

# Battery Specification

BAT557

Product      LiFeP04 battery

Model No.    18650-1500mAh

Standard     GB/T18287-2013

Customer Approval:

Prepared By	Reviewed by	Date
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## 1. Scope

This product specification describes lithium-ion rechargeable battery main performance index, please according to the specification of testing and the use of methods were used, if unknown, please and supplier negotiation

## 2. Model

Model: 18650-1500mAh

## 3. Reference standard

The standard reference GB/T18287-2013, UL1642 and CE61960 technology standards compiled.

## 4. Specification

Items	Specification	Remarks	
4.1 Nominal Capacity	1500mAh	0.2 C <sub>5</sub> A 放电 0.2 C <sub>5</sub> A Discharge	
4.2 Nominal Voltage	3.2V		
4.3 Discharge Cut-off Voltage	2.0V	0.2 C <sub>5</sub> A 放电 0.2 C <sub>5</sub> A Discharge	
4.4 Charge Limited Voltage	3.65±0.03V	0°C~60°C	
4.5 Standard Charge Current	0.2 C <sub>5</sub> A	0°C~60°C	
4.6 Standard Discharge Current	0.2 C <sub>5</sub> A	-10°C~+60°C	
4.7 Rapid Charge Current	0.5C <sub>5</sub> A	0°C~60°C	
4.8 Rapid Discharge Current	0.5C <sub>5</sub> A	-10°C~+60°C	
4.9 Max. Discharge Current	3C <sub>5</sub> A	Limited Voltage 2.0V	
4.10 Max. Pulse Discharge Current)	5C <sub>5</sub> A	ms	
4.11 Internal Impedance	≤30mΩ	At AC 1kHz	
4.12 Weight	About 40.50g	±2g	
4.13 Storage Temperature Range	≤ one month	-20°C ~ 45°C	Voltage of shipment 3.2V~3.4V
	≤ three months	-20°C ~ 35°C	
	≤ a year	-20°C ~ 25°C	

## 5. Electrical Characteristics

Items	Test Conditions	Specification
5.1 Standard Charge	(The "Standard Charge" means charging with constant current 0.2C 5 to 3.65V, then charging with constant voltage 3.65V to 0.01C 5 under 20±5 , °C charging time will not more than 8h.) (Use Lithium-ion battery charger, which with an accuracy ±0.05V.)	
5.2 Nominal Capacity	The capacity means the discharge capacity of the cell, which is measured with discharge current 0.2C 5 to cut-off voltage at 2.0V at 20±5°C rest for 30minutes after the Standard Charge.	Nominal Capacity ≥1500mAh
5.2 Cycle Life	After 2000 cycles of charge and discharge, the discharge capacity is measured with 0.2 C <sub>5</sub> A discharge current and 2.0V cut-off voltage.	≥80%Nominal Capacity
5.3 Storage Characteristic	1. Test the cell initial capacity using 0.2C 5 current at 23±2°C and record, then charge the cells with 45% capacity, then storage for 3, 6, 12 months respectively at 20±5°C and relative humidity of 45%~75%, then the cell is cycled for 5 times with charge with 0.2C 5 and discharge with 0.2C 5 at 23±2°C, The maximum discharge capacity (longest discharge time) is recorded.	0.2C discharge time: After 3 months storage ≥4.5hrs; After 6 months storage ≥4.25hrs; After 12 months storage ≥4.0hrs)
	2. The cell is charged and discharged using 0.2C 5 at 20±5°C. The discharge capacity is C1. The cell is stored for 28 days in 20 ±5°C after fully charged and then is discharged using 0.2C 5 at 20±5°C. The capacity is defined as C2.	(Capacity Retention C2/C1≥85%)
	3. After the test as C 2, The cell is charged and discharged using 0.2C 5 at 20±5°C, The discharge capacity is C3.	Capacity recoverable ratio C3/C1≥90%

