Specification of Lithium-ion Rechargeable Cell

Cylindrical Lithium-ion Battery Cell

HDCNR21700-5000mAh-3.7V

1. Application

This specification specifies the technical parameters and test standards of HDCNR21700-5000mAh-3.7V cylindrical lithium-ion battery supplied by Haidi Power Technology Co.,Ltd.

2. Description

2.1 Description: Rechargeable Cylindrical Lithium-ion Battery Cell

2.2 Battery Model No: HDCNR21700-5000mAh-3.7

3. Reference standards

This specification refers to GB 38031-2020、GB 31486-2015 and other technical standards.

4. Cautions

4.1 Please read this specification carefully before testing or using the battery to avoid the battery from failure, over-heat, electrolyte leakage, setting fire or explosion;

4.2 In charging or discharging, please apply professional testing equipment; no use of general constant current and constant voltage power which is not able to restrict current and voltage to avoid battery failure and dangers;

4.3 Please do not put the battery with false direction of “+” “-” when charging or connecting with the equipment; otherwise the product will suffer from over-charging or over-discharging, and will cause battery failure or explosion;

4.4 Don’t weld the battery directly, no opening of the battery;

4.5 In order to avoid short circuit, please don’t put and store the battery with metal stuff in bag or pocket, for instance, necklaces, coins, barrettes, screws, no connecting directly the “+” and “-”together with metal or other conductive materials;

4.6 No knocking, throwing or trampling the battery, not to mention put the battery in washing machines or high compress vessels;

4.7 Please keep the battery far away from heat source, such as fire, heater; do not store or use the battery under strong sunshine or high ambient temperature above 60℃, otherwise the battery will set fire , be over heated or failure;

4.8 Please do not damp the battery or put it into water; please keep the battery dry and be of low temperature in storage;

4.9 During the period of using, testing or storage, if the battery has been found got hot, expiring abnormal odors, changed color, transformed or in other unusual states, please stop relative handling at once, isolate the battery and keep away from it;

4.10 If the battery leaked and the electrolyte split into your eye, don’t knead your eye, flush it with clean water at once, go to see a doctor in the case of seriousness; if electrolyte spattered on your skin or clothes, please flush it with clean water.

5. Basic Specifications and Performance

Items		Specifications	
Capacity	Typical Capacity	5000mAh@0.2C，25℃	
	Minimum Capacity	4800mAh@1C，25℃	
Nominal Voltage		3.6V	
Internal Impedance		≤20mΩ	
Discharge Cut-off Voltage		2.5V	
Charging Voltage		4.2V	
Standard Charging		0.5C	
Maximum Charging		1C	
Standard Discharging		1C	
Quick Discharging		3C	
Max Discharge Current		5C（≤3S）	
Weight		72.0± 4.0g	
Dimensions		Diameter	21.65 ± 0.2mm
		Height	70.85 ± 0.2mm
Operating Temperature		Charge	0 ~45℃
		Discharge	20 ~60 ℃
Storage Temperature		1month: 1	20 ~ 60 ℃
		3months: 3	20 ~ 45℃
		1 year: 1	20 ~ 25 ℃

6. Test method

6.1 Testing Condition

Unless otherwise specified, the room temperature test should be conducted at below test condition: temperature 25℃±2℃, relative humidity 15%~90%, atmospheric pressure 86~106kPa.

6.2 Measurement Apparatus & Instrument Accuracy

Measurement Apparatus, Instrument Accuracy shall meet the following requirements;

—Voltages Measuring Instrument: not less than 0.5 degree;

—Current Measuring Instrument: not less than 0.5 degree;

—Temperature Measuring Instrument: ±0.5℃

—Time Measuring Instrument: ±0.1%

—Dimension Measuring Instrument: ±0.1%

—Weight Measuring Instrument: ±0.1%

6.3 charge

6.3.1 Standard Charge: The charger supplies 0.5*I*1(A) constant current until battery voltage reaches 4.2V at room temperature, then be charged at constant voltage of 4.2V while tapering the charge current to less than or equals to 0.03*I*1(A). Rest for 10 minutes.

6.3.2 Quick Charge: The charger supplies 1*I*1(A)constant current until battery voltage reaches 4.2V at room temperature, then be charged at constant voltage of 4.2V while tapering the charge current to less than or equals to 0.03 *I*1(A). Rest for 10 minutes.

6.4 discharge

6.4.1 Standard Discharge: The discharge supplies 1I1(A) current until the voltage down to 2.5 V at room temperature.

6.4.2 Large rate continued discharge: The discharge supplies 3I1(A) current until the voltage down to 2.5 V at room temperature.

