



**PLS Battery Co., Ltd**

**Ver:**

**A**

**DATE:**

**2013-09-20**

DOC No:

PLS-ICR18650MC-2000

**CUSTOMER NO:** \_\_\_\_\_

## Specification Approval Sheet

**MODEL: 18650**

(2000mAh 3.7V)

| Prepared By/Date | Checked By/Date | Approved By/Date |
|------------------|-----------------|------------------|
|                  |                 |                  |

**Customer Name:**

**Comment:**

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## Amendment Records

| Revision | Description   | Prepared by | Approved by | Date |
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## 1 Scope

This specification is applying to describe the related Battery product in this Specification and the Battery/cell supplied by PLS Battery Co., Ltd only.

## 2 Model:18650MC-2000mah-10C

## 3 Cell Specification

| No. | Items   | Specifications  |                       | Remark  |
|-----|---|---|-----------------------|---|
| 1   | Nominal Capacity                                  | 2000mAh   |                       | 0.2C Standard discharge   |
| 2   | Minimum Capacity                                  | 1960mAh   |                       |   |
| 3   | Nominal Voltage                                   | 3.7V  |                       | Mean Operation Voltage  |
| 4   | Delivery voltage                                  | 3.7~3.9V  |                       | Within 10 days from Factory   |
| 5   | Charge Voltage                                    | 4.2V±0.03V  |                       | By standard charge method   |
| 6   | Standard charging method                          | 0.2C constant current,4.2V constant voltage charge to 4.2V,continue charging till current decline to ≤0.01C |                       | About 5h (Ref)  |
| 7   | Charge current                                    | 0.5C  | 1000mA                | Standard charge, charge time about 4h(Ref)  |
|     |   | 1.0C  | 2000mA                | Rapid Charge, charge time about: 2.5h(Ref)  |
| 8   | Weight  | About 45g   |                       |   |
| 9   | Cell Internal Impedance                           | ≤60mΩ   |                       | Internal resistance measured at AC 1KHz after 50% charge  |
| 10  | Maximum charge current                            | 1C  | 2000mA                | For continuous charging mod   |
| 11  | Maximum discharge current                         | 10C   | 20000mA               | For continuous discharge mod, Initial discharge capacity in the standard of discharge capacity of more than 80%   |
| 12  | Operation Temperature and relative humidity Range | Charge  | 0~45℃<br>60±25%R.H.   | Charge at a very low temperature such as blew 0℃,will be get a lower capacity and reduce cycle life of the battery  |
|     |   | Discharge   | -20~60℃<br>60±25%R.H. |   |
| 13  | Storage temperature for a long time               | -20~25℃<br>60±25%R.H.   |                       | Do not storage exceed half year. Must charge once when storage for half year. must charge the battery which with protect circuit when storage for three months. |



## 4 Battery/Cell performance test Criteria

### 4.1 Appearance inspection by visual

There shall be no such defect as rust, leakage, which may adversely affect commercial value of battery.

### 4.2 Environmental test condition

Unless otherwise specified, all test stated in this product specification are conduct at below test condition

Temperature: 20℃~25℃

Relative Humidity:60%±25% R.H.

### 4.3 Cell Electrical characteristics

| No | Items  | Test Method and Condition  | Criteria   |        |
|----|--|--|--|--------|
| 1  | Rated Capacity at 0.2C(Min.)                 | After standard charge, the capacity shall be measured on 0.2C discharge till the voltage discharge to 3.0V   | ≥1960mAh   | ≥100%  |
|    | Rated Capacity at 0.5C(Min.)                 | After standard charge, the capacity shall be measured on 0.5C discharge till the voltage discharge to 3.0V   | ≥1911mAh   | ≥97.5% |
|    | Rated Capacity at 1C(Min.)                   | After standard charge, the capacity shall be measured on 1C discharge till the voltage discharge to 3.0V   | ≥1882mAh   | ≥96%   |
| 2  | Cycle Life                                   | Charging and discharging battery as blew conditions<br>0.2C standard charge to 4.2V end-off<br>0.2C standard discharge to 3.0V cut-off<br>Continuous charge and discharge for 500 cycles, the capacity will be measure after the 500 <sup>th</sup> cycle   | ≥70% of initial capacity                                   |        |
| 3  | Capacity retention                           | The battery to be charge in accordance with standard charge condition at 20~25℃, then storage the battery at an ambient temperature 20~25℃ for 28 days.<br>Measure the capacity after 30 days with 0.2C at 20~25℃ as retention capacity  | Retention capacity<br>≥85%                                 |        |
| 4  | Temperature Dependence of discharge capacity | Cells shall be charged per 3.3.1 and discharged @0.2 C <sub>5</sub> A to 3.0 volts. Except to be discharged at temperatures per Table 3.<br>Cells shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature.<br>The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 °C and the percentage shall be calculated. | Each cell shall meet or exceed the requirements of Table 3 |        |



