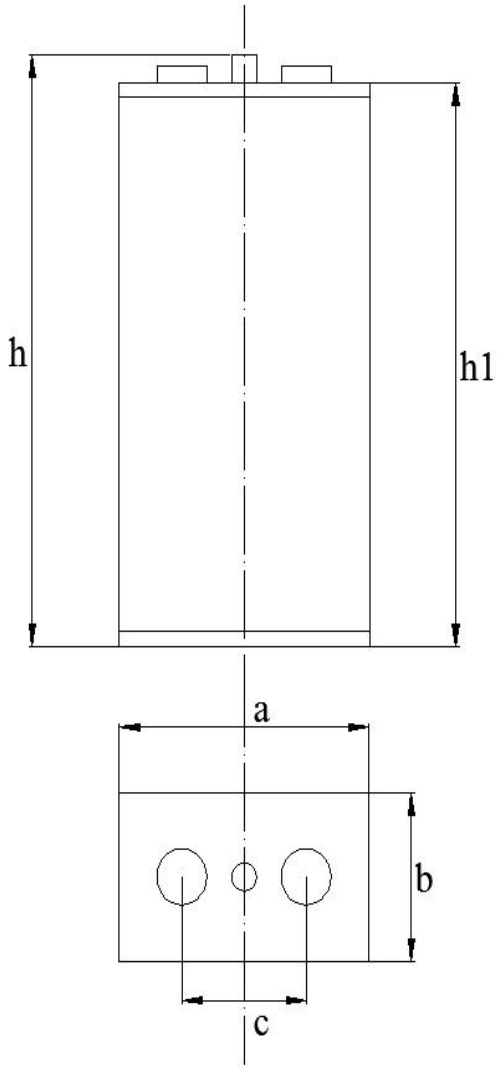
Lithium Ion Power Battery Specifications

Model：LPF78130305-220Ah

Customer approval	Checked /date	Approval /date

Prepared by	Checked by	Approved by

Product Specifications



Type ---------- Lithium-Ion Rechargeable cell
Model---------- LPF78130305-220Ah

Dimension (Including shrink sleeve/label)
h ---------- 304 ± 1 mm
h1 ---------- 287.2 ± 1 mm
a ---------- 130.5 ± 1 mm
b ---------- 79.2± 1 mm
c ---------- 78.0 ± 1 mm

Cell Weight---------- 6000 ± 100g

Nominal voltage---------- 3.2 V

Capacity （0.5 C discharge）
C : Nominal capacity---------- 220 Ah
Minimum capacity---------- 220 Ah

AC resistance---------- ≤ 0.35mΩ

Maximum charge voltage---------- 3.65 V

Maximum continuous charge current ---------- 1 C

Maximum continuous discharge current---------- 1 C

Discharge cut-off voltage---------- 2.5 V

Pulse discharge current at 10 sec---------- 3.0 C

Cycle life---------- 2000 times

Operation temperature
Charge ---------- 0 ~ 45 ℃
Discharge---------- -20 ~ 60 ℃
Storage ---------- -5 ~ 45 ℃

1. Scope

This specification describes the technical requirements, test methods and the notes of $LiFePO_4$ cells, which will be supplied to the customer.

2. Description

2.1 Product： Lithium-Ion Rechargeable cell

2.2 Model (Type)：LPF78130305

2.3 Designation：LPF78130305

2.3.1: " LP" Indicates the manufacturer

2.3.2: " F" Indicates the type of battery（LFP Battery）

2.3.3: "78130305" Indicates the Size of battery

2.4 C_1---- 1 h Rated capacity (Ah).

I_1-----1 h rate of discharge current, the value is equal to C_1(A).

3. Testing Environment

Unless otherwise specified, all tests stated in this document shall be performed at 25±2 ℃.

4. Performance and Test Conditions

4.1 Basic Performance

No.	item	performance
1	Voltage before delivery	≥ 3.25 V
2	AC resistance	≤ 0.35mΩ
3	Standard charge method	0.5 C constant current charge to 3.65V, followed by 3.65 V constant voltage charge until current is ≤0.02 C.
4	Standard discharge method	0.5 C constant current discharge to the discharge cut-off voltage.
5	Fast charge method	1C constant current charge to 3.65 V, followed by 3.65 V constant voltage charge until current is ≤0.01 C.
6	Charging ambient temperature	0～45 ℃
7	Discharging ambient temperature	-20～60 ℃
8	Storage temperature	-5～45 ℃

4.2 Electrical Characteristics

No.	Test item	Test conditions	Requirements
1	Appearance	Visual check	Appearance shall not be deformed and cracked, the surface without burr, dry, no trauma, no dirt, and should have a clear, correct sign.
2	Polarity	Voltmeter	Polarity identification should be correct and clear.
3	Outside dimensions and weight	Measuring the size and weight of the cell with measuring tools and weighting instruments	Cell size, weight should be consistent with the products provided by the technical conditions.
4	Discharge capacity at room temperature	After the standard charge, the cell discharged at $0.5I_1$(A) to the discharge cut-off voltage voltage at room temperature. Calculated discharge capacity (in Ah) .	The cell discharge capacity should not be less than the rated capacity.

