**Test Report issued under the responsibility of:**

# TEST REPORT
# IEC 62133-2
# Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems

| | |
|---|---|
| **Report Number. ..... :** | **XLZ-18JA0506YCSP** |
| **Date of issue ..... :** | **April 11, 2018** |
| **Total number of pages ..... :** | **25** |
| **Name of Testing Laboratory preparing the Report ..... :** | LCIE CHINA COMPANY LIMITED |
| **Applicant's name ..... :** | Suzhou Xinlvzhou Electronics Co., Ltd. |
| **Address ..... :** | No.158, Shanji Road, Xiangcheng District, Suzhou, Jiangsu, China |
| **Test specification:** | |
| **Standard ..... :** | IEC 62133-2:2017 |
| **Test procedure ..... :** | CB Scheme |
| **Non-standard test method ..... :** | N/A |
| **Test Report Form No. ..... :** | IEC62133_2A |
| **Test Report Form(s) Originator .... :** | DEKRA |
| **Master TRF ..... :** | Dated 2017-08-10 |



If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

**This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.**

**General disclaimer:**

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| | |
|---|---|
| **Test item description** ..... : | **Secondary Li-ion Cell** |
| **Trade Mark** ..... : | N/A |
| **Manufacturer**..... : | Suzhou Xinlvzhou Electronics Co., Ltd. |
| **Model/Type reference** ..... : | warriors ICR18650-2000mAh |
| **Ratings** ..... : | 3,7V 2000mAh |

**Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):**

| | | |
|---|---|---|
| ☐ **CB Testing Laboratory:** | LCIE CHINA COMPANY LIMITED | |
| **Testing location/ address**.....: | Building 4, No. 518, Xin Zhuan Road, CaoHejing Songjiang High-Tech Park, Shanghai P.R.C (201612) | |
| **Tested by (name, function, signature)**.....: | Yue CAI (Project Engineer) | |
| **Approved by (name, function, signature)**...: | Eric WANG (Sr. Project Engineer) | |

| | | |
|---|---|---|
| ☐ **Testing procedure: CTF Stage 1:** | | |
| **Testing location/ address**.....: | | |
| **Tested by (name, function, signature)**.....: | | |
| **Approved by (name, function, signature)**...: | | |

| | | |
|---|---|---|
| ☐ **Testing procedure: CTF Stage 2:** | | |
| **Testing location/ address**.....: | | |
| **Tested by (name + signature)** .....: | | |
| **Witnessed by (name, function, signature)**..: | | |
| **Approved by (name, function, signature)**...: | | |

| | | |
|---|---|---|
| ☐ **Testing procedure: CTF Stage 3:** | | |
| ☐ **Testing procedure: CTF Stage 4:** | | |
| **Testing location/ address**.....: | | |
| **Tested by (name, function, signature)**.....: | | |
| **Witnessed by (name, function, signature)**..: | | |
| **Approved by (name, function, signature)**...: | | |
| **Supervised by (name, function, signature)** : | | |

**List of Attachments (including a total number of pages in each attachment):**

1. Attachment 1 (Pictures): Page 22 to Page 25

**Summary of testing:**

**Tests performed (name of test and test clause):**

**- Fully safety tests had been performed on warriors ICR18650-2000mAh 3,7V 2000mAh.**

☐ 5.2 Insulation and wiring
☒ 7.1 Charging procedures for test purposes
☒ 7.2.1 Continuous charging at constant voltage (cells)
☐ 7.2.2 Moulded case stress at high ambient temperature (battery)
☒ 7.3.1 External short circuit (cell)
☐ 7.3.2 External short circuit (battery)
☒ 7.3.3 Free fall
☒ 7.3.4 Thermal abuse (cells)
☒ 7.3.5 Crush (cells)
☐ 7.3.6 Over-charging of battery
☒ 7.3.7 Forced discharge (cells)
☐ 7.3.8 Mechanical tests (batteries)
☐ 7.3.9 Design evaluation – Forced internal short circuit (cells)

The load conditions used during testing:

The unit is charging the empty battery cell and discharging the fully charged battery cell according to its rating.