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Table 3

| Discharge Temperature                     | -20℃ | -10℃ | 0℃  | 23℃  | 60℃ |
|---|------|------|-----|------|-----|
| Discharge Capacity (0.2 C <sub>5</sub> A) | 40%  | 50%  | 80% | 100% | 95% |

## 4.4 Mechanical characteristics

| No | Items          | Test Method and Condition  | Criteria                          |
|----|----------------|--|-----------------------------------|
| 1  | Free fall test | The battery to be fully charged in accordance with standard charge condition, then drop the battery three times from a height of 1,0 m onto a concrete floor. The batteries are dropped so as to obtain impacts in random orientations.  | No Fire,                          |
| 2  | Vibration test | After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes. | No explosion ,No leakage, No fire |



#### 4.5 Safety performance

| No | Items                 | Test Method and Condition  | Criteria  |
|----|-----------------------|--|---|
| 1  | Thermal exposure test | Each fully charged cell, stabilized at room temperature, is placed in a circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min $\pm$ 2 °C/min to a temperature of 130 °C $\pm$ 2 °C. The cell remains at this temperature for 10 min before the test is discontinued. | No explosion, No fire   |
| 3. | Short test            | The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100m $\Omega$ . Tests are to be conducted at room temperature 20~25°C.   | No explosion, No fire<br>The Temperature of the Battery surface not exceeded than 150°C |
| 4  | Short test            | The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100m $\Omega$ . Tests are to be conducted at room temperature about 60-65°C  | No explosion, No fire<br>The Temperature of the Battery surface not exceeded than 150°C |
| 5  | Forced discharge test | A discharged cell is subjected to a reverse charge at 1C for 90 min.   | No explosion, No fire   |
| 6  | Over charge test      | After standard charge, continue to charge with a constant voltage 10V per a cell, holding 8h.  | No explosion, No fire   |



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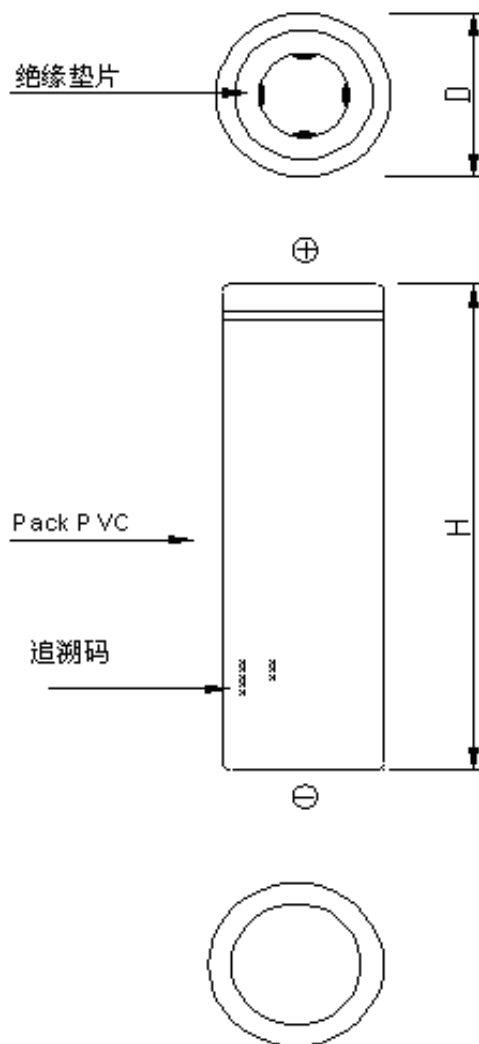
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## 5 Cell initial Dimensions



| NO | Items        | Units: mm |
|----|--------------|-----------|
| 1  | diameter (D) | 18.2±0.3  |
| 3  | Height (H)   | 65.0±0.5  |

| Draw | Checked | Approved |
|------|---------|----------|
|      |         |          |





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## 6 CAUTIONS IN USE

To ensure proper use of the battery please read the manual carefully before using it.

### . Handling

- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.

### . charge and discharge. Battery must be charged in appropriate charger only.

- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

### . storage: Store the battery in a cool, dry and well-ventilated area.

### . disposal

- Regulations vary for different countries. Dispose of in accordance with local regulations.

## 7 Period of Warranty

The period of warranty is one year from the date of shipment. PLS guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customer abuse and misuse.

## 8 Storage of the Batteries

The batteries should be stored at room temperature, charged to about 30% to 50% of capacity.

We recommend that batteries be charged about once per half a year to prevent over discharge.

## 9 Other The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

## 10 Note

Any other items which are not covered in this specification shall be agreed by both parties.

