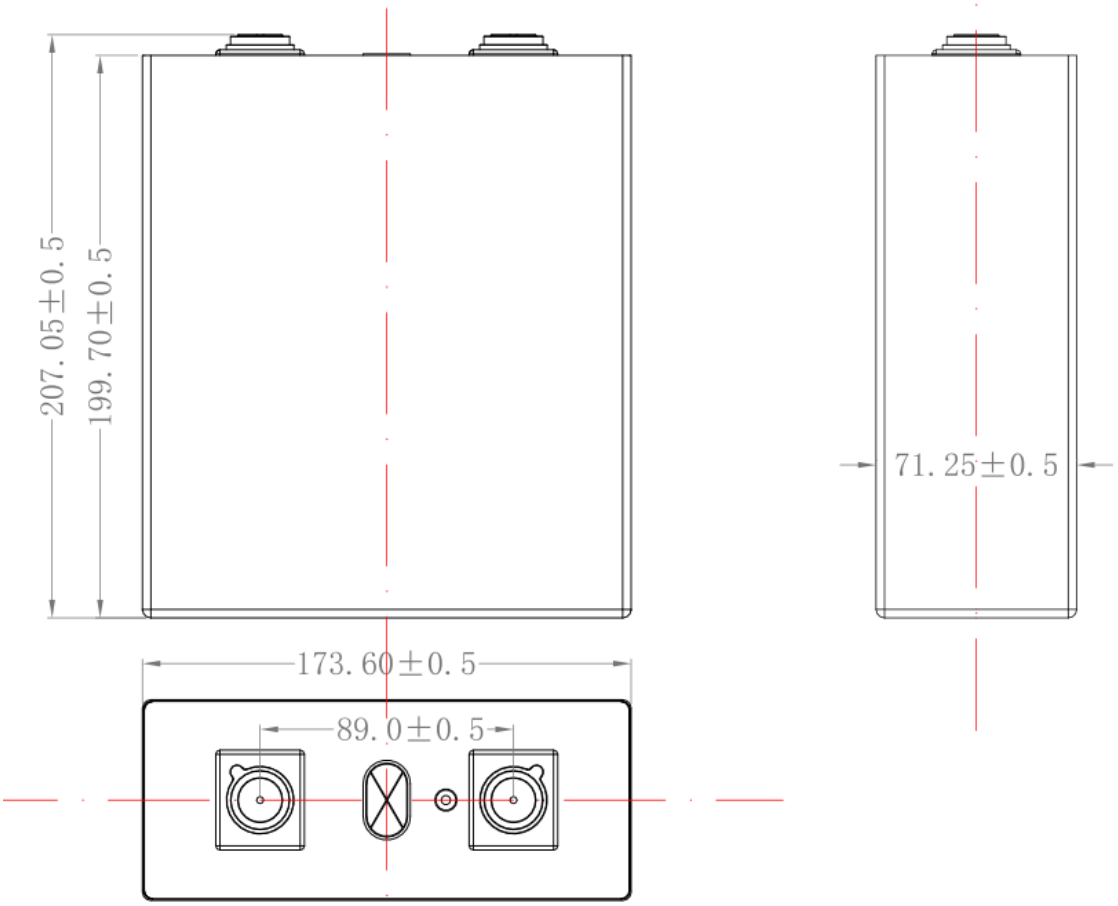


图 1 电池简易外形图（不含蓝膜）

Product Specification

Lithium Iron Phosphate Battery of LP71173207-280 Ah

Tianjin Lishen Battery Joint-Stock Co.,Ltd

www.lishen.com.cn

1. Scope

The product specification describes the requirement of the Prismatic Lithium Iron Phosphate Battery to be supplied to the customer by Tianjin Lishen Battery Joint-Stock Co., Ltd..

2. General Specifications

2.1 Abbreviation Definitions

C_1 —— the rated capacity (in ampere-hours) of the cell for a one-hour discharge.

I_1 —— a current corresponding to the one-hour discharge capacity (in ampere-hours), which is equal to, in numeral, the C_1.

In the following specification 1 I_1 (A) = 280A, 0.5 I_1 =140A, 0.2 I_1 =56A.

SOC —— the state of charge.

DOD —— the depth of discharge.

