

# Specification For Lithium-ion Rechargeable Cell

Cell Type : 18650



## 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 18650S20 -2000 cell supplied by Akyga battery.

## 2 Definition

## 2.1 Rated capacity:

Rated capacity: Cap=2000mAh.Under 25±2.5°C, It means the capacity value of being discharged by 5-hours rate to end voltage 2.75 V, which is signed Cap, the unit is mAh.

## 2.2 Standard charge method:

Under  $25\pm2.5$  °C, it can be charged to 4.2V with constant current of 0.5C, and then, charged continuously with constant voltage of 4.2V until the charged current is 0.01C.

## 2.3 Standard discharge method:

Under 25±2.5°C, it can be discharged to the voltage of 2.75V with constant current of 0.5C.

## 3 Cell type and size

## 3.1 Description and model

**Description:** Cylindrical Li-ion rechargeable cell **Model:** 18650S20 -2000mAh

## 3.2 Cell bar code and explanation

Cell bar code as following:

|              | Cell type | + | Cell batch code | - | + Serial number |
|--------------|-----------|---|-----------------|---|-----------------|
| For example: | 18650S20  | + | CL22E04         | + | 000001          |



# 3.3 Cell size

Cell physical dimension listed in Figure 1(unit: mm).



# 4 Cell specification

| ITEM                       | SPECIFICATION   |
|----------------------------|---|
| Normal capacity            | 2000 <u>mAh@0.5C</u>  |
| Minimum capacity           | 2000 <u>mAh@0.5C</u><br>(Discharge the cell from 4.2V to 2.75V by 0.5C current) |
| Normal voltage             | 3.7V  |
| Charging voltage           | 4.2 ±0.05 V   |
| Discharge ending voltage   | 2.75±0.05 V   |
| Standard charging current  | 0.5C(1000 mA)   |
| Standard discharge current | 0.5C(1000mA)  |



| Max charge current  | 1C(T≥10°C)                                   |  |
|---|--|--|
|   | 0.5C(10℃>T≥0℃)                               |  |
|   | 3C(T≥0°C)                                    |  |
| Max discharge current   | 1C(0°C>T≥-10°C)                              |  |
|   | 0.5C(-10°C>T≥-20°C)                          |  |
| Max discharge current   | 5C   |  |
| Max recommended charge and  | Charge:0~ 45°C                               |  |
| discharge cell body temperature   | Discharge:-20~ 60°C                          |  |
|   |  |  |
| Maximum short term allowable<br>charge and discharge cell body<br>temperature. Charging and<br>discharging at these conditions will<br>shorten cell cycle life. | Charge: 50℃<br>Discharge: 60℃                |  |
| Humidity range  | $0\sim90\%$ RH(non-condensing                |  |
| Internal resistance   | $\leq$ 35 m $\Omega$ (AC Impedance, 1000 Hz) |  |
| Cell dimension  | Height : 65.50mm Max                         |  |
|   | Diameter : 18.50mm Max                       |  |
| Weight  | < 48g  |  |

## 5 Technical characteristics

#### 5.1 Cell usage conditions

Temperature of charge :  $0 \sim 45^{\circ} C$ 

Temperature of discharge:  $-20 \sim 60 \,^{\circ}\text{C}$ 

## 5.2 Cell testing conditions

Unless otherwise specified, all tests stated according to following:

Temperature : 25±2.5℃

## 5.3 Requirement of the testing equipment

Voltage meter: The voltage tester internal resistance is  $\geq 10 \text{ K}\Omega/\text{V}$ 

Temperature meter: The precision is  $\leq 0.5$  °C



| 5.4   | Electronic performance                     |   |
|-------|--|---|
| NO.   | ITEM                                       | CRITERION   |
| 5.4.1 | Discharge rate capability                  | Cap(0.5C)/Cap(0.2C)≥95%<br>Cap(1.0C)/Cap(0.2C)≥90%<br>Cap(2.0C)/Cap(0.2C)≥80%   |
| 5.4.2 | Cycle life                                 | Cap(100th)/Cap(Avg10)≥90%<br>Cap(300th)/Cap(Avg10)≥80%  |
| 5.4.3 | High-Low temperature discharge performance | Cap(-10°C)/Cap(25°C)≥70%<br>Cap(0°C)/Cap(25°C)≥85%<br>Cap(60°C)/Cap(25°C)≥95%   |
| 5.4.4 | Storage performance                        | Residual capacity / Original discharge capacity $\ge 85\%$<br>Recover capacity / Original discharge capacity $\ge 85\%$ |

