


Test Report No.	TSZ23110539-P01-R01		
Total number of pages:	29 pages		
Client:	AN YUAN XIAN KAI WEN KE JI YOU XIAN GONG SI JIANG XI SHENG GAN ZHOU SHI AN YUAN XIAN CHAN CHENG XIN QI		
Test item:	Lithium manganese dioxide button Cell		
Identification:	CR2025, CR2032		
Serial No.	N/A		
Order content:	Test report		
Date of receipt:	2023-11-24		
Testing period:	2023-11-24 to 2023-12-08		
Testing location:	Shenzhen Tiansu Calibration and Testing Co., Ltd. No.2, Jinlong Road, Longgang District, Shenzhen, Guangdong, China		
Test specification:	UL 1642:2020 R10.22		
Test Result:	The test item passed the test specification(s).		
Testing Laboratory:	Shenzhen Tiansu Calibration and Testing Co., Ltd. No.2, Jinlong Road, Longgang District, Shenzhen, Guangdong, China		
Tested by (date, name, signature):	2023-12-13	Orren Zeng	
Reviewed by (date, name, signature):	2023-12-13	Lobb Sun	
Approved by (date, name, signature):	2023-12-13	Duanjiangtao	
Other Aspects:	<p>The complete test report includes the following documents:</p> <ul style="list-style-type: none"> - UL 1642 test report; - Attachment 1: Photo documentation. 		
Abbreviations:	<p>P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested</p>		
<p>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</p>			



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.....	CR2025, CR2032
Trademark	N/A
Nominal voltage.....	3.0V
	220mAh (Model: CR2032)
Rated capacity.....	150mAh (Model: CR2025)
Ambient temperature range.....	-20~85°C (discharge)
Utilization Type	Technician replaceable cell

Test clauses and results:

cl.10 Short-Circuit Test.....	P
cl.11 Abnormal Charging Test.....	P
cl.12 Forced-Discharge Test	N/A
cl.13 Crush Test	P
cl.14 Impact Test	P
cl.14A Round Bar Crush Test.....	N/A
cl.15 Shock Test.....	P
cl.16 Vibration Test.....	P
cl.17 Heating Test.....	P
cl.18 Temperature Cycling Test	P
cl.19 Low Pressure (Altitude Simulation) Test	P
cl.20 Projectile Test	P

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:

+ -
Lithium manganese dioxide button Cell
Model: CR2025
3.0V, 150mAh
YYYY/MM/DD
AN YUAN XIAN KAI WEN KE JI YOU XIAN GONG SI

Model: CR2025

+ -
Lithium manganese dioxide button Cell
Model: CR2032
3.0V, 220mAh
YYYY/MM/DD
AN YUAN XIAN KAI WEN KE JI YOU XIAN GONG SI

Model: CR2032

Remark:

1: For the date code YYYY/MM/DD:

“YYYY” means year for manufacture;

“MM” means month for manufacture;

“DD” means day for manufacture.

2: The applicant and manufacturer information, product name, model, trademark and other information in this report are all provided by the applicant, and this laboratory is not responsible for verifying its authenticity.



General product information:

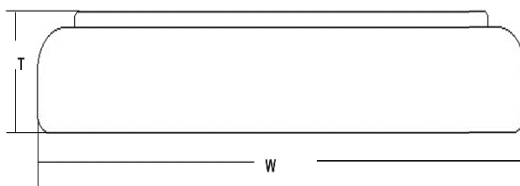
The cell is evaluated in this test report according to UL 1642:2020 R10.22, and passed all the tests.
 The cell (Model: CR2032) are available in eight different silk-screen prints, See photo page.
 The cell (Model: CR2025) are available in six different silk-screen prints, See photo page.

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.

