AA Portable Power Corp.
2700 Rydin Road, Unit D, Richmond CA 94804
Tel: 510-525-4710 Fax: 510-525-4728 Toll Free: 1-800-448-4428
Email: sales@aaportablepower.com Web: www.aaportablepower.com

Product model	**18500 battery**	VER	A
Product Specification	**3.6V 1400mAh**	Date	2005/1/3

Cylindrical Li-ion battery

Specification

Type: 18500

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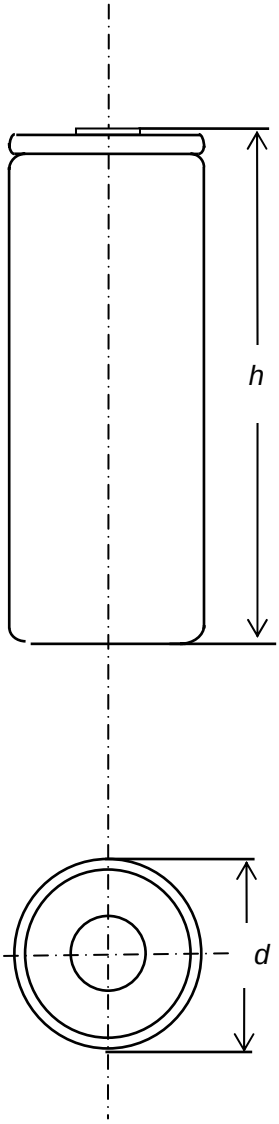
DATA SHEET



TYPE ---------- CYLINDRICAL

MODEL ---------- ICR18500

SPECIFICATION---------- 18500

Nominal voltage ---------- 3.6V

Weight approx. ---------- 33g

C_5mAh---------- 1400mAh

Charge voltage---------- 4.200±0.049V

Minimum discharge end voltage---------- 2.75V

Maximum charge voltage---------- 4.23V

Maximum continuous charge current---------- 1400mA

Maximum continuous discharge current------ 2600mA

Dimension (including shrink sleeve/label)

Diameter, d ---------- 18.3±0.2mm

height, h ---------- 50.5±0.5mm

Capacity (20℃, 0.2 C_5 to 2.75V)

Minimum capacity---------- 1400mAh

Internal impedance (20℃±5℃) ＜80mΩ

Charge conditions (20℃±5℃)

Standard charge---------- 700mA CC/CV

Fast charge---------- 1400mA CC/CV

Operation conditions (recommended)

Storage---temperature(15-35℃)
Relative humidity(45-75%)
Pressure(86-106Kpa)

Discharge---------- -20-60℃

Standard charge---------- 0-45℃

Standard Test Conditions (Except additional quest)

Temperature---------- 20℃±5℃

Relative humidity---------- 65±20%

Subject to change without prior notice

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1. Performance

Test item	Test conditions	Requirements
(1)Outside Appearance	Visual check	No abnormal stain, Deformation nor damage
(2) Standard test conditions	Measurements are carried out at 20±5℃and relative humidity of 65 ± 20% without other specified condition. Accuracy of voltmeters and ammeters used in test is equal to or better than the grade 0.5.	
(3) Standard charge	Battery is charged continuously at the constant current of 0.5 I_t end at voltage of 4.2V, then charge at the constant voltage of 4.2V until the end current of 20mA after Pre-discharge at the constant current of 0.2 I_t mA until the end voltage of 2.75V/cell	
(4) Fast charge	Charge shall be conducted continuously at the constant current of 1.0 I_t mA until the end voltage of 4.2V, then charge at the constant voltage of 4.2V until the end current of 20mA after Pre-discharge mentioned in Item (2).	
(5) Open-circuit voltage (OCV)		≥3.75V
(6)Rated Capacity	Discharge duration of the charged battery specified in Item (3) shall be measured at 0.2 I_t mA until the end voltage of 2.75V/cell, after rest for 0.25 hour. If the discharge duration does not reach the specified value, the test may be repeated up to three times in total.	Rated capacity: ≥100%C_5mAh
(7) Capacity high-rate discharge	Discharge duration of the charged battery specified in Item (3) shall be measured at 1.0 I_t mA until the end voltage of 2.75V/cell, after rest for 0.25 hour. If the discharge duration does not reach the specified value, the test may be repeated up to three times in total.	Discharge capacity: ≥90%C_5mAh
(8) Cycle Life (20℃)	Carry out cycles (1.0 I_t mA CC/CV(4.2V), discharge at the constant current of 1.0 I_t mA after rest for 0.25 hour) at 20± 2℃. The test end until the discharge capacity ＜80%C_5mAh	≥300 cycles
(9)Low temperature discharge	1)charge shall be conducted at Item (3)； 2)The battery shall be stored under -20℃±2℃ for 16h～24h; 3)Discharge shall be conducted at the constant current of 0.2I_tmA until the end voltage of 2.75V/cell;	Discharge capacity: ≥60%C_5mAh

