Produkte

Products

Prüfbericht - Nr.: *Test Report No.:*	**60385051 001**	**Seite 1 von 32** *Page 1 of 32*
Auftraggeber: *Client:*	ANHUI PINYOU BATTERY CO., LTD Building10, Innovation Park, Economic Development Area New district, Huaibei City, Anhui, P.R. China	
Gegenstand der Prüfung: *Test item:*	**Rechargeable lithium ion cell**	
Bezeichnung: *Identification:*	**See table 4 on page 5**	**Serien-Nr.:** *Serial No.:* **N/A**
Wareneingangs-Nr.: *Receipt No.:*	**168269882**	**Eingangsdatum:** *Date of receipt:* **17-06-2020**
Prüfort: *Testing location:*	**Dongguan ZRLK Testing Technology Co., Ltd.** Building D, No. 2, Jinyuyuan Industrial Park, No. 18, West Industrial Road, Songshan Lake High-tech Industrial Development Zone, Dongguan City, Guangdong 523808, P. R. China	
Prüfgrundlage: *Test specification:*	**UL 1642: 2012 R6.15**	
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test item passed the test specification(s).*	
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland (Shenzhen) Co., Ltd.** 1F East & 2-4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, 518057, Shenzhen, China	

geprüft/ *tested by:*			**kontrolliert/** *reviewed by:*		
Joe Wang			Eric Cui		
2020-07-27 Joe Wang / Project Engineer			2020-07-27 Eric Cui / Reviewer		
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other Aspects:*

TÜV Rheinland TÜVus mark approval procedure.

The complete test report includes the following documents:
- UL 1642 Test report (32 pages); - Attachment 1: Equipment list (2 pages); - Attachment 2: Photo documents (3 pages).

This report is compiled under supervision of Harris Yin. Harris Yin

Abkürzungen:				***Abbreviations:***			
	P(ass)	=	***entspricht Prüfgrundlage***		***P(ass)***	=	***passed***
	F(ail)	=	***entspricht nicht Prüfgrundlage***		***F(ail)***	=	***failed***
	N/A	=	***nicht anwendbar***		***N/A***	=	***not applicable***
	N/T	=	***nicht getestet***		***N/T***	=	***not tested***

Test item particulars:	
Information about the product needed to establish a correct test program, such as product mobility, type of power connections and similar.	(Test item particulars are selected by the TRF Originator base on the requirements in the standard)
Designation ..... :	See table 4 on page 5
Trademark ..... :	N/A
Nominal voltage ..... :	3.7V
Rated capacity ..... :	See table 4 on page 5
Maximum charge voltage ..... :	4.25V
End discharge voltage ..... :	2.75V
Manufacturer's charge method ..... :	Charge the cell at 0.5C CC to 4.20V, then 4.20V CV until charging current reaches 0.02C
Utilization Type……..:	Technician replaceable cell
Sample Number……..:	ZKS200500183 C001 to ZKS200500183 C345
Possible test case verdicts:	
Test case does not apply to the test object ..... :	N/A
Test object does meet the requirement..... :	P(ass)
Test object does not meet the requirement..... :	F(ail)
Testing:	
Date of receipt of test item ..... :	2020-05-11
Date(s) of performance of tests ..... :	2020-05-11 to 2020-06-15

General remarks:

This report shall not be reproduced, except in full, without the written approval of the testing laboratory.

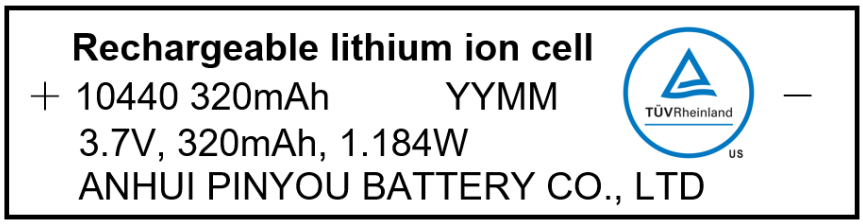
The test results presented in this report relate only to the object tested.

"(see remark #)" refers to a remark appended to the report.

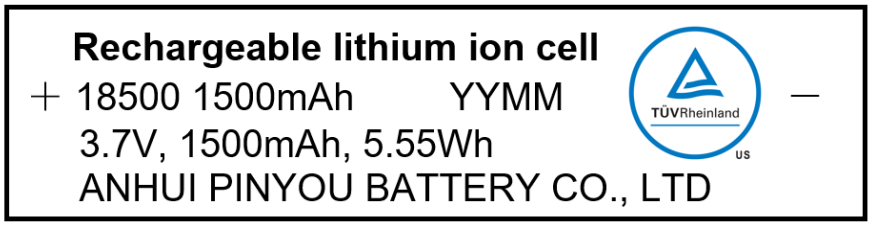
"(see appended table)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

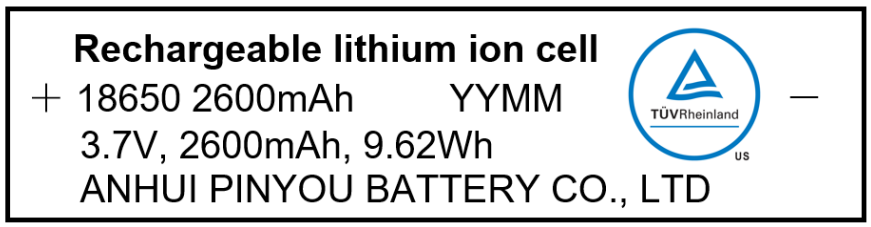
Copy of marking plate:



10440 320mAh



18500 1500mAh



18650 2600mAh

Remark: 1. “YYMM” represents the date of manufacture. “YY” represents the year, “MM” represents the month.

2. Due to similarity of the marking plate, only three represent models listed above.

Summary of testing:

The component cell is evaluated in this test report per the following test items according to UL 1642: 2012 R6.15. Charging method declared by the manufacturer in specification: Charging the cell with 0.5C of constant current and 4.20V constant voltage until charging current reach 0.02C.

Test items:

cl.10 Short-Circuit Test;
cl.11 Abnormal Charging Test;
cl.13 CrushTest;
cl.14 ImpactTest;
cl.15 Shock Test;
cl.16 Vibration Test;
cl.17 Heating Test;
cl.18 Temperature Cycling Test;
cl.19 Low Pressure (Altitude Simulation) Test;
cl.20 Projectile Test.

Description of the product:

This cell consists of the positive electrode plate, negative electrode plate, separator and electrolyte. The positive and negative electrode plates are housed in the case in the state being separated by the separator.

1) These tested cells have not been evaluated in combination with charger(s) or host product(s). Additional evaluation to determine compliance may be required on the combination(s) in the end product evaluation.

2) The tested cells were evaluated for a maximum charge current and maximum voltage limit outlined in the Table below. The end product evaluation shall ensure that current and voltage limits noted are maintained.

3) The fifteen models (Model name: 10440 320mAh, 13300 400mAh, 13400 550mAh, 14500 600mAh, 14500 800mAh, 18350 900mAh, 18500 1500mAh, 18650 1500mAh, 18650 1800mAh, 18650 2000mAh, 18650 2100mAh, 18650 2200mAh, 18650 2400mAh, 18650 2500mAh, 18650 2600mAh) are identical (same shape, same chemical system, using same material), except the model name and the capacity. The tested models 10440 320mAh, 18500 1500mAh and 18650 2600mAh are representatives of all models.

4) The charging temperature is 0-45°C and the discharging temperature is -20-60°C.

- Table 1: Electrical parameter of models 10440 320mAh:

Model	Nominal capacity	Nominal voltage	Nominal Charge current	Nominal discharge current	Max. charge current	Max. discharge current	Max. charge voltage	End discharge voltage
10440 320 mAh	320mAh	3.7V	160mA	160mA	320mA	1600mA	4.25V	2.75V

- Table 2: Electrical parameter of models 18500 1500mAh:

Model	Nominal capacity	Nominal voltage	Nominal Charge current	Nominal discharge current	Max. charge current	Max. discharge current	Max. charge voltage	End discharge voltage
18500 1500mAh	1500mAh	3.7V	750mA	750mA	1500mA	7500mA	4.25V	2.75V

- Table 3: Electrical parameter of models 18650 2600mAh:

Model	Nominal capacity	Nominal voltage	Nominal Charge current	Nominal discharge current	Max. charge current	Max. discharge current	Max. charge voltage	End discharge voltage
18650 2600mAh	2600mAh	3.7V	1300mA	1300mA	2600mA	13000mA	4.25V	2.75V

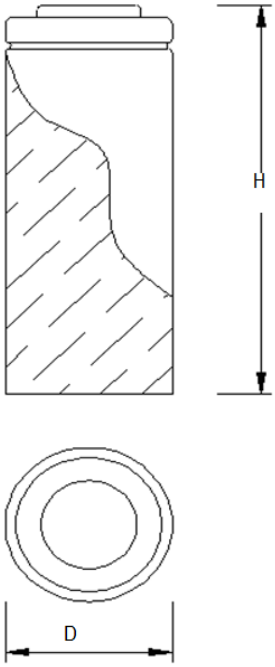
Remark: other models feature, see Table 4.

