

WORLD GREEN ENERGY SOURCE ORGANIZATION

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<b>Name</b>	<b>LiFePO<sub>4</sub> Battery</b>
<b>Number</b>	<b>LFP2009001</b>
<b>Type</b>	<b>LFP3210</b>
<b>Specification</b>	<b>3.2V/10.0Ah</b>
<b>Prepared</b>	
<b>Checked</b>	
<b>Approved</b>	

### 1. Summarization

This Specification describes the requirements of the LiFePO<sub>4</sub> rechargeable battery supplied by **WGESO(Shanghai)** Energy Group, The product mentioned in the specification accord with Q/SHB001-2006 (based on GB/T18287-2000).

### 2. Description

2.1 Name: LiFePO<sub>4</sub> Battery

2.2 Type: LFP3210

### 3. Parameters

No.	Item		Specifications	Remark
1	Nominal Capacity		10.0 Ah	Capacity according to standard discharge, After standard charge
2	Nominal Voltage		3.15 V	Average Voltage according to standard discharge, After standard charge
3	Charge Type		CC/CV	/
4	Charge Cut-off Voltage		3.65V	/
5	Discharge Cut-off Voltage		2.3V	/
6	Charge current		2.0A	constant current
7	Discharge current		5.0A	constant current
8	Max. instantaneous Charge current		30A	<15S
9	Weight		500g	/
10	Internal Resistance		<20 mΩ	/
11	Dimension (H×W×L)		23×100×98mm	/

12	Working Temperature	Charging		-10°C ~ 45°C	/
		Discharging		-20°C ~ 60°C	/
13	Preservation Temperature	1 month		-20°C ~ 60°C	/
		3 month		-20°C ~ 45°C	/
		1 year		-20°C ~ 25°C	/
	Atmospheric pressure			86~106Kpa	/
	Relative Humidity			45% ~ 75%RH	/

## 4. TECHNICAL REQUIREMENTS

### 4.1 Testing Conditions

- (1) Standard charge: Under temperature  $20\pm 5$  , charge with 0.2 C constant current till it reaches (to) charge cut off voltage, then starts to Charge with constant voltage, Till charge current $<0.01C$ .
- (2) Standard discharge: Under temperature  $20\pm 5$  °C, discharge with 0.5C constant current till(to) discharge cut-off voltage.
- (3) Standard testing environment:
  - Temperature:  $20\pm 5$ °C;
  - Relative Humidity: 45% ~ 75%RH;
  - Atmospheric pressure: 86kPa ~ 106kPa.

### 4.2 Electrical Characteristics:

No.	Item	Testing Instruction	Requirement
1	Nominal Capacity	Temperature $20\pm 5$ °C, After standard charge Measure discharge capacity to 2.3V cut-off within 0.5h~1h after standard charge.	$\geq 10.0$ A h
2	high-current discharge behavior	Temperature $20\pm 5$ °C, discharge with 1C constant current to discharge cut-off voltage within 0.5hrs~1hrs after standard charge.	Discharge time $\geq 50$ min. The battery shall not be metamorphose, rupture。
3	Low-temperature discharge behavior	Keep the battery at $-10\pm 2$ °C for 16hrs~24hrs after standard charge. Measure the discharge time with constant discharge current 0.2C to cut-off voltage. Then, Temperature $20\pm 5$ °C, lay the battery for 2hrs, observe the appearance of the battery.	Discharge time $\geq 3.5$ hrs The battery shall not be metamorphose, rupture。
4	High-temperature discharge behavior	Keep the battery at $55\pm 2$ °C for 2hrs after standard charge. Measure the discharge time with constant discharge current 1C to cut-off voltage. Then, Temperature $20\pm 5$ °C, lay the battery for 2hrs, Observe the appearance of the battery.	Discharge time $\geq 50$ min. The battery shall not be metamorphose, rupture。
5	Charge Retention	Temperature $20\pm 5$ °C after standard charge, keep the battery open circuit 28 days. Then, Measure the discharge time with constant discharge current 0.2C to cut-off voltage.	Discharge time $\geq 4.5$ hrs
6	Cycle Life	Temperature $20\pm 5$ °C, Charge with constant charge current 0.2C to charge cut-off voltage, Then charge with constant voltage to the current $\leq 0.01$ C, Then, stop charge. 10 min later, discharge with discharge current 0.5C to 100% of the capacity DOD. 10 min later, repeat the cycle, till the capacity of lasting 5 times $\leq 60\%$ of the Nominal Capacity, Then consider the life of battery end.	Cycle Life $\geq 1000$ time (Barring that 5 time cycle)