6.5 Internal Impedance measurement

The internal impedance is measured by AC impedance method and the frequency of equipment is 1KHz.

7. Appearance

The battery should be clean and dry, no technical damages, electrolyte leakage, rustiness, and what's more, the battery must have product identification on the surface.

8. Performances

8.1 Electrical Properties

Items	Inspecting Method	Standard	
Nominal capacity	Charge according to 6.3.1, then discharge supplies 1*I*1(A) current until the voltage down to 2.5 V at room temperature, calculate the discharge capacity.	≥4800mAh	
Initial capacity	Charge according to 6.3.1, The discharge supplies 1*I*1(A) current until the voltage down to 2.5 V at room temperature, the cycle should be 5 times. When the capacity gap of three times in succession are less than 3% nominal capacity, the test terminates. Calculate the average of last three experimental results.	capacity gap for three times <3%	
Initial resistance	6The internal impedance is measured by AC impedance method and the frequency	≤20mΩ	
Discharge Rate	Charge according to 6.3.1 under room temperature, rest for 10 minutes. Then the battery discharge with vary current to the end, measuring the discharge capacity percentage.	0.2C	101%
		1C	100%
		3C	95%
Quick Charge	discharge with 1*I*1(A) till the cut-off voltage 2.5V at room temperature, then rest for 1 hour, Charge with 2*I*1(A) for 30min while the cut-off voltage is 4.2V, and rest for 30min, then discharge with 1*I*1(A) till the cut-off voltage 2.5V, calculate the discharge capacity.	≥70% initial capacity	

Low temperature discharge	Charge according to 6.3.1, lay the battery aside for 4 hours in the ambient temperature of -20℃±2℃, then discharge with 1*I*1(A) till the cut-off voltage and calculate the discharge capacity.	≥70% initial capacity
High temperature discharge	Charge according to 6.3.1, lay the battery aside for 5H in the ambient temperature of 55 ℃ ±2 ℃ , then discharge with 1*I*1(A) till the cut-off voltage and calculate the discharge capacity.	≥98% initial capacity
Room temperature Capacity Retention& Capacity Recovery	Charge according to 6.3.1, store the battery for 28 days in the room temperature, then discharge with 1*I*1(A) till the cut-off voltage, calculate the remain capacity. Charge according to 6.3.1 again, then discharge with 1*I*1(A) till the cut-off voltage, calculate the capacity restoration.	Capacity retention ≥94% initial capacity capacity restoration ≥9 7% initial capacity
High temperature Capacity Holding& Capacity Recovery	Charge according to 6.3.1, store the battery for 7 days in the ambient temperature of 55℃±2℃, then rest for 5 hours at room temperature, discharge with 1*I*1(A) till the cut-off voltage calculate the remain capacity. Charge according to 6.3.1 again, then discharge with 1*I*(A) till the cut-off voltage, calculate the capacity restoration.	Capacity retention ≥90% initial capacity capacity restoration ≥95% initial capacity

Vibration	Charge according to 6.3.1, then fix the charged battery on the vibrating table. The conditions of vibration test: ---discharge current: 1/3*I*1(A); ---vibration direction: perpendicular to the surface of the vibrating table; ---vibration frequency: 10Hz~55Hz; ---maximum acceleration: 30m/S2; ---sweep cycle: 10 times ---vibration time: 3 hours	Current without sharp change, voltage without exception,the appearance of battery should not leakage,break or explosion
High temperature half electricity storage	Charge according to 6.3.1, then discharge with 1*I*1(A) for 30min, store the battery for 28 days in the ambient temperature of 45℃±2℃, then rest for 5 hours at room temperature, Charge according to 6.3.1, then discharge with 1*I*1(A) till the cut-off voltage, calculate the capacity restoration.	restoration≥90% initial capacity

Cycle Life 1	1. Charge it with the current of 0.5I1(A) （the charge current to less than or equals to 0.05I1(A)）, then store it for 10min;2. Discharge with 1I1(A) until the voltage down to 2.75V, then store it for 30min;the discharge capacity is over than 80% initial capacity after 800 cycles. 10min；	
Cycle Life 2	1. Charge it with the current of 0.5I1(A) to 4.15V（the charge current to less than or equals to 0.05I1(A)）, then store it for 10min;2. Discharge with 1I1(A) until the voltage down to 3.0V, then store it for 30min;the discharge capacity is over than 80% initial capacity after 1000 cycles.	1000 cycles≥80%

8.2 Safety Performance

Item	Testing Method	Standard
Over Discharge	Charge according to 6.3.1; Discharge 90 min with the constant current 1I1(A); Observe 1 hour. Charge according to 6.3.1; Charge with the constant current	No explosion, no fire, no leakage
Over charge	3I1(A) to the end voltage 10V or charge to 115% SOC with the constant current 3I1(A); Observe 1 hour.	No explosion, no fire.