- Table 4: All of the models:

Model	Energy density (Wh/L)	Nominal voltage (V)	Capacity (mAh)	Diameter (mm)	Height (mm)	Nominal charge current (mA)	Nominal discharge current (mA)	Max. Charge current (mA)	Max. discharge current (mA)
10440 320mAh	288.64	3.7	320	10.8	44.8	160	160	320	1600mA
13300 400mAh	321.43	3.7	400	13.8	30.8	200	200	400	2000mA
13400 550mAh	333.64	3.7	550	13.8	40.8	275	275	550	2750mA
14500 600mAh	254.15	3.7	600	14.8	50.8	300	300	600	3000mA
14500 800mAh	338.87	3.7	800	14.8	50.8	400	400	800	4000mA
18350 900mAh	335.26	3.7	900	18.8	35.8	450	450	900	4500mA
18500 1500mAh	393.77	3.7	1500	18.8	50.8	750	750	1500	7500mA
18650 1500mAh	304.01	3.7	1500	18.8	65.8	750	750	1500	7500mA
18650 1800mAh	364.81	3.7	1800	18.8	65.8	900	900	1800	9000mA
18650 2000mAh	405.34	3.7	2000	18.8	65.8	1000	1000	2000	10000mA
18650 2100mAh	425.61	3.7	2100	18.8	65.8	1050	1050	2100	10500mA
18650 2200mAh	445.88	3.7	2200	18.8	65.8	1100	1100	2200	11000mA
18650 2400mAh	486.41	3.7	2400	18.8	65.8	1200	1200	2400	12000mA
18650 2500mAh	506.68	3.7	2500	18.8	65.8	1250	1250	2500	12500mA
18650 2600mAh	526.94	3.7	2600	18.8	65.8	1300	1300	2600	13000mA

Note: All the models have the same nominal voltage 3.7V and the same end discharge voltage 2.75V, and have the same Max. charge voltage 4.25V.

Construction:



Cell (Dimensions refer to Table 4)

Factory location :

ANHUI PINYOU BATTERY CO., LTD
Building10, Innovation Park, Economic Development Area New district, Huaibei City, Anhui, P.R. China

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			
1	**Scope**		P
2	**General**		P
3	**Glossary**		P
CONSTRUCTION			
4	**General**		N/A
4.1	**Casing**		N/A
4.1.1	The casing of a lithium battery shall have the strength and rigidity necessary to resist the abuses to which it may be subjected, without resulting in a risk of fire. The casing of a user-replaceable lithium battery shall have the strength and rigidity necessary to resist the abuses to which it may be subjected without resulting in a risk of injury to persons.	Rechargeable lithium ion cell without enclosure	N/A
4.1.2	A cell of a user-replaceable battery shall be in a rigid casing of sufficient strength to prevent flexing. A tool providing the mechanical advantage of a pliers, screwdriver, or hacksaw shall be the minimum capable of opening the user-replaceable cell casing, if opening of the casing will expose metallic lithium.	See above	N/A
4.2	**Electrolyte**		N/A
4.2.1	A user-replaceable battery shall not contain pressurized vapor or liquid that could spray materials into the eyes or leak more than 5 milliliters of liquid when the battery casing is punctured under normal laboratory conditions, 23 ±2°C (73 ±3.6°F).	Technician-replaceable Batteries	N/A
4.3	**Use**		N/A
4.3.1	A lithium battery shall be protected from abnormal charging currents during use. A battery tested and found acceptable for the charging current, I_C (see Section 11), under fault conditions specified by the manufacturer, shall be protected from larger charging currents in the end product application by: a) Two blocking components, such as diodes, or b) One blocking component and one current limiting component, such as a resistor or a fuse. The current limiting component shall limit the charging current to one-third the value used in the Abnormal Charging Test, Section 11.	Cell only	N/A
PERFORMANCE			
5	**General**		P
5.1	**Technician-replaceable Batteries**		P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
5.1.1	Technician-replaceable lithium cells or batteries are to be tested as described in Sections 10 – 20. Section 12, Forced-Discharge Test, is applicable only to cells intended to be used in series-connected multicell applications such as battery packs. For multicell installations, also see 5.3.1.		P
5.1.2	When a fire or explosion occurs as a result of the Crush Test, Section 13, or the Impact Test, Section 14, or the cell or battery ruptures to the extent that the aluminum test cage is penetrated during the Projectile Test, Section 20; the use of the technician replaceable cell or battery shall be restricted to applications in which it is not exposed to, or is protected from, any conditions shown to cause a fire or explosion.	No fire or explosion occurs	P
5.1.3	Cells and batteries subjected to the Shock Test, Section 15, Vibration Test, Section 16, Temperature Cycling Test, Section 18, and Low Pressure (Altitude Simulation) Test, Section 19, shall also not leak or vent. For these tests, unacceptable leakage is determined to have occurred when the resulting mass loss exceeds the values shown in Table 5.1, Venting and leakage mass loss criteria.	No leak or vent	P
5.2	**User-replaceable Batteries**		N/A
5.2.1	User-replaceable lithium cells or batteries are to be tested as described in Sections 10-20. Section 12, Forced Discharge Test, is applicable only to cells intended to be used in multicell applications such as battery packs. In addition to complying with the requirements for a technician replaceable cell or battery as specified in 5.1.1, a user-replaceable cell or battery shall not explode or ignite when subjected to the Crush Test, Section 13, or the Impact Test, Section14.	Technician-replaceable Cell	N/A
5.2.2	Sets of five specimens each are to be used for the Projectile Test, Section 20.3; see Table 6.3. When only one specimen from a set of five does not comply with the requirements, another set of five specimens is to be tested. All specimens from this second set shall comply with the requirements.	Technician-replaceable Cell	N/A
5.3	**Multi-cell Installation**		N/A
5.3.1	A technician-replaceable or user-replaceable cell intended for use in multicell installations or battery packs shall also be tested as described in 10.3 and Section 12. No fire or explosion shall occur as a result of these tests. In addition, batteries subjected to the test described in 10.3 shall meet the requirements as described in 5.1.1 and 5.2.1 for a cell or battery subjected to the Short-Circuit Test, Section10.	Single cell	N/A
6	**Samples**		P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
6.1	Fully charged primary cells or batteries and primary cells or batteries that have been conditioned by partial or complete discharge, or both, are to be used for the tests described in Sections 10-20. The number of samples to be used in each test for a primary technician-replaceable cell or battery is shown in Table 6.1. The number of samples to be used in each test for a primary user-replaceable cell or battery is shown in Table 6.3. When a group of cells or batteries of different sizes, but similar chemistries is involved, selected sizes representative of the range are to be tested.	The samples are Rechargeable lithium ion Cells.	N/A
6.2	Fully charged secondary cells or batteries and secondary cells or batteries that have been conditioned by charge-discharge cycling are to be used for the tests described in Sections 10 – 20. The number of samples to be used in each test for a secondary technician-replaceable cell or battery is shown in Table 6.2. The number of samples to be used in each test for a secondary user-replaceable cell or battery is shown in Table 6.4. When a group of cells or batteries of different sizes, and similar chemistries is involved, selected sizes representative of the range are to be tested.	The samples are Rechargeable lithium ion Cells. Prepared as required.	P
6.3	Prior to conducting the testing in Section 17, the Lithium-ion Polymer Rechargeable Cell samples shall be pre-conditioned as outlined in 6.4 and 6.5.	Prepared as required.	P
6.4	For the heating test of Section 17, two sets of five Lithium-ion Polymer Rechargeable Cell samples are to be fully discharged (i.e. to the manufacturer's specified end point voltage). The samples are then placed in a test chamber and conditioned for 1 to 4 h (5 samples at the upper temperature limit and 5 samples at the lower temperature limit of the operating region) as outlined in Table 6.3.	Prepared as required.	P
6.5	While still in the test chamber set at the temperature limits, the samples are charged (5 samples at the upper temperature limit and 5 samples at lower temperature limit) at the specified maximum charging current and upper limit charging voltage per Table 6.3, using a constant voltage charging method. Charging is continued until the charge current is reduced to the specified end of charge conditions (i.e. 0.05 times the charge current).	Prepared as required.	P
7	**Conditioning of Samples**		P
7.1	**Discharge**		N/A