5.4Rate Capacity)	1. The discharge capacity is measured with 0.2 C5A discharge current and 2.0V cut-off voltage after full charged.	$\geq 100\%$ Nominal Capacity
	2.The discharge capacity is measured with 0.5 C5A discharge current and 2.0V cut-off voltage after full charged.	0.5C/0.2C=96%
	3. The discharge capacity is measured with 1 C5A discharge current and 2.0V cut-off voltage after full charged.	1C/0.2C=93%
	4. The discharge capacity is measured with 3 C5A discharge current and 2.0V cut-off voltage after full charged.	3C/0.2C=85%

## 6 Environment Characteristics.

Items	Test Conditions	Specification
6.1 Temperature Performance	Cells shall be charged according to 5.1 and discharged at 0.2C 5 to 2.0 V. Cells shall be stored for 4 hours at the test temperature prior to discharging and then shall be discharged at the test temperature, The percentage shall be calculated using discharging capacity compared to the minimum capacity.	No leakage, No Appearance defect
		-20°C/25°C $\geq$ 40%
		-10°C/25°C $\geq$ 60%
		0°C/25°C $\geq$ 85%
		25°C/25°C $\geq$ 100%
		60°C/25°C $\geq$ 98%
6.2 Constant Temperature and Humidity	Under the temperature of $23 \pm 2^\circ\text{C}$ , after charging the cell with 0.2C 5 ,then put the cell into the constant temperature and humidity oven with $40 \pm 2^\circ\text{C}$ and 90~95% for 48h, then store the cells at RT for 2hrs, and discharge the cellswith0.2C 5 to 2.0 volts.	The cell should be no deformation, no rust, no leakage, no fire, no smoking and no explosion. Discharge time $\geq 3\text{h}$
6.3 Free Fall Test	The fully charged cell is dropped three times from a height of 1000 mm (the lowest point of the cell) onto a concrete floor. The cells or batteries are dropped so as to obtain impacts in random orientations. After the test, the cell shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.	No explosion, No fire, No smoke. The OCV after the test no less than 90% before free-fall test.

6.4Vibration Test	A full-charged cell is to be subjected to simple harmonic motion with amplitude of 0.8mm total maximum excursion. The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz. After the test is completed, And the cell returned to the starting position. The cell shall be vibrated for 90~100 minutes per axis of XYZ axes. The samples should be observed for 6 hours after the test, and also check the weight loss of cells before and after the test.	Not explosion, No fire, No leakage, Mass loss $\leq 0.1\%$
6.5Crush Test	A full charged cell is to be crushed between two flat surfaces. The force for the crushing is applied by a hydraulic ram exerting a force of $13 \pm 1\text{KN}$ . Once the maximum force has been applied, or an abrupt voltage drop of one- third of the original voltage has been obtained, or 10% of deformation has occurred compared to the initial dimension, the force is released	No explosion, No fire
6.6Shock Test	The full charged cell has only two axes of symmetry in which case only two directions shall be tested. Each shock is to be applied in a direction normal to the face of the cell. For each shock the cell is to be accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g. The peak acceleration shall be between 125 and 175g. The samples should be observed for 6 hours after the test, and also check the weight loss of cells before and after the test. Cells shall be tested at a temperature of $20 \pm 5^\circ\text{C}$ .	No explosion, No fire, No leakage. Mass loss $\leq 0.1\%$
6.7 Altitude Simulation Test	The full-charged cells are to be stored for 6 hours at an absolute pressure of 11.6 KPa and a temperature of $20 \pm 3$ .	No explosion, No fire, No leakage. Mass loss $\leq 0.1\%$

