

Specification For Lithium-ion Rechargeable Cell

Cell Type : LFP60220112-156Ah

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Contents

Contents	1
1. Preface	2
2. Norms and Standard	2
3. Definition 定义.....	2
3.1 Room Temperature 室温.....	2
3.2 Rated capacity 额定容量.....	2
3.3 Charge Rate 充电倍率.....	2
3.4 Cycle life 循环寿命.....	3
3.5 Open circuit voltage (OCV) 开路电压.....	3
3.6 Operating Voltage 工作电压.....	3
3.7 Standard charge method 标准充电.....	3
3.8 Standard discharge method 标准放电.....	3
3.9 Restore capacity 可恢复容量.....	3
3.10 Charge retention 荷电保持能力.....	4
3.11 Capacity recovery capability 容量恢复能力.....	4
3.12 State of charge (SOC) 荷电状态.....	4
3.13 Units of measurement 测量单位.....	4
4. Cell type and size 电池型号及尺寸.....	5
4.1 Description and model 电池说明及型号.....	5
4.2 Cell size 电池尺寸.....	5
5. Product Performance 产品性能.....	5
5.1 Technical Parameters 技术参数.....	5
5.2 Charging Model 充电模式.....	6
5.3 Discharging Model 放电模式.....	7
5.4 Safety Characteristics 安全性能.....	9
5.5 Storage Performance 储存性能.....	11
6. Precautions for Transportation 运输注意事项.....	11
7. Warranty 质量保证.....	11
8. Storage and Shipment Requirement 存储及运输要求.....	12
9. Warning and cautions in handling the lithium-ion cell 电池使用时警告事项及注意事项.....	12
10. Emergency Treatment 紧急情况处理.....	14
11. The restriction of the use of hazardous substances 有害物质控制要求.....	15
12. Contact information 联系方式.....	15

1. Preface

This specification describes the type and size, performance, technical characteristics, warning and caution of the lithium ion rechargeable cell. The specification only applies to LFP60220112-156Ah prismatic cell supplied by Fuzhou BAK Power

2. Norms and Standard

The cells must be fulfilled the following Norms and Standard:

No.	Standard name	Remark
N1	UL1642	5th Edition
N2	UN38.3	UN Transportation Test
N3	IEC 62133	Edition 2 , Secondary cells and batteries
N4	IEC 61960	Secondary lithium cells and batteries for portable applications
N5	GB/T 31484-2015	
N6	GB/T 31486-2015	
N7	GB 38031-2020	

3. Definition 3.1 Room

Temperature $25\pm 2^{\circ}\text{C}$

3.2 Rated capacity

Rated capacity: $\text{Cap}=156\text{Ah}$. Under $25\pm 2^{\circ}\text{C}$, It means the capacity value of being discharged by 1-hours rate to end voltage 2.5V, which is signed Cap, the unit is Ah.

3.3 Charge Rate

The current value that the battery need to discharge its rated capacity in a stated time, which equal to a multiple of the rated capacity of the battery on the data value, usually expressed with the letter "C".

3.4 Cycle life

With the repeated charging and discharging, the battery's capacity will gradually decline. Usually the rated capacity of the battery is a standard, the number of charge-discharge cycles a battery can go through before it reaches 80% of its rated capacity called cycle life.

3.5 Open circuit voltage (OCV)

Open-circuit voltage is the difference of electrical potential between two terminals of a device when disconnected from any circuit.

3.6 Operating Voltage

Operating voltage, also known as the discharge voltage or load voltage, is defined as the potential difference between the battery terminals when the current transmits through the external circuit. Working voltage is always lower than the open circuit voltage, because when the current transmits through the battery internal, the polarization resistance and ohmic resistance must be overcome.

3.7 Standard charge method

Under $25\pm 2^{\circ}\text{C}$, it can be charged to 3.65V with constant current of 1.0C , and then, charged continuously with constant voltage of 3.65V until the charged current is 0.05C .

3.8 Standard discharge method

At $25\pm 2^{\circ}\text{C}$, it can be discharged to the ending voltage of 2.5 V with constant current of 1.0C .

3.9 Restore capacity

After storage, the capacity tested according to the standard charge and discharge conditions listed in section 3.7 and 3.8, the maximum of 3 measured values were selected as restore capacity.

3.10 Charge retention

The percentage of the discharge capacity and rated capacity after the battery stored in a certain temperature and time condition.

3.11 Capacity recovery capability

The percentage of the discharge capacity and rated capacity with recharging after the battery stored in a certain temperature and time.

3.12 State of charge (SOC)

The percentage of remaining energy. Only with estimating the battery SOC accurately can improve the utilization efficiency of the battery, and ensure the battery life and safety.

