WAMA ELECTRONICS TECH CO.,LTD

1. SCOPE AND APPLICATION

This specification describes the definition, technical requirement, testing method, warning and caution of the lithium ion rechargeable battery. The specification only applies to battery ***ICR18650 2600mah*** .

2. DEFINITION

2.1 Rated Capacity: Under 20±5℃, 65±5%RH, its means the capacity value of charging to End Voltage. The capacity value can be expressed with code C_5. Its unit is mAh. For battery icr-18650, C_5 =2600

2.2 End Voltage： The end voltage of discharge is 2.75V, which is defined specially.

2.3Standard Charge: Under 20±5℃, 65±5%RH, it can be charged to 4.2V with constant current of 0.2 C_5mA, and then , charged continuously with constant voltage of 4.2V until the charged current is less than 0.01 C_5mA.

2.4 Quick Charge: Under 20±5℃, 65±5%RH, it can be charged to 4.2V with constant current of 1 C_5mA, and then , charged continuously with constant voltage of 4.2V until the charged current is less than 0.01 C_5mA.

2.5。Standard Discharge: Under 20±5℃, 65±5%RH, it can be discharged to the voltage of 2.75V with constant current 0.2 C_5mA.

2.6 Quick Discharge: Under 20±5℃, 65±5%RH, it can be discharged to the voltage of 2.75V with constant current 1 C_5mA.

3. NAMING INSTRUCTION

3.1 Naming instruction of product is shown as Fig. 1

ICR 18 65

Physical Dimension : Diameter Height

4. STRUCTRUE

The battery consists of the positive electrode plate, negative electrode plate, separator, electrolyte and case.

5. 技 TECHNICAL REQUIREMENT

5.1 Usage Conditions

Charging Temperature: 0~45℃

Discharging Temperature: -20~65℃

Related Humidity: <93%

Atmospheric Pressure: 86~106Kpa

5.2

Appearance: without break, scratch, distortion, contamination and leakage.

5.3 Rated Capacity : 2600mAh

5.4 Internal resistance: 40~80mΩ

5.5 Open Voltage: 3.6V

5.6 Weight: About 45 g

5.7 Discharging Characteristic

Time of Standard Discharge should be more than 5hrs.

Time of Quick Discharge should be more than 0.9hrs.

5.8 Charge Retention: more than 4.25hrs. discharge

5.9 Cycle Life: more than 300 cycles

5.10 Environmental Characteristic

5.10.1 Hi-temperature testing: discharging time can meet item 5.7 and Visual inspection can meet item 5.2 after testing.

5.10.2 Low-temperature testing: discharging time can meet item 5.7 and Visual inspection can meet item

5.2 after testing.

5.10.3 Constant temperature and humidity testing: discharging time can meet item 5.7 and Visual inspection can meet item 5.2 after testing.

5.10.4 Vibration: discharging time can meet item 5.7 and Visual inspection can meet item 5.2 after testing.

5.10.5 Impacting testing: discharging time can meet item 5.7 and Visual inspection can meet item 5.2 after testing.

5.10.6 Free fall: discharging time can meet item 5.7 and Visual inspection can meet item 5.2 after testing.

5.11 Safe Characteristic

5.11.1 Over charge testing: without break, leakage and the time of quick discharge meet item 5.7 after testing.

5.11.2 Over discharge testing: without break, leakage and the time of quick discharge meet item 5.7 after testing.

6. TESTING METHODS

6.1 Testing conditions

Temperature: 15-35℃

Relative Humidity: 45-75%

Atmospheric pressure: 86-106Kpa

6.2 Requirement of the Testing Equipment

Voltage tester: the precision of voltage tester is no less than grade 0.5 , the internal resistance is no less than 10KΩ/V.

Current tester: the precision is no less than grade 0.5.

Stopwatch: the precision is no more than 0.1%.

6.3 Visual inspection。

Eyeballing will be used to inspect the appearance, construction and marking of the battery. And also its result can meet Item 5.2.

6.4 Standard Capacity testing

At average temperature 20±5℃, the battery will be charged according to the requirement of standard charge, after keeping the battery for 1~12hrs., The battery will be discharged until the voltage reaches end voltage according to the requirement of standard discharge.

6.5 Charge Retention Testing

At average temperature 20±5℃, the battery will be charged according to the requirement of standard charge after passing item 6.4, and to keep the battery open-circuit 28 days , then the battery will be discharged according to the requirement of standard discharge . The discharging time can meet the requirement of item 5.7.

6.6 Cycle life testing

The battery will be discharged according to the requirement of standard discharge before cycle life testing. At average temperature 20±5℃, the battery will be charged for 2.5hrs. according to the requirement of quick charge, then it will be discharged with current $0.5C_5$mA until the voltage reaches the end voltage. So continuous three cycle will be finished. To do the cycle continuously, once the discharge time of any cycles is less than 96min., the cycle life testing will be stopped.

6.7 Environmental Characteristic

6.7.1 Hi-temperature testing

a) At room temperature （20±5℃） and normal atmospheric pressure , to inspect the sample battery visually ,then the battery will be charged according to standard charge.

b) The battery will be charged according to the requirement of standard discharge before testing ， keep the battery at 65±5℃ for 2hrs. , then the battery will be discharged according to the requirement of quick discharge, the discharging time can meet the requirement of item 5.7.

c) After above testing, to keep the battery at 20±5℃ and the environment of normal atmospheric pressure for 1~2hrs. , the result of visual inspection can meet item 5.2.

