

	杭州力奥科技有限公司	文件编号 Doc No: LIAO-TC-01
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Lithium-ion Rechargeable Battery

Product Specification

Product Name: LiFePO4 Battery Cell

Model No.: LAF12-1865148

Specification No.: LAF3.2V/12Ah

Issue Date : 2011-04-06

Prepared By	Checked by	Approved by
黄镇财	吴红英	季贵波

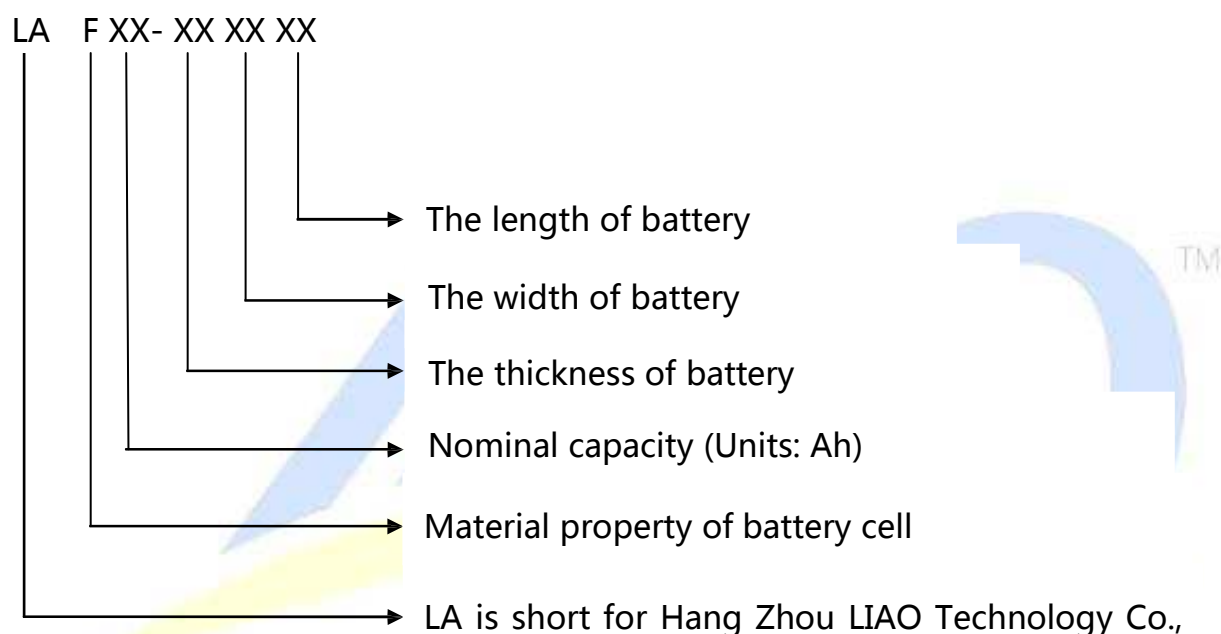
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1、 Scope

This specification describes the performance, testing method, warning and caution of the LiFePO₄ Li-ion battery pack supplied by Hangzhou LIAO Technology Co., LTD.

2、 Product model Naming Rules

Code of battery pack is as below:



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3、Performance

Item	Specification	Remark
3-1 Nominal capacity	12Ah	20±5℃, 0.5C, CC(constant current)discharged to 2V.
3-2 Nominal voltage	3.2V	
3-3 Standard charge current	2.4A	0.2C(2.4A) CC (constant current) charged to 3.65V, then CV (constant Voltage) 3.65V charge till current decline to 200mA.
3-4 Max. charge current	12A	1C(12A) CC(constant current)charged to 3.65V, then CV(constant Voltage)3.65V charge till current decline to 200mA.
3-5 Charge cut-off voltage	3.65V	
3-6 Standard discharge current	2.4A	0.2C(2.4A) , CC (constant current)discharged to 2V
3-7 Max. constant discharge current	36A	3C(36A) , CC (constant current)discharged to 2V.
3-8 Max. peak discharge current	60A	
3-9 Discharge cut-off voltage	2V	
3-10 Standard charge time	5-6h	
3-11 Rapid Charge time	1.2-1.5h	
3-12 Impedance	≤3mΩ	Between discharge port of positive and negative extremes
3-12 Battery Weight	340g	
3-13 Operating temperature range	-20 ~ 60℃	
3-13 Storage temperature range	-10 ~ 45℃	

