Product Specification

Lithium Iron Phosphate Battery of LP27148134-40 Ah

Tianjin Lishen Battery Joint-Stock Co.,Ltd

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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) = 40A.

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	LP27148134
3	Nominal Capacity☆	40.0 Ah
4	Average Working Voltage☆	3.2V
5	AC-impedance☆	≤0.7mΩ
6	Weight	1060±20g
7	Maximum Charge Current	$6I_1$（Continuous） $10I_1$ (30s)
8	Charging End Voltage	3.65V
9	Maximum Discharge Current	$6I_1$（Continuous） $10I_1$(30s)
10	Discharge End Voltage	2.0V
11	Max Operating Temperature Range	
	Charge（Environment）	0℃ ～55℃
	Discharge (Environment)	-20℃ ～60℃

	Charge（Battery）	0℃ ~ 70℃
	Discharge (Battery)	-20℃ ~ 70℃
12	Optimal Operating Temperature Range	
	Charge	15℃ ~ 35℃
	Discharge	15℃ ~ 35℃
13	Storage Temperature	
	1 month	-40℃ ~ 45℃
	6 months	-20℃ ~ 35℃
*Cells should be stored at the state of 20%-40%SOC or the voltage is between 3.275V and3.304V.		

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 $1I_1$ (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 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	1060±20g
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 2.0V within 1h after charging cells per 4.3.1. Record the capacity. The cycle can repeat 5 times. The test can be terminated when the capacity difference of 3 times continuously are less than 3%. Tack the average of last 3 discharge capacity.	$1I_1$ Capacity ⩾ Nominal Capacity
5	Maximum Charge Current	Continuous: Charge cells per 4.3.1. Discharge cells to 2.0V 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 0.05 I_1 (A). ("n" is an integer) 50%SOC: Charge cells per 4.3.1. Discharge cells 0.5h at a $1I_1$ (A) current. Charge cells 30s at a nI_1 (A) current and the cut-off voltage is 3.65V. ("n" is an integer)	$6I_1$ (A)(Continuous); $10I_1$ (A)(30s,50%SOC);
6	Maximum Discharge Current	Continuous: Discharge cells at a $1I_1$ (A) current to 2.0V after charge cells per 4.3.1. And record the capacity. Charge cells per 4.3.1. Discharge cells in a nI_1 (A) current to 2.0V. ("n" is an integer). 50%SOC: Discharge cells at a $1I_1$ (A) current for 0.5h after charging cells per 4.3.1. Discharge cells 30s at a n I_1	6 I_1 (A)(Continuous); 10 I_1 (A)(30s,50%SOC);

		(A) current and the cut-off voltage is 2.0 V. (“n” is an integer)	
7	Cycle Life☆	Charge cells per 4.3.1. Discharge cells to 2.0V at a constant current of $1I_1$ (A), 100%DOD. Rest 10 minutes before recharge. Discharge capacity shall be measured after 5000 cycles. Cells shall be clamped during cycle test.	Discharge Capacity (5000^{th} Cycle)≥ 80% Initial Capacity
8	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 2.0V at a 1 I_1 (A) current. Record the residual capacity. Charge cells per 4.3.1. Discharge cells to 2.0V at a 1 I_1 (A) current. Record the recovery capacity.	Residual Capacity ≥ 90% of Initial Capacity Recovery capacity ≥ 93% of Initial Capacity
9	Capacity Retention at High Temperature☆	After charging per 4.3.1, store the testing cells at (60±2)℃ for 7 days, then discharge cells to 2.0V at a 1 I_1 (A) current. Record the residual capacity. Charge cells per 4.3.1. Discharge cells to 2.0V at a 1 I_1 (A) current. Record the recovery capacity.	Residual Capacity ≥ 90% of Initial Capacity Recovery capacity ≥ 93% of Initial Capacity
10	Characteristics at High Temperature	Cells shall be charged per 4.3.1 and stored for 5h at (60±2)℃. Then discharge cells to 2.0V at a 1 I_1 (A) current and record the capacity.	Residual Capacity≥ 95% of Initial Capacity
11	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
12	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
13	Short-Circuit Test ★	Cells, 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
14	Overcharge Test ★	After charged per 4.3.1, test cells shall be overcharged with a sort of method below: 1^{st} Method: Charge test cells at $1I_1$ (A). Stop it when the	No Explosion, No Fire

		cell voltage reached 1.5 times of end voltage. Observe 1h. 2nd Method: Charge test cells 1h at 1I_1 (A). Observe 1h.	
15	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
16	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
17	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
18	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
19	Drop Test★	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.	No Explosion, No Fire, No Leakage
20	Seawater Immersion Test★	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.	No Explosion, No Fire
21	Thermal Cycle★	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.	No Explosion, No Fire, No Leakage

温度 ℃	时间增量 min	累计时间 min	温度变化率 ℃/min
25	0	0	0
-40	60	60	13/12
-40	90	150	0
25	60	210	13/12
85	90	300	2/3
85	110	410	0
25	70	480	6/7

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 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 environment is -20 ℃~ 60℃ and the discharge temperature range of battery is -20 ℃~ 70℃.