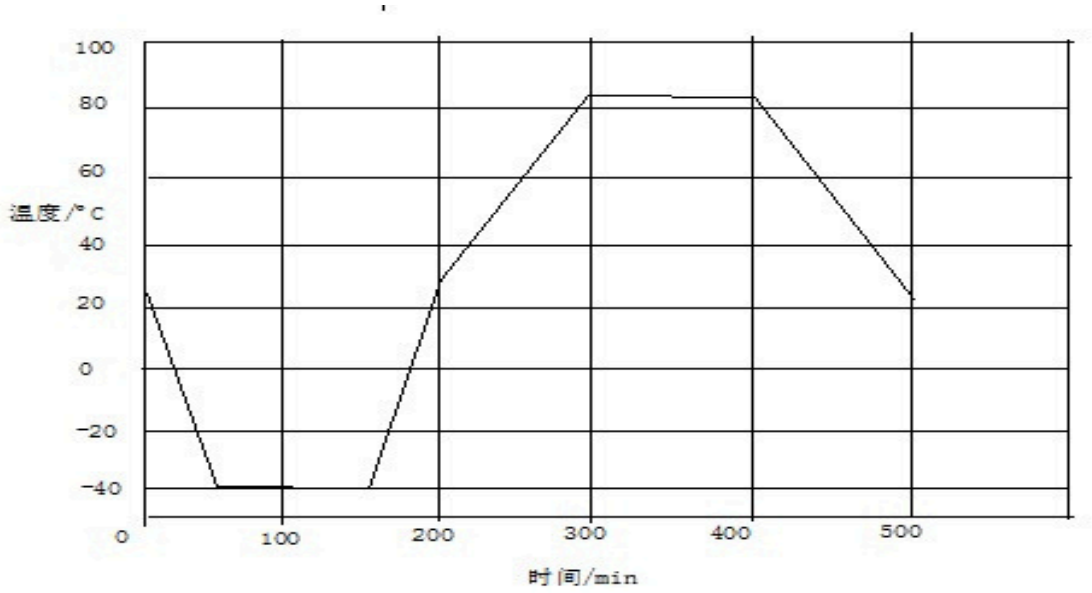
Short Circuit	Charge according to 6.3.1; Use a total external resistance of 80±20mΩ to a short circuit condition for 10min; Observe 1 hour.	No explosion, no fire.
Heat shock	Charge according to 6.3.1; The cell is placed in a thermal chamber. Temperature is raised to 130±2°C at the rate of 5°C/min and held for 10 minutes, then cooled to room temperature; Observe 1 hour.	No explosion, no fire.
Crush	Charge according to 6.3.1; A battery is crushed between two flat surfaces.The applied force is 13kN±0.2kN by hydrocylinder, Once the maximum pressure has been obtained or voltage decrease to 1/3 of nominal voltage sharply,then release pressure. Observe 1 hour;	No explosion, no fire.
Temperature Cycle	Charge according to 6.3;The cell is placed in a thermal chamber. Temperature is adjusted according to the following table 1 and figure 1. The cycle shall be 5 times; Observe 1 hour.	No explosion, no fire

Table 1 The temperature and time of a cycle

Temperature	time increment	cumulative time	Temperature change rate
25	0	0	0
-40	60	60	13/12
-40	90	150	0
25	60	210	13/12

85	90	300	2/3
85	110	410	0
25	70	480	6/7

Fig.1 The graph of temperature cycling test



9. Package

Battery in the package must be under half-charged state. On the surface of the package, there should be with product name, type, rated voltage, number, gross, leaving factory time and corresponding internal resistant and capacity.

10. Shipment

The battery should be packed in cartons for shipment. The violent vibration, impaction or squeezing should be avoided in the transport process; neither exposed in the sunlight nor rain. The transport vehicles may be automobile, train, ship, airplane, etc.

11. Storage

The battery should be store in a clean, dry, ventilated room with a temperature required in 5 -

Storage Temperature and 75% RH. Keep away from corrosive material, fire and heat source. In addition, the battery should be store in half-charging state, in order to avoid over-discharge caused by self-discharge, and this will lead to irreversible capacity loss.

12. The quality guarantee period is 12 months from the time leaving factory.

13. We are irresponsible for any accident caused by handling not according to this specification.

14. We have the right to modify this specification, the revised new specification will be sent to the clients and inform the modified content

15. Details not be involved in this specification through the discussion between the manufacturer and the clients.