### 4.3 Environment Adaptability:

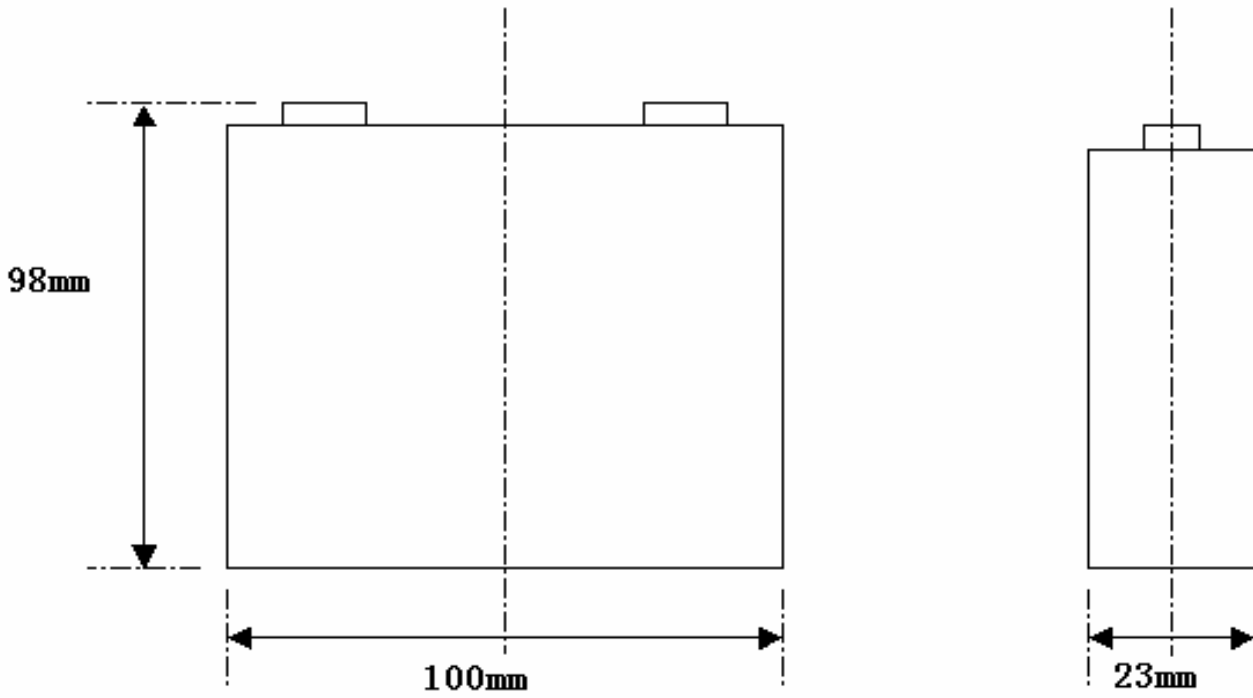
No.	Item	Testing instruction	Requirement
1	Constant temperature /humidity	Keep the battery at $40\pm 2^{\circ}\text{C}$ and 90~95%RH for 48hrs after standard charge. Then, Temperature $20\pm 5^{\circ}\text{C}$ , lay the battery for 2hrs, Observe the appearance of the battery. Measure the discharge time with constant discharge current 1C to cut-off voltage.	The battery shall not metamorphose observably, rust, smoke or explode. Discharge time $\geq 36$ min
2	Vibration	The battery will be vibrated for 30 min in three directions X,Y,Z with changing frequency between 10 and 55Hz. The rate of frequency sweep: 1oct/min; The rate of scanning frequency: 10Hz~30Hz; Amplitude of displacement: 0.38mm; The rate of scanning frequency: 30Hz~55Hz; Amplitude of displacement: 0.19mm; Observe the appearance of the battery, Measure voltage of the battery.	The battery shall not metamorphose observably, rust, smoke or explode. Voltage of the battery $\geq 3.0\text{V}$ .
3	Impacting Testing	The battery will be impacted $1000\pm 10$ times with the acceleration of $100\text{ m/s}^2$ and pulse lasting time 16ms. Observe the appearance of the battery, Measure voltage of the battery.	The battery shall not metamorphose observably, rust, smoke or explode. Voltage of the battery $\geq 3.0\text{V}$ .

