# Product Specification

Lithium Iron Phosphate Battery of LP54173207-202 Ah



**Shenzhen, China**

## 1. Scope

The product specification describes the requirement of the Prismatic Lithium Iron Phosphate Battery to be supplied to the customer by Lishen Power Battery System Co.,Ltd. If there is any additional information required by the customer, customers are advised to contact Lishen Power Battery System 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) = 202A.

SOC —— the state of charge.

DOD —— the depth of discharge.

2.2 General Specifications

| Number | Item | Specification |
|---|---|---|
| 1 | Cell Type | Lithium iron phosphate battery |
| 2 | Cell Model | LP54173207-202Ah |
| 3 | Nominal Capacity☆ | 202.0Ah |
| 4 | Average Working Voltage☆ | 3.2V |
| 5 | AC-Impedance☆ | ≤0.2mΩ |
| 6 | Weight | 3.95± 0.1kg |
| 7 | Maximum Charge Current at Room Temperature | $1I_1$（Continuous） $2I_1$ (50%SOC，10s) |
| 8 | Charging End Voltage | 3.65V |
| 9 | Maximum Discharge Current at Room Temperature | $1I_1$（Continuous） $3I_1$ (50%SOC，30s) |
| 10 | Discharge End Voltage | 2.5V（＞0℃）<br>2.0V（≤0℃） |
| 11 | Max Operating Temperature Range | |

| | | |
|---|---|---|
| | Charge | 0℃ ~ 55℃ |
| | Discharge | -30℃ ~ 60℃ |
| 12 | Optimal Operating Temperature Range | |
| | Charge | 15℃ ~ 35℃ |
| | Discharge | 15℃ ~ 35℃ |
| 13 | Storage Temperature | |
| | 1 month | -40℃~ 45℃ |
| | 6 months | -20℃ ~ 35°C |
| *Cells should be stored at the state of 20%~40%SOC or the voltage is between 3.275V and3.304V. | | |

Note: The temperature shown in the above table is the cell temperature. That is, the temperature of the cell measured by the temperature sensor connected to the battery. No matter what charging and discharging mode the battery is in, the battery will be stopped when the temperature exceeds the maximum operating temperature range.

## 3. Appearance and Dimension

Appearance and Dimension refer to the attached drawing 1.The dimension includes the insulating film outside of the battery.

## 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 $1I_1$ (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 more than 0.5h.

### 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<br>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 | 3.95 ± 0.1kg |
| 3 | Open Circuit Voltage☆ | Measure the open circuit voltage within 1h after charging cells per 4.3.1. | OCV ⩾ 3.350V |
| 4 | Nominal Discharge Capacity ☆ | Discharge cells at a $1I_1$(A) current to 2.5V within 1h after charging cells per 4.3.1. Record the capacity. The cycle can repeat 5 times, when the capacity difference of 3 times continuously are less than 3%, the test can be terminated. Tack the average of last 3 discharge capacity. | $1I_1$ Capacity ⩾ Nominal Capacity |
| 5 | Maximum Charge Current at Room Temperature | Continuous: Charge cells per 4.3.1. Discharge cells to 2.5V at a $1I_1$ (A) current. And record the capacity. Charge cells to 3.65V at a $nI_1$ (A) current, and then charge cells at constant voltage (3.65V) until the current has tapered to $0.05I_1$ (A).<br>50%SOC: Charge cells per 4.3.1. Discharge cells to 50%SOC at a $1I_1$ (A) current. Charge cells 10s in a $nI_1$ (A) current. | $1I_1$(A)(Continuous);<br>$2I_1$(A)(10s,50%SOC); |