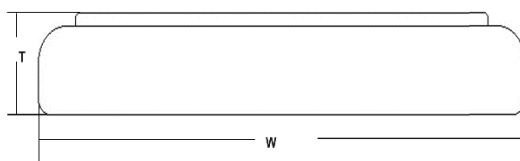
- Table: Electrical parameter:

Model	Rated capacity	Nominal voltage	Nominal Discharge Current	Max Charge Current	End discharge voltage
CR2032	220mAh	3.0V	0.2mA	0.000001mA	2.0V
CR2025	150mAh	3.0V	0.2mA	0.000001mA	2.0V

Construction:



T: 3.2 Max W: 20.0 Max
 Model: CR2032
 Cell: (Unit: mm)



T: 2.5 Max W: 20.0 Max
 Model: CR2025
 Cell: (Unit: mm)

Factory:

AN YUAN XIAN KAI WEN KE JI YOU XIAN GONG SI
 JIANG XI SHENG GAN ZHOU SHI AN YUAN XIAN CHAN CHENG XIN QI



UL1642:2020			
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.	Technician replaceable 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 mL of liquid when the battery casing is punctured under normal laboratory conditions, 23 ±2°C (73 ±3.6°F).	Technician-replaceable Battery.	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, IC (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.	Single cell only.	N/A



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Clause	Requirement + Test	Result - Remark	Verdict

PERFORMANCE			
5	General		P
5.1	Technician-replaceable Batteries		P
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 Round Bar Crush Test, Section 14A, 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, Section 14. A user-replaceable battery shall comply with the requirements for Sections 10 – 20 and with the applicable construction requirements outlined in	Technician-replaceable cell.	N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	Section 4. Secondary lithium cells shall not be considered user-replaceable.		
5.2.2	Sets of five specimens each are to be used for the Projectile Test, Section 20.3; see Table 6.1. 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	Multicell Installations		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, Section 10.	Single cell.	N/A
6	Samples		P
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 cell or battery is shown in Table 6.1. 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 primary cells.	P
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 cell or battery is shown in Table 6.2. 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.		N/A
6.3	Prior to conducting the testing in Section 17, the lithium ion cell samples shall be pre-conditioned as outlined in 6.4 and 6.5.		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
6.4	For the heating test of Section 17, two sets of five lithium ion 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.		N/A
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).		N/A
7	Conditioning of Samples		P
7.1	Discharge		P
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. 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 primary cells.	P
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.		N/A
7.2	Charge-discharge cycling		N/A
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	The samples are primary cells.	N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	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% 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.		
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, 11, 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) and not to touch the lithium battery while the surface temperature exceeds 45°C (113°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
9.1	Temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG (0.21 mm ²) and not smaller than 30 AWG (0.05 mm ²) 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. Casing temperature was recorded on the center of the cell surface.	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-	Tested as required. See	P



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Clause	Requirement + Test	Result - Remark	Verdict
	circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of $80 \pm 20 \text{ m}\Omega$. The temperature of the battery case is to be recorded during the test. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ ($\pm 18^\circ\text{F}$) of ambient temperature. The voltage at the end of the test may not reach 0.2 V due to operation of protective devices in the circuit. The return to near ambient of the battery (cell) casing in an indication of ultimate results.	table 10.	
10.2	Tests are to be conducted at $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$) and at $55 \pm 5^\circ\text{C}$ ($131 \pm 9^\circ\text{F}$). The batteries are to reach equilibrium at $20 \pm 5^\circ\text{C}$ or $55 \pm 5^\circ\text{C}$, 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 protective device activates 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. Protective devices that are relied upon to meet the compliance criteria for the short circuit test shall comply with 2.3.1.	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 test results meet the requirements.	P
11	Abnormal Charging Test		P
11.1	Primary cells or batteries shall comply with 11.2 – 11.7.	Primary cells.	P
11.2	Cells or batteries conditioned in accordance with Tables 6.1, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$).		P