### 4.4 Safety Characteristics:

No.	Item	Testing instruction	Requirement
1	Thermal Shock Characteristics	Keeping the battery in oven, The temperature is rising (at the rate of $5\pm 2^{\circ}\text{C}$ ) to $130\pm 2^{\circ}\text{C}$ , Then keep it for 30 min. Observe the appearance of the battery.	The battery shall not fire or explode.
2	Short Circuit	The battery with thermocouple in the fume cupboard is to be short-circuited by connecting the positive and negative terminals of it (The resistance of the circuitry $\leq 50\text{ m}\Omega$ ). Notice the change of the temperature during the experiment. The experiment is to be finished when the temperature of the battery descends to $10^{\circ}\text{C}$ below the maximum temperature. Check the appearance and temperature of the battery.	The battery shall not fire or explode. external temperature of the battery $\leq 150^{\circ}\text{C}$ .

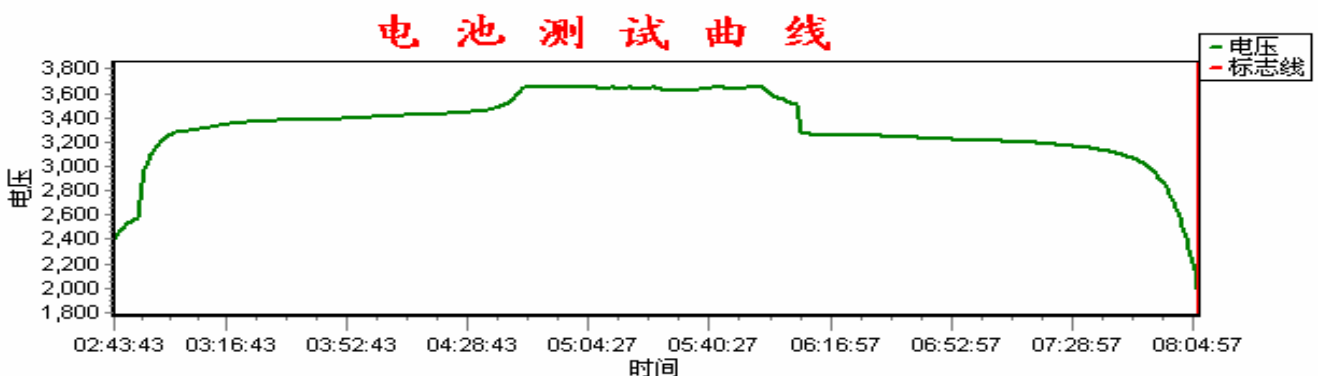
3	Over charge testing	The battery with thermocouple is to be put into the fume cupboard by connecting with the constant current and constant voltage electrical source. Charge it with constant charge current 2C to 4.1 voltage. Then turn to charge it with the constant charge voltage to 0A. The experiment is to be finished when the temperature of the battery descends to 10°C below the maximum temperature. Observe the appearance of the battery.	The battery shall not fire or explode.
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### 5. Sketch map of product ( 3.2v 10ah Dimension ):



