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ORION®

21700 Li-ion Series

Lithium-ion Rechargeable Cell Specification

High Energy and Power Cylindrical Cell

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Revision History

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1. Scope

This specification describes the technical parameters and testing standards for the lithium-ion rechargeable cell ORION 21700 manufactured and supplied by Pilsan Elektronik Co., Ltd.

2. Product Specification

2.1 Type：Cylindrical Lithium-ion Rechargeable Cell

2.2 Model：ORION 21700 ,

3. Basic Characteristics

Technical Parameters	Specification		Condition/Note
3.1 Capacity	Typical	5000mAh (0.2C) 4900mAh (1.0C)	Standard charge (Refer to 4.1)
	Minimum	4900mAh (0.2C) 4800mAh (1.0C)	
3.2 Nominal Voltage	3.62V		0.2C
3.3 Internal Impedance	≤25mΩ		AC 1kHz
3.4 Standard Charge (Refer to 4.1)	0.2C(960mA) 4.2V 96mA		Constant current Constant voltage End condition(Cut off)
3.5 Standard Discharge	1.0C(4800mA) 2.5V		Constant current End voltage(Cut off)
3.6 Rapid Charge	0.5C(2400mA) 4.2V 96mA		Constant current Constant voltage End condition(Cut off)
3.7 Max. Continuous Discharge Current	2C(9600mA)		Without temperature cut
	3C(14400mA)		With 70℃ temperature cut
3.8 Weight	70.0 ± 2.0g		
3.9 Max. Dimension	Diameter (Φ)	21.9mm	
	Height (H)	71.1mm	
3.10 Operating Temperature (Charge)	Temperature	Max. Continuous Charge Current	
	0℃ ≤ T ≤ 10℃	0.1C(480mA)	
	10℃ <T ≤ 20℃	0.2C(960mA)	

	20℃ <T ≤ 45 ℃	0.7C(3360mA)	
3.11 Operating Temperature (Discharge)	Temperature	Max. Continuous Discharge Current	
	-20℃ ≤ T ≤20℃	1.0C(4800mA)	
	20℃ <T ≤ 45℃	2.0C(9600mA)	
	45℃ < T ≤ 60℃	1.0C(4800mA)	
3.12 Storage Temperature	One month	-20℃ ~ 50℃	
	Three months	-20℃ ~ 45℃	
	One year	-20℃ ~ 25℃	
3.13 Overheat Protection	70℃（The cell must stop discharging when surface temperature exceeds 70℃ ）		

4. Standard Conditions for Test

1. Without stating specifically, all the electrical characteristics are obtained under the following conditions: Ambient temperature: 25 ± 2℃; Relative humidity: ≤ 75%.

2. Without stating specifically, all the safety tests are conducted under the following conditions: Ambient temperature: 20 ± 5℃; Relative humidity: ≤ 75%.

4.1 Standard Charge	0.2C(960mA), CC-CV to 4.2V, 96mA cut off
4.2 Standard Discharge	1.0C(4800mA), CC to 2.5V

5. Characteristics

5.1 Electrical Characteristics

Items	Test Procedure	Requirements
5.1.1 Nominal Voltage	Charge as described in 4.1, and discharge with 0.2C to 2.5V. Calculate the average working voltage during discharge process.	3.62V
5.1.2 Discharge Characteristic	Charge as described in 4.1, rest less than 1h, and discharge as described in 4.2.	≥ 4800mAh