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 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 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.

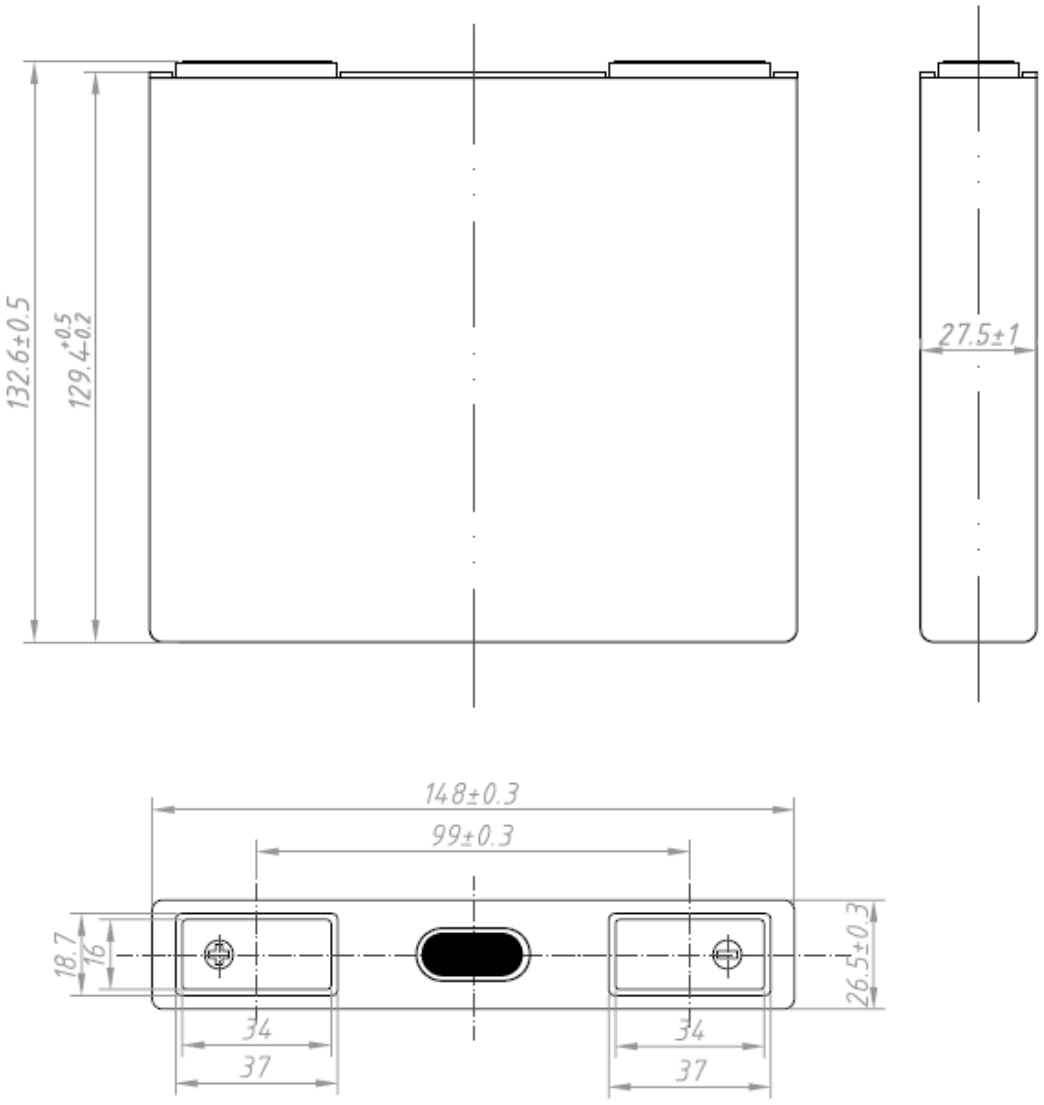
7.2 The delivery battery should be at10%~50%SOC charged state.

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