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|---|---|---|---|
| 6 | Maximum Discharge Current at Room Temperature | Continuous: Discharge cells at a 1 $I_1$ (A) current to 2.5V after charge cells per 4.3.1. And record the capacity. Charge cells per 4.3.1. Discharge cells in a n$I_1$ (A) current to 2.5V.<br>50%SOC: Discharge cells to 50%SOC at a 1 $I_1$ (A) current after charging cells per 4.3.1. Discharge cells 30s at a n$I_1$ (A) current. | 1$I_1$(A)( Continuous);<br>3$I_1$(A)(30s,50%SOC); |
| 7 | Cycle Life（Normal Temperature）☆ | Charge cells per 4.3.1. Discharge cells to 2.5V at a constant current of 1$I_1$ (A), 100%DOD. Discharge capacity shall be measured after 3500 cycles. Cells should be clamping during cycling. | 500th Discharge Capacity ≥ 191.9Ah( 95% Nominal Capacity )or<br>1000th Discharge Capacity ≥185.8Ah(92% Nominal Capacity)or<br>3500th Discharge Capacity ≥161.6Ah(80% Nominal Capacity) |
| 8 | Cycle Life（High Temperature）☆ | Store the testing cells at (45±2)℃ for 5 hours and then began the cycle test. Charge cells per 4.3.1. Discharge cells to 2.5V at a constant current of 1$I_1$ (A), 100%DOD. Discharge capacity shall be measured after 2000 cycles. Cells should be clamping during cycling. | 500th Discharge Capacity ≥ 183.8Ah( 91% Nominal Capacity )or<br>1000th Discharge Capacity ≥175.7Ah(87% Nominal Capacity) or 2000th Discharge Capacity ≥ 161.6Ah(80% Nominal Capacity) |
| 9 | Capacity Retention and Capacity Recovery 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 the cells to 2.5V at a 1 $I_1$ (A) current. Record the retention capacity.<br>Charge cells per 4.3.1. Discharge the cells to 2.5V at a 1 $I_1$ (A) current. Record the recovery capacity. | Capacity Retention ≥ 92%<br>Capacity Recovery ≥ 95% |

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|---|---|---|---|
| 10 | Capacity Retention and Capacity Recovery at High Temperature☆ | After charging per 4.3.1, store the testing cells at (55±2)℃ for 7 days, then discharge the cells to 2.5V at a 1 $I_1$ (A) current. Record the discharge capacity.<br>Charge cells per 4.3.1. Discharge the cells to 2.5V at a 1 $I_1$ (A) current. Record the discharge capacity. | Capacity Retention ≥ 92%<br>Capacity Recovery ≥ 95% |
| 11 | 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 1 $I_1$ (A) current and record the capacity. | Residual Capacity ≥ 95% of Initial Capacity |
| 12 | 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 1 $I_1$ (A) current and record the capacity. | Residual Capacity ≥ 75% of Initial Capacity |
| 13 | Short-Circuit Test★ | Cells, charged per 4.3.1, with thermocouples，shall be short circuited 10 minutes in fuming cupboard by connecting the positive and negative terminals through the external wires. And the resistance of external wires will be less than 5mΩ. Observe 1h. | No Explosion, No Fire |
| 14 | Overcharge Test★ | After charged per 4.3.1, test cells (with thermocouple) shall be overcharged with a sort of method below:<br>1st Method: Charge test cells at1 $I_1$ (A), and stop test when the voltage reached 1.5 times of end voltage. Observe 1h.<br>2nd Method: Charge test cells at 1 $I_1$ (A), then stop the test when the charge time reached 1h. Observe 1h. | No Explosion, No Fire |
| 15 | Over Discharge test★ | Cell shall be charged per 4.3.1. Discharge cells at a 1 $I_1$ (A) current for and stop the test when the discharge time reached 90 min. Observe 1h. | No Explosion, No Fire, No Leakage |
| 16 | Thermal Test★ | Put cells (with thermocouple) into the oven, then close the door. The oven temperature shall be raised at a rate of 5℃/min to (130±2) ℃ . The | No Explosion, No Fire |

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|---|---|---|---|
| | | cells shall be remained at this temperature for 30 min. Then, stop the test and observe 1h. | |
| 17 | Crush Test★ | 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. | No Explosion, No Fire |

## 5.Caution

5.1 Charge

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

b) No reverse charging.

c) The charge temperature range of cell is 0℃ ~ 55℃.

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

5.2 Discharge

a) No short circuit.

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

c) The discharge temperature range of cell is -30 ℃~ 60℃.

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 -40℃ ~+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 thesunshine.

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 amoisture.