Note:

(1) Unless otherwise stated, the charging procedure for test purposes is carried out in an ambient temperature of 20±5°C, using the method declared by the manufacturer.

(2) Prior to charging, the battery shall have been discharged at 20±5°C at a constant current of 0,2 $I_t$ A down to a specified final voltage.

**Testing location:**

LCIE CHINA COMPANY LIMITED

Building 4, No. 518, Xin Zhuan Road, CaoHejing Songjiang High-Tech Park, Shanghai P.R.C (201612)

**Summary of compliance with National Differences**

**List of countries addressed: N/A**

**Copy of marking plate:**

+ warriors ICR18650-2000mAh (ICR19/66) -
3,7V 2000mAh

Suzhou Xinlvzhou Electronics Co., Ltd.

Date: XXXX-XX-XX


NOTE: The date code will be marked on the product after production.

| | |
|---|---|
| **Test item particulars.....:** | |
| **Classification of installation and use.....:** | N/A |
| **Supply Connection.....:** | Terminals |
| **Recommend charging method declared by the manufacturer.....:** | 0,5C CC charge to 4,25V, then CV charge till charge current decline to ⩽0,02C |
| **Discharge current (0,2 It A).....:** | 400mA |
| **Specified final voltage.....:** | 2,75V |
| **Upper limit charging voltage per cell.....:** | 4,25V |
| **Maximum charging current.....:** | 2000mA |
| **Charging temperature upper limit.....:** | 45°C |
| **Charging temperature lower limit.....:** | 0°C |
| **Polymer cell electrolyte type.....:** | ☐ gel polymer ☐ solid polymer ☒ N/A |
| **Possible test case verdicts:** | |
| **- test case does not apply to the test object.....:** | N/A |
| **- test object does meet the requirement.....:** | P (Pass) |
| **- test object does not meet the requirement.....:** | F (Fail) |
| **Testing.....:** | |
| **Date of receipt of test item .....:** | January 22, 2018 |
| **Date (s) of performance of tests.....:** | January 22 ~ April 11, 2018 |
| | |
| **General remarks:** | |
| "(See Enclosure #)" refers to additional information appended to the report.<br>"(See appended table)" refers to a table appended to the report.<br><br>**Throughout this report a ☒ comma / ☐ point is used as the decimal separator.** | |
| **Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:** | |
| The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... : | ☐ **Yes**<br>☒ **Not applicable** |
| **When differences exist; they shall be identified in the General product information section.** | |
| **Name and address of factory (ies) ..... :** | Suzhou Xinlvzhou Electronics Co., Ltd.<br>No.158, Shanji Road, Xiangcheng District, Suzhou, Jiangsu, China |

**General product information and other remarks:**

(1) The equipment under test (EUT) models: warriors ICR18650-2000mAh is Secondary Li-ion Cell. The designation of the cell is ICR19/66.