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
7.1.1	Primary batteries are to be completely discharged by connecting their terminals through resistors that provide the desired level of discharge within 60 days. Completely discharged is considered to be the state in which the closed-circuit voltage has been reduced to less than 0.2 volts and the short-circuit current to less than 1.0 milliamperes. Batteries are to be discharged at room temperature. Cells with a liquid cathode such as thionyl chloride or sulfur dioxide, shall also be conditioned by one-half discharge	The samples are Rechargeable lithium ion Cells.	N/A
7.1.2	For solid electrolyte and other types of primary lithium batteries that cannot be discharged within 60 days because of the small currents they inherently produce, longer discharge times plus discharge at higher temperatures may be used to obtain the desired level of discharge. The manufacturer's recommended discharge procedures are to be followed so as to obtain the required discharge level in the minimum time.	The samples are Rechargeable lithium ion Cells.	N/A
7.2	**Charge-discharge cycling**		P
7.2.1	Secondary cells are to be conditioned at 25°C (77°F). Cells are continuously cycled as per the manufacturer's specifications. The specification shall be such that the full rated capacity of the cell is utilized and the number of cycles accumulated shall be at least equal to 25 percent of the advertised cycle life of the cell or cycled continuously for 90 days, whichever is shorter. Cycling is to be done either individually or in groups. Cells are to be recharged prior to testing as indicated in Table 6.2 and Table 6.4.	The samples are cycled at manufacturer's factory before they were sent for test.	P
8	**Important test considerations**		P
8.1	Some lithium batteries are capable of exploding when the tests described in Sections 10-20 are conducted. It is important that personnel be protected from the flying fragments, explosive force, sudden release of heat, and noise that results from such explosions. The test area is to be well ventilated to protect personnel from possible harmful fumes or gases.	Prepared the tests as required.	P
8.2	As an additional precaution, the temperatures on the surface of the battery casings shall be monitored during the tests described in Sections 10, 12, 13, and 14. All personnel involved in the testing of lithium batteries are to be instructed never to approach a lithium battery while the surface temperature exceeds 90°C (194°F).	Prepared the tests as required.	P
8.3	For protection, the Projectile Test, Section 20 is to be conducted in a room separate from the observer.	Prepared the tests as required.	P
9	**Temperature measurements**		P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
9.1	Temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG (0.21 mm2) and not smaller than 30 AWG (0.05 mm2) and a potentiometer-type instrument.	Prepared the tests as required.	P
9.2	The temperature measurements on the batteries are to be made with the measuring junction of the thermocouple held tightly against the metal casing of the battery.	Prepared the tests as required.	P
TESTS FOR TECHNICIAN-REPLACEABLE AND USER-REPLACEABLE BATTERIES			
ELECTRICAL TESTS			
10	**Short-Circuit Test**		P
10.1	Each test sample battery, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a maximum resistance load of *0.1* ohm. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.1 volts and the battery case temperature has returned to ±10°C (±18°F) of ambient temperature.	Tested as required. See table 10	P
10.2	Tests are to be conducted at 20 ±5°C (68 ±9°F) and at 55 ±5°C (131 ±9°F). The batteries are to reach equilibrium at 20 ±5°C or 55 ±5°C, as applicable, before the terminals are connected.	Tested as required.	P
10.3	A battery is to be tested individually unless the manufacturer indicates that it is intended for use in series or parallel. For series or parallel use, additional tests on five sets of batteries are to be conducted using the maximum number of batteries to be covered for each configuration.	Tested as required.	P
10.4	When an overcurrent or thermal protective device that has been investigated for the purpose actuates during the test, the test shall be repeated with the battery supply connected to the maximum load that does not cause the protective device to open. A protective device that has not been investigated for the purpose shall be short-circuited.	Only one single lithium-ion cell, no over-current or thermal protective device was integrated into the cell.	N/A
10.5	The samples shall not explode or catch fire. The temperature of the exterior cell or battery casing shall not exceed 150°C (302°F).	The test results meet the requirements.	P
11	**Abnormal Charging Test**		P
11.1	Primary cells or batteries shall comply with 11.2—11.7.	Secondary cell	N/A
11.2	Cells or batteries conditioned in accordance with Tables 6.1 or 6.3, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).		N/A

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
11.3	Each test sample battery is to be subjected to a charging current of three times the current I, specified by the manufacturer by connecting it in opposition to a dc-power supply. The specified charging current is to be obtained by connecting a resistor of the specified size and rating in series with the battery. The test charging time is to be calculated using the formula: $t_c = \frac{2.5C}{3(I_c)}$, in which ***$t_c$*** *is the charging time in hour* ***C*** *is the capacity of the cell/batteiy in ampere-hours, and* ***I_c*** *is the maximum charging current, in amperes, specified by the manufacturer.* The minimum charging time is to be 7 hours.		N/A
11.4	When a non-resettable overcurrent or thermal protective device that has been investigated for the purpose operates during the test, the test is to be repeated at a charge current below the level that the protective device operates. When a resettable protective device operates during the test, the protector is allowed to reset to a total of 10 cycles; or until the appropriate charging time has been completed, but not less than 7 hours. A protective device that has not been investigated for the purpose is to be short-circuited. See 2.3.2.		N/A
11.5	The samples shall not explode or catch fire.		N/A
11.6	Secondary cells or batteries shall comply with 11.7—11.10.	See table 11, tested as required	P
11.7	Cells or batteries conditioned in accordance with Tables 6.2 or 6.4, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).	Tested as required.	P
11.8	Each test sample battery is to be discharged at a constant current of 0.2c/Ihour, to a manufacturer specified discharge endpoint voltage. The cell or battery is then to be charged with a constant maximum specified output voltage and a current limit of three times the maximum charging current, I, specified by the manufacturer. Charging duration is to be 7 hours or the time required to reach the manufacturer's specified end-of-charge condition, whichever is greater.	Tested as required.	P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
11.9	The cell/battery is to be tested without the assistance of overcurrent or thermal protective devices, unless such protective devices have been investigated for the purpose. When a non-resettable overcurrent or thermal protective device operates during the test, the test shall be repeated at an overcharging current below the level that the protection device operates. When a resettable protective device operates during the test, the protector is to be allowed to reset to a total of 10 cycles; or until the appropriate charging time has been completed, but not less than 7 hours. A protective device that has not been investigated for the purpose is to be short-circuited. See 2.3.2.	The samples are to be tested without any assistance of over-current or thermal protective devices.	N/A
11.10	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test	P
12	**Forced-Discharged Test**		N/A
12.1	This test is intended for cells that are to be used in series-connected, multicell applications, such as battery packs.	One single cell	N/A
12.2	A completely discharged cell is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged cell is to equal the maximum number less one of the cells to be covered for series use. Five cells are to be completely discharged, at room temperature.		N/A
12.3	Once the completely discharged cell is connected in series with the specified number of fully charged cells the resultant battery pack is to be short circuited.		N/A
12.4	The positive and negative terminals of the sample are to be connected with a copper wire with a maximum resistance load of 0.1 ohm. The sample is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 volts and the battery case temperature has returned to ±10°C (18°F) of ambient temperature.		N/A
12.5	When an overcurrent or thermal protective device that has been investigated for the purpose operates during the test, the test shall be repeated with the battery supply connected to the maximum load that does not cause the protective device to open. A protective device that has not been investigated for the purpose shall be short-circuited.		N/A
12.6	The samples shall not explode or catch fire.		N/A
MECHANICAL TESTS			
13	**Crush Test**		P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
13.1	A battery is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cells and the crushing is to be continued until an applied force of 13 ±1 kN (3000 ±224 lbs) is reached. Once the maximum force has been obtained it is to be released.	Tested as required. See table 13	P
13.2	A cylindrical, pouch or prismatic cell is to be crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides will be subjected to the crushing force. Each sample is to be subjected to a crushing force in only one direction. Separate samples are to be used for each test. Exception: For Lithium ion systems, a cylindrical, pouch or prismatic cell is to be crushed with its longitudinal axis parallel to the flat surface of the crushing apparatus. Each sample is to be subjected to a crushing force in only one direction. Test only the longitudinal axis of pouch and prismatic cells.	Tested as required. The samples are cylindrical Rechargeable lithium ion Cells.	P
13.3	A coin or button battery is to be crushed with the flat surface of the battery parallel with the flat surfaces of the crushing apparatus.	Not a coin or button battery	N/A
13.4	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test	P
14	**Impact Test**		P
14.1	A test sample battery is to be placed on a flat surface. A 15.8 ±0.1-mm (5/8 ±0.004-in) diameter bar is to be placed across the center of the sample. A 9.1 ±0.46-kg (20 ±1-lb) weight is to be dropped from a height of 610 ±25 mm (24 ±1 in) onto the sample.	Prepared the test as required. See table 14	P
14.2	A cylindrical, pouch or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides are subjected to the impact. Each sample is to be subjected to only a single impact. Separate samples are to be used for each test. Exception: For Lithium ion systems, a cylindrical, pouch or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. Each sample is to be subjected to only a single impact. Test only the longitudinal axis of pouch and prismatic cells.	Tested as required. The samples are cylindrical Rechargeable lithium ion Cells.	P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
14.3	A coin or button battery is to be impacted with the flat surface of the test sample parallel to the flat surface and the 15.8-mm (5/8-in) diameter curved surface lying across its center.	Not a coin or button battery	N/A
14.4	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test	P
15	**Shock Test**		P
15.1	The cell is to be secured to the testing machine by means of a rigid mount which supports all mounting surfaces of the cell. Each cell shall be subjected to a total of three shocks of equal magnitUde. The shocks are to be applied in each of three mutually perpendicular directions unless it has only two axes of symmetry in which case only two directions shall be tested. Each shock is to be applied in a direction normal to the face of the cell. For each shock the cell is to be accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g (where g is the local acceleration due to gravity). The peak acceleration shall be between 125 and 175 g. Cells shall be tested at a temperature of 20 ± 5°C (68 ± 9°F).	Prepared the test as required. See table 15	P
15.2	The samples shall not explode or catch fire. In addition, the sample shall not vent or leak as described in 5.1.1.	No explosion or catch fire, the sample not vent or leak	P
16	**Vibration Test**		P
16.1	A battery is to be subjected to simple harmonic motion with an amplitude of 0.8 mm (0.03 inch) [1.6 mm (0.06 inch) total maximum excursion].	Prepared the test as required. See table 16.	P
16.2	The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz, and return in not less than 90 nor more than 100 minutes. The battery is to be tested in three mutually perpendicular directions. For a battery that has only two axes of symmetry, the battery is to be tested perpendicular to each axis.	Tested as required.	P
16.3	The samples shall not explode or catch fire. In addition the sample shall not vent or leak as described in 5.1.1.	The test results meet the requirements.	P
ENVIRONMENTAL TESTS			
17	**Heating Test**		P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
17.1	A battery is to be heated in a gravity convection or circulating air oven with an initial temperature of 20 ±5°C (68±9°F). The temperature of the oven is to be raised at a rate of 5 ±2°C (9±3.6°F) per minute to a temperature of 130 ±2°C (266±3.6°F) and remain for 10 min. The sample shall return to room temperature (20±5°C) and then be examined. For batteries specified for temperatures above 100°C (212°F), the conditioning temperature shall be increased from 130 ±2°C (266±3.6°F), to 30±2°C (86±3.6°F) above the manufacturers maximum specified temperature. For a battery of lithium metal chemistry, the conditioning temperature shall be increased to a maximum of 170 ±2°C (338±3.6°F).	Tested as required. Oven temperature: 130°C.	P
17.2	The samples shall not explode or catch fire.	The test results meet the requirements.	P
18	**Temperature Cycling Test**		P
18.1	The batteries are to be placed in a test chamber and subjected to the following cycles: Raising the chamber-temperature to 70 ±3°C (158 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. Reducing the chamber temperature to 20 ±3°C (68 ±5°F) within 30 minutes and maintaining this temperature for 2 hours. Reducing the chamber temperature to minus 40 ±3°C (minus 40 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. Raising the chamber temperature to 20 ±3°C (68 ±5°F) within 30 minutes. Repeating the sequence for a further 9 cycles. After the 10th cycle, storing the batteries for a minimum of 24 hours, at a temperature of 20 ±5°C (68 ±9°F) prior to examination.	Tested as required. See table 18	P
18.2	The samples shall not explode or catch fire. In addition, the samples shall not vent or leak as described in 5.1.1.	The test results meet the requirements.	P
19	**Low Pressure (Altitude Simulation) Test**		P
19.1	Sample batteries are to be stored for 6 hours at an absolute pressure of 11.6 kPa (1.68 psi) and a temperature of 20 ± 3°C (68 ± 5°F).	Tested as required. See table 19	P
19.2	The samples shall not explode or catch fire as a result of the Altitude Simulation Test. In addition, the samples shall not vent or leak as described in 5.1.1.	The test results meet the requirements.	P
TESTS FOR USER-REPLACEABLE LITHIUM BATTERIES			
20	**Projectile Test**		P
20.1	When subjected to the test described in 20.2 - 20.5 no part of an exploding cell or battery shall penetrate the wire screen such that some or all of the cell or battery protrudes through the screen.	The test results meet the requirements.	P