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Clause	Requirement + Test	Result - Remark	Verdict
11.3	<p>Each test sample battery is to be subjected to a charging current of three times the current I_c, 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:</p> $t_c = \frac{2.5C}{3(I_c)}, \text{ in which}$ <p>t_c is the charging time in hour C is the capacity of the cell/battery 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.</p>		P
11.4	<p>When a non-resettable overcurrent or protective device 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. Protective devices that are relied upon to meet the compliance criteria for the abnormal charging test shall comply with 2.3.1.</p>		P
11.5	The samples shall not explode or catch fire.		P
11.6	Secondary cells or batteries shall comply with 11.7 – 11.10.	Primary cells.	N/A
11.7	Cells or batteries conditioned in accordance with Tables 6.2, as applicable, are to be used for this test. The batteries are to be tested in an ambient temperature of $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$).		N/A
11.8	Each test sample battery is to be discharged at a constant current of $0.2 C/1 \text{ h}$, 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_c ,		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	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.		
11.9	When a non-resettable overcurrent or 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. Protective devices that are relied upon to meet the compliance criteria for the abnormal charging test shall comply with 2.3.1.		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 fully 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 fully 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 resistance load of $80 \pm 20 \text{m}\Omega$. The sample is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ (18°F) of ambient temperature. The voltage at the end of the test may not reach 0.2V due to operation of		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
	protective devices in the circuit. The return to near ambient of the cell casing is an indication of ultimate results.		
12.5	When an overcurrent or protective 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. Protective devices that are relied upon to meet the compliance criteria for the forced discharge test shall comply with 2.3.1.		N/A
12.6	The samples shall not explode or catch fire.		N/A
MECHANICAL TESTS			
13	Crush Test		P
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.		N/A
	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 wide side of pouch and prismatic cells.		N/A
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.	Button cell.	P
13.4	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test.	P



UL1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
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. See Figure 14.1.	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.		N/A
	Exception 1: 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 wide side of pouch and prismatic cells.		N/A
	Exception 2: Pouch cells not evaluated to this test, and with a capacity greater than 300 mAh, shall comply with the Round Bar Crush Test in Section 14A.		N/A
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.	Button cell.	P
14.4	The samples shall not explode or catch fire.	No explosion or catch fire.	P
14A	Round Bar Crush Test		N/A
14A.1	With reference to Exception No. 2 in 14.2, pouch cells not evaluated with the Impact Test in Section 14 and with a capacity greater than 300 mAh shall be evaluated with this test.		N/A



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Clause	Requirement + Test	Result - Remark	Verdict
14A.2	The sample shall be fully charged with the method recommended by the manufacturer.		N/A
14A.3	The sample shall be positioned on a flat surface with a 25 ±1 mm (1 ±0.039 in) diameter steel round bar placed on top of the sample. The edge of the bar is to be aligned with the top edge of the cell body, with the longitudinal axis of the bar perpendicular to the tab of the cell. The bar shall extend beyond the width of the test sample on each side by at least 5 mm (0.197 in) as shown in Figure 14A.1. A preload pressure of 0.4 – 0.6 N/cm ² (0.58 – 0.87 psi) shall be applied before the sample thickness is measured in 14A.5 and the crush force in 14A.6 is applied. See 14A.4. NOTE: A sample may be taped, glued or clamped to the flat surface, avoiding obstructing the round bar placement and crush plate motion, to eliminate any unevenness between the sample and the flat test surface.		N/A
14A.4	For cells with the positive tab and negative tab on opposite sides, the bar placement in 14A.3 and the crush force application in 14A.6 are applied on each side of the cell near the tabs, using a different set of samples for each side.		N/A
14A.5	After the bar placement per 14A.3 or 14A.4 and the preload pressure is applied per 14A.3, the thickness of the sample shall be measured allowing a tolerance of ±0.1 mm (±0.039 in), using the Measuring Method of Cell Thickness in the Annex for Dimensions of the Cell with a Laminate Film Case in the Standard for Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes – Secondary Lithium Cells and Batteries for Portable Applications – Part 3: Prismatic and Cylindrical Lithium Secondary Cells, and Batteries Made from Them, IEC 61960-3.		N/A
14A.6	A crush force shall be applied onto the round bar, with a crushing direction of 90 ±1° between the crushing direction and round bar and the crushing direction and test platform. The displacement in the vertical direction shall be measured. The moving speed of the crush plate is to be no greater than 0.1 mm/s (0.004 in/s). The displacement of the crush plate shall be		N/A