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **4** | **PARAMETER MEASUREMENT TOLERANCES** | | **P** |
| | Parameter measurement tolerances | Both normal and foreseeable misuses are evaluated in the report. All control and measure values were within the tolerances. | P |
| **5** | **GENERAL SAFETY CONSIDERATIONS** | | **P** |
| **5.1** | **General** | | P |
| | Cells and batteries so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse | The cells are safety under conditions of both intended use and reasonably foreseeable misuse. | P |
| **5.2** | **Insulation and wiring** | See below | N/A |
| | The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery (excluding electrical contact surfaces) is not less than 5 MΩ | | N/A |
| | Insulation resistance (MΩ) ..... : | | — |
| | Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements | No internal wiring. | N/A |
| | Orientation of wiring maintains adequate clearance and creepage distances between conductors | No internal wiring. | N/A |
| | Mechanical integrity of internal connections accommodates reasonably foreseeable misuse | No internal connections. | N/A |
| **5.3** | **Venting** | See below | P |
| | Battery cases and cells incorporate a pressure relief mechanism or are constructed so that they relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition | The holes on the top (“+”) side of cell as the pressure relief mechanism. | P |
| | Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief | | N/A |
| **5.4** | **Temperature, voltage and current management** | See below | P |
| | Batteries are designed such that abnormal temperature rise conditions are prevented | No such device | N/A |
| | Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer | No such device | N/A |
| | Batteries are provided with specifications and charging instructions for equipment manufacturers so that specified chargers are designed to maintain charging within the temperature, voltage and current limits specified | Provide in the cell specification | P |
| **5.5** | **Terminal contacts** | See below | P |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current | | P |
| | External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance | Single cell | N/A |
| | Terminal contacts are arranged to minimize the risk of short-circuit | | P |
| **5.6** | **Assembly of cells into batteries** | See below | N/A |
| 5.6.1 | General | Single cell | N/A |
| | Each battery have an independent control and protection for current, voltage, temperature and any other parameter required for safety and to maintain the cells within their operating region | Single cell | N/A |
| | This protection may be provided external to the battery such as within the charger or the end devices | Single cell | N/A |
| | If protection is external to the battery, the manufacturer of the battery provide this safety relevant information to the external device manufacturer for implementation | Single cell | N/A |
| | If there is more than one battery housed in a single battery case, each battery have protective circuitry that can maintain the cells within their operating regions | Single cell | N/A |
| | Manufacturers of cells specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly | Single cell | N/A |
| | Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer | Single cell | N/A |
| | Protective circuit components added as appropriate and consideration given to the end-device application | Single cell | N/A |
| | The manufacturer of the battery provide a safety analysis of the battery safety circuitry with a test report including a fault analysis of the protection circuit under both charging and discharging conditions confirming the compliance | Single cell | N/A |
| 5.6.2 | Design recommendation | See below | N/A |
| | For the battery consisting of a single cell or a single cellblock, it is recommended that the charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Table 2 | Single cell | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that the voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Table 2, by monitoring the voltage of every single cell or the single cellblocks | Single cell | N/A |
| | For the battery consisting of series-connected plural single cells or series-connected plural cellblocks, it is recommended that charging is stopped when the upper limit of the charging voltage is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks | Single cell | N/A |
| | For batteries consisting of series-connected cells or cell blocks, nominal charge voltage not be counted as an overcharge protection | Single cell | N/A |
| | For batteries consisting of series-connected cells or cell blocks, cells have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer | Single cell | N/A |
| | It is recommended that the cells and cell blocks not discharged beyond the cell manufacturer's specified final voltage | Single cell | N/A |
| | For batteries consisting of series-connected cells or cell blocks, cell balancing circuitry incorporated into the battery management system | Single cell | N/A |
| 5.6.3 | Mechanical protection for cells and components of batteries | See below | N/A |
| | Mechanical protection for cells, cell connections and control circuits within the battery provided to prevent damage as a result of intended use and reasonably foreseeable misuse | Single cell | N/A |
| | The mechanical protection can be provided by the battery case or it can be provided by the end product enclosure for those batteries intended for building into an end product | Single cell | N/A |
| | The battery case and compartments housing cells designed to accommodate cell dimensional tolerances during charging and discharging as recommended by the cell manufacturer | Single cell | N/A |
| | For batteries intended for building into a portable end product, testing with the battery installed within the end product considered when conducting mechanical tests | Single cell | N/A |
| **5.7** | **Quality plan** | See below | P |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | The manufacturer prepares and implements a quality plan that defines procedures for the inspection of materials, components, cells and batteries and which covers the whole process of producing each type of cell or battery | Provide declaration | P |
| **5.8** | **Battery safety components** | See below | N/A |
| | According annex F | Single cell | N/A |

| **6** | **TYPE TEST AND SAMPLE SIZE** | | **P** |
|---|---|---|---|
| | Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old | The cells under testing were less than 6 months old. | P |
| | Coin cells with resistance ≤ 3 Ω (measured according annex D) are tested according table 1 | | N/A |
| | Unless otherwise specified, tests are carried out in an ambient temperature of 20 °C ± 5 °C | The testing was conducted at the ambient range of 20°C~25°C. | P |
| | The safety analysis of 5.6.1 identify those components of the protection circuit that are critical for short-circuit, overcharge and overdischarge protection | | N/A |
| | When conducting the short-circuit test, consideration given to the simulation of any single fault condition that is likely to occur in the protecting circuit that would affect the short-circuit test | | N/A |