2.2 General Specifications

Table 1

Number	Item	Specification
1	Cell Type	Lithium Iron Phosphate Battery
2	Cell Model	LP71173207
3	Nominal Capacity☆	280Ah(25℃, 0.2 I_1)
4	Average Working Voltage☆	3.22V(25℃, 0.2 I_1)
5	AC-impedance☆	≤0.2mΩ（1 kHz）
6	Weight	5255±100g
7	Maximum Charge Current	I_1（Continuous）
8	Charging End Voltage	3.65V
9	Maximum Discharge Current	I_1（Continuous）
10	Discharge End Voltage	2.5V(＞0℃)、2.0V(≤0℃)
11	Max Operating Temperature Range	
	Charge	0℃ ~ 60℃
	Discharge	-20℃ ~ 60℃

12	Optimal Operating Temperature Range	
	Charge	20℃ ~ 35℃
	Discharge	15℃ ~ 35℃
13	Storage Temperature	
	1 month	-30℃ ~ 45℃
	6 months	-20℃ ~ 35℃

3. Appearance and Dimension

Appearance and Dimension refer to the attached drawing 1.

4. Characteristics

4.1 Test Condition

Cells should be tested within a month after purchase and the charge-discharge times of the test cells should be less than 5. Unless noted otherwise, all tests will be conducted at standard temperature which is (25±2) ℃ and standard humidity which is (65±20)%. The room temperature mentioned in this specification means (25±2) ℃.

4.2 Test Equipment

a) Voltmeter Inner impedance>1000Ω per volt.

b) Slide caliper The slide caliper should have a minimum scale of 0.02mm.

c) Impedance meter The impedance meter should be operated at AC 1kHz.

d) Electronic Scale The electronic scale should have a minimum scale of 0.001g.

4.3 Test Process and Specification

4.3.1 Charge Method

Cells are charged with Constant Current and Constant Voltage (CC/CV) method at room temperature. The constant current is $0.2I_1$ (A) and the constant voltage is 3.65V. Charge shall be terminated when the charge current has tapered to $0.05\ I_1$ (A), then store cells for 1h.

4.3.2 Test Item and Specification

Test item and specification should refer to table 2.

Table 2

Number	Item	Test profile	Specification
1	Appearance and Dimension	1. Eyeballing 2. Test cells' dimension with slide caliper	No Deep Scratch, No Transformation, No leakage , Dimension should refer to the attached drawing 1.
2	Weight	Electronic Scale	5255±100g
3	Nominal Discharge Capacity☆	Discharge cells at a 0.2I_1(A) current to 2.5V within 1h after charging cells per 4.3.1. Record the capacity.	0.2I_1 Capacity ≥ Nominal Capacity
4	Cycle Life☆	Cells are charged with Constant Current and Constant Voltage (CC/CV) method at room temperature. The constant current is 0.5 I_1 (A) and the constant voltage is 3.65V. Charge shall be terminated when the charge current has tapered to 0.05 I_1 (A), then store cells for 30min. Discharge cells to 2.5V at a constant current of 0.5I_1 (A), 100%DOD. Rest 1 h before recharge. Discharge capacity shall be measured after 5000 cycles. Cells shall be clamped during cycle test.	Discharge Capacity (5000th Cycle)≥ 80% Initial Capacity
5	Capacity Retention at Room Temperature☆	After charging per 4.3.1, store the testing cells for 28 days at the environment temperature of（25±2）℃, then discharge cells to 2.5V at a 0.2 I_1 (A) current. Record the residual capacity. Charge cells per 4.3.1. Discharge cells to 2.5V at a 0.2 I_1(A) current. Record the recovery capacity.	Residual Capacity ≥ 95% of Initial Capacity Recovery capacity ≥ 96% of Initial Capacity
6	Capacity Retention at High Temperature☆	After charging per 4.3.1, store the testing cells at (60±2)℃ for 7 days. Rest 5 h at the environment temperature of（25±2）℃, then discharge cells to 2.5V at a 0.2 I_1(A) current. Record the residual capacity. Charge cells per 4.3.1. Discharge cells to 2.5V at a 0.2 I_1(A) current. Record the recovery capacity.	Residual Capacity ≥ 90% of Initial Capacity Recovery capacity ≥ 94% of Initial Capacity