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	stopped and held for 30 s once the cell deformation reaches $13 \pm 1\%$ of the cell thickness (starting from the preload thickness measured in 14A.5) or the crush force reaches the force value in Table 14A.1, whichever comes first. See Figure 14A.1 and Figure 14A.2.		
14A.7	The samples shall not explode or catch fire.	No explosion or catch fire during and after the test.	N/A
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 ms 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 $20 \pm 5^\circ\text{C}$ ($68 \pm 9^\circ\text{F}$).	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 Hz/min between 10 and 55 Hz, and return in not less than 90 nor more than 100 min. 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	The test results meet the requirements.	P



UL1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	in 5.1.1.		
ENVIRONMENTAL TESTS			
17	Heating Test		P
17.1	A battery is to be heated in a gravity convection or circulating air oven with an initial temperature of $20 \pm 5^{\circ}\text{C}$ ($68 \pm 9^{\circ}\text{F}$). The temperature of the oven is to be raised at a rate of $5 \pm 2^{\circ}\text{C}$ ($9 \pm 3.6^{\circ}\text{F}$) per minute to a temperature of $130 \pm 2^{\circ}\text{C}$ ($266 \pm 3.6^{\circ}\text{F}$) and remain for 10 min. The sample shall return to room temperature ($20 \pm 5^{\circ}\text{C}$) and then be examined. For batteries specified for temperatures above 100°C (212°F), the conditioning temperature shall be increased from $130 \pm 2^{\circ}\text{C}$ ($266 \pm 3.6^{\circ}\text{F}$), to $30 \pm 2^{\circ}\text{C}$ ($86 \pm 3.6^{\circ}\text{F}$) above the manufacturers maximum specified temperature. For a battery of lithium metal chemistry, the conditioning temperature shall be increased to a maximum of $170 \pm 2^{\circ}\text{C}$ ($338 \pm 3.6^{\circ}\text{F}$).	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: a) Raising the chamber-temperature to $70 \pm 3^{\circ}\text{C}$ ($158 \pm 5^{\circ}\text{F}$) within 30 minutes and maintaining this temperature for 4 hours. b) Reducing the chamber temperature to $20 \pm 3^{\circ}\text{C}$ ($68 \pm 5^{\circ}\text{F}$) within 30 minutes and maintaining this temperature for 2 hours. c) Reducing the chamber temperature to minus $40 \pm 3^{\circ}\text{C}$ (minus $40 \pm 5^{\circ}\text{F}$) within 30 minutes and maintaining this temperature for 4 hours. d) Raising the chamber temperature to $20 \pm 3^{\circ}\text{C}$ ($68 \pm 5^{\circ}\text{F}$) within 30 minutes. e) Repeating the sequence for a further 9 cycles. f) After the 10th cycle, storing the batteries for a minimum of 24 hours, at a temperature of $20 \pm 5^{\circ}\text{C}$ ($68 \pm 9^{\circ}\text{F}$) 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	The test results meet the requirements.	P



UL1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	described in 5.1.1.		
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 $20 \pm 3^{\circ}\text{C}$ ($68 \pm 5^{\circ}\text{F}$).	Tested as required. See table 19.	P
19.2	The samples shall not explode or catch fire as a result of the Low Pressure (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
FIRE EXPOSURE TEST			
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
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 25.4 mm (1 in) and a wire diameter of 0.43 mm (0.017 in).	Prepared the test as required.	P
20.3	The screen is to be mounted 38 mm (1-1/2 in) above a Meker type 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-ft) across and 305-mm (1-ft) 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-in) diameter aluminum wire with 16 -18 wires per 25.4 mm (1 inch) 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			



UL1642:2020			
Clause	Requirement + Test	Result - Remark	Verdict
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 factory only.	N/A
22	Primary Batteries		P
22.1	A primary battery shall be marked with the word "WARNING" and the following or an equivalent statement: "Risk of fire and burns. Do not recharge, open, crush, heat above (the manufacturer's specified temperature rating), or incinerate." If space does not permit marking on the battery, the marking may be on the smallest unit package.		P
22.2	The packaging for a user-replaceable battery shall be marked with the word "CAUTION" and the following or equivalent statements: "Risk of fire and burns. Do not recharge, disassemble, heat above (the manufacturer's specified temperature rating), or incinerate. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly."	Technician replaceable cell	N/A
22.3	For user replaceable lithium primary coin cells (3.0 V) the packaging shall also include the following or equivalent: "WARNING – Never put batteries in mouth. Swallowing may lead to serious injury or death. If ingested, immediately seek medical attention and have the doctor phone the National Capital Poison Control Center." This marking may be combined with the marking of 22.2, if the signal word "WARNING" is used instead of "CAUTION."	Technician replaceable cell	N/A