5	The discharge capacity at room temperature	After the standard charge, the cell discharged at $2I_1$(A) (Maximum current ≤400 A) to the discharge cut-off voltage at room temperature. Calculated the percentage of nominal capacity.	Capacity ratio ≥90%
6	Room temperature charging performance	After the standard charge, the cell discharged at $1I_1$(A) to the discharge cut-off voltage allowed to stand for 1 h. The cell was charged to charge cut-off voltage at a current of $2I_1$(A) (Maximum current ≤400 A) and the total charge time was not more than 30 min and left standing for 1 h. the cell discharged at $1I_1$(A) to the discharge cut-off voltage at room temperature. Calculated the percentage of nominal capacity.	Capacity ratio ≥80%
7	Low temperature discharge capacity	After the standard charge, the cell were placed in a -20℃±2℃ incubator and left for 24 h. The cell discharged at $0.5I_1$(A) to 2.0 v at -20℃±2℃. Calculated the percentage of nominal capacity.	Capacity ratio ≥70%
8	High temperature and discharge capacity	After the standard charge, The cell were placed in a 55 ℃±2℃ incubator and left for 5 h. The cell discharged at $1I_1$(A) to the discharge cut-off voltage at 55 ℃±2℃. Calculated the percentage of nominal capacity.	Capacity ratio ≥90%
9	Charge retention and recovery	Room temperature: After the standard charge, the cell is left at room temperature for 28 days and then discharged at $1I_1$(A) to the discharge cut-off voltage. Calculates the percentage of nominal capacity. After the standard charge, the cell discharged at $1I_1$(A) to the discharge cut-off voltage at room temperature. Calculated the percentage of recovery capacity to nominal capacity. High temperature: After the standard charge, the cell is left at 55 ℃ for 7 days and then discharged at $1I_1$(A) to the discharge cut-off voltage. Calculates the percentage of nominal capacity. After the standard charge, the cell discharged at $1I_1$(A) to the discharge cut-off voltage at room temperature. Calculated the percentage of recovery capacity to nominal capacity.	Hold capacity ratio ≥85% Recovery capacity percentage ≥90% Hold capacity ratio ≥85% Recovery capacity percentage ≥90%
10	Resistant to vibration	After the standard charge, the cell was fastened to the vibration test stand. Linear sweep vibration test under the following conditions: discharge current: 1/3 I_1(A); Vibration direction: up and down a single vibration; Vibration frequency: 10 Hz ~ 55 Hz; maximum acceleration: 30 m/s^2; sweep cycle: 10 times; vibration time: 3 h. During the vibration test, observed the presence or absence of abnormal phenomena.	Cell did not allow discharge current changes, abnormal voltage, battery shell deformation, electrolyte overflow and other anomalies. Cell was to maintain a continuous and reliable, well-structured.
11	Storage	After the standard charge, the cell was discharged at $1I_1$(A) for 30 min at room temperature. It is stored for 28 days at 45 ℃±2℃. It was left for 5 hours at room temperature. After the standard charge, the cell discharged at $1I_1$(A) to the discharge cut-off voltage at room temperature. Calculated the percentage of nominal capacity.	Capacity ratio ≥90%

4.3 Safety performance

No.	Test item	Test conditions	Requirements
1	Over charge	After standard charged, the cell was charged at $1I_1$(A) constant current to 1.5 times the charge termination voltage or charging time of 1 h to stop charging. Watch for 1 h.	No fire, nor explosion
2	Over discharge	After the standard charge, the cell was discharged at $1I_1$(A) for 90 min. Watch for 1 h.	No fire, nor explosion，no leakage.
3	Short circuit	After the standard charge, cell positive and negative was external short-circuit 10 min. External line resistance should be less than 5 mΩ. Watch for 1 h.	No fire, nor explosion.
4	Drop	The cell shall be standard charged and then dropped onto concrete from the height of 1.5 m. Watch for 1 h.	No fire, nor explosion，no leakage.
5	Hot	The charged batteries are heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of 5 ℃ per minute. The oven is to remain for 30 minutes at 130±2 ℃ before the test is discontinued. Watch for 1 h.	No fire, nor explosion.
6	Extrusion	After the standard charge, the cell was tested under the following conditions. Extrusion direction: perpendicular to the direction of the cell plate pressure (Figure 1); Extrusion plate form: 75 mm radius of the semi-cylindrical body, semi-cylindrical length (L) is greater than the size of the cell being squeezed; Extrusion speed: (5 ± l) mm / s; Extrusion: When the voltage reaches 0 V or the deformation reaches 30% or the extrusion pressure reaches 200 kN, the extrusion is stopped. Watch for 1 h.	No fire, nor explosion.
7	Acupuncture	After the standard charge, with Φ5mm-Φ8mm high-temperature steel needle at (25 ± 5) mm/s speed from the direction perpendicular to the cell plate through. Through the position should be close to the geometric center of the thorn, steel needle stuck in the cell. Watch for 1 h.	No fire, nor explosion.
8	Seawater immersion	After the standard charge, the cell was immersed in 3.5 % NaCl solution for 2 h. Water depth should be completely over cell.	No fire, nor explosion.
9	Depression	After the standard charge, the cell put into the low pressure tank and adjust the chamber pressure 11.6 kPa at the room temperature. Let stand for 6 h. Watch for 1 h.	No fire, nor explosion，no leakage.
10	Temperature cycle	After the standard charge, the cell put into the temperature box. The temperature of the temperature box is adjusted according to Table 1 and Fig 2. The temperature was cycled 5 times. Watch for 1 h.	No fire, nor explosion，no leakage.