| **7** | **SPECIFIC REQUIREMENTS AND TESTS** | | **P** |
|---|---|---|---|
| **7.1** | **Charging procedure for test purposes** | See below | P |
| 7.1.1 | First procedure | | P |
| | This charging procedure applies to subclauses other than those specified in 7.1.2 | | P |
| | Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer | Charge method: 0,5C CC charge to 4,25V, then CV charge till charge current decline to ⩽0,02C | P |
| | Prior to charging, the battery have been discharged at 20 °C ± 5 °C at a constant current of 0,2 It A down to a specified final voltage | Specified final voltage: 2,75V | P |
| 7.1.2 | Second procedure | | P |
| | This charging procedure applies only to 7.3.1, 7.3.4, 7.3.5, and 7.3.9 | | P |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | After stabilization for 1 h and 4 h, respectively, at ambient temperature of highest test temperature and lowest test temperature, as specified in Table 2, cells are charged by using the upper limit charging voltage and maximum charging current, until the charging current is reduced to 0,05 It A, using a constant voltage charging method | The charge temperature upper limit is 45°C and the charge temperature lower limit is 0°C in the cell specification.<br>The upper limit charge voltage is 4,25V.<br>Maximum charging current is 2000mA. | P |
| **7.2** | **Intended use** | See below | P |
| 7.2.1 | Continuous charging at constant voltage (cells) | | P |
| | Fully charged cells are subjected for 7 days to a charge using the charging method for current and standard voltage specified by the cell manufacturer | Constant voltage is 4,25V<br>Five fully charged cells were submitted to 7 days test. | P |
| | Results: No fire. No explosion. No leakage.....: | (See appended table 7.2.1) | P |
| 7.2.2 | Case stress at high ambient temperature (battery) | Single cell | N/A |
| | Oven temperature (°C).....: | | — |
| | Results: No physical distortion of the battery case resulting in exposure of internal protective components and cells | | N/A |
| **7.3** | **Reasonably foreseeable misuse** | See below | P |
| 7.3.1 | External short-circuit (cell) | Five cells per temperature were fully charged and tested for this condition. | P |
| | The cells were tested until one of the following occurred: | | P |
| | - 24 hours elapsed; or | | N/A |
| | - The case temperature declined by 20 % of the maximum temperature rise | | P |
| | Results: No fire. No explosion.....: | (See appended table 7.3.1) | P |
| 7.3.2 | External short-circuit (battery) | Single cell | N/A |
| | The batteries were tested until one of the following occurred: | | N/A |
| | - 24 hours elapsed; or | | N/A |
| | - The case temperature declined by 20 % of the maximum temperature rise | | N/A |
| | In case of rapid decline in short circuit current, the battery pack remained on test for an additional one hour after the current reached a low end steady state condition | | N/A |
| | A single fault in the discharge protection circuit conducted on one to four (depending upon the protection circuit) of the five samples before conducting the short-circuit test | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | A single fault applies to protective component parts such as MOSFET, fuse, thermostat or positive temperature coefficient (PTC) thermistor | | N/A |
| | Results: No fire. No explosion..... : | (See appended table 7.3.2) | N/A |
| 7.3.3 | Free fall | Three cells were fully charged and tested for this condition. | P |
| | Results: No fire. No explosion | No fire. No explosion. | P |
| 7.3.4 | Thermal abuse (cells) | Five cells per temperature were fully charged and tested for this condition:130°C for 30 minutes | P |
| | Oven temperature (°C) ..... : | 130°C | — |
| | Results: No fire. No explosion | | P |
| 7.3.5 | Crush (cells) | Five cells per temperature were fully charged and tested for this condition. | P |
| | The crushing force was released upon: | | P |
| | - The maximum force of 13 kN ± 0,78 kN has been applied; or | | P |
| | - An abrupt voltage drop of one-third of the original voltage has been obtained | | N/A |
| | Results: No fire. No explosion..... : | (See appended table 7.3.5) | P |
| 7.3.6 | Over-charging of battery | Single cell | N/A |
| | The supply voltage which is: | | N/A |
| | - 1,4 times the upper limit charging voltage presented in Table A.1 (but not to exceed 6,0 V) for single cell/cell block batteries or | | N/A |
| | - 1,2 times the upper limit charging voltage resented in Table A.1 per cell for series connected multi-cell batteries, and | | N/A |
| | - Sufficient to maintain a current of 2,0 It A throughout the duration of the test or until the supply voltage is reached | | N/A |