10	TABLE: Short-Circuit Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C01#	C02#	C03#	C04#	C05#	
Ambient temperature: (at 20±5°C, °C)	23.7	23.7	23.7	23.7	23.7	
Max. casing temp Tmax (°C)	45.3	43.5	46.5	45.9	44.8	
Sample No.	C06#	C07#	C08#	C09#	C10#	
Ambient temperature: (at 55 ±5°C, °C)	55.5	55.5	55.5	55.5	55.5	
Max. casing temp Tmax (°C)	55.6	55.8	56.0	55.6	55.7	
Supplementary information: Tmax was recorded on the centre of the cell surface; No explode or catch fire.						

10	TABLE: Short-Circuit Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C01#	C02#	C03#	C04#	C05#	
Ambient temperature: (at 20±5°C, °C)	23.6	23.6	23.6	23.6	23.6	
Max. casing temp Tmax (°C)	44.1	43.4	43.8	44.1	43.2	
Sample No.	C06#	C07#	C08#	C09#	C10#	
Ambient temperature: (at 55 ±5°C, °C)	55.4	55.4	55.4	55.4	55.4	
Max. casing temp Tmax (°C)	55.5	55.7	56.1	55.8	55.9	
Supplementary information: Tmax was recorded on the centre of the cell surface; No explode or catch fire.						



11	TABLE: Abnormal Charging Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C11#	C12#	C13#	C14#	C15#	
Ambient temperature: (°C)	23.6	23.6	23.6	23.6	23.6	
Max. casing temp Tmax (°C)	24.2	23.8	23.9	24.0	23.9	
Complete discharged Cell						
Sample No.	C16#	C17#	C18#	C19#	C20#	
Ambient temperature: (°C)	23.8	23.8	23.8	23.8	23.8	
Max. casing temp Tmax (°C)	23.8	23.9	24.0	24.1	24.0	
Supplementary information: Tmax was recorded on the centre of the cell surface; The cell is charged with current limit $3 \times 0.000001 \text{mA} = 0.000003 \text{mA}$; No explode or catch fire.						

11	TABLE: Abnormal Charging Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C11#	C12#	C13#	C14#	C15#	
Ambient temperature: (°C)	23.5	23.5	23.5	23.5	23.5	
Max. casing temp Tmax (°C)	23.8	23.8	23.7	23.6	23.8	
Complete discharged Cell						
Sample No.	C16#	C17#	C18#	C19#	C20#	
Ambient temperature: (°C)	23.6	23.6	23.6	23.6	23.6	
Max. casing temp Tmax (°C)	23.8	23.7	23.8	24.0	24.0	
Supplementary information: Tmax was recorded on the centre of the cell surface; The cell is charged with current limit $3 \times 0.000001 \text{mA} = 0.000003 \text{mA}$; No explode or catch fire.						



13	TABLE: Crush Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C21#	C22#	C23#	C24#	C25#	
Fire or explosion?	No	No	No	No	No	
Crush direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						

13	TABLE: Crush Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C21#	C22#	C23#	C24#	C25#	
Fire or explosion?	No	No	No	No	No	
Crush direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						

14	TABLE: Impact Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C26#	C27#	C28#	C29#	C30#	
Fire or explosion?	No	No	No	No	No	
Impact direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						

14	TABLE: Impact Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C26#	C27#	C28#	C29#	C30#	
Fire or explosion?	No	No	No	No	No	
Impact direction	Wide side	Wide side	Wide side	Wide side	Wide side	
Supplementary information: no explosion or catch fire.						