5.1.3 Cycle Life	Charge with the constant current of 0.3C(1440mA) and constant voltage of 4.2V, cut off at 0.05C(240mA), and rest for 30min; discharge with 1.0C and cut off at 2.5V, and rest for 30min. Repeat cycling till discharge capacity in 2 successive cycles is less than 70% of the initial capacity.	≥ 1000 cycles	
5.1.4 Rate Performance	Fully charge as described in 4.1, rest for 30min, and discharge with different constant currents and cut off at 2.5V. Calculate the ratio of above capacities to the discharge capacity at 0.2C.	0.2C	= 100%
		0.5C	≥ 95%
		1.0C	≥ 93%
		2.0C	≥ 90%
5.1.5 Temperature Dependency of Capacity	Fully charge as described in 4.1, rest for 3h in the environment with different temperatures, and discharge as described in 4.2. Calculate the ratio of above capacity to the standard discharge capacity at 25℃.	-20℃(2.0V)	≥ 70%
		0℃	≥ 80%
		25℃	= 100%
		45℃	≥ 95%
5.1.6 Storage at Room Temperature	Fully charge as described in 4.1, store for 28 days, discharge as described in 4.2 and calculate the retention ratio of capacity; then charge and discharge as described in 4.1 and 4.2, respectively, and calculate the recovery ratio of capacity.	Retention ratio ≥ 85% Recovery ratio ≥ 90%	
5.1.7 Storage at High Temperature	Fully charge as described in 4.1, store for 7 days in the environment with temperature of 60 ± 2℃, discharge as described in 4.2 and calculate the retention ratio of capacity; then charge and discharge as described in 4.1 and 4.2, respectively, and calculate the recovery ratio of capacity.	Retention ratio ≥ 85% Recovery ratio ≥ 90%	

5.2 Electrical Tests

Items	Test Procedure	Requirements
5.2.1 Short Circuit at 20 ± 5℃	The sample cell should be fully charged as described in 4.1, and short-circuited by connecting positive and negative terminals with a circuit load having a resistance of 80 ± 20mΩ at 20 ± 5℃. The temperature of the case should be measured during the test. The cell should remain on test for 24 hours or until the temperature of the case declines by 20% of the maximum temperature.	No fire , no explosion, and maximum surface temperature ≤ 150℃
5.2.2 Short Circuit at High Temperature	The sample cell should be fully charged as described in 4.1, and stored at 55 ± 5℃ for 1h ~ 4h. Then the cell is to be short-circuited by connecting positive and negative terminals with a circuit load having a resistance of 80 ± 20mΩ. The temperature of the case should be measured during the test. The cell should remain on test for 24 hours or until the temperature of the case declines by 20% of the maximum temperature.	No fire , no explosion, and the maximum surface temperature ≤ 150℃
5.2.3 Abnormal Charge	The sample cell should be discharged as described in 4.2, and subjected to the charging process to 4.6V with the current of the greater one between the 3C and three times of the charging current recommended by the manufacturer. The temperature of the case should be measured during the test. The test should be continued until the charging time reaches 7 hours or the temperature of the case declines by 20% of the maximum temperature.	No fire, no explosion
5.2.4 Forced-Discharge	The sample cell should be discharged as described in 4.2, and subjected to the forced discharge process with the reverse current of 1C. The test time is 90 min.	No fire, no explosion

5.3 Mechanical Tests

Items	Test Procedure	Requirements
5.3.1 Vibration	The sample cell should be fully charged as described in 4.1, and firmly secured to the platform of the vibration machine. Test conditions are: a) Scanning mode: sinusoidal waveform with the logarithmic scanning mode; b) Frequency range: 7Hz~200Hz; c) Specific mode: start at the frequency of 7Hz, and maintain the peak acceleration of $1g_n$ until the frequency is increased to 18Hz; maintain the amplitude of 0.8mm (1.6mm total excursion) and increase frequency to ~50Hz; maintain the peak acceleration of $8g_n$ until the frequency is increased to 200Hz; back to 7Hz; d) Scanning time of each cycle: 15min. The above process should be conducted at both axial and radical directions(three mutually perpendicular directions for prismatic and pouch cell). The test should be repeated 12 times for 3 hours in each direction.	No fire, no explosion, and no leakage.
5.3.2 Drop	The sample cell should be fully charged as described in 4.1, and dropped onto a flat concrete floor from 1m height. The positive and negative electrode side should be dropped once, respectively, and the cylindrical surface twice. Each cell should be dropped four times.	No fire, no explosion.

