

## SPECIFICATION

### Rechargeable Lithium Iron Phosphate Cell

Product Model	LFP14500-600
Document No.	U048-001
Edition	C0
Pages	11

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Customer Approval 客户确认	Signature/签字	Date/日期
	Company Name/公司名称	
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## 1. Preface

This product specification covers the requirements for the following rechargeable Lithium Iron Phosphate cell manufactured and delivered by **JYH Technology Co., Ltd.**

## 2. Product Description

2.1	Product Name	Rechargeable Lithium Iron Phosphate Cell
2.2	Model	LFP14500-600
2.3	Description	Cylindrical flat top 14500 600mAh 3.2V LiFePO4 cell

## 3. Ratings

3.1	Nominal Voltage	3.2V
3.2	Nominal Capacity	600mAh
3.3	Typical Capacity	630mAh after standard charge and standard discharge
3.4	Minimum Capacity	580mAh after standard charge and standard discharge
3.5	Standard Charge	Constant current at 300mA charge to 3.65V, then constant voltage at 3.65V charge till current decline to $\leq 6$ mA
3.6	Fast Charge	Constant current at 600mA charge to 3.65V, then constant voltage at 3.65V charge till current decline to $\leq 6$ mA
3.7	Standard Discharge	120mA to 2.0V.
3.8	Fast Discharge	600mA to 2.0V.
3.9	Maximum Continuous Charge Current	600mA
3.10	Maximum Continuous Discharge Current	1800mA
3.11	Operating Temperature	Charge 0°C to 60°C Discharge -10°C to 70°C
3.12	Storage Temperature	<1 year -20°C to 25°C <3 months -20°C to 40°C <30days -20°C to 50°C
3.13	Typical Weight	18g

## 4. Electrical Performance

Unless otherwise stated, tests should be conducted under the following conditions:

Time frame	Within one month after delivery
Ambient temperature	25°C ± 5°C
Relative Humidity	65% ± 20%
Atmospheric Pressure	86kPa-106kPa

### 4.1 Standard Capacity

Standard capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V within 1 hour after the standard charge. Up to three cycles are permitted for this test.

Criteria: Discharge capacity ≥ minimum capacity

### 4.2 Open Circuit Voltage

The open circuit voltage is measured within 1 hour after standard charge.

Criteria: Open circuit voltage ≥ 3.35V

### 4.3 Initial Internal Impedance

The initial internal impedance is measured at the frequency of 1kHz within 1 hour after standard charge.

Criteria: Initial internal impedance ≤ 70mΩ

### 4.4 Fast Discharge Capacity

The capacity is measured with a discharge current of 1C to a discharge final voltage of 2.0V within 1 hour after the standard charge.

Criteria: Discharge capacity ≥ 90% of initial capacity

### 4.5 Charge Retention

Charge retention is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V after standard charge and storage time of 28 days.

Criteria: Discharge capacity ≥ 85% of initial capacity

### 4.6 Charge Recovery

After charge retention test, the cell shall be done standard charge within 24 hours and stored for 1 hour.

Charge recovery is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

Criteria: Discharge capacity ≥ 90% of initial capacity

### 4.7 Cycle Life

During this cycle life test, the ambient temperature should be kept at 23°C ± 2°C. The cell shall be charged at CC/CV=0.5C/3.65V, cut off till current decline to 0.05C, stored for 10mins, then discharged at a constant current of 0.5C to a final voltage of 2.0V, after that, stored 10mins prior to next charge/discharge cycle. The cell shall be continuously charged and discharged for 1000 times.

Criteria: Discharge capacity at the 1000th cycle ≥ 80% of initial capacity.

## 5. Environmental Performance

### 5.1 Discharge Capacity at High Temperature

After the standard charge, the cell is stored at an ambient temperature of 55°C ± 2°C for not less than 16h and not more than 24h. The capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

Criteria: Discharge capacity ≥ 95% of initial capacity

## 5.2 Discharge Capacity at Low Temperature

After the standard charge, the cell is stored at an ambient temperature of  $-10^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for not less than 16h and not more than 24h. The discharge capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

Criteria: Discharge capacity  $\geq 50\%$  of initial capacity

## 5.3 Constant Temperature and Humidity

After the standard charge, the cell is stored in an ambient temperature of  $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$  (90-95%RH) for 48h, then placed in room temperature for 2h. After that, check its appearance, the discharge capacity is measured with a discharge current of 0.2C and a discharge final voltage of 2.0V.

Criteria: No explosion, no fire, no leakage. Discharging capacity  $\geq 60\%$  of initial capacity.

# 6 Mechanical Performance

## 6.1 Vibration Test

After standard charge, the cell is installed onto the vibration desk with clamps. The test is to be varied at the rate of 1oct/min between 10 and 55Hz. Repeat vibration for 30min in three mutually perpendicular directions. Equipment parameters of frequency and amplitude are as follows: Vibration frequency: 10-30Hz, amplitude: 0.38mm; 30-55Hz, amplitude: 0.19mm

Criteria: No scratch, no leakage, no fume, no explosion. Cell voltage  $\geq 3.2\text{V}$ .

## 6.2 Drop Test

After standard charge, the cell is dropped from a height of 1m to a concrete surface. Each cell is to be dropped once in the positive and negative directions of three mutually perpendicular mounting positions for a total of 6 times, then rest for 1 hrs.

Criteria: No leakage, no fume, no explosion

# 7 Safety Performance

## 7.1 Overcharge

At standard testing condition, the cell is charged with constant current 3C to voltage 5.0V, then charged with constant voltage of 5.0V till current decline to 0.005C. Charge time is no less than 8hrs.