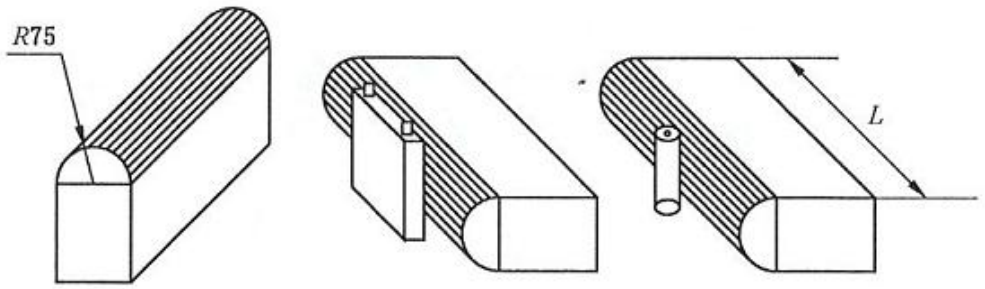


Fig 1. Schematic diagram of single extruded plate and extrusion

Table 1 Temperature cycling tests the temperature and time of a cycle

Temp. ℃	Time increment min.	Cumulative time Min.	Temp. Changing rate ℃/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

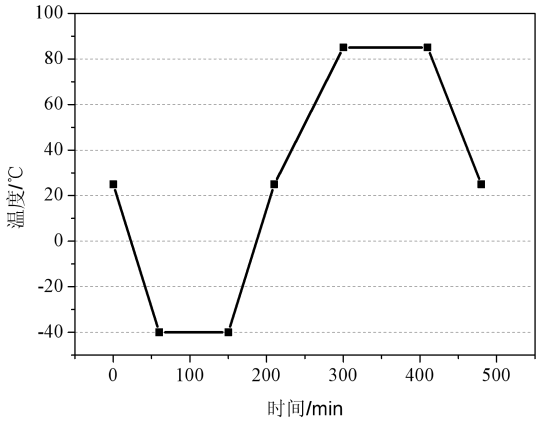


Fig 2. Schematic diagram of temperature cycle

4.4 Cycle life

No.	Test item	Test conditions	Requirements
1	Room temperature capacity and energy	The cell discharged at $0.5I_1$(A) to the discharge cut-off voltage. It was left for 30 min. After the standard charge, the cell was left for 30 min and discharged at $0.5I_1$(A) to the discharge cut-off voltage. The discharge capacity (in Ah) and the discharge energy (in Wh) are calculated.	The cell discharge capacity should not be less than the rated capacity, and not more than 110% of the rated capacity.
2	Standard cycle life	The cell discharged at 0.5 I_1(A) to the discharge cut-off voltage. It was left for 30 min. After the standard charge, the cell was left for 30 min and discharged at 0.5 I_1(A) to the discharge cut-off voltage. The discharge capacity was recorded. Continuous cycle 2000 times. The room-temperature discharge capacity and the discharge energy were measured.	When the number of cycles reaches 2000, the discharge capacity should not be less than 80% of the initial capacity.

5. Notes

(1)Please check the completeness of the accessories after open the package and read introduction carefully.
(2)Do not short circuit batteries in any event.
(3)Please charge the new cell to full capacity before discharge for the first use.
(4)Each cell pack matches and installs corresponding BMS system to protect single cell from over charge and over-discharge.
(5)Please use the same copper part to connect cell packs and fix with hydraulic pliers.
(6)The charger should be approved by our company in order to match with our lithium batteries.
(7)It will shorten cell cycle lifetime and damage cell due to overcharge and over-discharge if not do according to the above requirements.

6. Requirement for safety guarantees

For the sake of safety guarantees, if there is any application in equipment design, protective circuit of lithium-ion battery cell system or high current, fast charge and other aspects, please consult with us for related matters.