HAIDI

Specification
For
Lithium Ion Battery Cell

(Cell Type) : HDCNR26650-4500mAh-3.7V

1 Preface

This specification describes the type and dimensions, performance, technical characteristics, warning and caution of
the lithium ion battery cell. The specification only applies to 26650 cell supplied by Haidi Power Technology Co.,Ltd.

2 Definition

2.1 Rated capacity and minimum capacity:

Rated capacity: Cap=4500mAh, minimum capacity: Cap=4450mAh. Under 25±3℃, It means the capacity value of being discharged by 5-hours rate to end voltage 2.5V, which is signed Cap, the unit is mAh.

2.2 Standard charge method:

Under 25±3℃, it can be charged to 4.2V with constant current of 0.2C, and then, charged continuously with constant voltage of 4.2V until the charged current is 0.02C.

2.3 Standard discharge method:

Under 25±3℃, it can be discharged to the voltage of 2.5V with constant current of 0.5C.

3 Cell type and dimensions

3.1 Description and model

Description: Cylindrical NCM rechargeable cell
NRC EP DB
Model:26650-4500 mAh

3.2 Cell bar code and explanation

HDCNR 26650-4500mAh-3.7V

HD NRC EP DB JHAA 009763

Figure 1

Cell bar code includes six parts(Figure 1):

Company Abbreviations + Battery type + Cell type + Cell batch code + Cell ordinal code

For example HD + NRC+ EP +DB + JHAA+ 009763

①Company Abbreviations

The abbreviations of “HD”

Battery Type

②

Material Abbreviations	Cell Shape	battery size
F mea ns LiFePO4 C me a ns LiCoO2 M means LiMnO2 N means LiNixCoyMnzO2	R means cylinder type battery P means square battery X means polymer battery	A means 18650 battery B means21700 battery C means 26650 battery D means 32650 battery E means 32700 battery means 26700 battery

③battery type：

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EP stands for dynamic energy compatibility

LP stands for dynamic type

HP represents the tool-start model

④Cell Type：

DB means 26650-4500 mAh

⑤Cell batch code definition as following（Be constituting by the ingredients of date）：

J	H	AA
Manufacture Year For example: J means 2019 J	Manufacture month H is for August.	Manufacture day For example: A Ameans date1th

⑥Cell ordinal code

009763 produces the 009763th battery

⑦ Combination rules

Code spray-code content is; Company name + battery capacity + batch number+ water code

For example HD +DB + JHAA+ 009763

4 Characteristics

4.1 Cell specification

ITEM	SPECIFICATION
Normal capacity	4500 mAh@0.2C
Minimum capacity	4450 mAh@0.2C
Normal voltage	3.7V
Charging voltage	4.2±0.05 V
Discharge ending voltage	2.5 ±0.05 V
Standard charging current	0.2C(900 mA)
Standard discharge current	0.5C(2250mA)
Max charge current	0.5C (25±3℃) (not for cycle life)
Max discharge current	3C (25±3 ℃) (not for cycle life)
Normal temperature cycle	100%DOD ＞500@80% ＞800@80% ＞1200@80%
recommended charge and discharge cell environment temperature	Charge: 0~55℃ Discharge: -20~65℃
Maximum short term allowable charge and discharge cell body temperature. Charging and discharging at these conditions will shorten cell cycle life.	Charge: 60℃ Discharge: 70℃
Internal resistance	≤ 20mΩ(AC Impedance, 1000 Hz)
Cell dimensions(with PET film)	Height ： 65.5± 0.2mm Diameter ： 26.2± 0.2mm
Weight	≤ 93.0g

4.2 Cell dimensions and Structural diagram

Cell physical dimensions listed in Figure 2(unit: mm):

Height： 65.5±0.2mm

Diameterφ1： 10.0±0.2 mm

Diameterφ2： 26.2±0.2 mm

Diameterφ3：26.2±0.2 mm

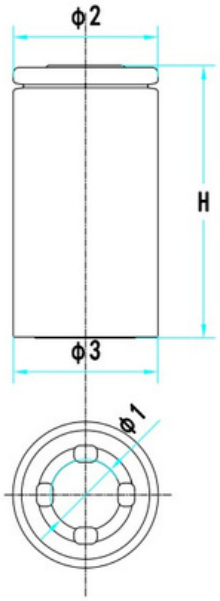

Figure 2

5 Technical requirements

5.1 Cell storage conditions

Temperature： 1-3 months -10～45℃ 3-12 months -10 Relative～35℃ 1years -10 ～25℃ humidity： 0～45%RH

5.2 Cell testing conditions

Unless otherwise specified, all tests stated according to following:

Temperature： 25±3℃ Use standard charge and standard discharge method

5.3 Requirement of the testing equipment测

Voltage meter: The voltage tester internal resistance is ≥ 10 KW/V

Temperature meter: The precision is ≤0.5℃

5.4 Characteristics

NO.	Item	Standard	Test Method
1	Discharge Characteristics (Room Temperature)	Discharge capacity / Nominal capacity *100% A) 0.5C ≥100% B) 1C ≥97% C) 2C ≥95% D) 3C ≥93% The charging and discharging curves must be smooth A) 0.5C ≥100% B) 1C ≥97% C) 2C ≥95% D) 3C ≥93%	In 1 standard atmospheric pressure, ambient temperature of 25 ℃ ± 3 ℃, relative humidity is 15% ~ 90%, 0.2 C standard battery charge (if no specific instructions, below are placed under the condition, is by the way), suspended 10 min, respectively by 0.5 C, 1C， 2C and 3 C discharged to the threshold voltage of 2.5V, and for three to five times, when there is a meet the requirements, which meet the standard requirements (the same-below).

2	Normal Storage	Residual capacity ≥ Nominal capacity *90 % Recovery capacity ≥ Nominal capacity *95%	Tested the initial condition and initial capacity of battery. Store for 28 days after standard charged, tested the final condition of battery. Then discharge at 0.5C to the discharge cut-off voltage 2.5V, tested the residual capacity of battery. 0.2C /0.5 C tested the recovery capacity of battery. Charge/discharge cycle can be conducted for 3-5 times before meeting the Standards.
3	Cycle Life	Residual capacity ≥ Nominal capacity *80%	1、Measured the initial condition and initial capacity of battery. Then conduct 0.5C/1C.

4	Long Time Storage	Residual capacity ≥ Nominal capacity *95%	Measured the initial capacity， charged to the voltage of 4.2±0.05V , after storage for 90d at 25±3°C after the standard charged and then discharge for 2h at 0.5C, measured with charge and discharge current 0.5C to cut-off voltage. Cycle three to five times, when one meets the standard, that is the standard requirements.

5.5 Safety Performance

NO.	Item	Standard	Test Method
1	Overcharge	No fire, No explosion	After the standard charging of the battery, measure the initial state of the battery to ensure that the battery state is normal (the same below), charge with 1 c current to 1.5 times the charging termination voltage or stop charging after the charging time reaches 1H, and observe for 1 hour.

2	Over Discharge	No fire, No explosion, No leakage	After the standard charging of the battery, measure the initial capacity and state of the battery, discharge with 1C current for 90min, and observe for 1H.
3	Short Circuit at Room Temperature	No fire, No explosion	Measured the initial state of battery after standard charging. Keep the battery into a ventilation cabinet and short-circuit the positive and negative terminals directly (Total resistance of the line 50mΩ -80mΩ). Stop the test when the time is 10 mintes . Observe the variation of the battery's appearance and temperature.
4	Crush	No fire, No explosion	Standard charge. Use the half cylinder radius 75 mm (half the size of the cylinder are greater than the length of the squeezed battery), with (5±1mm/s speed in vertical direction extrusion batteries, battery plate until the voltage reaches 0 v or deformation after reaching 15% or extrusion of 100 kN stop pressing, observation of 1 h.

5	Hot Oven	No fire, No explosion	Standard charge. Keep the battery connected with a thermocouple and put it into a gravity convection or circulating air oven. Temperature is raised at a rate of 5 ℃±2 ℃ per minute to a temperature of 130 ℃±2 ℃ and remained for 30 min at this temperature. observation of 1 h.Observe the variation of the battery's appearance.

5.6 Environmental characteristics

NO.	Item	Standard	Test Method
1	Thermal cycling Properties	No leakage \ fire \ explosion	Standard charge. Put battery into rapid temperature change box, starting from 25 ℃ with 60 min cooled to -40 ℃, and held to -40 ℃ environment after 90 min, with 60 min to 25 ℃, with another 90 min at 85 ℃ and 85 ℃ under the environment of 110 min, with another 70 min to 25 ℃.As a cycle, a total of 5 loop, observation of 1 h.
2	Seawater immersion	No fire, No explosion	Standard charge. Battery in 3.5% NaCl solution for 2h, the depth of the water completely below the battery, observation of 1 h.