5.4 Environmental Tests

Items	Test Procedure	Requirements
5.4.1 Temperature Cycling	The sample cell should be fully charged as described in 4.1, and stored in a test chamber. Test conditions are: a) Raise the chamber temperature to 72 ± 2℃ and maintain this temperature for at least 6 hours; b) Reduce the chamber temperature to -40 ± 2 ℃ and maintain this temperature for at least 6 hours; c) Repeat above steps 10 times. The time interval between two test temperatures should be less than 30 minutes.	No fire, no explosion and no leakage
5.4.2 Low Pressure	The sample cell should be fully charged as described in 4.1, stored for 6 hours in the environment with the absolute pressure of 11.6kPa (1.68psi) and the temperature of 20 ± 5°C, and observed for 1 hour.	No fire, no explosion, and no leakage
5.4.3 Heating	The sample cell should be fully charged as described in 4.1, and placed in a gravity or circulating air convection oven with an initial temperature of 20 ± 5℃. Raise the oven temperature at a rate of 5 ± 2℃/min to the test temperature 130 ± 2℃ and remain at this temperature for 30 minutes.	No fire, No explosion.

6. Outline Dimensions

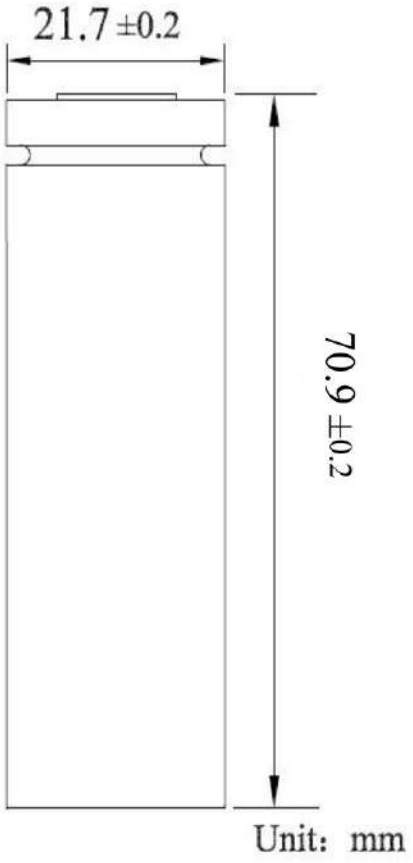

Fig.1 Outline Dimensions of ORION 21700 (with tube)

7. Cautions

Please read this specification carefully before testing or using the cells because improper handling of the Li-ion cells may lead to function failure, heating, electrolyte leakage, ignition or even explosion.

7.1 Caution in Use

7.1.1 Abnormal operations such as overcharge (voltage > 4.2V), over discharge (voltage < 2.5V) and overcurrent charge-discharge (maximum current allowed at present temperature) should be prohibited during cell using. It is strictly prohibited to use the cell in the environment easily causing problems, such as static electricity and poor sealing (water and dust entering).

7.1.2 Charging with the current more than 0.5C, using in the high-temperature/low-temperature, vibration, or humid environment, and matching unstable cells will reduce the cycle life of the cell.

7.1.3 The cell shall not be used in the environment of high frequency microwave or ultrasonic wave. When using in series and parallel, it is recommended to coat the high-voltage wire with electromagnetic insulation cover to prevent the electromagnetic wave from damaging adjacent devices and human body.

7.1.4 Avoid overlapping or contact between the positive and negative terminal wires of the battery to

reduce the risk of short circuit.

7.1.5 The battery should be charged and discharged in strict accordance with this specification to ensure the battery's cycle life and safety.