| | Test was continued until the temperature of the outer casing: | | N/A |
| | - Reached steady state conditions (less than 10 °C change in 30-minute period); or | | N/A |
| | - Returned to ambient | | N/A |
| | Results: No fire. No explosion..... : | (See appended table 7.3.6) | N/A |
| 7.3.7 | Forced discharge (cells) | Five cells were fully discharged and tested for this condition. | P |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | If the discharge voltage reaches the negative value of upper limit charging voltage within the testing duration, the voltage is maintained at the negative value of the upper limit charging voltage by reducing the current for the remainder of the testing duration | | N/A |
| | If the discharge voltage does not reach the negative value of upper limit charging voltage within the testing duration, the test is terminated at the end of the testing duration | | P |
| | Results: No fire. No explosion..... : | (See appended table 7.3.7) | P |
| 7.3.8 | Mechanical tests (batteries) | Single cell | N/A |
| 7.3.8.1 | Vibration | | N/A |
| | Results: No fire, no explosion, no rupture, no leakage or venting. ..... : | (See appended table 7.3.8.1) | N/A |
| 7.3.8.2 | Mechanical shock | | N/A |
| | Results: No leakage, no venting, no rupture, no explosion and no fire ..... : | (See appended table 7.3.8.2) | N/A |
| 7.3.9 | Design evaluation – Forced internal short-circuit (cells) | Polymer cell | N/A |
| | The cells complied with national requirement for ..... : | France, Japan, Korea, Switzerland | — |
| | The pressing was stopped upon: | | N/A |
| | - A voltage drop of 50 mV has been detected; or | | N/A |
| | - The pressing force of 800 N (cylindrical cells) or 400 N (prismatic cells) has been reached | | N/A |
| | Results: No fire ..... : | (See appended table 7.3.9) | N/A |
| **8** | **INFORMATION FOR SAFETY** | | **P** |
| **8.1** | **General** | | P |
| | Manufacturers of secondary cells ensure that information is provided about current, voltage and temperature limits of their products | Provided in the cell specification. | P |
| | Manufacturers of batteries ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards | Not for end-users | N/A |
| | Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product | Not for end-users | N/A |
| | As appropriate, any information relating to hazard avoidance resulting from a system analysis provided to the end user | Not for end-users | N/A |
| | Do not allow children to replace batteries without adult supervision | Not for end-users | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **8.2** | **Small cell and battery safety information** | Not small cell | N/A |
| | The following warning language is to be provided with the information packaged with the small cells and batteries or equipment using them: | | N/A |
| | - Keep small cells and batteries which are considered swallowable out of the reach of children | | N/A |
| | - Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2 h of ingestion | | N/A |
| | - In case of ingestion of a cell or battery, seek medical assistance promptly | | N/A |
| **9** | **MARKING** | | **P** |
| **9.1** | **Cell marking** | | P |
| | Cells marked as specified in IEC 61960, except coin cells | See the copy on page 4 | P |
| | Coin cells whose external surface area is too small to accommodate the markings on the cells show the designation and polarity | Not coin cells | N/A |
| | By agreement between the cell manufacturer and the battery and/or end product manufacturer, component cells used in the manufacture of a battery need not be marked | | N/A |
| **9.2** | **Battery marking** | Single cell | N/A |
| | Batteries marked as specified in IEC 61960, except for coin batteries | | N/A |
| | Coin batteries whose external surface area is too small to accommodate the markings on the batteries show the designation and polarity. Batteries also marked with an appropriate caution statement | | N/A |
| | Terminals have clear polarity marking on the external surface of the battery | | N/A |
| | Batteries with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections | | N/A |
| **9.3** | **Caution for ingestion of small cells and batteries** | Not small cell | N/A |
| | Coin cells and batteries identified as small batteries according to 8.2 include a caution statement regarding the hazards of ingestion in accordance with 8.2 | | N/A |
| | When small cells and batteries are intended for direct sale in consumer-replaceable applications, caution for ingestion given on the immediate package | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **9.4** | **Other information** | | P |
| | Storage and disposal instructions | Added in the cell specification. | P |