6.7.2 Low temperature testing

a) At room temperature （20±5℃） and normal atmospheric pressure , to inspect the sample battery

visually ,then the battery will be charged according to standard charge.

b) To keep the battery at the temperature of -20±2℃for 2 hrs., Then the battery will be discharged according to standard discharge, and the time of Standard Discharge should be more than 3.5hrs. After above testing , to keep the battery at 20±5℃ and the environment of normal atmospheric pressure for 1~2hrs. The result of visual inspection can meet item 5.2

c) According to the requirement of quick discharge, the battery will be discharged and the time can meet item 5.7

6.7.3 Constant temperature and humidity testing

a) At room temperature （20±5℃） and normal atmospheric pressure , to inspect the sample battery visually ,then the battery will be charged according to standard charge.

b) To keep the battery at the temperature of 40±2℃, and the relative humidity of 90~95% for 48hrs. After above testing , to keep the battery at 20±5℃ and the environment of normal atmospheric pressure for 1~2hrs.The result of visual inspection can meet item 5.2.

c) According to the requirement of quick charge and quick discharge, the battery will be discharged and the time can meet item 5.7 no more than 3 cycles.

6.7.4 Vibration testing

a) At room temperature （20±5℃） and normal atmospheric pressure , to inspect the sample battery visually ,then the battery will be charged according to standard charge.

b) The battery will be vibrated 10 times in each direction of X, Y, Z with changing frequency of 10~55HZ and amplitude of 0.35 mm. The rate of scan frequency is from 10~55HZ per min.

c) After above testing, to keep the battery at 20±5℃ and the environment of normal atmospheric pressure for 1~2hrs. , The result of visual inspection can meet item 5.2.

d) According to the requirement of quick discharge, the battery will be discharged and the time can meet item 5.7

6.7.5 Impact Testing

a) At the temperature of （20±5）℃ and the normal atmospheric pressure ,to inspect the sample battery visually .And the battery will be charged according to the requirement of standard charge.

b) The battery will be impacted 1000±10 times with the acceleration of 100m/s^2 and pulse lasting time 16ms.

c) After above testing, to keep the battery at （20±5）℃ and the environment of normal atmospheric pressure for 1-2hrs.The result of visual inspection can meet item 5.2.

d) According to the requirement of standard discharge, the battery will discharged and the time can meet item 5.7.

6.7.6 Free fall testing

a) At the temperature of （20±5）℃ and the normal atmospheric pressure, to inspect the sample battery visually . And the battery will be charged according to the requirement of standard charge.

b) The battery will be dropped free five times in each direction of X, Y, Z from the height of 700mm onto the hard board with the thickness of 20mm.

c) After above testing, to keep the battery at （20±5）℃ and the environment of normal atmospheric pressure for 1-2hrs.The result of visual inspection can meet item 5.2.

d) According to the requirement of standard discharge, the battery will discharged and the time can meet item 5.7.

6.8 Safe Characteristic

6.8.1 Over charge Testing

a) At the temperature of （20±5）℃ and the normal atmospheric pressure, to inspect the sample battery visually . And the battery will be charged according to the requirement of standard charge.

b) The battery charged completely will be charged continuously at 1C current with a voltage limit of 4.8V. There is no smoking, explosion and fire.

c) According to the requirement of standard discharge, the battery will be discharged until the voltage reaches end voltage. And according to the requirement of standard charge, the battery will be charged.

Then the battery will be discharged according to the requirement of quick discharge. The discharge time can meet item5.7.

6.8.2 Over Discharge Testing

a) At the temperature of （20±5）℃ and the normal atmospheric pressure, to inspect the sample battery visually . And the battery will be charged according to the requirement of standard charge.

b) According to the requirement of standard charge, the battery will be charged to end voltage, then connect with external load of 30Ω for 24hrs.There will be no explosion, fire, smoking and leakage.

c) According to the requirement of standard discharge, the battery will be discharged until the voltage reaches end voltage. And according to the requirement of standard charge, the battery will be charged. Then the battery will be discharged according to the requirement of quick discharge. The discharge time can meet item5.7.

Note: Above testing of safe characteristic must be with protective equipment.

7.

WARNINGS AND CAUTIONS IN HANDING THE LITHIUM-ION BATTERY

warning

Danger warning should be described in manual or instruction for users

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
- Do not use and leave the battery near a heat source as fire or heater
- When recharging, use the battery charger specifically for that purpose
- Don’t reverse the position and negative terminals
- Do not connect the battery to an electrical outlet
- Do not discard the battle in fire or heat it
- Do not short-circuit the battery by directly connecting the positive and negative terminal with metal objects such wire.
- Do not transport and store the battery together with metal objects such as necklaces, hairpins etc.
- Do not strike or throw the battery.
- Do not directly solder the battery and pierce the battery with a nail or other sharp object.
- ◆

Do not use or leave the battery at very high temperature (for example, at strong direct sunlight or a vehicle in extremely hot conditions). Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.

- ◆ Do not use it in a location where static electricity is great, otherwise, the safety devices may be damaged, causing hidden trouble of safety.
- ◆ If the battery leaks, and the electrolyte get into the eyes. Do not rub eyes, instead, rinse the eyes, with clean running water, and immediately seek medical attention. Otherwise, eye injury can result.
- ◆ If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during use, recharging or storage, immediately remove it from the device or battery charge and stop using it.
- ◆ In case the battery terminals are dirt, clean the terminals with a dry cloth before use. Otherwise power failure or charge failure may occur due to the poor connection with the instrument.

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