UL1642:2012			
Clause	Requirement + Test	Result - Remark	Verdict
20.2	Each test sample cell or battery is to be placed on a screen that covers a 102 mm (4 inch) diameter hole in the center of a platform table. The screen is to be constructed of steel wire mesh having 20 openings per inch (25.4 mm) and a wire diameter of 0.017 inch (0.43 mm).	Prepared the test as required.	P
20.3	The screen is to be mounted 38 mm (1-1/2 inch) above a burner. The fuel and air flow rates are to be set to provide a bright blue flame that causes the supporting screen to glow a bright red.	Prepared the test as required.	P
20.4	An eight-sided covered wire cage, 610 mm (2 feet) across and 305 mm (1 foot) high, made from metal screening is to be placed over the test sample. See Figure 20.1. The metal screening is to be constructed from 0.25 mm (0.010 inch) diameter aluminum wire with 16 — 18 wires per inch (25.4 mm) in each direction.	Tested as required.	P
20.5	The sample is to be heated and shall remain on the screen until it explodes or the cell or battery has ignited and burned out. It is not required to secure the sample in place unless it is at risk of falling off the screen before the test is completed. When required, the sample shall be secured to the screen with a single wire tied around the sample.	Tested as required.	P
MARKING			
21	**General**		P
21.1	A battery shall be legibly and permanently marked with: The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified; A distinctive ("catalog" or "model") number or the equivalent; The date or other dating period of manufacture not exceeding any three consecutive months.	See marking plate on page 3	P
21.2	If a manufacturer produces a battery at more than one factory, each battery package shall have a distinctive marking to identify it as the product of a particular factory.	One single factory	N/A

Critical Components

Material: e.g. external enclosure, PCB, closed-end connector, sleeves, cord anchorage etc

Components with winding: e.g. motor, transformer, magnetic coil etc.

Other components: e.g. switch, thermostat, heater, plug, internal wire, capacitor, relay, varistor etc.

Object/ Part No.	Manufacturer/ trademark	Type/ Model	Technical data	Standard	Mark(s) of conformity
-Positive electrode	Long Power Systems (Suzhou) Co., Ltd.	N54A	$LiNi_xCo_yMn_{1-x-y}O_2$, Ni: Co: Mn= 5: 2: 3	--	--
-Negative electrode	JiangXi ZETO New Energy Sc. & Tech. Joint-stock Co., Ltd.	ZT-T15	Graphite	--	--
-Separator	Liaoyuan Hongtu Lithium-ion Battery Separator Technology Co., Ltd	16HP	PE, Shutdown temperature: 140°C	--	--
-Electrolyte	Henan fine electrolyte New Energy Technology Co. LTD	FT-1108-02	$LiPF_6$, DEC, DMC, EC, VC, PS, LiBOB	--	--

10	TABLE: Short-Circuit Test				P
Fully Charged Cell (model: 10440 320mAh)					
Ambient temperature: 22.7°C					
Sample No.	ZKS200500183 C001	ZKS200500183 C002	ZKS200500183 C003	ZKS200500183 C004	ZKS200500183 C005
Tmax(°C)	124.6	116.9	124.9	126.7	126.3
Failure Mode	No	No	No	No	No
Ambient temperature: 56.2°C					
Sample No.	ZKS200500183 C011	ZKS200500183 C012	ZKS200500183 C013	ZKS200500183 C014	ZKS200500183 C015
Tmax(°C)	130.7	125.1	125.4	132.9	131.1
Failure Mode	No	No	No	No	No
Cycled Cell (model: 10440 320mAh)					
Ambient temperature: 23.1°C					
Sample No.	ZKS200500183 C006	ZKS200500183 C007	ZKS200500183 C008	ZKS200500183 C009	ZKS200500183 C010
Tmax(°C)	123.8	119.2	115.8	132.4	126.9
Failure Mode	No	No	No	No	No
Ambient temperature: 55.7°C					
Sample No.	ZKS200500183 C016	ZKS200500183 C017	ZKS200500183 C018	ZKS200500183 C019	ZKS200500183 C020
Tmax(°C)	123.9	126.2	126.2	128.2	124.1
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of the cell sureface. No explode or catch fire. The temperature of the cell casing does not exceed 150°C.					

10	TABLE: Short-Circuit Test				P
Fully Charged Cell (model: 18500 1500mAh)					
Ambient temperature: 24.5°C					
Sample No.	ZKS200500183 C116	ZKS200500183 C117	ZKS200500183 C118	ZKS200500183 C119	ZKS200500183 C120
Tmax(°C)	110.7	111.7	114.3	101.4	106.1
Failure Mode	No	No	No	No	No
Ambient temperature: 55.1°C					
Sample No.	ZKS200500183 C126	ZKS200500183 C127	ZKS200500183 C128	ZKS200500183 C129	ZKS200500183 C130
Tmax(°C)	122.2	109.9	112.1	105.4	117.0
Failure Mode	No	No	No	No	No
Cycled Cell (model: 18500 1500mAh)					
Ambient temperature: 24.5°C					
Sample No.	ZKS200500183 C121	ZKS200500183 C122	ZKS200500183 C123	ZKS200500183 C124	ZKS200500183 C125
Tmax(°C)	101.8	113.8	116.6	120.8	122.6
Failure Mode	No	No	No	No	No
Ambient temperature: 55.1°C					
Sample No.	ZKS200500183 C131	ZKS200500183 C132	ZKS200500183 C133	ZKS200500183 C134	ZKS200500183 C135
Tmax(°C)	118.3	121.7	128.7	123.0	102.6
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of the cell surface. No explode or catch fire. The temperature of the cell casing does not exceed 150°C.					