## 7. Safety Characteristics

Items	Test Conditions	Specification
7.1 Short Circuit	Each test sample cell is to be short-circuited by connecting the positive and negative terminals of the cell with a Cu wire having a maximum resistance load of $80 \pm 20\text{m}\Omega$ . The sample is to discharge until a fire or exposition is obtained, or until it has reached a completely discharge state of less than 0.2V and the sample case temperature has returned to $\pm 10$ of the ambient temperature. Tests are to ${}^\circ\text{C}$ be conducted at $20 \pm 5^\circ\text{C}$ and $55 \pm 5^\circ\text{C}$ . Cell Condition: Fresh, Fully charged cell.	No fire, No explosion; Max.Temp.of battery surface should not exceed $150^\circ\text{C}$
7.2Over-charge Characteristics	The battery is charged at a $3\text{ C}_5\text{A}$ constant current with a voltage limit of 4.8V for 8 hours after fully charged	No fire, No explosion; Max.Temp.of battery surface should not exceed $150^\circ\text{C}$ .
7.3	(After standard charge. Cells are discharged at constant Current of $0.2\text{C}$	

Over Discharge	5 to 2.0V, and the positive and negative terminal is connected by a $30\Omega$ wire for 24 hours. Cell Condition: Fresh, Fully charged cell.)	(No explosion, No fire)
7.4 Hot oven Characteristics	The fully charged battery is placed the battery in the hot box, then rose to $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$ in the temperature to $5^{\circ}\text{C} \pm 2^{\circ}\text{C}/\text{min}$ rate , insulation 30min.	No fire, No explosion
7.5 Forced Discharge	(The cell shall be discharge to 2.0V with the current 0.2C 5, then the discharge cell is subjected to reverse charge at 1.0C 5 for not less than 90minutes.)	No explosion, No fire
7.6 High Temperature Storage Test	(Put cell into the $80^{\circ}\text{C}$ box and keep the cell in the box for 7 hours after it be charged according to 6.1, and then take it out. Cell Condition: Fresh, Fully charged cell.)	No explosion, No fire
7.7 Thermal-cold Cycling Performance Test	The full-charged cell is placed in $75 \pm 2^{\circ}\text{C}$ for 6h, and then put the Cell in $-40^{\circ}\text{C}$ for 6h; change temperature time $<30\text{min}$ , then repeat it for 10 cycles. Finally the cell is placed in room temperature for 24h. Watch the appearance of cell.	No explosion, No fire, No smoke, Open circuit voltage changed not less than 90%, mass loss limit: $\leq 0.1\%$
7.8 Impact Test	A test sample cell is to be placed on a flat surface. A $15.8 \pm 0.1\text{mm}$ diameter bar is to be placed across the center of the sample. A $9.1\text{Kg} \pm 0.46\text{Kg}$ mass is to be dropped from the height of $610 \pm 25\text{mm}$ to the center of the cell vertically. Cell Condition: Fresh, Fully charged cell.	No explosion, No fire

## 8. Standard Testing Conditions and Requirements

### 8.1 Standard Testing Conditions and Requirements

All the tests are at a temperature of  $15\text{~}35^{\circ}\text{C}$ , humidity is  $65 \pm 25\%$ , test items except for special requirements.

### 8.2 Measurement Equipment and Instrumentation

#### 8.2.1 Measurement Tool

With a precision of 0.01mm caliper or higher precision instruments for measuring size, range  $0\text{~}100\text{mm}$ .

#### 8.2.2 Measurement Voltage

With a precision of 0.01V voltage meter measuring voltage, range  $0\text{~}20\text{V}$ .

#### 8.2.3 Measurement Current

With a precision of  $\pm 0.4\%$  current Ammeter to measure the current, range  $0\text{~}10\text{A}$ .

#### 8.2.4 Measurement Impedance

The impedance is measured with 1KHz sinusoidal alternating current resistance instrument.

## 9. Outside Appearance

There should not be any appearance defect such as leakage, rust, deformation, severe blow fire effect on cell performance.

## 10. Packing/Storage/Shipment

### 10.1 Pre shipment inspection

The battery should be checked the voltage, resistance and the function of protective circuit before shipment.

### 10.2 Packing and Shipping

10.2.1 The battery should be transported to the factory assembly, to pay special attention to the packing, in order to avoid transport stress. We suggest to use the same packaging when the battery be transported. Even the package is opened, please pack with the components and materials as same as LangTaiFeng,Ltd.