3.13 Units of measurement

- ① “V” (Volt) ,Unit of voltage
- ② “A” (Ampere) ,Unit of current
- ③ “Ah” (Ampere-Hour) ,Unit of electric charge
- ④ “Wh” (Watt-Hour) ,Unit of energy
- ⑤ “mΩ” (MilliOhm) ,Unit of resistance
- ⑥ “℃” (degree Celsius) ,Unit of temperature
- ⑦ “mm” (millimeter) ,Unit of length
- ⑧ “s” (second) ,Unit of time

⑨ “Hz” (Hertz) ,Unit of frequency

4. Cell type and size

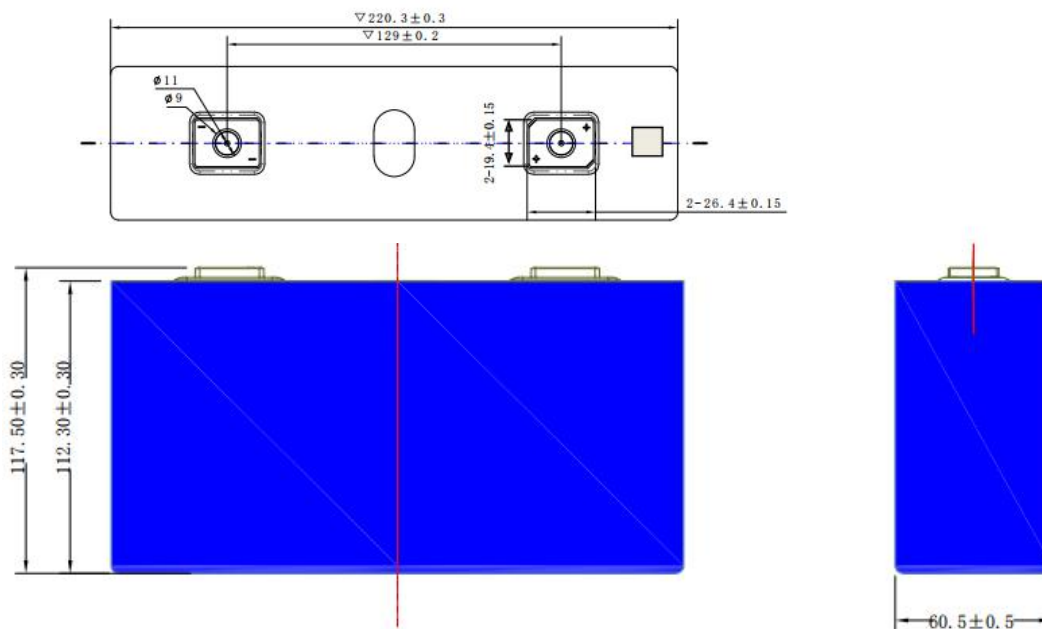
4.1 Description and model

Description: Prismatic Li-ion rechargeable cell

Model: LFP60220112-156Ah

4.2 Cell size

Cell physical dimension listed in following figure(unit: mm).



5. Product Performance

Fresh cell, tested at $25 \pm 2^\circ\text{C}$, standard charge and discharge unless otherwise specified

5.1 Technical Parameters

ITEM	SPECIFICATION
Typical capacity	156Ah

Nominal voltage	3.2V	
Charge voltage (End current)	3.65V	
Discharge ending voltage	2.5V	
Nominal energy	499.2Wh	
Max continuous discharge current	400A	
Max. charge current	312A	
Charge temperature range	0~+55℃	
Discharge temperature range	-20~+55℃	
Storage temperature		-10~+35℃
		-30~+55℃
Internal resistance	≤ 0.5mΩ(AC Impedance, 1000 Hz)	
Cycle life	≥2000cycles (standard charge and standard discharge)	
Weight	2.92±0.05kg	

5.2 Charging Model

NO.	Parameter	Values	Remarks
5.2.1	Standard Charging Model	the standard charge model according to the conditions listed in section 3.7	
5.2.2	Standard Charging Temperature	25±2℃	Cell Temperature
5.2.3	Absolute Charging Temperature	0~55℃	No matter what the charging model is, once the temperature of the cell is above the absolute charging temperature, charging should be stopped. —

5.2.4	Absolute Charging Voltage	Maximum 3.65V	No matter what the charging model is, including pulse charging, once the voltage of the cell is above the absolute charging voltage, charging should be stopped.
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<0°C			
0°C ~ 10°C	1/3C	0.5C	1C
10°C ~ 20°C	0.5C	1C	2C
20°C ~ 30°C	1C	2C	400A
30°C ~ 40°C	1C	1.5C	2C
40°C ~ 55°C	1/3C	1C	1C
>55°C			

5.3 Discharging Model

① Test Conditions

Unless otherwise specified, all the experiments should be carried out under ambient temperature: $25 \pm 2^\circ\text{C}$, relative humidity: 15%~90% and atmospheric pressure: 86KPa~106KPa.