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4、Performance Data

4.1 Electrochemical Characteristics

NO.	Item		Criterion	Test Method
1	Temperature dependence of capacity	60°C (Storing 4h)	≥98% Nominal capacity	Standard charge the battery at 0.2C CC/CV to 3.65V, cut off on current≤0.02C, at 20±5°C, and store it at 60°C for 4h,
		45°C (Storing 4h)	≥98% Nominal capacity	Standard charge the battery at 0.2C CC/CV to 3.65V, cut off at current≤0.02C, at 20±5°C,
		25°C	100% Nominal capacity	Standard charge the battery at 0.2C CC/CV to 3.65V, cut off at current≤0.02C at 20±5°C,
		-20°C (Storing 20h)	≥60% Nominal capacity	Standard charge the battery at 0.2C CC/CV to 3.65V, cut off at current≤0.02C, at 20±5°C, and store it at -20°C for 20h,

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2	Cycle-Life Characteristics	≥2000cycles	Standard charge at 0.2C CC/CV To 3.65V, cut off when current ≤0.02C at 20±5℃. Standard discharge at 0.5C CC to 20V. Repeat the cycle of standard charge and discharge, When the battery capacity is less than 80% of the nominal capacity, stop the test.
3	Retention ability of Charge capacity	≥90% Nominal capacity	Standard charge at 0.2C CC/CV to 3.65V, cut off current ≤0.02C at 20±5℃. Discharge at 0.5C CC to 2V after store it at 20±5℃ for 28days record the battery discharge capacity.

4.2 Environment Characteristics

NO.	Item	Criterion	Test Methods
1	Constant temperature and constant humidity test	No fire, no explosion, no leakage. discharge capacity is not less than 60% nominal capacity.	After standard charge, test condition as follows: Temperature: 40±5℃ Relative Humidity: 90-95%RH Storage Time: 48Hours Then return to room temperature for 2 hours, discharge to cut-off Voltage at 1C.
2	Vibration test	No fire, no explosion, no leakage.	After standard charged, fix the cell to vibration table, then subjected to vibration test for 30 minutes per axis of XYZ axes. Frequency rate: 1oct/min Vibration frequency: 10Hz-30Hz Excursion (single amplitude): 0.38mm Vibration frequency: 30Hz-55Hz Excursion (single amplitude): 0.19mm
3	Shock test	No fire, no explosion, no leakage.	After standard charged, test condition: Acceleration: 100m/s ² Pulse lasting time: <16ms Shock times: 1000±10 times

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4	Drop test	No fire, no explosion e, no leakage.	Drop the battery in the shipment condition from 1m height onto 5cm or thicker concrete with p-tile on it 3 times each of X, Y and Z directions.
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4.3 Safety Performance

No.	Item	Criterion	Test Method
1	Over-charge test	No fire, no explosion	Charge in accordance with the following two ways(Choosing one between the two). (1)Charge at 1C current for 90min or until the voltage of the battery reaches 5.0V(stop test when fulfills either condition). (2)Charge at 3C current until the voltage of the battery reaches 10.0V, then stop the test.
2	Over-discharge test	No fire, no explosion	Charge the battery. Place at 20±5℃ for 1h, then discharge in 1/3C current at the same temperature until the cell's voltage is 0V .
3	Heating test	No fire, no explosion	After standard charged, the battery is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of (5±2)℃/min to a temperature of 150℃±2℃, keep that temperature for 30 minutes before the test is discontinued.
4	Short circuit test	No fire, no explosion	After standard charged, the battery shall be subjected to a short-circuit condition with a wire of resistance less than 3mΩ for 1 hour. Temperature less than 115℃.
5	Prick test	No fire, no explosion	After standard charged, hitting from the direction perpendicular to the series batteries with a nail of 3~8mm diameter and more than 90 mm in length, nail pierces through at least three parallel batteries. Keep the nail in the batteries for at least 1h.
6	Impact test	No fire, no explosion	After standard charged, the battery is to be placed on a flat surface, A 10Kg weight is to be dropped from a height of 1m onto the battery.

