



Specification for Lithium-ion Rechargeable Cell

Cell Type: 32140FS

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1. Preface

This Product Specification describes the technique requirements, test procedures and precaution notes of cylindrical type Lithium-ion Rechargeable cell to be supplied to customer by NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED.

2. Description

2.1. Product : Lithium-ion Rechargeable cell

2.2. Model (Type) : 32140FS

2.3. Designation :

32	140	F	S
①	②	③	④

①: Indicates the diameter of cell

②: Indicates the overall height of cell

③: Indicates the property of the cell

The letter "F" defines LiFePO₄ series cathode

④: Indicates the property of the cell

The letter "S" defines steel can cell

3. Cell Size

For details, please refer to Figure A. Remark: contain PET cover

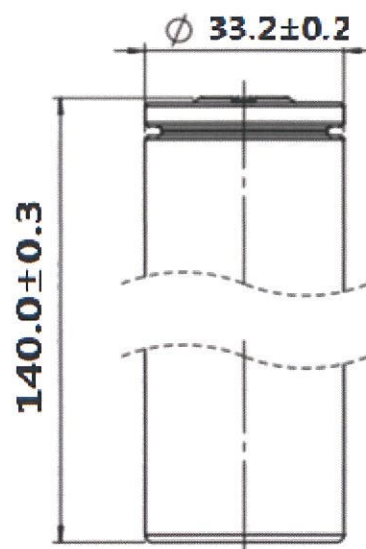


Figure A

4. Construction

A cell is made of cathode, anode, separator, steel can and caps.



5. Specification

Fresh cell, all tests stated in this Specification is Standard Test Conditions.

Item		Specification				Remark	
Typical Capacity		15000mAh				0.5C discharge capacity	
Minimum Capacity		14500mAh					
Internal Impedance		1.0 mΩ≤IR<3.0mΩ				By AC 1 kHz	
Nominal Voltage		3.20 V					
Cell Weight		300±5.0g				contain package	
Energy Density		160Wh/kg					
End-of-charge Voltage		3.6V				At CC mode	
End-of-discharge Voltage		2.0V				At CC mode	
Standard Charging		0.5C CC/CV, cut off 0.05C				180min	
Standard Discharging		0.5C CC, cut off 2.0V					
Max Continuous Charge (Cell Surface Temperature)		0~10℃	10~20℃	20~45℃	45~50℃	50~55℃	55~60℃
		0.2C	0.5C	1C	0.5C	0.2C	0.1C
Max Continuous Discharge		2C					
Max Pulse Discharge		6C (10s)					
Cycle Life		≥2000 cycles				+0.5C/-0.5C, 25±2℃	
Operating Temperature Range	Charging/Discharging Temperature (Cell Surface Temperature)	0~60℃ /-30~60℃					
	Storage Temperature	-20~45℃				3month	
		-10~25℃				6month	
Shelf Life		1year					
Appearance		Without break, scratch, distortion, contamination, leakage and so on					



6. Test Conditions

6.1. Standard Test Conditions

Unless otherwise specified, all tests stated in this Specification are conducted at temp. $25 \pm 2^{\circ}\text{C}$ and humidity 15-90%RH

6.2. Standard Charge and Discharge Method

The "Standard Charge" means charging the Cell at a constant current of 0.5C until the voltage is 3.6V, then charged at a constant voltage of 3.6V until its current is less than 0.05C.

The "Standard Discharge" means discharging the Cell at a constant current of 0.5C until the voltage is 2.0V

7. Electrical Characteristics

Test Item	Test Method	Criteria
1) High Temperature Performance	A cell is charged in accordance with Standard Charge, and stored in an ambient temp. of $60 \pm 2^{\circ}\text{C}$ for 4hrs, then discharged in accordance with Standard Discharging. After that, fetch out the cell and place it in Standard Test Conditions for 4hrs, then check its appearance.	1. Capacity $\geq 95\%$; 2. No distortion, no rupture.
2) Low Temperature Performance	A cell is charged in accordance with Standard Charge, and stored in an ambient temp. of $-20 \pm 2^{\circ}\text{C}$ for 4hrs, then discharged to 1.8V at a constant current of 0.5C. After that, fetch out the cell and place it in Standard Test Conditions for 4hrs, then check its appearance.	1. Capacity $\geq 70\%$ 2. No distortion, no rupture
3) C-Rate Performance	A cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged to cut-off voltage at a constant current of 0.2C, after that, stored 30min; then the cell is charged and discharge as above except that at a discharged constant current of 0.5C; then the cell is charged and discharge as above except that at a discharged constant current of 1C; then the cell is charged and discharge as above except that at a discharged constant current of 2C.	0.5C Capacity/0.2C Capacity $\geq 95\%$; 1C Capacity/0.2C Capacity $\geq 93\%$; 2C Capacity/0.2C Capacity $\geq 90\%$;