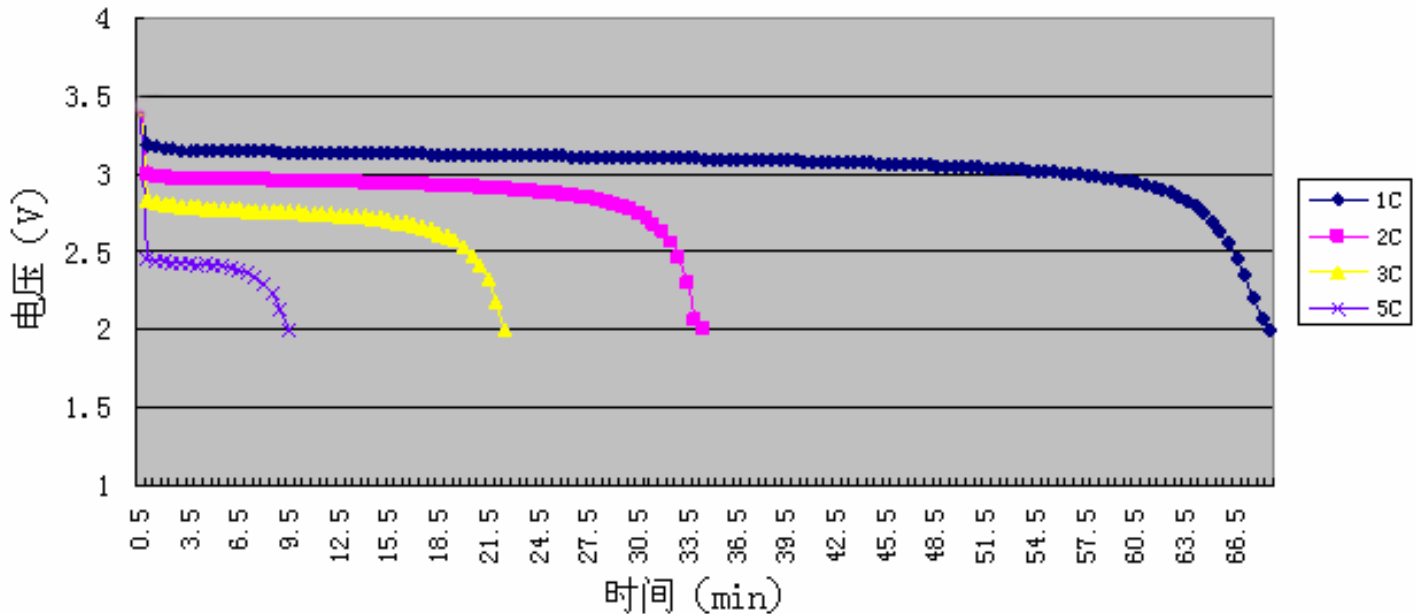
### 6. Typical curve graph

#### 6.1 Typical charge/discharge curve graph:



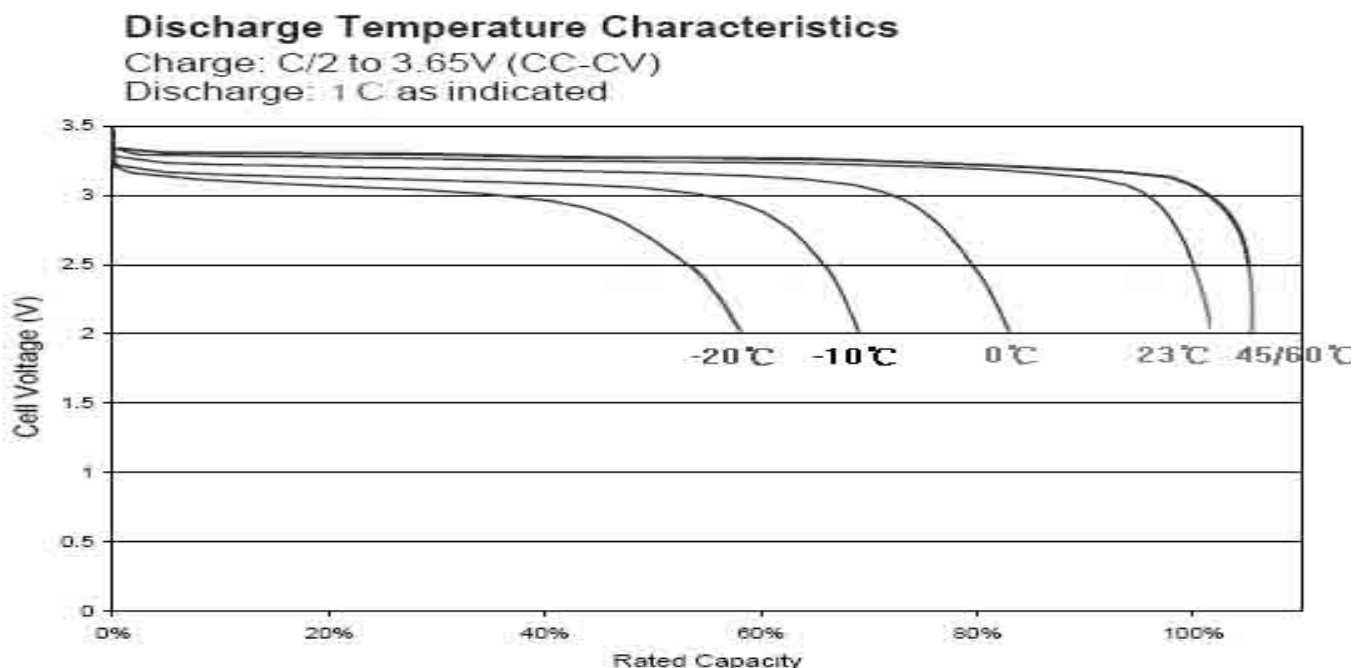
## 6.2 Different multiplier discharge typical curve graph:

10Ah电池1C、2C、3C、5C倍率放电曲线图

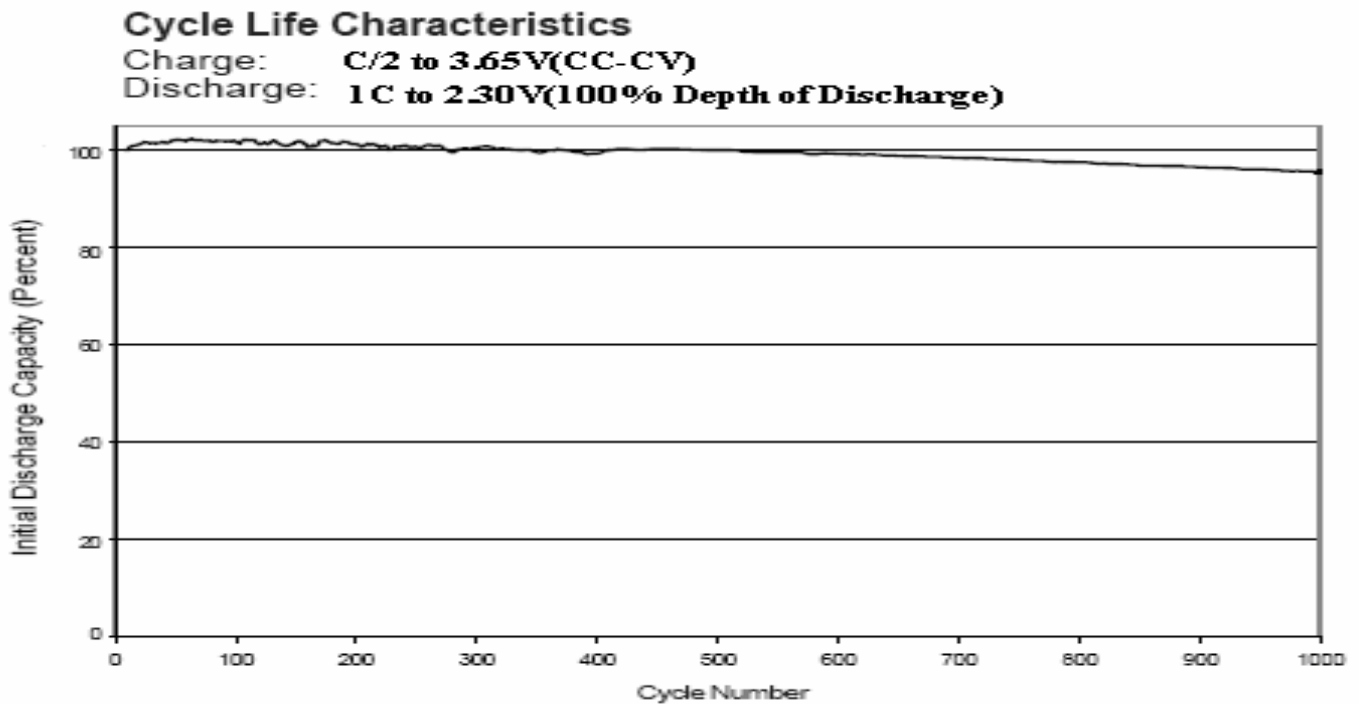


This graph shows the exertion effect of the big multiplier discharge capacity of the battery the Max. discharge constant current is 2C, instantaneous discharge current is 3~5C (within 15s), Do not discharge lasting more than 15s upwards 3C.

## 6.3 High/Low-temperature testing typical curve graph:



### 6.4 Cycle life curve graph:



## 7. Storage of Products

The place of preserving the battery must accord with those following requirements: Indoor, The temperature of environment is between  $-5^{\circ}\text{C} \sim 35^{\circ}\text{C}$ , The relative humidity is  $\leq 75\%$ , The place must be clean dry and ventilative;

Avoid contacting to the corrosives;

Keep far away from fire and heat;

Keep the battery 50%  $\sim$  60% charge estate;

Avoid over charge, the battery should be charged once per 3~6 month when preserved.