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7	Squeeze test	No fire, no explosion	After standard charged, Put the battery between two squeeze plates of the Extrusion equipment, then increase pressure to 13kN, hold on for 1 min. The squeeze direction is on the direction perpendicular to arranged battery.
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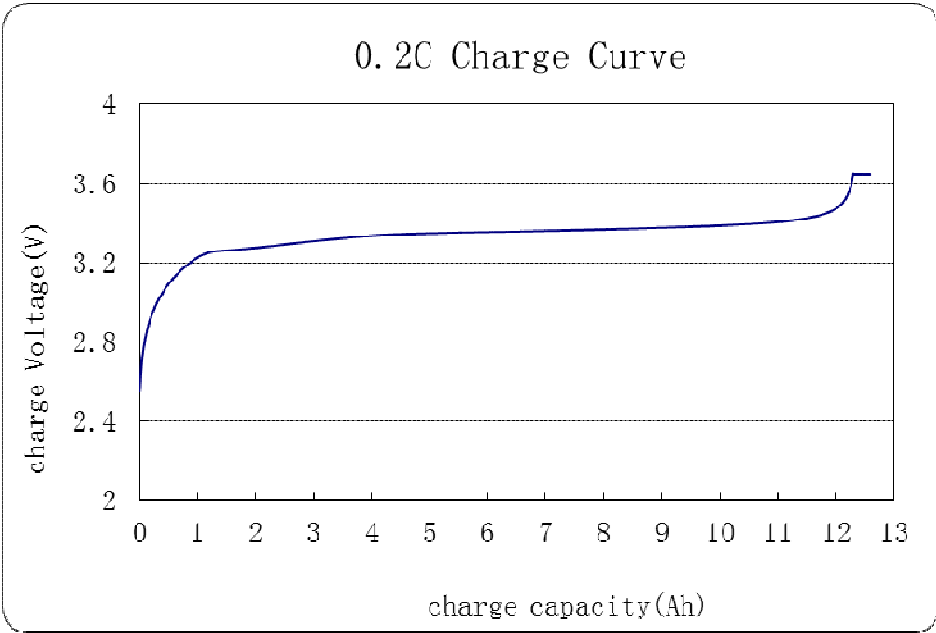


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5、Characteristic curve

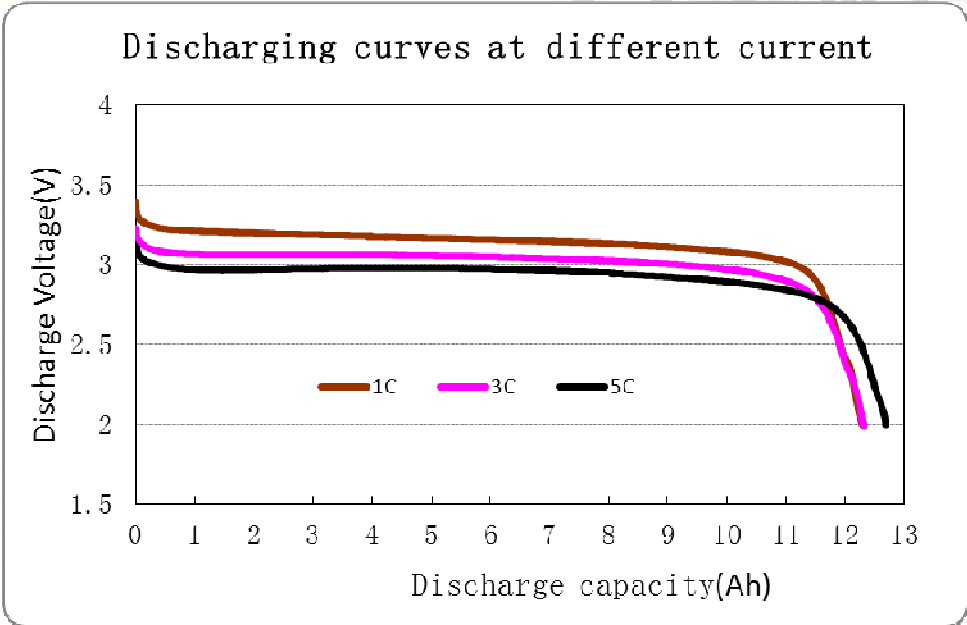
5.1 Charge curves at room temperature

Charge at 0.2C at room temperature, Cut-off current of charge is 0.2A, Cut-off voltage of charge is 3.65V.