14A	TABLE: Round Bar Crush Test					N/A
Fully Charged Cell						
Sample No.						
Fire or explosion? (near negative tab)						
Cell thickness (mm)						
Supplementary information:						

15	TABLE: Shock Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C31#	C32#	C33#	C34#	C35#	
Mass before test (g)	2.875	2.888	2.962	2.865	2.879	
Mass after test (g)	2.874	2.887	2.960	2.864	2.877	
Mass loss ratio (%)	0.035	0.035	0.068	0.035	0.069	
Complete discharged Cell						
Sample No.	C36#	C37#	C38#	C39#	C40#	
Mass before test (g)	2.842	2.812	2.853	2.806	2.833	
Mass after test (g)	2.840	2.811	2.851	2.805	2.831	
Mass loss ratio (%)	0.070	0.036	0.070	0.036	0.071	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						



15	TABLE: Shock Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C31#	C32#	C33#	C34#	C35#	
Mass before test (g)	2.553	2.508	2.486	2.504	2.489	
Mass after test (g)	2.551	2.507	2.485	2.502	2.487	
Mass loss ratio (%)	0.078	0.040	0.040	0.080	0.080	
Complete discharged Cell						
Sample No.	C36#	C37#	C38#	C39#	C40#	
Mass before test (g)	2.548	2.510	2.489	2.500	2.510	
Mass after test (g)	2.547	2.509	2.488	2.498	2.509	
Mass loss ratio (%)	0.039	0.040	0.040	0.080	0.040	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						

16	TABLE: Vibration Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C41#	C42#	C43#	C44#	C45#	
Mass before test (g)	2.881	2.878	2.869	2.887	2.845	
Mass after test (g)	2.880	2.876	2.867	2.885	2.843	
Mass loss ratio (%)	0.035	0.069	0.070	0.069	0.070	
Complete discharged Cell						
Sample No.	C46#	C47#	C48#	C49#	C50#	
Mass before test (g)	2.854	2.865	2.785	2.845	2.845	
Mass after test (g)	2.852	2.864	2.783	2.843	2.844	
Mass loss ratio (%)	0.070	0.035	0.072	0.070	0.035	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						



16	TABLE: Vibration Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C41#	C42#	C43#	C44#	C45#	
Mass before test (g)	2.542	2.510	2.530	2.512	2.504	
Mass after test (g)	2.540	2.509	2.528	2.510	2.503	
Mass loss ratio (%)	0.079	0.040	0.079	0.080	0.040	
Complete discharged Cell						
Sample No.	C46#	C47#	C48#	C49#	C50#	
Mass before test (g)	2.533	2.489	2.485	2.520	2.501	
Mass after test (g)	2.531	2.488	2.482	2.518	2.500	
Mass loss ratio (%)	0.079	0.040	0.121	0.079	0.040	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						

18	TABLE: Temperature Cycling Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C56#	C57#	C58#	C59#	C60#	
Mass before test (g)	2.856	2.902	2.789	2.865	2.878	
Mass after test (g)	2.854	2.899	2.787	2.861	2.875	
Mass loss ratio (%)	0.070	0.103	0.072	0.140	0.104	
Complete discharged Cell						
Sample No.	C61#	C62#	C63#	C64#	C65#	
Mass before test (g)	2.823	2.784	2.900	2.899	2.875	
Mass after test (g)	2.820	2.780	2.896	2.897	2.871	
Mass loss ratio (%)	0.106	0.144	0.138	0.069	0.139	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						



18	TABLE: Temperature Cycling Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C56#	C57#	C58#	C59#	C60#	
Mass before test (g)	2.500	2.486	2.478	2.502	2.488	
Mass after test (g)	2.496	2.484	2.474	2.500	2.485	
Mass loss ratio (%)	0.160	0.080	0.161	0.080	0.121	
Complete discharged Cell						
Sample No.	C61#	C62#	C63#	C64#	C65#	
Mass before test (g)	2.532	2.485	2.500	2.496	2.495	
Mass after test (g)	2.528	2.481	2.496	2.492	2.490	
Mass loss ratio (%)	0.158	0.161	0.160	0.160	0.200	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						