## 5.5 Environmental characteristics

| NO.   | ITEM      | CRITERION                                | TESTING METHOD  |
|-------|-----------|--|---|
|       |           |  |   |
| 5.5.1 | Vibration | There shall be no<br>electrolyte leakage | After standard fully charge, cell shall be attached to a vibration table directly and subjected to vibration that consists of 10 Hz to 55 Hz to 10 Hz at the speed of 1Hz/min in 90~100mins.The total excursion of the vibration is 0.8mm(0.060 inches). The cell shall be vibrated in each direction along axis of the cylinder and the vertical directions of axis of the cylinder. |



# 5.6 Safety characteristics

| NO.   | ITEM                  | CRITERION   | TESTING METHOD   |
|-------|-----------------------|---|--|
| 5.6.1 | Overcharge<br>test    | No leakage、No flame、<br>No fire、No explode  | The cell is discharged following the standard discharge method. Apply a 5V power supply and a 3C charge current for 1.5hrs.  |
| 5.6.2 | 130℃hot oven<br>test  | When the temperature<br>of the cell is 130°C.<br>Cell must not fire or<br>explode in 60 minutes | The cell is charged following the standard charge method. After charging the cell is put in the oven. And then the oven temperature will be ramped at $5^{\circ}$ C per minute to $130^{\circ}$ C and held at $130^{\circ}$ C. When the temperature of the cell reach $130^{\circ}$ C, the cell is maintained in the $130^{\circ}$ C oven for a maximum of 60 minutes or until a fire or explosion is obtained, whichever comes first. Record the time that the cell temperature reaches $130^{\circ}$ C and the time when a fire or explosion occurs. |
| 5.6.3 | Crush test            | No fire、No explode  | After charging a cell following the standard charge method, the cell shall<br>be crushed between two flat surfaces. The direction of the crushing force<br>shall be vertical to axis of the cylinder. The crushing force is to be applied<br>by a hydraulic ram with a 32mm diameter piston. Crushing force is<br>approximately 13 KN. Once the maximum pressure has been obtained it is<br>to be released.  |
| 5.6.4 | Short circuit<br>test | No fire、No explode  | Cell shall first be charged according to standard charge method, and then cell is to be short-circuited by connecting the positive and negative terminals of the cell with copper wire having a maximum resistance load of 50 m $\Omega$ . This test is done at room temperature and at 60°C (different cells). Monitor the cell temperature while testing. The cell is continuously discharged until the cell case temperature has returned to be 10°C less then peak temperature.  |



| 5.6.5 | Impact test  | No flame、No fire、No<br>explode | Cell shall first be charged according to standard charge method, then the<br>battery cell was placed on a flat surface so that the longitudinal axis of the<br>battery cell shall be parallel with it.<br>A 7.9mm diameter bar is to be placed across the center of the sample.<br>A 9 1kg weight is to be dropped from a height of 61cm on the sample |
|-------|--|--------------------------------|--|
| Note  | All above safety tests will be conducted at 25°C±2.5°C except where specified differently. Use proper ventilation with protective equipment. |                                |  |

# 6 Warning and cautions in handling the lithium-ion cell

To prevent the possibility of the cell from leaking, heating, explosion, please observe the following precautions:

- » Don't immerse the cell in water.
- » Don't use and leave the cell near a heat source such as fire or heater.
- **w** When charging, use a cell charger specifically for that purpose.
- » Don't reverse the positive and negative terminals.
- » Don't connect the cell to an electrical outlet directly.
- » Don't discard the cell in fire or heater.
- » Don't connect the positive and negative terminal directly with metal objects.
- » Don't transport and store the cell together with metal objects such as necklaces, hairpins.
- » Don't strike, throw or trample the cell.
- » Don't directly solder the cell.
- » Don't pierce the cell with a nail or other sharp object.



## Caution

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

## 7 The restriction of the use of hazardous substances

This model of lithium-ion cell is in accordance with our company's request of "environmental substances control standard".