3	Drop	No leakage \ fire \ explosion	After the battery is charged, measure the initial status of the battery, and drop the positive and negative terminals of the battery from the height of 1.2m to a hard board with a thickness of 20mm (the board is paved on the concrete floor). Observe the battery in each direction once for one hour.
4	Discharge Characteristics under Different Temperature	Discharge capacity / Nominal capacity *100% 55 ℃ ≥ 96% 10 ℃ ≥ 98% 0 ℃ ≥ 80% -10 ℃ ≥ 75% -20 ℃ ≥ 70%	Measure the initial capacity and initial state of the battery. After charging the battery standard, put it at 10℃, 55℃ for 2h, put it at 0℃, -10℃，-20℃ for 8h, discharge to the termination voltage of the battery discharge at 0.5C.Measure the corresponding termination capacity of the battery, and finally put it for 2 hours at room temperature to measure the final state of the battery and observe the appearance changes of the battery.
5	Depression	No leakage \ fire \ explosion	After the standard charging , measure the initial state of the battery, put the battery into the low air pressure box, adjust the air pressure in the test box to 11.6kpa and the temperature to room temperature, stand for 6h and observe for 1H.

Comments: the definitions of some nomenclatures of this specification

(1) Standard Charge: Charge with current 0.2C to limit charge voltage 4.2V under the condition of 25℃±3℃ surrounding temperature, then change to charge with constant voltage till the current less than or equal to 0.02 C.

(2) Initial State: The initial appearance, open-circuit voltage and internal resistance of battery.

(3) Final State: The final appearance, open-circuit voltage and internal resistance of battery.

(4) Residual Capacity: After a specific testing program, the first discharge capacity of battery.

(5) Recovery capacity: After a specific testing program, and through the repeatedly charging and discharging to the recovery state, then the discharge capacity of battery.

6 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".

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HANDLING INSTRUCTIONS

FOR

LITHIUM ION RECHARGEABLE CELL

1 CAUTION AND PRECAUTION

1.1 Charging

a) Charging voltage must be set 4.2V/cell. Concerning charge voltage tolerance of charger, charging voltage must be set below 4.3V/cell. Even if the charge could be out of order, charge voltage of charger should not be above 4.3V/cell to avoid over- charging. Cell life will be shorten by charging voltage above 4.3V.

b) Charger should start charging at temperature range 0 ~ +45°C.

c) Charge the cell at a constant current of 0.2C until 4.2V is attained. Charge rates greater than 1C are NOT recommended.(C: Rated Capacity of cell，The cell may fail when used beyond 1C.)。

d) Maintain charge voltage at 4.2V for 3.0 hours

e) The battery must be charged by constant current and constant voltage mode, not continuous charging mode.

f) Do not continue to charge cell over specified time.

g) No reverse charging

h) In case of cell voltage is below 2.5V, cell should be charged with pre-charge that current is below 0.45A (0.1C). Then cell voltage reach over2.5V, standard charge starts. And if cell voltage never reaches to 2.5Vin specified period (timer), charger will stop charging.

i) By timer, current detection and open circuit voltage detection, charger detects full charge. When charger detect cell is full charged, charger stop charging.

1.2 Discharging

a) Discharge current must be below 3C (13500mA)

b) Discharge end voltage must be over 2.5V.

c) Do not over-discharge cell below 2.5V

d) Discharge temperature range should be -20 °C ~ +65°C

1.3 Environmental using conditions

When the cell is charged.： 0°C ~ +45°C

When the cell is discharged.： -20°C ~ +65°C

Charge or discharge out of recommended range might cause the generating heat or serious damage of cell. And also, it might cause the deterioration of cell's characteristics and cycle life.

1.4 Storage

Any storage, cell should be in low humidity, no corrosive gas atmosphere area. And there is no press and condensation on the cell. Best temperature range20~30℃.

1.5 Precautions on Handling Lithium Ion Cells

a) When the cells are connected in series, use same rank cells, use same lot number cells and use same charging date cells. These date show label for carton on the master carton. Further, the cell’s voltage and impedance have to be checked and matched as uses of cells. Haidi Power Technology Co.,Ltd. recommend match cells keep voltage within3mV difference and impedance within 3mΩ difference at least.

b) Inspect voltage and internal impedance before using.

c) When cells are re-shipped to assembling factory, make enough attention the packing to avoid stress by shipping. Haidi Power Technology Co.,Ltd. recommends the same package shipped from Haidi Power Technology Co.,Ltd. when re-shipping. Even if after open package, when re-shipping, use the same parts and materials from Haidi Power Technology Co.,Ltd. for re-packing.

d) Do not use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.

e) Do not use or leave the cell under the blazing sun (or in heated car by sunshine). The cell may generate heat, , it might cause the deterioration of cell's characteristics or cycle life.

f) Do not use cell nearby the place where generates static electricity (more than 100V).

g) Please read the manual before using the cell and please reread if necessary.

h) Please read the manual of specified charger about charging

method.

i) When the cell has rust, bad smell or something abnormal at first-time-using, do not use the equipment and go to bring the cell to the place which it was bought.

j) In case younger children use the cell, their parents teach how to use cells according to the manual with care.

k) Keep the cell out of the reach of younger children. And also, pay attention to cell be taken out it from the charger or equipment by little children.

l) If the skin or cloth is smeared with liquid from the cell, wash with fresh water. It may cause the skin inflammation, see a doctor immediately.