4) Capacity Retention and recovery	A cell is charged in accordance with Standard Charge, and stored in $55 \pm 2^{\circ}\text{C}$ for 7d, after that stored for 5hrs at room temperature, then discharged in accordance with Standard Discharging. After that, stored 30min the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharging.	Capacity retention: $\geq 90\%$ Capacity recovery: $\geq 95\%$
	A cell is charged in accordance with Standard Charge, and stored in Standard Test Conditions for 28d, then discharged in accordance with Standard Discharging. After that, stored 30min the cell is charged in accordance with Standard Charge, after that stored for 30min, then discharged in accordance with Standard Discharging.	Capacity retention: $\geq 90\%$ Capacity recovery: $\geq 95\%$
5) Cycle Life	At Temp.: $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, a cell is charged at a constant current of 0.5C until the voltage is 3.6V, then charged at a constant voltage of 3.6V until its current is less than 0.05C, after that stored for 30min; then discharged at a constant current of 0.5C until the voltage is 2.0V, after that, stored 30min prior to next charge-discharge cycle. The cell shall be continuously charged and discharged for 2000 times.	capacity retention: $\geq 80\%$

8. Safety Characteristics

All below tests are carried out on the equipment with forced ventilation and explosion-proof device. Before test, all cells are charged in accordance with Standard Charge, and stored 1hrs prior to testing.

Test Item	Test Method	Criteria
1) Forced-Discharge Test (GB 38031 8.1.2)	A cell is discharged at a constant current of 1C until the discharge time reaches 90min, then observed the cell for 1h.	No fire, no explosion.



2) Overcharge Test (GB 38031 8.1.3)	A cell is charged in accordance with Standard Charge, then charged the cell up to 4V or 115%SOC at CC of 1C, then observed the cell for 1h.	No fire, no explosion.
3) Short-circuit Test (GB 38031 8.1.4)	Short circuit the positive terminal and negative terminal of the cell externally for 10min (external line resistance < 5mΩ), then observe for 1h.	No fire, no explosion.
4) Heating Test (GB 38031 8.1.5)	A cell is to be heated in a circulating air oven. The temperature of the oven is to be raised at a rate of 5℃±2℃ per minute to a temperature of 130℃ ±2℃ and remain for 30min at that temperature before the test is discontinued, then observed the cell for 1h.	No fire, no explosion
5) Temperature Test (GB 38031 8.1.6)	A cell is charged in accordance with Standard Charge, heated the cell to be in an oven. In 60min, the temperature of the oven is to be dropped to the temperature of -40℃ and remain for 90min at -40℃; In 60min, the temperature of the oven is to be raised to the temperature of 25℃; In 90min, the temperature of the oven is to be dropped to the temperature of 85℃ and remain for 110min at 85℃; In 70min, the temperature of the oven is to be dropped to the temperature of 25℃; Repeat this for 5 cycles, after that observed the cell for 1h, then check cell's appearance.	No fire, no explosion.
6) Crush Test (GB 38031 8.1.7)	A cell is to be placed on the crush surface, the axis is parallel to the crush surface, it is to be crushed between two flat surfaces. The pressure is gradually increased at an extrusion speed of ≤2mm/s until the voltage reaches 0V or the deformation reaches 15% or the squeezing force reaches 100kN or 1000 times the weight of the cell, keep the pressure for 10 minutes, and observe for 1 hour.	No fire, no explosion.