② Requirements of Measuring Instruments and Facilities

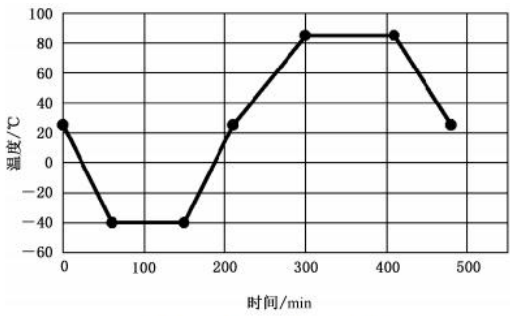
All of the measuring instruments and facilities (include the equipments which monitor the test parameters) should be verified and calibrated qualified by relevant Chinese Calibration Regulation or certain standards within the valid date. All the test instruments and equipments should have adequate precision and stability and the precision should be an order higher than the tested indicators or the tolerance should be less than one third of the tested parameters.

NO.	Items	Technical Requirements	Test Methods
1	Appearance	No damage, leakage, oil contamination. Legibly marked.	Visual Inspection
2	Discharging performance under room temperature	Discharging Capacity/Minimal Capacity×100% : a) Discharged at 1C ≥100% b) Discharged at 400A ≥90%	It's the capacity (in Ah) when batteries are discharged to 2.5V with 1C (or400A) at 25±
3	Discharging characteristics under high and low temperatures	Discharging Capacity/Minimal Capacity×100% : a) 55℃时≥95% Discharged at 55℃ ≥95% b) -20℃时≥70% Discharged at -20℃ ≥70%	High-temperature discharge capacity: a)Standard charge b)Be set aside for 5h at 55±2℃; c)Discharging the battery to 2.5V with 1C at 55±2℃, calculate the capacity. Low-temperature discharge capacity test: a)Standard charge b)Discharging the battery to 2.0V with 1C at -20±2℃, calculate the capacity 在-20±2℃
4	Cycle Life	≥次 ≥2000 cycles	a) At room temperature, charged to 3.65V at a constant current of 0.05C, b) Discharged at 1.0C to the cut-off voltage 2.5V

			<p>at room temperature;</p> <p>c) Repeating steps of a) ~ b), until the discharge capacity reached the 80% of rated capacity, the number of cycles completed was defined as the battery cycle life.</p>
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5.4 Safety Characteristics

NO.	Items	Technical Requirements	Test Methods & Steps
1	Over-discharge Test	No explosion. No fire. No leakage.	a) Standard charge b) Discharged for 90min with 1C current, observe 1 hour.
2	Overcharge Test	No explosion. No fire.	a) 1C CC Charge the battery to 1.1 times of the max charge voltage or continue to charge for 15%SOC after charge the battery to the max charge voltage, observe 1 hour.1C
3	Short-circuit Test	No explosion. No fire.	a)Standard charge b)Connect the battery positive and negative terminals with wire for 10min directly. The resistance of external line should be less than 5mΩ, observe 1 hour.
4	Thermal shock	No explosion. No fire.	a) Standard charge b) Put the battery into an oven at RT, and increase the temperature at a rating of 5 °C /min to 130±2°C, maintain for 30 minutes at that temperature, observe 1 hour.

5	Temperature cycling	No explosion. No fire. No leakage.	<p>a) Standard charge b) Reducing the chamber temperature to -40°C within 60 minutes and maintaining this temperature for 90 minutes. Raising the chamber temperature to 25°C within 60 minutes. Raising the chamber temperature to 85°C within 90 minutes and maintaining this temperature for 110 minutes. Reducing the chamber temperature to 25°C within 70 minutes. Repeating the sequence for a further 4 cycles, observe 1 hour.</p>  <table border="1" data-bbox="893 1164 1404 1478"> <caption>Temperature Cycling Data</caption> <thead> <tr> <th>时间/min</th> <th>温度/°C</th> </tr> </thead> <tbody> <tr><td>0</td><td>25</td></tr> <tr><td>60</td><td>-40</td></tr> <tr><td>150</td><td>-40</td></tr> <tr><td>210</td><td>25</td></tr> <tr><td>300</td><td>85</td></tr> <tr><td>410</td><td>85</td></tr> <tr><td>480</td><td>25</td></tr> </tbody> </table>	时间/min	温度/°C	0	25	60	-40	150	-40	210	25	300	85	410	85	480	25
时间/min	温度/°C																		
0	25																		
60	-40																		
150	-40																		
210	25																		
300	85																		
410	85																		
480	25																		
5	Crushing Test	No explosion. No fire.	<p>a) Standard charge b) Crush battery with half cylinder at a speed of $\leq 2\text{mm/s}$. The diameter of the half cylinder is 75mm. Stop to crush when voltage reached 0V or deformation amount reached 30% or pressure reached 100KN or 1000 times the weight of the subject, observe 1 hour.</p>																