| | Recommended charging instructions | Added in the cell specification. | P |
| **10** | **PACKAGING AND TRANSPORT** | | **P** |
| | Packaging for coin cells not small enough to fit within the limits of the ingestion gauge of Figure 3 | Not coin cell | N/A |
| | The materials and packaging design are chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of environmental contaminants | | P |
| **ANNEX A** | **CHARGING AND DISCHARGING RANGE OF SECONDARY LITHIUM ION CELLS FOR SAFE USE** | | **P** |
| **A.1** | **General** | | P |
| **A.2** | **Safety of lithium ion secondary battery** | | P |
| **A.3** | **Consideration on charging voltage** | | P |
| A.3.1 | General | | P |
| A.3.2 | Upper limit charging voltage | 4,25V | P |
| A.3.2.1 | General | | P |
| A.3.2.2 | Explanation of safety viewpoint | | P |
| A.3.2.3 | Safety requirements, when different upper limit charging voltage is applied | | N/A |
| **A.4** | **Consideration of temperature and charging current** | | P |
| A.4.1 | General | | P |
| A.4.2 | Recommended temperature range | | P |
| A.4.2.1 | General | | P |
| A.4.2.2 | Safety consideration when a different recommended temperature range is applied | The recommended temperature range: 0°C to 45°C. | P |
| A.4.3 | High temperature range | The upper limit charging temperature is 45°C in the cell specification | P |
| A.4.3.1 | General | | P |
| A.4.3.2 | Explanation of safety viewpoint | | P |
| A.4.3.3 | Safety considerations when specifying charging conditions in the high temperature range | | P |
| A.4.3.4 | Safety considerations when specifying a new upper limit in the high temperature range | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| A.4.4 | Low temperature range | The lower charging temperature is 0°C in the cell specification | P |
| A.4.4.1 | General | | P |
| A.4.4.2 | Explanation of safety viewpoint | | P |
| A.4.4.3 | Safety considerations, when specifying charging conditions in the low temperature range | | P |
| A.4.4.4 | Safety considerations when specifying a new lower limit in the low temperature range | | N/A |
| A.4.5 | Scope of the application of charging current | | P |
| A.4.6 | Consideration of discharge | | P |
| A.4.6.1 | General | | P |
| A.4.6.2 | Final discharge voltage and explanation of safety viewpoint | | P |
| A.4.6.3 | Discharge current and temperature range | | P |
| A.4.6.4 | Scope of application of the discharging current | | P |
| **A.5** | **Sample preparation** | | N/A |
| A.5.1 | General | | N/A |
| A.5.2 | Insertion procedure for nickel particle to generate internal short | | N/A |
| A.5.3 | Disassembly of charged cell | | N/A |
| A.5.4 | Shape of nickel particle | | N/A |
| A.5.5 | Insertion of nickel particle in cylindrical cell | | N/A |
| A.5.5.1 | Insertion of nickel particle in winding core | | N/A |
| A.5.5.2 | Marking the position of the nickel particle on both ends of the winding core of the separator | | N/A |
| A.5.6 | Insertion of nickel particle in prismatic cell | | N/A |
| **A.6** | **Experimental procedure of the forced internal short-circuit test** | | N/A |
| A.6.1 | Material and tools for preparation of nickel particle | | N/A |
| A.6.2 | Example of a nickel particle preparation procedure | | N/A |
| A.6.3 | Positioning (or placement) of a nickel particle | | N/A |
| A.6.4 | Damaged separator precaution | | N/A |
| A.6.5 | Caution for rewinding separator and electrode | | N/A |
| A.6.6 | Insulation film for preventing short-circuit | | N/A |
| A.6.7 | Caution when disassembling a cell | | N/A |
| A.6.8 | Protective equipment for safety | | N/A |
| A.6.9 | Caution in the case of fire during disassembling | | N/A |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| A.6.10 | Caution for the disassembling process and pressing the electrode core | | N/A |
| A.6.11 | Recommended specifications for the pressing device | | N/A |
| **ANNEX B** | **RECOMMENDATIONS TO EQUIPMENT MANUFACTURERS AND BATTERY ASSEMBLERS** | | **P** |
| **ANNEX C** | **RECOMMENDATIONS TO THE END-USERS** | | **N/A** |
| **ANNEX D** | **MEASUREMENT OF THE INTERNAL AC RESISTANCE FOR COIN CELLS** | | **N/A** |
| **D.1** | **General** | | N/A |
| **D.2** | **Method** | | N/A |
| | A sample size of three coin cells is required for this measurement..... : | (See appended table D.2) | N/A |
| | Coin cells with an internal resistance of less than or equal to 3 Ω are subjected to the testing according to Clause 6 and Table 1 | | N/A |
| | Coin cells with an internal resistance greater than 3 Ω require no further testing | | N/A |
| **ANNEX E** | **PACKAGING AND TRANSPORT** | | **N/A** |
| **ANNEX F** | **COMPONENT STANDARDS REFERENCES** | | **N/A** |