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2 Mechanical test

Test Item	Test Conditions	Requirements
(1)Vibration Test	Vibrate test sample for 90minutes each at room temperature after rated charge. Amplitude: 1.6, (p-p) Vibration: 10-55Hz (sweep 1 Hz//min) Direction: X, Y, Z Then measure resistance, voltage of battery and check outside appearance.	No rupture, fire, smoke, Nor critical damage ≧90% C_5mAh
(2) Drop Test	Drop 100% charged test sample from 1 meter above onto concrete board with more than 5cm thickness two times each for every direction at room temperature. Then measure resistance, voltage of battery and check outside appearance.	No rupture, fire, smoke, Nor critical damage ≧90% C_5mAh

3 Safety evaluation

Test Item	Test Conditions	Requirements
(1) Hot Oven Test	The charged battery is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of 5±2℃ .The oven is to remain for 10 minutes at 150±2℃ before the test is discontinued.	No rupture, fire, smoke, Nor leakage.
(2)Short Circuit Test	After fast charge at 20±2℃, Connect battery terminals with electric wire (electric resistance: 50m Ω or less). And stop the test when the temperature of battery is 10℃ lower than peak temperature.	No rupture, fire, smoke, Nor leakage.
(3) Overcharge	After discharged at 1 I_t mA and end at 2.75V, the battery shall be charged at 3 I_t mA current with a voltage limit of 4.6V.	No rupture, fire, smoke, Nor leakage.
(4)Dip test	The charged battery shall be dipped in water for 24h in an ambient temperature of 20℃±5℃.	No rupture, fire, smoke, Nor leakage.

4 Charge State of Battery before shipment

To be determined.(Recommendation Approx. 3.75 - 3.85V 30% charge)

5 Duration of guarantee the product

We can keep on the quality in six month.

6 Handling precautions on Lithium Ion Rechargeable Battery

To assure product safety, describe the following precautions in the instruction manual of the

equipment.

! Danger

- When charging the battery, use dedicated chargers and follow the specified conditions.
- Use the battery only in the specified equipment.
- Do not connect battery directly to an electric outlet or cigarette lighter charger.
- Do not heat or throw battery into a fire.
- Do not use, leave battery close to fire or inside of a car where temperature may be above 60℃. Also do not charge / discharge in such conditions.
- Do not immerse, throw, and wet battery in water/ seawater.
- Do not put batteries in your pockets or a bag together with metal objects such as necklaces. Hairpins, coins, or screws. Do not store batteries with such objects.
- Do not short circuit the (+) and (-) terminals with other metals.
- Do not place battery in a device with the (+) and (-) in the wrong way around.
- Do not pierce battery with a sharp object such as a needle.
- Do not hit with a hammer, step on or throw or drop to cause strong shock.
- Do not disassemble or modify the battery.
- Do not solder a battery directly.
- Do not use a battery with serious scar or deformation.

! Warning

- Do not put battery into a microware oven, dryer, or high-pressure container.
- Do not use battery with dry cells and other primary batteries, or batteries of a different package, type, or brand.
- Stop charging the battery if charging is not completed within the specified time.
- Stop using the battery if abnormal heat, odor, discoloration, deformation or abnormal condition is detected

During use, charge, or storage.

- Keep away from fire immediately when leakage or foul odor is detected.
- If liquid leaks onto your skin or clothes, wash well with fresh water immediately.

If liquid leaking from the battery gets into your eyes, do not rub your eyes. Wash them well with clean water and go to see a doctor immediately.

! Caution

- Store batteries out of reach of children so that they are not accidentally swallowed.
- If younger children use the battery, their guardians should explain the proper handling.
- Before using the battery, be sure to read the user's manual and cautions on handling thoroughly.
- Thoroughly read the user's manual for the charger before charging the battery.
- For information on installing and removing from equipment, thoroughly read the user's manual for the specific equipment.