10	TABLE: Short-Circuit Test				P
Fully Charged Cell (model: 18650 2600mAh)					
Ambient temperature: 24.0°C					
Sample No.	ZKS200500183 C231	ZKS200500183 C232	ZKS200500183 C233	ZKS200500183 C234	ZKS200500183 C235
Tmax(°C)	100.1	80.3	90.0	97.7	109.5
Failure Mode	No	No	No	No	No
Ambient temperature: 57.0°C					
Sample No.	ZKS200500183 C241	ZKS200500183 C242	ZKS200500183 C243	ZKS200500183 C244	ZKS200500183 C245
Tmax(°C)	93.2	86.7	78.2	86.2	93.5
Failure Mode	No	No	No	No	No
Cycled Cell (model: 18650 2600mAh)					
Ambient temperature: 24.0°C					
Sample No.	ZKS200500183 C236	ZKS200500183 C237	ZKS200500183 C238	ZKS200500183 C239	ZKS200500183 C240
Tmax(°C)	103.0	111.7	98.3	121.1	95.1
Failure Mode	No	No	No	No	No
Ambient temperature: 56.8°C					
Sample No.	ZKS200500183 C246	ZKS200500183 C247	ZKS200500183 C248	ZKS200500183 C249	ZKS200500183 C250
Tmax(°C)	118.4	93.7	102.7	104.6	102.8
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of the cell surface. No explode or catch fire. The temperature of the cell casing does not exceed 150°C.					

11	TABLE: Abnormal Charging Test (model: 10440 320mAh)				P
Ambient temperature: 24.0°C					
Id	0.064 A		Ue	2.75 V	
Ic	0.32 A		Uc	4.25 V	
Fully Charged Cell					
Sample No.	ZKS200500183 C021	ZKS200500183 C022	ZKS200500183 C023	ZKS200500183 C024	ZKS200500183 C025
Tmax(°C)	70.3	70.7	70.4	66.1	70.7
Failure Mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C026	ZKS200500183 C027	ZKS200500183 C028	ZKS200500183 C029	ZKS200500183 C030
Tmax(°C)	60.9	68.9	70.9	65.5	65.6
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of cell surface; Test current is 0.96A. No explode or catch fire.					

11	TABLE: Abnormal Charging Test (model: 18500 1500mAh)				P
Ambient temperature: 24.6°C					
Id	0.3 A		Ue	2.75 V	
Ic	1.5 A		Uc	4.25 V	
Fully Charged Cell					
Sample No.	ZKS200500183 C136	ZKS200500183 C137	ZKS200500183 C138	ZKS200500183 C139	ZKS200500183 C140
Tmax(°C)	40.9	38.3	36.3	40.9	36.0
Failure Mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C141	ZKS200500183 C142	ZKS200500183 C143	ZKS200500183 C144	ZKS200500183 C145
Tmax(°C)	41.2	43.7	42.7	39.1	38.9
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of the cell surface; Test current is 4.5A. No explode or catch fire.					

11	TABLE: Abnormal Charging Test (model: 18650 2600mAh)				P
Ambient temperature: 22.2°C					
Id		0.52 A	Ue		2.75 V
Ic		2.6 A	Uc		4.25 V
Fully Charged Cell					
Sample No.	ZKS200500183 C251	ZKS200500183 C252	ZKS200500183 C253	ZKS200500183 C254	ZKS200500183 C255
Tmax(°C)	42.6	45.5	44.2	44.7	42.5
Failure Mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C256	ZKS200500183 C257	ZKS200500183 C258	ZKS200500183 C259	ZKS200500183 C260
Tmax(°C)	43.4	46.6	44.6	45.0	44.8
Failure Mode	No	No	No	No	No
Supplementary information: Tmax was recorded on the centre of the cell surface; Test current is 7.8A. No explode or catch fire.					

13	TABLE: Crush Test (model: 10440 320mAh)				P
Ambient temperature: 24.2°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C031	ZKS200500183 C032	ZKS200500183 C033	ZKS200500183 C034	ZKS200500183 C035
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C036	ZKS200500183 C037	ZKS200500183 C038	ZKS200500183 C039	ZKS200500183 C040
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

13	TABLE: Crush Test (model: 18500 1500mAh)				P
Ambient temperature: 24.4°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C146	ZKS200500183 C147	ZKS200500183 C148	ZKS200500183 C149	ZKS200500183 C150
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C151	ZKS200500183 C152	ZKS200500183 C153	ZKS200500183 C154	ZKS200500183 C155
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

13	TABLE: Crush Test (model: 18650 2600mAh)				P
Ambient temperature: 23.6°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C261	ZKS200500183 C262	ZKS200500183 C263	ZKS200500183 C264	ZKS200500183 C265
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C266	ZKS200500183 C267	ZKS200500183 C268	ZKS200500183 C269	ZKS200500183 C270
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Crush direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

14	TABLE: Impact Test (model: 10440 320mAh)				P
Ambient temperature: 24.7°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C041	ZKS200500183 C042	ZKS20050018 3 C043	ZKS200500183 C044	ZKS20050018 3 C045
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C046	ZKS200500183 C047	ZKS200500183 C048	ZKS200500183 C049	ZKS20050018 3 C050
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

14	TABLE: Impact Test (model: 18500 1500mAh)				P
Ambient temperature: 24.1°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C156	ZKS200500183 C157	ZKS200500183 C158	ZKS200500183 C159	ZKS2005001 83 C160
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C161	ZKS200500183 C162	ZKS200500183 C163	ZKS200500183 C164	ZKS2005001 83 C165
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

14	TABLE: Impact Test (model: 18650 2600mAh)				P
Ambient temperature: 24.1°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C271	ZKS200500183 C272	ZKS200500183 C273	ZKS200500183 C274	ZKS200500183 C275
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Cycled cell					
Sample No.	ZKS200500183 C276	ZKS200500183 C277	ZKS200500183 C278	ZKS200500183 C279	ZKS200500183 C280
Catch fire	No	No	No	No	No
Explode	No	No	No	No	No
Impact direction	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis	Longitudinal axis
Failure mode	No	No	No	No	No
Supplementary information: no explosion or catch fire.					

15	TABLE: Shock Test (model: 10440 320mAh)				P
Ambient temperature: 23.4°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C051	ZKS200500183 C052	ZKS200500183 C053	ZKS200500183 C054	ZKS200500183 C055
Mass before test (g)	8.775	8.935	8.794	8.854	8.817
Mass after test (g)	8.774	8.935	8.792	8.853	8.812
Mass loss ratio (%)	0.01	0.00	0.02	0.01	0.02
Cycled cell					
Sample No.	ZKS200500183 C056	ZKS200500183 C057	ZKS200500183 C058	ZKS200500183 C059	ZKS200500183 C060
Mass before test (g)	8.795	8.654	8.776	8.657	8.655
Mass after test (g)	8.793	8.654	8.774	8.656	8.653
Mass loss ratio (%)	0.02	0.00	0.02	0.01	0.02
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

15	TABLE: Shock Test (model: 18500 1500mAh)				P
Ambient temperature: 23.4°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C166	ZKS200500183 C167	ZKS200500183 C168	ZKS200500183 C169	ZKS200500183 C170
Mass before test (g)	33.865	33.957	33.656	33.879	33.796
Mass after test (g)	33.861	33.956	33.653	33.877	33.795
Mass loss ratio (%)	0.01	0.00	0.01	0.01	0.00
Cycled cell					
Sample No.	ZKS200500183 C171	ZKS200500183 C172	ZKS200500183 C173	ZKS200500183 C174	ZKS200500183 C175
Mass before test (g)	33.827	33.573	33.569	33.546	33.659
Mass after test (g)	33.823	33.571	33.568	33.544	33.656
Mass loss ratio (%)	0.01	0.01	0.00	0.01	0.01
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

15	TABLE: Shock Test (model: 18650 2600mAh)				P
Ambient temperature: 22.9°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C281	ZKS200500183 C282	ZKS200500183 C283	ZKS200500183 C284	ZKS200500183 C285
Mass before test (g)	45.584	45.589	45.519	45.511	45.617
Mass after test (g)	45.580	45.586	45.514	45.507	45.615
Mass loss ratio (%)	0.01	0.01	0.01	0.01	0.00
Cycled cell					
Sample No.	ZKS200500183 C286	ZKS200500183 C287	ZKS200500183 C288	ZKS200500183 C289	ZKS200500183 C290
Mass before test (g)	44.916	45.234	45.194	45.277	45.416
Mass after test (g)	44.911	45.230	45.192	45.274	45.414
Mass loss ratio (%)	0.01	0.01	0.00	0.01	0.00
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