7) Drop Test (GB/T 31485 6.2.5)	A cell is charged in accordance with Standard Charge, then dropped the cell from a height of 1.5m to the concrete ground with positive and negative terminals downward, then observed the cell for 1h.	No leakage, no fire, no explosion
8) Impact Test (UL 1642 14)	A cell is to be placed on the impact flat. A $\Phi 15.8\text{mm}$ bar is to be placed on the center of the cell. A 9.1kg weight is to be dropped from a height of 610mm onto the cell, the distortion is allowed.	No fire, no explosion
9) Vibration Test (UL 1642 16)	A cell is charged in accordance with Standard Charge, then installed onto the vibration desk with clamps. Equipment parameters of frequency and amplitude are as follows (the frequency is to be varied at the rate of 1Hz/min between 10 and 55 hertz, and repeat vibration for 90-100min, amplitude: 0.16mm. The cell is to be tested in three mutually perpendicular directions)	No leakage, no fire, no explosion
10) Low-pressure Test (UL1642 19)	A cell is charged in accordance with Standard Charge, then stored it for 6hrs at an absolute pressure of 11.6kPa, then check cell's appearance.	No leakage, no fire, no explosion

9. Shipment

The Cell shall be shipped in 20-30% state of charge (SOC) or in accordance with customers' requirement. The remaining capacity before charging shall be changed depending on the storage time and conditions.

10. Warranty

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

NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED will not be responsible for trouble occurred by handling outside of the precautions in instructions.



NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED will not be responsible for trouble occurred by matching electric circuit, cell pack and charger.

NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED will be exempt from warrantee any defect cells during assembling after acceptance.

11. Precautions and Safety Instructions

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 NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED in advance, if and when the customer needs other applications or operating conditions than those described in this document.

Note 2. NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

11.1 Standard cell Precautions

- a) Do not throw the Battery cell into fire or heat it.
- b) Do not short circuit, over-charge or over-discharge the cell.
- c) Do not subject the cell to strong mechanical shocks.
- d) Do not immerse the cell in water or sea water, or get it wet.
- e) Do not reverse the polarity of the cell for any reason.
- f) Do not disassemble or modify the cell.
- g) Do not handle or store with metallic like necklaces, coins or hairpins, etc.
- h) Do not use the cell with conspicuous damage or deformation.
- i) Do not connect cell to the plug socket or car-cigarette-plug.
- j) Do not touch a leaked cell directly.
- k) Do not use Lithium-ion cell in mixture.
- l) Do not use or leave the cell under the blazing sun (or in heated car by sunshine).



- m) Keep cell away from children.
- n) Do not drive a nail into the cell, strike it by hammer or tread it.
- o) Do not give cell impact or fling it.
- p) Do not put Battery Cell into microwave oven or high pressure container.

11.2 Cell Operation Instructions

11.2.1 Charging

- a) When the Battery Cell is charged, the specified charge method and current described in this PS-Document should apply. If charge current exceeds the upper limit of the specified range, characteristics and safety of the Battery Cell could be deteriorated, or it may cause heat, explosion and fire.
- b) Charge voltage should not exceed 3.65V.
- c) Charge the cell in a temperature range of 0°C to 60°C.
- d) Use a constant current, constant voltage (CC/CV) lithium-ion (Li+) cell charge controller.

11.2.2 Discharging

- a) The discharge current should not exceed the designated current described in this PS-Document. If the discharge current exceeds the specified value, discharge capacity could be extremely deteriorated or the Cell could be heated
- b) For maximum performance, discharge the cell in a temperature range of -30°C to + 60°C.

11.2.3 Storage Recommendations

- a) Do not store the Battery Cell together with combustibles.
- b) In case of long period storage (more than 3 months), storage the cell at temperature range of -10 ~ 25°C, low humidity, no corrosive gas atmosphere, and recommend to charge/discharge once every 3 months, and the SOC remains between 25-75%.
- c) No press on the cell

2. Consultation

As to the obscurity, contact the following.

Address: No. 5, Cangxi Road, Gaochun District, Nanjing

Tel No.: +86—025—57878020

<http://www.cbak.com.cn>



3. Requirement for Safety Assurance

For the sake of safety, please consult NANJING CBAK ENERGY TECHNOLOGY COMPANY LIMITED for equipment design, lithium-ion cell system protection circuit or high current, fast charging and other special applications.