19	TABLE: Low Pressure (Altitude Simulation) Test (Model: CR2032)					P
Fully Charged Cell						
Sample No.	C66#	C67#	C68#	C69#	C70#	
Mass before test (g)	2.812	2.885	2.896	2.778	2.837	
Mass after test (g)	2.810	2.883	2.894	2.775	2.834	
Mass loss ratio (%)	0.071	0.069	0.069	0.108	0.106	
Complete discharged Cell						
Sample No.	C71#	C72#	C73#	C74#	C75#	
Mass before test (g)	2.852	2.885	2.879	2.902	2.835	
Mass after test (g)	2.850	2.883	2.877	2.900	2.831	
Mass loss ratio (%)	0.070	0.069	0.069	0.069	0.141	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						



19	TABLE: Low Pressure (Altitude Simulation) Test (Model: CR2025)					P
Fully Charged Cell						
Sample No.	C66#	C67#	C68#	C69#	C70#	
Mass before test (g)	2.553	2.447	2.585	2.467	2.475	
Mass after test (g)	2.550	2.444	2.582	2.465	2.474	
Mass loss ratio (%)	0.118	0.123	0.116	0.081	0.040	
Complete discharged Cell						
Sample No.	C71#	C72#	C73#	C74#	C75#	
Mass before test (g)	2.442	2.435	2.542	2.521	2.504	
Mass after test (g)	2.440	2.433	2.540	2.520	2.503	
Mass loss ratio (%)	0.082	0.082	0.079	0.040	0.040	
Supplementary information: no explosion or catch fire, in addition the sample did not vent or leak. Max loss less than 0.2%.						



ATTACHMENT 1 Photo Documentation

Product: Lithium manganese dioxide button Cell

Type Designation: CR2032, CR2025

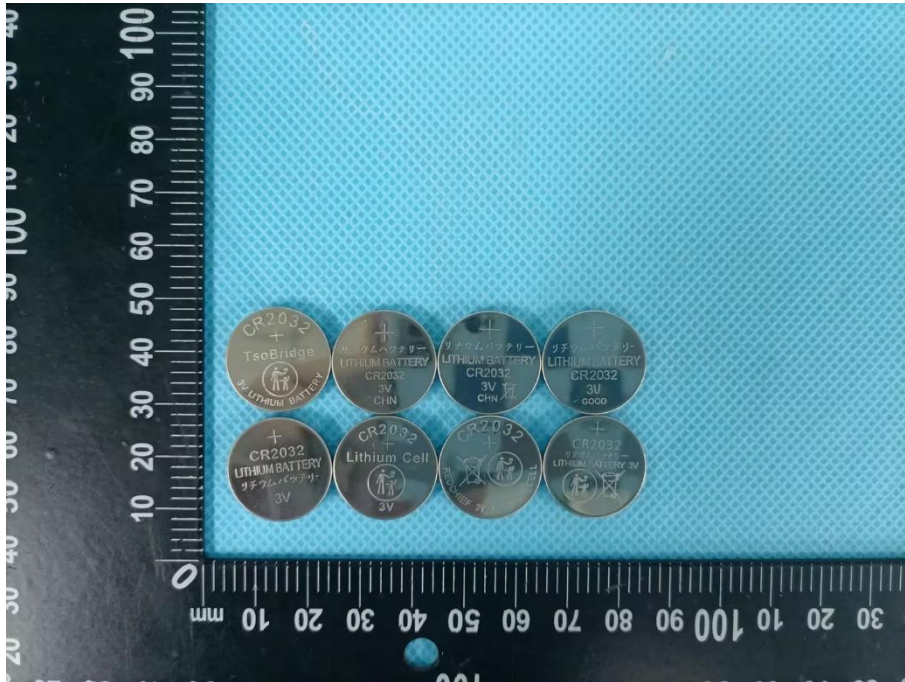


Figure 1 Front view of cell (Model: CR2032)