7	Characteristics at High Temperature	Cells shall be charged per 4.3.1 and stored for 5h at (55±2)℃. Then discharge cells to 2.5V at a 0.2I_1 (A) current and record the capacity.	Residual Capacity≥ 95% of Initial Capacity
8	Characteristics at Low temperature	Cells shall be charged per 4.3.1 and stored for 24h at (-20±2)℃. Then discharge cells to 2.0V at a 0.2 I_1 (A) current and record the capacity.	Residual Capacity≥ 70% of Initial Capacity
9	Low Pressure Test ★	Cells shall be charged per 4.3.1 and stored 6h at 11.6kPa and room temperature in low pressure test chamber. Observe 1h.	No Explosion, No Fire, No Leakage
10	Short-Circuit Test ★	Cells shall be charged per 4.3.1, shall be short circuited 10 minutes by connecting the positive and negative terminals through the external wires. And the resistance of external wires will be less than 5 mΩ. Observe 1h.	No Explosion, No Fire
11	Overcharge Test★	After charged per 4.3.1, test cells shall be overcharged with a sort of method below: 1st Method: Charge test cells at 1I_1 (A). Stop it when the cell voltage reached 1.5 times of end voltage. Observe 1h. 2nd Method: Charge test cells 1h at 1I_1 (A). Observe 1h.	No Explosion, No Fire
12	Over Discharge Test★	Cells shall be charged per 4.3.1. Discharge cells 90 min at a 1 I_1 (A) current. Observe 1h.	No Explosion, No Fire, No Leakage
13	Thermal Test★	Put cells into the oven. The oven temperature shall be raised to（130±2 ）℃ at a rate of 5℃/min . Cells shall be remained at this temperature for 30 min. Then, stop the test and observe 1h.	No Explosion, No Fire
14	Nail penetration Test★	Charge cells per 4.3.1. Then penetrate completely the center of cells in the vertical direction by a stainless steel nail with the speed of (25±5)mm/s. The diameter of the nail is Φ5.0-Φ8.0mm. The angle of cone on the point of the nail shall be 45 °~60 °. And the nail shall be clean, non-rust, non-oxidizing and without pollution. The nail will be stay in cells and observe for 1h.	No Explosion, No Fire

<table>
<tr><td>15</td><td>Crush Test★</td><td>After charged per 4.3.1, crush the cells vertically at the speed of (5±1) mm/s until cells’ deformation reach to 30%, or the voltage tapered to 0V, or the press reach to 200KN. Observe 1h.</td><td>No Explosion, No Fire</td></tr>
<tr><td>16</td><td>Drop Test★</td><td>Charge cells per 4.3.1. Then drop cells from a height of 1.5m to the concrete ground. Cells shall be dropped with the terminals down.</td><td>No Explosion, No Fire, No Leakage</td></tr>
<tr><td>17</td><td>Seawater Immersion Test★</td><td>Cells, charged per 4.3.1, shall be immerged completely in NaCl solution with concentration of 3.5% (mass fraction, as similar with the composition of seawater) for 2h.</td><td>No Explosion, No Fire</td></tr>
<tr><td>18</td><td>Thermal Cycle★</td><td>Cells, charged per 4.3.1, shall be put into the oven. Set the temperature as the following form. Charge and discharge the cells for 5 times. Observe 1h.
<table>
<tr><th>Temperature /℃</th><th>Time increment /min</th><th>Total time /min</th><th>Temperature change rate ℃/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></td><td>No Explosion, No Fire, No Leakage</td></tr>
</table>

5.Caution

5.1 Charge

a) No over-charge，the charge voltage should not be over 3.65V.

b) No reverse charging.

c) Optimal charge temperature range is 20℃ ~ 35℃.

5.2 Discharge

a) No short circuit.

b) The end of discharge voltage must be over 2.0V.

c) Optimal discharge temperature range is 15 ℃~ 35℃.

5.3 Put cells away from children.

5.4 Storage

a) For any short time storage (in one month), cell should be in a clean and dry area （humidity ≤65% RH） and at -30℃ ~+45℃ at 20~40% SOC charged stage.

b) For any long time storage (in 6 month), cell should be in a clean and dry area（humidity ≤65% RH） and at -20℃ ~+35℃ at 20~40% SOC charged stage.

6. Warning

6.1 Read the specification carefully before application. Be have profound understanding with the warnings and announcements.

6.2 Avoid overheat in any circumstances. Don’t modify or disassemble the battery. It will be dangerous, and may cause ignition, heating, leakage or explosion.

6.3 Don’t put cells in overheat circumstances or disposed in fire, don’t put cells under the sunshine.

6.4 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 and may even cause fire and explosion.