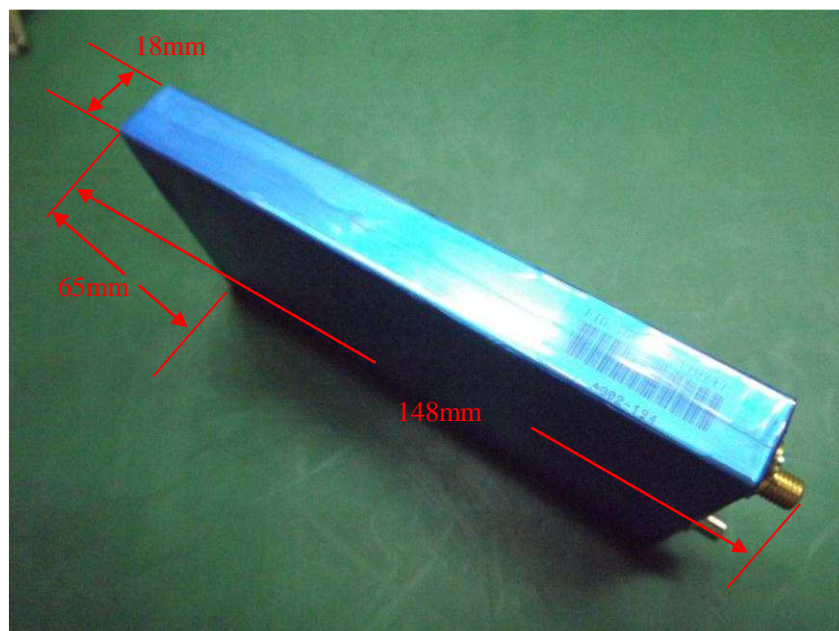
5.2 Discharging curves at different current

Discharge at different current of 1C, 3C and 5C to cut-off voltage at 2V.



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6、Structure of the Product Structure



7、Storage, Maintenance and Transportation

7.1 Storage

When the battery pack to be long-term stored, charge the battery pack to about 50% capacity(after discharging completely, charge for 2- 3h at 4A),store in dry and ventilated place, charge 1 to 2h for every 3 months. The battery pack and charger should be stored in clean, dry and ventilated place, avoid contacting with corrosive materials and be away from fire and heat.

7.2 Transportation

The battery pack and charger should be packaged for transport, prevent excessive vibration, shock or extrusion in transport process and prevent the sun and rain. The battery pack can be transported by cars, trains, ships, aircraft and other vehicles etc.

7.3 Maintenance

- The battery pack should be stored in 40%~60% charged capacity.
- If battery pack is not used for a long period, it should be replenish charging one time for 1 to 2h for every

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three month.

c) In the maintenance process, please do not disassemble the battery pack, otherwise it will cause a decline of battery performance.

d) Forbid to remove any cell in the battery pack. Forbid dissecting battery cells.

8、Battery Handling Precautions

- * Forbid to immerse battery in water or get wet!
- * Don't charge, use and store battery near a heat source such as fire and heater! If the battery leaks or releases strange odor, please remove it from place near fire place immediately. Fully charge the battery before first-time using.
- * Forbid to reverse the positive and negative pole!
- * Forbid to throw the battery pack into fire or heat it!
- * Forbid to short-circuit battery with wire or other metal objects!
- * Forbid to nail, knock or trample battery!
- * Forbid to disassemble the battery and battery pack in any way!
- * Forbid to put the battery into microwave oven or pressure vessel!
- * If the battery pack gives off odor, gets heat, deformation, discoloration or appears any abnormal phenomenon, stop using it; please remove the battery from electrical appliances and stop using it, when the battery is being used or charged!
- * Forbid to use battery pack in an extreme hot environment, such as under direct sunlight or in car on hot day. Otherwise, the battery pack will overheat which will affect battery performance and shorten battery life!
- * If the battery leaks and electrolyte leakage enters into the eyes, do not rub, rinse with water immediately and seek immediate medical assistance. If not in time, eyes will be hurt!
- * Ambient temperature will affect the discharge capacity, if the ambient temperature is beyond the standard environment (25±5)°C the discharge capacity will drop!

Special Considerations:

- * During charging, if there is odor and unusual noise, immediately stop charging.
- * During discharging, if there is odor, unusual noise, immediately stop discharging.
- * If there are above phenomenon, please contact the manufacturer, do not disassemble by yourself.

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9、Product Liability

9.1 The warranty term of the single cell is 24months from delivery.

9.2 We assume no responsibility for the accident of not operating in accordance with the specification.

9.3 If the contents of this specification changed because of improving product quality or upgrading technical parameters, we will not give notice. For the latest product information, please feel free to contact us as following:

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