10.2.2 The battery should be in a half state of charge packaging boxes for transport, in the transport process, prevent severe vibration, shock, extrusion, prevent the sun and rain, should be in automobile, train, ship, airplane and other forms.

### 10.3 Abnormal Condition

Do not use the battery when it's smell like abnormal cell electrolyte because of transport stress, sag, short circuit or any other.

## 11. Safety precaution and prohibitions

In order to prevent battery leakage, heating, fire, reduced performance or life drops, explosion and other accidents, please do the following provisions of the normal use of battery, and compliance with preventive matters.

### 11.1 Charging

#### 11.1.1 Charging Current

Charging current should be less than maximum charge current specified in the Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical and safety performance and could lead to heat generation or leakage.

#### 11.1.2 Charging Voltage

Charging shall be done by voltage less than that specified in the Product Specification (4.2V/cell). Charging beyond 4.25V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition. It is very dangerous that charging with higher voltage than maximum voltage may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation, leakage or explosion.

#### 11.1.3 Charging Temperature

The cell shall be charged within 0°C~45°C range in the Product Specification.

#### 11.1.4 Reverse charging is prohibited.

The cell shall be connected correctly. The polarity has to be confirmed before wiring, In case of the cell is connected improperly, the cell cannot be charged. Simultaneously, the reverse charging may cause damaging to the cell which may lead to degradation of cell performance and damage the cell safety, and could cause heat generation, leakage or explosion.

### 11.2 Discharging

#### 11.2.1 Discharging Current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

#### 11.2.2 Discharging Temperature

The cell shall be discharged within -10°C~60°C range specified in the Product Specification.

#### 11.2.3 Over-Discharging

It should be noted that the cell would be at over-discharged state by its self-discharge characteristics

in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 3.6V and 3.9V. Over-discharging may cause loss of cell performance, characteristics, or battery functions. The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voltage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures.

### 11.3 Exception Handling

Do not use the cell if you find it in unusual conditions such as distortion, leakage (or odors). The cell should be kept away from fire to avoid an explosion.

## 12. Storage

### 12.1 Storage temperature and humidity

The cell shall be stored at temperature range of -5 °C ~ +35 °C, relative humidity of 25~75%, clearing, drying, ventilated, and kept away from corrosive substances and fire.

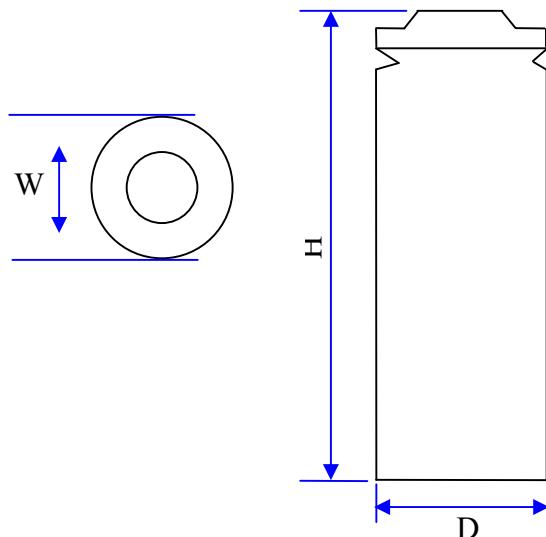
### 12.2 Long Time Storage

If the battery is stored for a long time, the battery should be conducted a cycle of charge and discharge, and the voltage should be about 3.8V and the battery is to be stored at temperature range of -5 °C ~ +25 °C, low moisture and corrosive gases environment.

## 13. Guarantee Period of Quality

The guarantee period of quality extend for one year after code. FBTech Electronics Ltd would replace battery which due to the manufacturing problems and it is not abnormal use, if the battery appears during the abnormal situation.

## 14. Appearance structure and Size of The Battery



Items	Size(mm)	Tolerance(mm)
Width	7.8	+0.3
		-0.3
Height	65.2	+0.3
		-0.3
Diameter	18.2	+0.25
		-0.15