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- Batteries have life cycles. If the time that the battery powers equipment becomes much shorter than usual, the battery life is at an end. Replace the battery with a new same one.
- Remove a battery whose life cycle has expired from equipment immediately.
- When the battery is thrown away, be sure it is non-conducting by applying vinyl tape to the (+) and (-) terminals.
- When not using battery for an extended period, remove it from the equipment and store in a place with low humidity and low temperature.
- While the battery pack is charged, used and stored, keep it away from objects or materials with static electric charges.
- If the terminals of the battery become dirty, wipe with a dry clothe before using the battery.
- The battery can be used within the following temperature ranges. Do not exceed these ranges.
  Charge temperature range : 0℃ to 45℃
  Discharge temperature range : -20℃ to 60℃
  (When using equipment)

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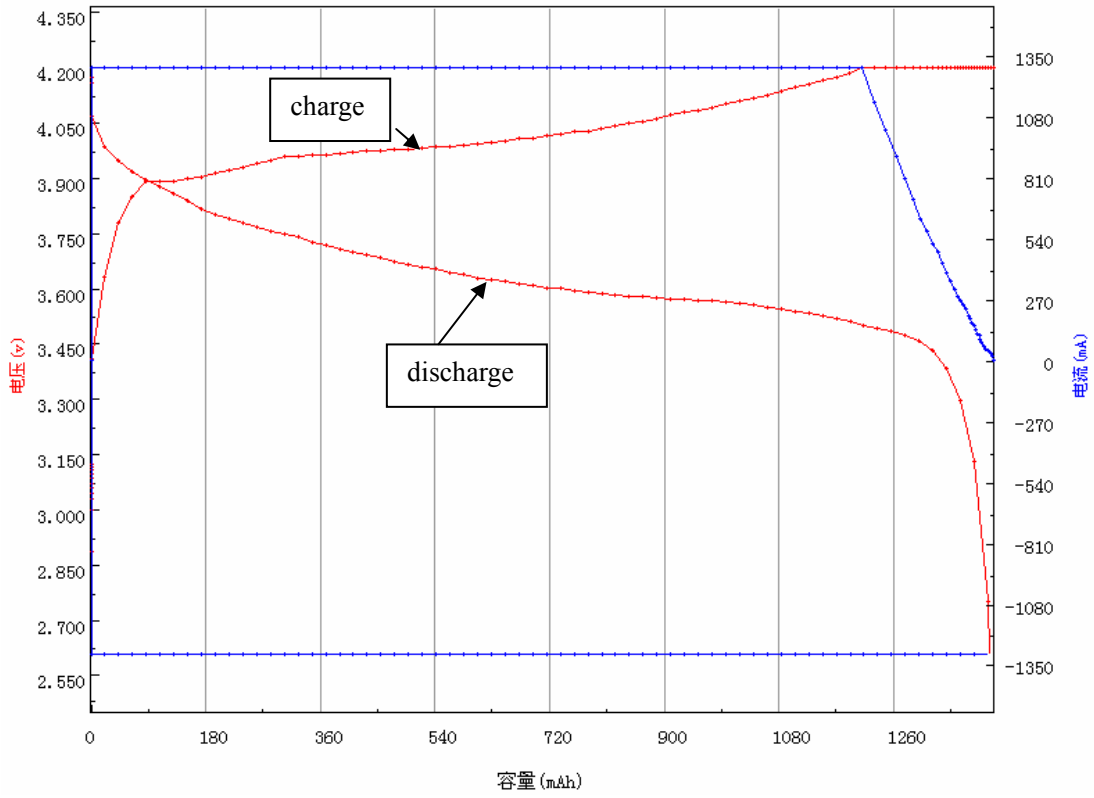
Test report

Charge-discharge test

Origin of samples：from a batch of HCT batteries

Test condition：The battery is charged at 700mA constant current ending at 4.2 Voltage，and charged at 4.2V ending at current less than 20mA(1300mA CC/CV to 4.2V)，then discharged at 1300mA constant current ending at 2.75Voltage