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Notes: Refer to GB 38031-2020 *Safety requirements for traction battery of electric vehicle* for battery safety test.

5.5 Storage Performance

NO.	Parameter	Specifications	Condition
5.5.1	Restorable capacity (Short term)	$\geq 90\%$	Standard charged to 100% SOC, and storage for 30 days at $25 \pm 2^\circ\text{C}$
5.5.2	Restorable capacity (Long term)	$\geq 90\%$	Standard charged to 30% SOC, and storage for 90 days at $25 \pm 2^\circ\text{C}$

6. Precautions for Transportation

The Cell shall be shipped in capacity range of 30% ~ 40% or in accordance with customers' requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.

The batteries should be packed in boxes for transportation which should be conducted less than 30% SOC. They are also should be prevented from vibration, shock, extrusion, sun-scorched and rain-drenched. It could be delivered by car, train, boat, etc. If it will be delivered by air, please refer to MH/T 1020-2013 Standards for transport of lithium batteries by air.

7. Warranty

The Warranty period of cell is made according to business contract. However, even though the problem occurs within this period, BAK won't replace a new cell for free as long as the problem is not due to the failure of BAK manufacturing process or is due to customer's abuse or misuse.

BAK will not be responsible for trouble occurred by handling outside of the precautions in instructions.

BAK will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.

BAK will be exempt from warrantee any defect cells during assembling after acceptance.

8. Storage and Shipment Requirement

Item		Requirement
Storage environment	Short period less than 1 month	-30°C ~ +55°C, 90%RH Max
	Long period more than 3 month	-10°C ~ + 45°C, 90%RH Max
	Recommend storage	-10°C ~ + 35°C , 85%RH Max

Long time storage :

If the cell is stored for a long time, the cell's storage capacity rate should be less than 60% .Also, it is recommended to charge the cell every six months.

9. Warning and cautions in handling the lithium-ion cell

Lithium-Ion rechargeable batteries subject to abusive conditions can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before using utilization.

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

2. BAK will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

Danger warning (it should be described in manual or instruction for users, indicated especially) to prevent the possibility of the battery from leaking, heating, explosion. Please observe the following precautions:

Don't immerse the battery in water and seawater. Please put it in cool and dry environment if no using.

Don't use and leave the cell near a heat source such as fire or heater.

Do not use or leave the cell under the blazing sun (or in heated car by sunshine).

Being charged, using the battery charger specifically for that purpose.

Don't reverse the positive and negative terminals

Do not disassemble or modify the cell.

Do not use the cell with conspicuous damage or deformation..

Don't connect the cell to an electrical outlet directly.

Don't discard the cell in fire or heater.

Do not short circuit, over-charge or over-discharge the cell.

Don't transport and store the cell together with metal objects such as necklaces, hairpins.

Do not use lithium ion battery and others different lithium battery model in mixture.

Keep the battery away from babies.

Don't strike, throw or trample the cell.

Prohibition of use of damaged cells.

Battery pack designing and packing Prohibition injury batteries.

The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

Be aware discharged batteries may cause fire; tape the terminals to insulate them..

Do not use it in a location where is electrostatic and magnetic greatly, otherwise, the safety devices may be damaged, causing hidden trouble of safety.

Do not directly solder the battery and pierce the battery with a nail or other sharp object.

When disposing of secondary cells, keep cells of different electrochemical systems separate from each other.

Cautions!

Don't use or leave the cell at very high temperature conditions (for example, strong direct sunlight or a vehicle in extremely hot conditions).

10. Emergency Treatment

If the cell leaks and the electrolyte get into your eyes, don't wipe eyes, instead, thoroughly rinse the eyes with clean running water for at least 15 minutes, and immediately seek medical attention. Otherwise, eyes injury can result.

If the cell gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during usage, recharging or storage, immediately remove it from the device or cell charger and stop using it.

In case the cell terminals get dirty, clean the terminals with a dry cloth before use.

11. The restriction of the use of hazardous substances

This model of lithium-ion cell is in accordance with our company's request of

“The hazardous substances and material management standard” or customer's requirements.