16	TABLE: Vibration Test (model: 10440 320mAh)				P
Ambient temperature: 22.9°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C061	ZKS200500183 C062	ZKS200500183 C063	ZKS200500183 C064	ZKS200500183 C065
Mass before test (g)	8.765	8.916	8.744	8.765	8.678
Mass after test (g)	8.763	8.915	8.743	8.765	8.676
Mass loss ratio (%)	0.02	0.01	0.01	0.00	0.02
Cycled cell					
Sample No.	ZKS200500183 C066	ZKS200500183 C067	ZKS200500183 C068	ZKS200500183 C069	ZKS200500183 C070
Mass before test (g)	8.596	8.555	8.654	8.710	8.724
Mass after test (g)	8.595	8.554	8.652	8.707	8.722
Mass loss ratio (%)	0.01	0.01	0.02	0.03	0.02
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

16	TABLE: Vibration Test (model: 18500 1500mAh)				P
Ambient temperature: 23.2°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C176	ZKS200500183 C177	ZKS200500183 C178	ZKS200500183 C179	ZKS200500183 C180
Mass before test (g)	33.774	33.657	33.754	33.569	33.796
Mass after test (g)	33.771	33.655	33.753	33.566	33.793
Mass loss ratio (%)	0.01	0.01	0.00	0.01	0.01
Cycled cell					
Sample No.	ZKS200500183 C181	ZKS200500183 C182	ZKS200500183 C183	ZKS200500183 C184	ZKS200500183 C185
Mass before test (g)	33.847	33.597	34.096	33.665	33.651
Mass after test (g)	33.843	33.595	34.095	33.663	33.650
Mass loss ratio (%)	0.01	0.01	0.00	0.01	0.00
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

16	TABLE: Vibration Test (model: 18650 2600mAh)				P
Ambient temperature: 23.1°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C291	ZKS200500183 C292	ZKS200500183 C293	ZKS200500183 C294	ZKS200500183 C295
Mass before test (g)	45.547	45.169	45.617	44.917	45.617
Mass after test (g)	45.544	45.165	45.614	44.915	45.613
Mass loss ratio (%)	0.01	0.01	0.01	0.00	0.01
Cycled cell					
Sample No.	ZKS200500183 C296	ZKS200500183 C297	ZKS200500183 C298	ZKS200500183 C299	ZKS200500183 C300
Mass before test (g)	45.569	45.227	45.177	45.269	45.345
Mass after test (g)	45.564	45.224	45.172	45.266	45.342
Mass loss ratio (%)	0.01	0.01	0.01	0.01	0.01
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

18	TABLE: Temperature Cycling Test (model: 10440 320mAh)				P
Ambient temperature: 23.2°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C091	ZKS200500183 C092	ZKS200500183 C093	ZKS200500183 C094	ZKS200500183 C095
Mass before test (g)	8.769	8.917	8.973	8.884	8.859
Mass after test (g)	8.765	8.912	8.970	8.880	8.855
Mass loss ratio (%)	0.05	0.06	0.03	0.05	0.05
Cycled cell					
Sample No.	ZKS200500183 C096	ZKS200500183 C097	ZKS200500183 C098	ZKS200500183 C099	ZKS200500183 C100
Mass before test (g)	8.776	8.657	8.641	8.689	8.716
Mass after test (g)	8.772	8.654	8.638	8.685	8.711
Mass loss ratio (%)	0.05	0.03	0.03	0.05	0.06
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1 %					

18	TABLE: Temperature Cycling Test (model: 18500 1500mAh)				P
Ambient temperature: 23.2°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C206	ZKS200500183 C207	ZKS200500183 C208	ZKS200500183 C209	ZKS200500183 C210
Mass before test (g)	33.869	33.991	33.771	33.826	33.516
Mass after test (g)	33.860	33.984	33.765	33.821	33.510
Mass loss ratio (%)	0.03	0.02	0.02	0.01	0.02
Cycled cell					
Sample No.	ZKS200500183 C211	ZKS200500183 C212	ZKS200500183 C213	ZKS200500183 C214	ZKS200500183 C215
Mass before test (g)	33.416	33.517	33.617	33.165	33.596
Mass after test (g)	33.410	33.513	33.612	33.162	33.590
Mass loss ratio (%)	0.02	0.01	0.01	0.01	0.02
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

18	TABLE: Temperature Cycling Test (model: 18650 2600mAh)				P
Ambient temperature: 23.8°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C321	ZKS200500183 C322	ZKS200500183 C323	ZKS200500183 C324	ZKS200500183 C325
Mass before test (g)	45.570	44.917	45.170	45.119	46.105
Mass after test (g)	45.563	44.912	45.162	45.114	46.101
Mass loss ratio (%)	0.02	0.01	0.01	0.01	0.01
Cycled cell					
Sample No.	ZKS200500183 C326	ZKS200500183 C327	ZKS200500183 C328	ZKS200500183 C329	ZKS200500183 C330
Mass before test (g)	45.159	45.557	44.987	45.161	45.195
Mass after test (g)	45.152	45.553	44.980	45.157	45.190
Mass loss ratio (%)	0.02	0.01	0.02	0.01	0.01
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

19	TABLE: Low Pressure (Altitude Simulation) Test (model: 10440 320mAh)				P
Ambient temperature: 23.5°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C101	ZKS200500183 C102	ZKS200500183 C103	ZKS200500183 C104	ZKS200500183 C105
Mass before test (g)	8.654	8.715	8.723	8.574	8.693
Mass after test (g)	8.653	8.715	8.722	8.574	8.693
Mass loss ratio (%)	0.01	0.00	0.01	0.00	0.00
Cycled cell					
Sample No.	ZKS200500183 C106	ZKS200500183 C107	ZKS200500183 C108	ZKS200500183 C109	ZKS200500183 C110
Mass before test (g)	8.473	8.711	8.623	8.572	8.594
Mass after test (g)	8.472	8.710	8.623	8.570	8.594
Mass loss ratio (%)	0.01	0.01	0.00	0.02	0.00
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

19	TABLE: Low Pressure (Altitude Simulation) Test (model: 18500 1500mAh)				P
Ambient temperature: 24.5°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C216	ZKS200500183 C217	ZKS200500183 C218	ZKS200500183 C219	ZKS200500183 C220
Mass before test (g)	33.856	34.097	33.654	33.541	33.546
Mass after test (g)	33.855	34.094	33.650	33.539	33.544
Mass loss ratio (%)	0.00	0.01	0.01	0.01	0.01
Cycled cell					
Sample No.	ZKS200500183 C221	ZKS200500183 C222	ZKS200500183 C223	ZKS200500183 C224	ZKS200500183 C225
Mass before test (g)	33.771	33.569	33.793	33.846	33.916
Mass after test (g)	33.768	33.568	33.792	33.844	33.913
Mass loss ratio (%)	0.01	0.00	0.00	0.01	0.01
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

19	TABLE: Low Pressure (Altitude Simulation) Test (model: 18650 2600mAh)				P
Ambient temperature: 23.9°C					
Fully Charged Cell					
Sample No.	ZKS200500183 C331	ZKS200500183 C332	ZKS200500183 C333	ZKS200500183 C334	ZKS200500183 C335
Mass before test (g)	45.170	45.226	44.991	45.217	45.416
Mass after test (g)	45.168	45.223	44.990	45.215	45.413
Mass loss ratio (%)	0.00	0.01	0.00	0.00	0.01
Cycled cell					
Sample No.	ZKS200500183 C336	ZKS200500183 C337	ZKS200500183 C338	ZKS200500183 C339	ZKS200500183 C340
Mass before test (g)	45.415	45.493	45.226	45.317	45.557
Mass after test (g)	45.412	45.490	45.224	45.315	45.554
Mass loss ratio (%)	0.01	0.01	0.00	0.00	0.01
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.1%					

--End of report--

Attachment 1
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Produkte
Products