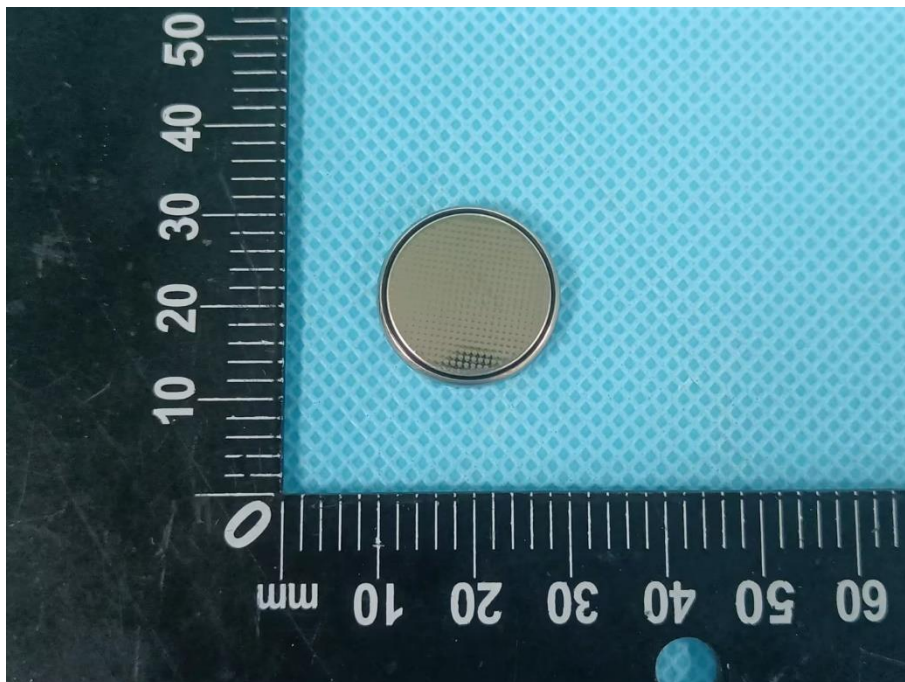


Figure 2 Back view of cell (Model: CR2032)



ATTACHMENT 1 Photo Documentation

Product: Lithium manganese dioxide button Cell

Type Designation: CR2032, CR2025



Figure 3 Front view of cell (Model: CR2025)

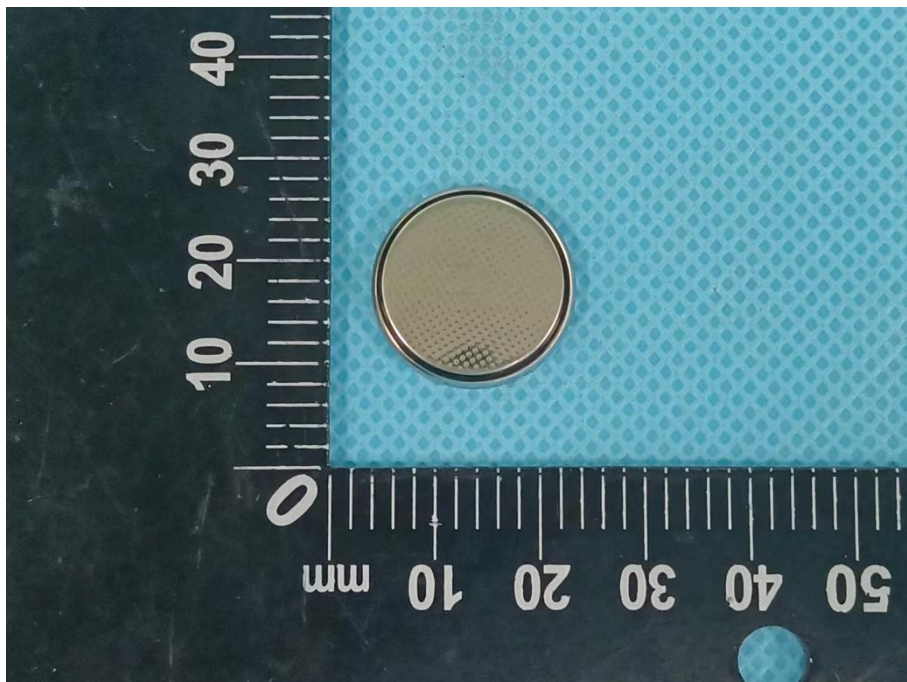


Figure 4 Back view of cell (Model: CR2025)

-- End of Report --