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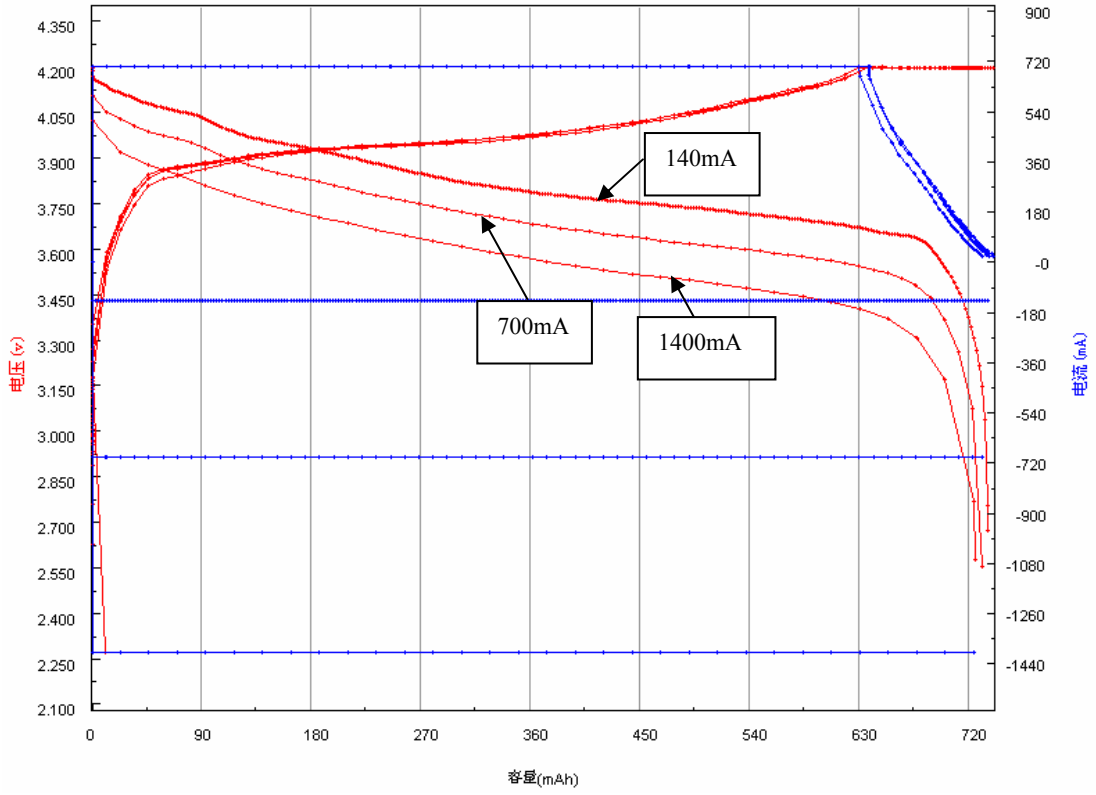
Discharge at various rate capacity

Origin of samples：from a batch of HCT batteries

Test condition：The battery is charged at 700mA constant current ending at 4.2 Voltage，and charged at 4.2V ending at current less than 20mA(700mA CC/CV to 4.2V)，then discharged at 140mA, 700mA and 1400mA constant current ending at 2.75Voltage。



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Mechanical test

(1) Vibration Test

Numbers of test samples：5

Vibrate test sample for 90minutes each at room temperature after rated charge.

Amplitude: 1.6, (p-p)

Vibration: 10-55Hz (sweep 1 Hz//min)

Direction: X, Y, Z

Then measure resistance, voltage of battery and check outside appearance.

Before vibration	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	49.5	50.6	48.6	49.3	51.2
Voltage (V)	3.82	3.82	3.82	3.82	3.82
After vibration					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	49.5	50.6	48.6	49.3	51.2
Voltage (V)	3.82	3.82	3.82	3.82	3.82

(2) Drop Test

Numbers of test samples：5

Drop 100% charged test sample from 1 meter above onto concrete board with more than 5cm thick two times each for every direction at room temperature. Then measure resistance, voltage of battery and check outside appearance.

Then measure resistance, voltage of battery and check outside appearance.

Before drop	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	49.8	51.3	47.5	49.3	51.6
Voltage (V)	4.2	4.2	4.2	4.2	4.2
After drop					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	49.8	51.3	47.5	49.3	51.6
Voltage (V)	4.2	4.2	4.2	4.2	4.2