	Eq. No.	Name	Manufacturer	Model No.	Date of Calibration	Date of next Calibration
☒	ZKSB-1001	Battery Test System	RePower	CTS 5V-5A	2020-03-14	2021-03-13
☒	ZKSB-1002	Battery Test System	RePower	CTS 5V-10A	2020-03-14	2021-03-13
☐	ZKSB-1003	Battery Test System	RePower	CTS 20V-10A	2020-03-14	2021-03-13
☐	ZKSB-1004	Power bank test system	RePower	CTS 6V-5A	2020-03-14	2021-03-13
☐	ZKSB-1045	Battery Test System	RePower	CTS 60V-40A	2020-03-14	2021-03-13
☒	ZKSB-1006	Temperature Chamber cycling	Kewen	TEMI880(408)	2020-03-14	2021-03-13
☒	ZKSB-1007	Impact tester	DGBELL	BE-5066	2020-03-14	2021-03-13
☒	ZKSB-1008	Crush tester	DGBELL	BE-6047	2020-03-14	2021-03-13
☐	ZKSB-1009	Free fall tester	DGBELL	BE-F-315S	2020-03-14	2021-03-13
☒	ZKSB-1010	Oven	GWS	SPH101	2020-03-14	2021-03-13
☒	ZKSB-1011	Oven	Shengxin	101-3	2020-03-14	2021-03-13
☒	ZKSB-1012	Vacuum chamber	HongHua	DZF-6050	2020-03-14	2021-03-13
☒	ZKSB-1013	Vibration tester	LABTONE	EV203	2020-03-14	2021-03-13
☒	ZKSB-1014	Shock tester	LABTONE	HSKT10	2020-03-14	2021-03-13
☒	ZKSB-1015	Projectile Tester	DGBELL	BE-6046	2020-03-14	2021-03-13
☐	ZKSB-1078	ESD TEST GENERATOR	TESEQ	NSG438	2020-03-14	2021-03-13
☐	ZKSB-1016	Battery function tester	Chaoshishi	RBM-200	2020-03-14	2021-03-13
☐	ZKSB-1017	Forced internal short circuit tester	DGBELL	BE-6045W	2020-03-14	2021-03-13
☐	ZKSB-1018	Electronic Digital Calliper	UPM	ST-089	2020-03-14	2021-03-13
☐	ZKSS-1039	Pull & Push Gage	DESK	FB-500	2020-03-14	2021-03-13
☒	ZKSS-1051	Timer	AnBiao instrument	PC396	2020-03-14	2021-03-13
☒	ZKSB-1020	Electronic balance	Huazhi	HZK-FA 300	2020-03-14	2021-03-13
☒	ZKSB-1021	Multimeter	FLUKE	287C	2020-03-14	2021-03-13
☒	ZKSB-1030	DC power supply	GWINSTEK	PSW 80-27	2020-03-14	2021-03-13
☐	ZKSB-1022	Electronic Load	ITECH	IT8511	2020-03-14	2021-03-13
☒	ZKSB-1023	Temperature measurement recorder	Toprie Electronic Co., Ltd.	TP700	2020-03-14	2021-03-13
☐	ZKSS-1001	Oscilloscope	RIGOL	DS 3102M	2020-03-14	2021-03-13
☐	ZKSS-1002	Insulation resistance tester	Yangzi	YD 9820A	2020-03-14	2021-03-13
☒	ZKSB-1081	External short circuit tester	ZRLK	ZKSB-032	2020-03-14	2021-03-13
☐	ZKSB-1025	Resister	ZRLK	ZKSB-033	2020-03-14	2021-03-13
☐	ZKSB-1026	Washing tester	CEPREI	7206A	2020-03-14	2021-03-13
☐	ZKSB-1027	Battery protect circuit test system	CEPREI	7207A	2020-03-14	2021-03-13
☐	ZKSB-1028	DC Low-resistance tester	Yangzi	YD 2511	2020-03-14	2021-03-13
☐	ZKSB-1037	Glove box	Nangjing Nangda	1	2020-03-14	2021-03-13
☒	ZKSB-1029	DC power supply	GWINSTEK	PSP-2010	2020-03-14	2021-03-13
☐	ZKSS-1004	Power meter	QingZhi	8716B1	2020-03-14	2021-03-13
☐	ZKSS-1005	Power meter	YuangFang	PF 9808B	2020-03-14	2021-03-13
☐	ZKSB-1041	AC/DC withstand voltage tester	TOSSTAR	TOS 7020	2020-03-14	2021-03-13
☐	ZKSS-1007	Oven	Shengxin	LC-233	2020-03-14	2021-03-13
☐	ZKSS-1008	Voltage Regulator,	HuaTong Jidian	TDGC2-5KVA	2020-03-14	2021-03-13
☐	ZKSS-1009	Voltage Regulator,	HuaTong Jidian	TDGC2-5KVA	2020-03-14	2021-03-13
☐	ZKSS-1010	Power Supply	HengXinLong	HXL-3130	2020-03-14	2021-03-13
☒	ZKSB-1064	Digital Thermometer & Hygrometer	Shenzhen UYIGAO	CTH-608	2020-03-14	2021-03-13

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Statement of Uncertainty

Unless otherwise specified, combined measurement uncertainty for values stated in the test report is as stated below:

Voltage measurement:		±1.50% (true rms value) ±1.0% (DC voltage)
Current measurement:		±1.56% (true rms value) ±1.0% (DC current)
Touch current (below 30 mA)		±2.04%
Power	- less than 1 W	±20 mW
	- below 3 kW	±0.53%
	- 3 kW and more	±0.58%
Power factor		±0.01
Frequency		±0.06%
Resistance	- between 100 mΩ and 1 MΩ	±1.25%
	- another values	±2.05%
Temperature	- below 100°C	±1.25°C (without thermocouple; for thermocouple add 2°C)
	- between 100 and 500°C	±1.45°C (without thermocouple; for thermocouple add 2°C)
Time	- below 20 s	±0.74%
	- more than 20 s (manual meas.)	±0.2 s
Linear dimensions	- less than 1 mm	±0.01 mm
	- from 1 to 25 mm	±0.05 mm
	- more than 25 mm	±0.30%
Mass	- below 5 kg	±2%
	- 5 kg and more	±1%
Force		±1%
Torque		±3%
Angles		±12’
Relative humidity		±5%
Air pressure (barometric)		±0.2 kPa
Pressure		±3.34%
Flow		±1.5%

Values stated in this document represent the worst case for equipment which is in possession of the laboratory and setups commonly used for testing.

For units or cases not specified in this document the evaluation of uncertainty shall be made upon request on individual basis.

The reported combined uncertainty is stated as standard uncertainty of reported value multiplied by coverage factor k = 2, which for normal distribution corresponds to a coverage probability of approximately 95%.

ATTACHMENT 2 Photo Documentation

Product: Rechargeable lithium ion cell

Type Designation: 10440 320mAh, 13300 400mAh, 13400 550mAh, 14500 600mAh, 14500 800mAh, 18350 900mAh, 18500 1500mAh, 18650 1500mAh, 18650 1800mAh, 18650 2000mAh, 18650 2100mAh, 18650 2200mAh, 18650 2400mAh, 18650 2500mAh, 18650 2600mAh

Remark: All of the models are the same chemistry, but with different capacities. The photos of the represent models are listed as below.

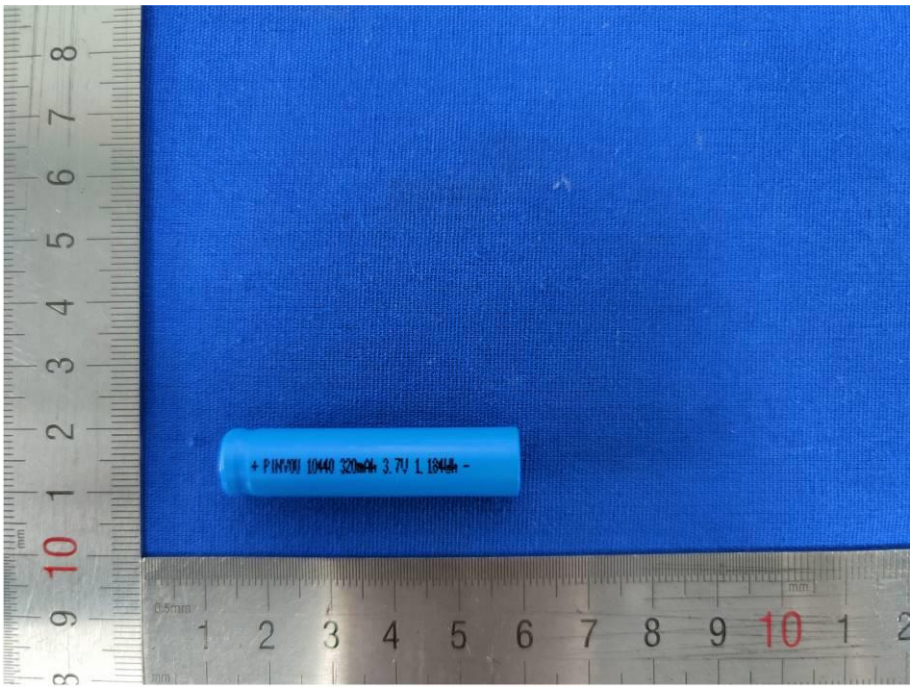

Figure 1 Side view of cell (10440 320mAh)