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

6.6 Don't put cells in water or other conductive liquids or let cells absorb moisture.

6.7 Don't impact cells excessively.

6.8 Don't weld 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.

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

6.10 Keep away from static circumstances during storage and using.

6.11 Don't use cells together with other one-shot batteries and secondary batteries. Don't use cells together with different packages, types and brands.

6.12 Stop using and process the cells accordingly when the following circumstances happened: getting hot sharply, smelling, changing colors, deformation or others.

6.13 If there is leaked electrolyte from batteries, please scrub it away with fresh water to avoid any skin discomfort.

7. Shipping

7.1 During transportation, keep the battery from acutely vibration, impacting, insolation, drenching.

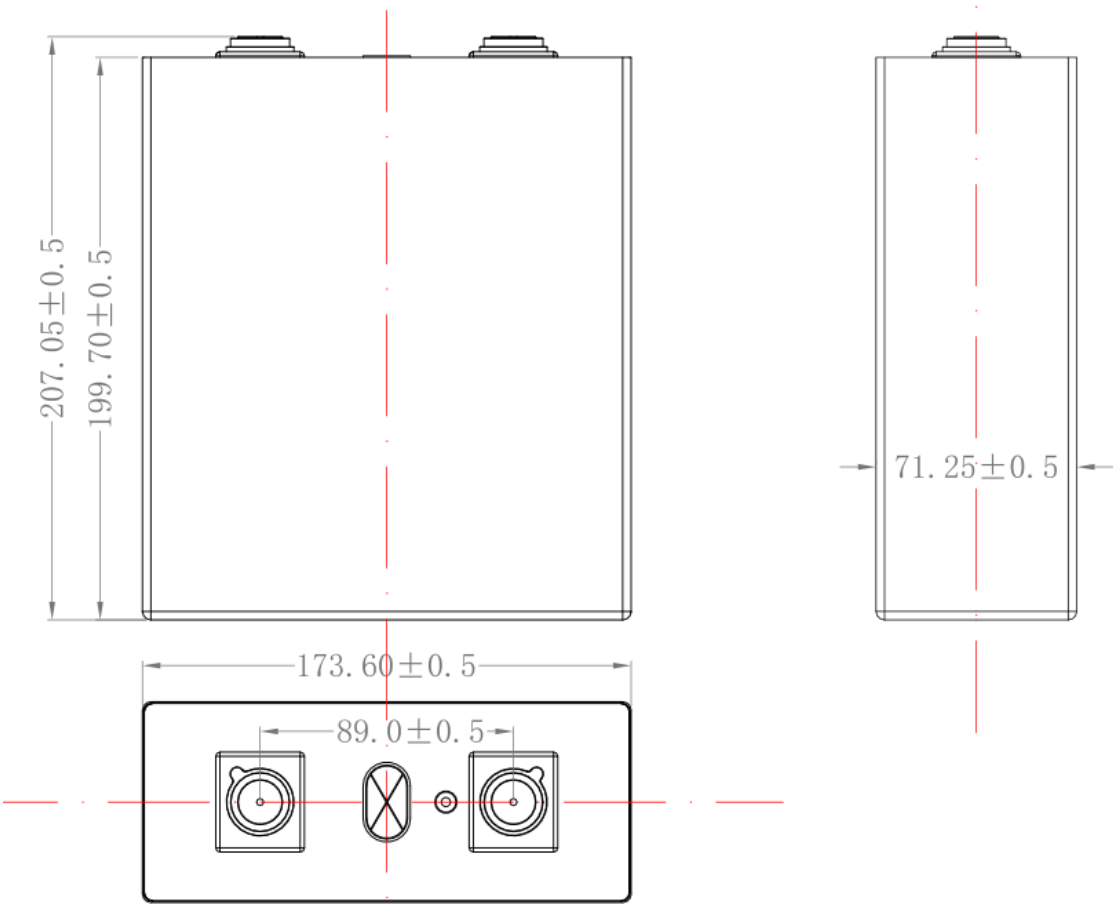
7.2 The delivery battery should be at 20%~40%SOC charged state.

8. Others

If customers need to use or operating cells beyond the specified range of this file, please contact Tianjin Lishen Battery Joint-Stock Co., Ltd. Manufacturer will not be responsible for trouble caused by using cells beyond the specified range of this file.

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.



Drawing 1. Appearance and dimension of the battery（without blue film）