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Safety evaluation

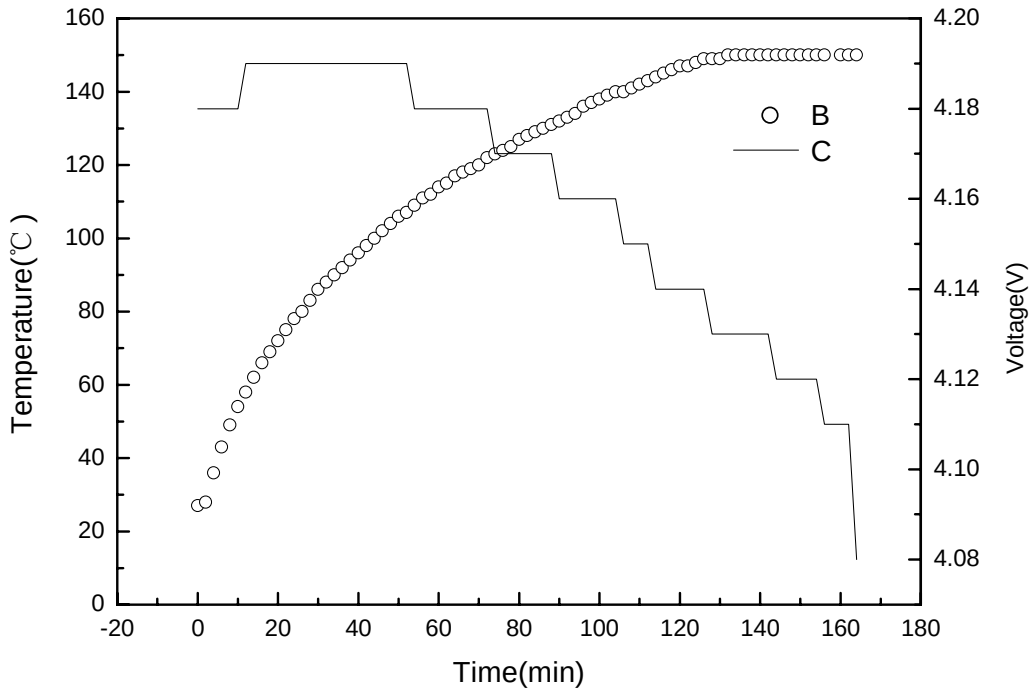
1） Hot Oven Test

Numbers of test samples：5

The charged battery is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be raised at a rate of 5±2℃ .The oven is to remain for 10 minutes at 150 ±2℃ before the test is discontinued.

Then measure resistance, voltage of battery and check outside appearance.

Before heat	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	47.8	49.2	50.6	51.7	48.9
Voltage (V)	4.2	4.2	4.2	4.2	4.2
After heat					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	＞2000	＞2000	＞2000	＞2000	＞2000
Voltage (V)	4.09	4.09	4.09	4.09	4.09



Temperature (B) and Voltage (C) curves

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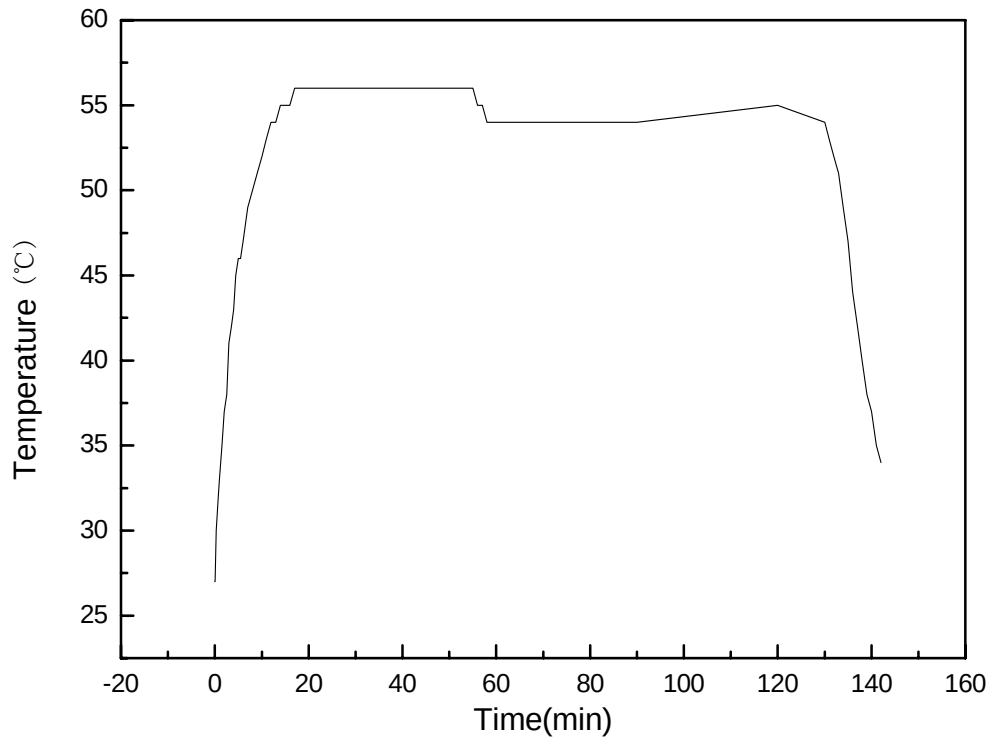
2) Short Circuit Test