Criteria: No fire, no explosion.

## 7.2 Over-discharge

At standard testing condition, the cell is discharged at 0.2C current to final voltage of 2.0V, then connect  $30\Omega$  load to discharge for 24 hours.

Criteria: No leakage, no fume, no fire

## 7.3 Crush

At standard testing condition, the cell is charged by standard charge, then placed on the crush flat, the axis is parallel to the crush flat, it is to be crushed between two flat surfaces. Crushing force is approximately 13kN and hold for 1 min

Criteria: No fire, no explosion.

## 7.4 Short-circuit

At standard testing condition, the cell is charged by standard charge, then connect the positive and negative terminals of the cell with a circuit load having a resistance load of  $80\text{m}\Omega \pm 20\text{m}\Omega$ . The temperature of the battery case is to be recorded during the test. Stop the test until the cell surface temperature lower  $10^{\circ}\text{C}$  than the temperature max.

Criteria: No fire, no explosion

#### 7.5 Heating

At standard testing condition, the cell is charged at standard charge, put the cells in the oven, the temperature of the oven is to be raised at  $5^{\circ}\text{C} \pm 2^{\circ}\text{C}$  per minute to a temperature of  $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and remain for 30 minutes.

Criteria: No fire, no explosion

#### 7.6 Impact

At standard testing condition, the cell is charged at standard charge, then is placed on a flat surface so that the longitudinal axis of the cell shall be parallel with it. A 7.9mm diameter bar is to be placed across the center of the sample. A 9.1kg weight is to be dropped from a height of 610mm on the sample.

Criteria: No fire, no explosion

#### 7.7 Low Pressure

At standard testing condition, charge the cell at standard charge, then store for 6hrs at absolute pressure of 11.6kPa. After that, rest for 2hrs at  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

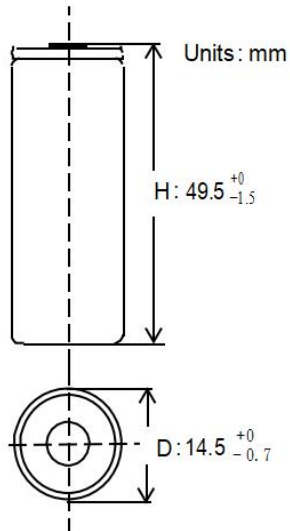
Criteria: No leakage, no fire, no explosion

## 8 Appearance

The cell shall be free from deformation, cracks, scratches, rusts and leakage.

## 9 Outline Dimensions

Cell outline dimensions refer to the following drawing and specification.



## 10 Shipment

The cell shall be shipped in voltage range of 3.2-3.4V or in accordance with customers' requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.

## 11 Warranty

As long as the cell is treated in accordance with this product specification, from date of delivery, one year limited warranty against workmanship and material defects is given.

## Precautions and Safety Instructions

The cell/battery subject to abusive conditions can cause damage to the cell/battery and/or personal injury. Please read and observe the standard battery precautions below before using utilization.

Note 1: The customer is required to contact JYH in advance, if and when the customer needs other applications or operating conditions than those described in this document.

Note 2: JYH will take no responsibility for any accident when the cell/battery is used under other conditions than those described in this document.

### 1. Precaution

- a) Do not expose the cell/battery to extreme heat or flame.
- b) Do not short circuit, over-charge or over-discharge the battery.
- c) Do not subject the cell/battery to strong mechanical shocks.
- d) Do not immerse the cell/battery in water or sea water, or get it wet..
- e) Do not reverse the polarity of the cell/battery for any reason.
- f) Do not disassemble or modify the cell/battery.
- g) Do not handle or store with metallic like necklaces, coins or hairpins, etc.
- h) Do not use the cell/battery with conspicuous damage or deformation.
- i) Do not connect cell/battery to the plug socket or car-cigarette-plug.
- j) Do not make the direct soldering onto a cell/battery.
- k) Do not touch a leaked cell/battery directly.
- l) Do not use for other equipment.
- m) Do not use LiFePO<sub>4</sub> cell/battery in mixture.
- n) Do not use or leave the cell/battery under the blazing sun (or in heated car by sunshine).
- o) Keep cell/battery away from children.
- p) Do not drive a nail into the cell/battery, strike it by hammer or tread it.
- q) Do not give cell/battery impact or fling it.

### 2. Cell/Battery Operation Instruction

#### 2.1. Charging

- a) Charge the cell/battery in a temperature range of 0°C to + 45°C.
- b) Charge the cell/battery at the specified current until 3.65V is attained. Charge rates greater than 1C are NOT recommended.

- c) Maintain charge voltage at 3.65V for 2.0 hours (recommended for maximum capacity).
- d) Use a constant current, constant voltage (CC/CV) lithium-ion cell/battery charge controller.
- e) Do not continue to charge cell/battery over specified time.

## 2.2. Discharging

- a) Recommended discharge final voltage is 2.0V. Recommended max continuous discharge current is 3C.
- b) For maximum performance, discharge the cell/battery in a temperature range of -20°C to +60°C.

## 2.3. Storage Recommendations

- a) Storage Temperature and Humidity

Store the cell/battery at temperature of -20°C to +35°C, low humidity and no corrosive gas atmosphere.

- b) Long Period Storage

In case of long period storage (more than 3 months), store the cell/battery at temperature range of -10°C to +25°C, low humidity, no corrosive gas atmosphere.

- c) No press on the cell/battery.

## Requirement for Safety Assurance

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion cell/battery with JYH in advance. And consult about the high rate current, rapid charge and special application in the same way.