1.6 Cell position in equipment and charger.

To avoid degradation of cell performance by heat, a cell should set the place apart from heat generating

electronic
parts inside equipment and charger.

1.7 Precautions on Battery Pack Design.

a) Battery pack Shape, Mechanism and Material

・Do not make the shape and mechanism which easy connect to other equipment and charger.

・Do not make the terminal shape which easy cause short circuit by metal object such as necklaces, hairpins, etc. And further, have over current protection function to prevent outer short circuit.

・Do not make the terminal shape and mechanism which connect reverse to equipment.

・Do not make the shape and mechanism which static electricity and water easy go through the battery pack inside.

・Make the shape and mechanism which can inspect protection circuit function before the battery pack makes completely.

・Fix cells with mold case by rib, tape, glue etc., but do not make damage cells (especially sealing part) by rib or sharp part of mold case. In case of the battery pack is struck by hard shock or vibration, the battery pack has

possibility to cause leakage, smoke, explosion.

・Weld mold case by glue. Not weld mold case by ultra sonic welding.

b) Protection Circuit insure safety of battery

・Overcharge protection should work below4.3V/cell by charge. Then charge current shall be shut down.

・At the voltage range 2.5V/cell, over-discharge protection should work. Then discharge current shall be shut down and consumption current is below 1μA.

c) Electric circuit

・To avoid to discharge during storage, design the low consumption current electronic circuit(e.g. Protection circuit, fuel gauge, etc) inside battery pack.

d) Cell connection

・Do not solder onto a cell in order to avoid a damage on the cell. Weld spot welding lead plate onto cell, and solder lead wire or lead plate.

2 PRECAUTIONS AND SAFETY INSTRUCTIONS

The cell includes the flammable objects such as the organic solvent. If the handling is missed there will be possibility that the cell rupture flames or hot, or it will cause the damage to the cell and/or personal injury. Please observe the following prohibitive matters. And also, add the protection device the equipment for fear that the trouble would affect the cell by the abnormality of equipment. Please read and observe the standard cell precautions below before using utilization.

2.1 Don't use or expose the cell to extreme heat, flame, disposed in fire or water or get it wet. Don't modify or disassemble the cell. It will be dangerous, and may cause ignition, heating, leakage or explosion.

2.2 Don't short-circuit cell positive(+) and negative(-) terminals. Keep away from metal or other conductive materials. Jumbling the cells of direct contact with positive(+) and negative(-) terminals or other conductive materials may cause short-circuit. Don't reverse the positive (+) and negative (-) terminals for any reason.

2.3 Don't use the unspecified charger and breach charging requirement. Cell charged with unspecified condition maybe lead cell to be overcharged or abnormal chemical reaction. It causes the generating heat, smoke,rupture .

2.4 Don’t overcharge, over-discharge, drive nail into the cell, strike it by hammer or tread it.

2.5 Don’t give cell impact or drop, and not use the cell with conspicuous damage or deformation.

2.6 Don’t connect cell to the plug socket or car-cigarette-plug. Don’t use lithium-ion cell in mixture of different batch or use cell for other equipment.

2.7 Do not use or leave the cell under the blazing sun (or in heated car by sunshine), and keep cell away from little children in order to avoid troubles by Swallowing. In case of swallowing the cell, see a doctor immediately.

2.8 If the cell gives off an odor, generates heat, becomes discolored, or in any way appears abnormal during use, recharging or storage, immediately remove (Don’t touch a abnormal cell directly) it from the device or cell charger and stop using it.

2.9 Do not continue to charge cell over specified time. If the cell is not finished charging over regulated time, let it stop charging. There is possibility that the cell might generate heat, smoke, rupture or flame.

2.10 Do not get cell into a microwave or a high pressure container. It causes the generating heat, smoke, rapture or flame because of a sudden heat or damage of sealing condition of cell.

2.11 Don’t solder the cell directly. Excessive heating may cause deformation of the cell components such as the gasket, which may lead to the cell swelling, leakage, or ignition.

2.12 Do not touch a leaked cell directly or put a leaked cell nearby fire.

2.13 Don’t use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.

2.14 Scrap/abandoned cell should be handed in to a professional cell recycling company for processing, private

disposal is prohibited.

2.15 Laser welding process is prohibited on the negative electrode side。

3 CONSULTATION

3.1 If there are problems in this specification, Haidi Power Technology Co.,Ltd. can consider to change specification after discussion, please contact us as following:

3.2 For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium-ion cell with Haidi Power Technology Co.,Ltd. in advance. And consult about the high rate current, rapid charge and special application in the same way.

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