Numbers of test samples: 5

After fast charge at 20±2℃, Connect battery terminals with electric wire (electric resistance: 50mΩ or less). And stop the test when the temperature of battery is 10℃ lower than peak temperature.

Then measure resistance, voltage of battery and check outside appearance.

Before short	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	46.4	47.3	49.6	47.8	50.1
Voltage (V)	4.2	4.2	4.2	4.2	4.2
After short					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	204	250	300	312	286
Voltage (V)	0.45	0.35	0.50	0.38	0.48



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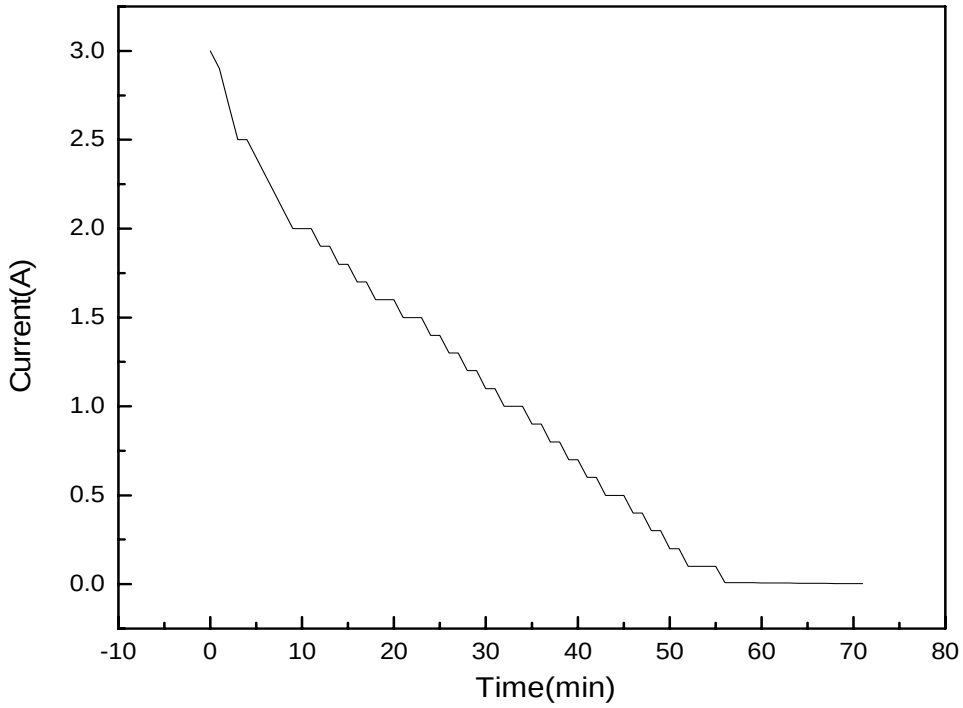
3） Overcharge

Numbers of test samples：5

After discharged at 1 I_t mA and end at 2.75V, the battery shall be charged at 3 I_t mA current with a voltage limit of 4.6V.

Then measure resistance, voltage of battery and check outside appearance.

Before overcharge	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	45.6	46.5	47.8	49.2	50.8
Voltage (V)	3.21	3.22	3.21	3.21	3.22
After overcharge					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	60.5	66.2	70.6	65.3	69.1
Voltage (V)	4.55	4.55	4.55	4.55	4.55



4) Dip test

Numbers of test samples: 5

The charged battery shall be dipped in water for 24h in an ambient temperature of 20℃±5℃. Then measure resistance, voltage of battery and check outside appearance.

Before dip	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	46.3	47.5	48.5	49.6	51.0
Voltage (V)	4.20	4.20	4.20	4.20	4.20
After dip					
Appearance	OK	OK	OK	OK	OK
Resistance（mΩ）	46.3	47.5	48.5	49.6	51.0
Voltage (V)	4.20	4.20	4.20	4.20	4.20