7.1.6 When the batteries are assembled in a module for use, the cells with the same capacity, internal resistance, batch and charged state shall be used. The packing standard of the batteries should be strictly in accordance with the technical agreement. The temperature difference inside the battery pack should be less than 5℃ when the pack is working.

7.1.7 Do not charge the battery when temperature is less than 0℃. Please store it in the environment with temperature more than 0℃ for a period of time before charging. Recommended store time as follows:

Outside Temperature	-5℃ ≤ T ≤ 0℃	-10℃ ≤ T ≤ -5℃	-15℃ ≤ T ≤ -10℃	-20℃ ≤ T ≤ -15℃
Time	2h	5h	8h	10h

7.2 Safety Caution

7.2.1 The battery should be placed away from babies and children. If there is any emergency such as deglutition, scald or explosion，please go to the hospital immediately.

7.2.2 When charging or discharging the battery, please use professional test equipment designed for Li-ion batteries. Do not use ordinary constant current or constant voltage (CC/CV) power chargers without limitation of current or voltage. These chargers do not protect the battery from being overcharged and over-discharged, and may lead to function failure and be dangerous.

7.2.3 When charging, discharging, or assembling the battery, avoid reversing the positive and negative terminals. Otherwise, it would lead to overcharge and over-discharge of the battery, causing serious failure, or even explosion.

7.2.4 Do not solder the battery directly. Do not disassemble the battery.

7.2.5 Do not put the battery in pockets or bags with metal objects, such as necklaces, hairpins, coins, screws, etc. Neither store the battery without proper isolation, nor connect the positive and negative electrodes directly with conductive materials. Or the battery may be short-circuited.

7.2.6 Do not hammer, throw or trample the battery. Do not put the battery into washing machines or high-pressure containers.

7.2.7 Keep the battery away from heat sources, such as fires, heaters, etc. Do not use or store the battery in direct sunlight or at places where temperature could exceed 60℃. Or the battery may generate excessive heat, ignite and fail.

7.2.8 Do not get the battery wet or throw it into water. When the battery is not in use, place it in a dry environment with relatively low temperature.

7.2.9 If the battery becomes abnormally hot, give out smell, change color, deform or show any other

abnormalities during using, testing or storing, please stop using or testing immediately. Attempt to isolate the battery and stay away.

7.2.10 If the leaking electrolyte from the battery gets into your eyes, do not rub your eyes. Rinse the eyes with clean water and seek medical attention if problems remain. If the electrolyte gets onto the skin or clothing, wash with clean water immediately.

8. Packing

Cells need to be at half-charged state when packed. The surface of the packing boxes shall contain the following information: product name, type, nominal voltage, quantity, gross weight, date, capacity and impedance.

9. Transportation

During transportation, do not subject the cells or the boxes to violent shaking, bumps, rain or direct sunlight. Cells can be transported by truck, train, ship and airplane, etc.

10. Long-term Storage

When delivered, cells are charged to the voltage of 3.45V ~ 3.70V. Storing cells at more than 80% SOC for a long time will lead to capacity loss and cycle life loss, please keep cells into use within 90 days when the capacity is more than 80%.

Cells may have lower capacity than they're expected due to the self-discharge when cells are to be delivered at 20% SOC.

Do not use or store the cells when the voltage is less than 2.5V.

11. Brand

ORION brand is a registered trademark of Pilsan electronic co.,ltd - Istanbul
it cannot be used for other companies.

12. Exclusion of Liability

The company is not liable for any problems arising from non compliance with this specification.

The company is not liable for any problems arising from the use of electrical circuits, battery packs and chargers.

The company does not guarantee the quality of the defective batteries caused by customers in the battery assembly process after shipment.

13. Statements

The information in this specification is subjected to change without prior notice.

PILSAN ELEKTRONIK SAN. Ve TIC. LTD.STI.
Pilsan Plaza, Esenkent Mah. Erzincan Cad. No:22
Dudullu O.S.B./ 34776 / Ümraniye / İstanbul/ TÜRKİYE