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 Cell cans were connected with positive (+) terminals. Don't contact cans with negative (-) terminals or other cell cans during the using process. It will be dangerous, and may cause ignition or explosion.

6.11 Keep away form static circumstances during storage and using.

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

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

6.14 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.

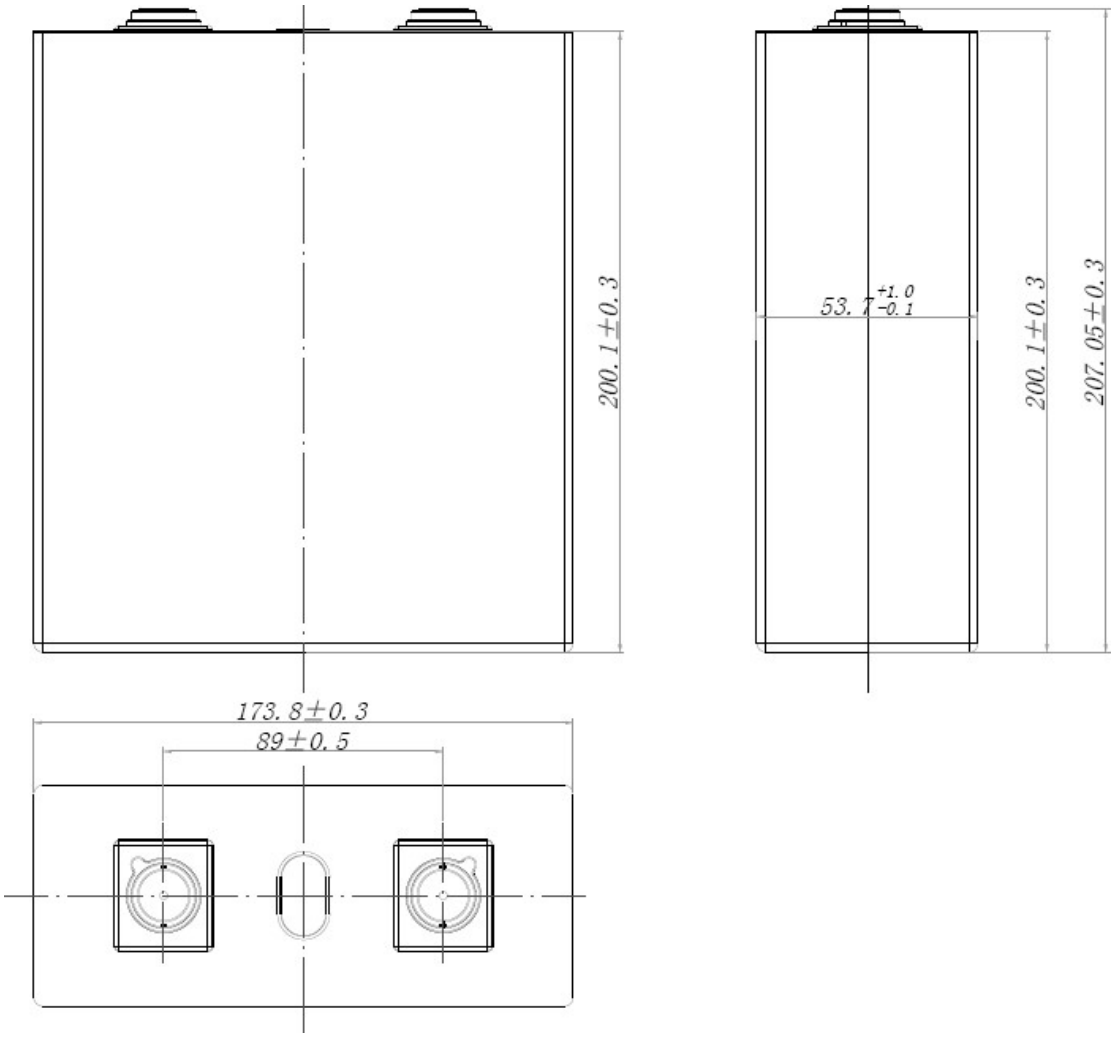
7.2 The delivery battery should be at 10%~50%SOC charged state.

## 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