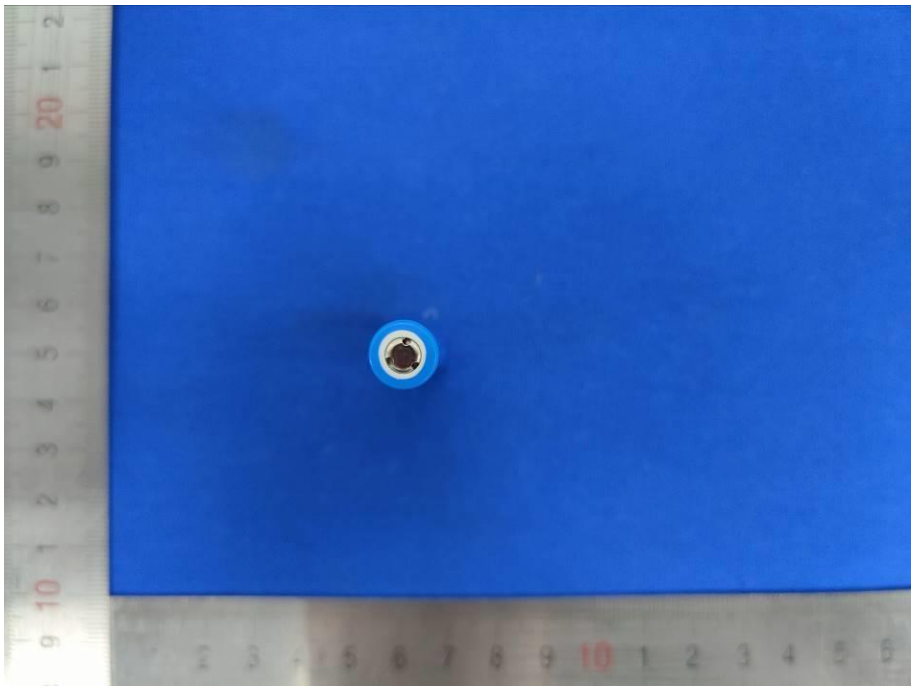

Figure 2 Terminal view of cell (10440 320mAh)

ATTACHMENT 2 Photo Documentation

Product: Rechargeable lithium ion cell

Type Designation: 10440 320mAh, 13300 400mAh, 13400 550mAh, 14500 600mAh, 14500 800mAh, 18350 900mAh, 18500 1500mAh, 18650 1500mAh, 18650 1800mAh, 18650 2000mAh, 18650 2100mAh, 18650 2200mAh, 18650 2400mAh, 18650 2500mAh, 18650 2600mAh

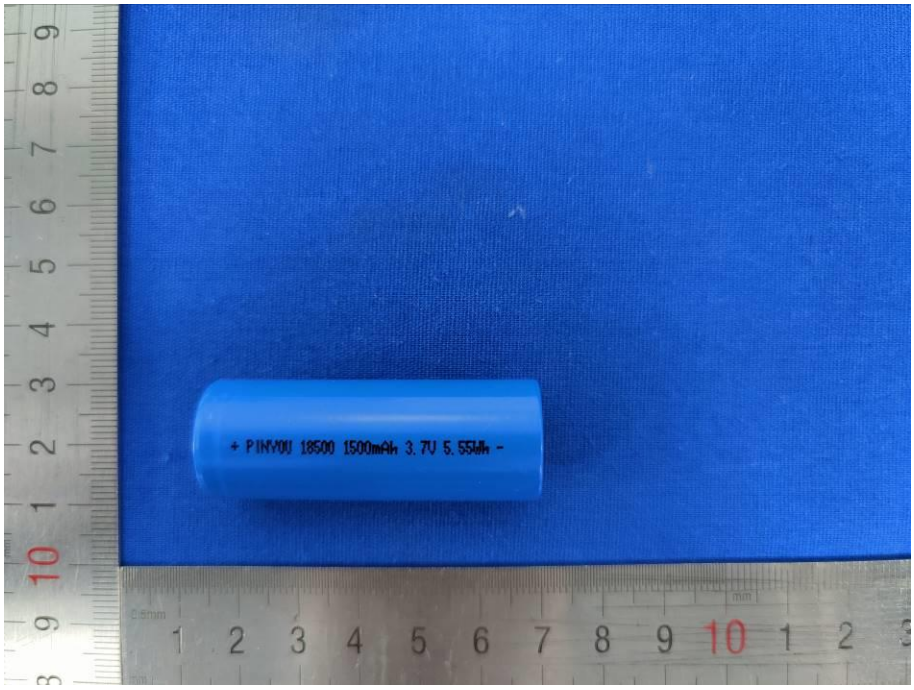

Figure 3 Side view of cell (18500 1500mAh)

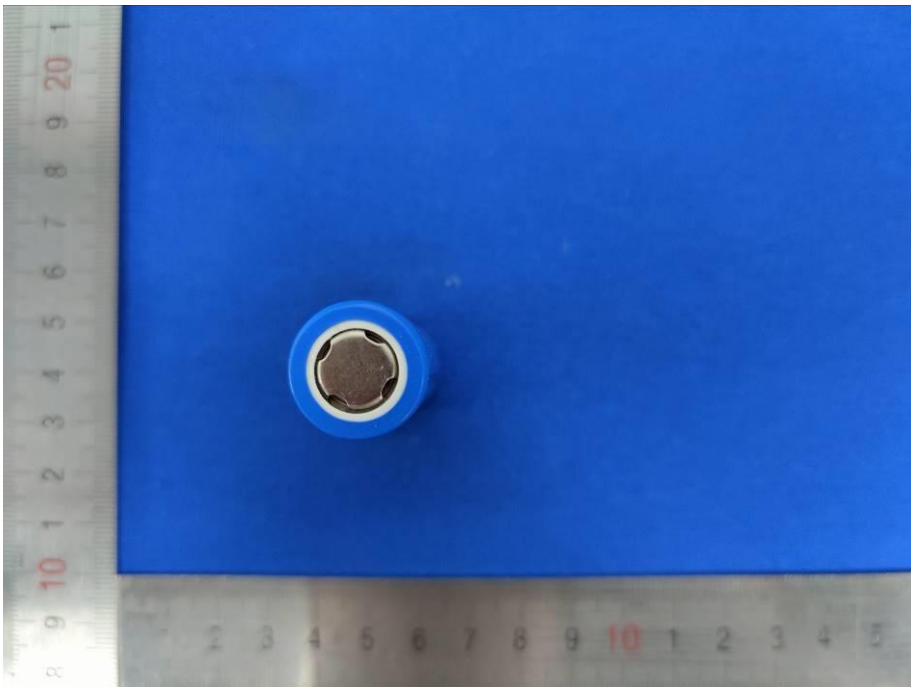

Figure 4 Terminal view of cell (18500 1500mAh)

ATTACHMENT 2 Photo Documentation

Product: Rechargeable lithium ion cell

Type Designation: 10440 320mAh, 13300 400mAh, 13400 550mAh, 14500 600mAh, 14500 800mAh, 18350 900mAh, 18500 1500mAh, 18650 1500mAh, 18650 1800mAh, 18650 2000mAh, 18650 2100mAh, 18650 2200mAh, 18650 2400mAh, 18650 2500mAh, 18650 2600mAh

Figure 5 Side view of cell (18650 2600mAh)

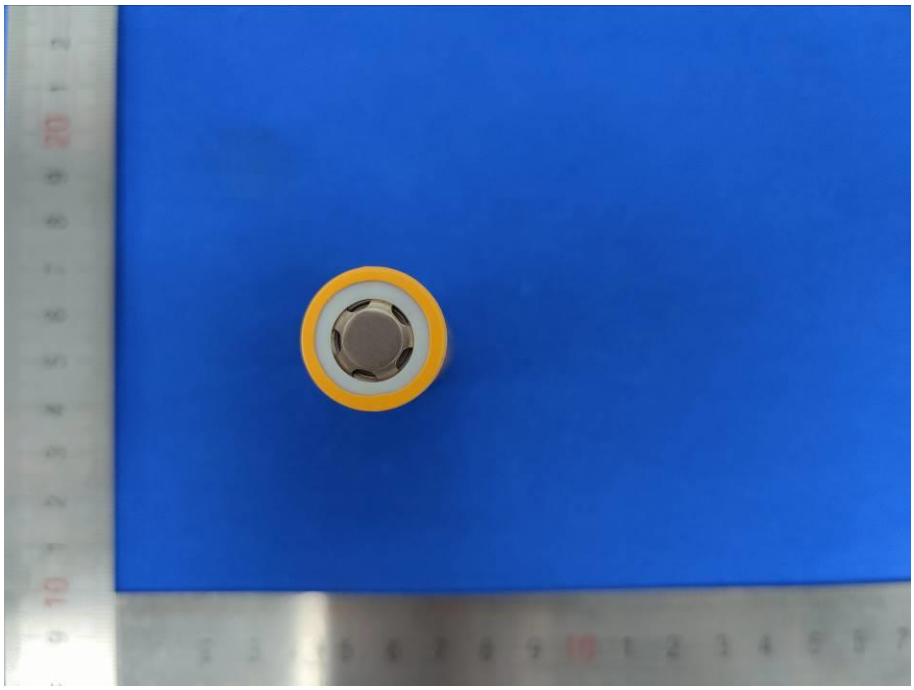

Figure 6 Terminal view of cell (18650 2600mAh)