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|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| | TABLE: Critical components information | | | | N/A |
|---|---|---|---|---|---|
| **Object / part No.** | **Manufacturer / trademark** | **Type / model** | **Technical data** | **Standard** | **Mark(s) of conformity[1)]** |
| - | - | - | - | - | - |
| Supplementary information: None | | | | | |

| 7.2.1 | TABLE: Continuous charging at constant voltage (cells) | | | P |
|---|---|---|---|---|
| **Sample no.** | **Recommended charging voltage Vc (Vdc)** | **Recommended charging current $I_{rec}$ (A)** | **OCV before test (Vdc)** | **Results** |
| Q43N01 | 4,25V | - | 4,209 | Pass |
| Q43N02 | 4,25V | - | 4,199 | Pass |
| Q43N03 | 4,25V | - | 4,201 | Pass |
| Q43N04 | 4,25V | - | 4,211 | Pass |
| Q43N05 | 4,25V | - | 4,207 | Pass |

**Supplementary information:**

- No fire or explosion
- No leakage
- Others (please explain)

| 7.3.1 | TABLE: External short-circuit (cell) | | | | P |
|---|---|---|---|---|---|
| **Sample no.** | **Ambient T (°C)** | **OCV before test (Vdc)** | **Resistance of circuit (mΩ)** | **Maximum case temperature rise ΔT (K)** | **Results** |
| **Samples charged at charging temperature upper limit** | | | | | |
| Q43N06 | 54,5 | 4,231 | 0,076 | 63,9 | Pass |
| Q43N07 | 54,5 | 4,226 | 0,081 | 60,8 | Pass |
| Q43N08 | 54,5 | 4,232 | 0,076 | 75,7 | Pass |
| Q43N09 | 54,5 | 4,227 | 0,082 | 62,2 | Pass |
| Q43N10 | 54,5 | 4,215 | 0,077 | 68,1 | Pass |
| **Samples charged at charging temperature lower limit** | | | | | |
| Q43N11 | 54,5 | 4,203 | 0,076 | 61,3 | Pass |
| Q43N12 | 54,5 | 4,201 | 0,081 | 66,1 | Pass |
| Q43N13 | 54,5 | 4,197 | 0,076 | 58,9 | Pass |
| Q43N14 | 54,5 | 4,207 | 0,082 | 63,4 | Pass |
| Q43N15 | 54,5 | 4,211 | 0,077 | 67,0 | Pass |

**Supplementary information:**

- No fire or explosion
- Others (please explain)

| IEC 62133-2 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| 7.3.2 | TABLE: External short-circuit (battery) | | | | | N/A |
|---|---|---|---|---|---|---|
| **Sample no.** | **Ambient T (°C)** | **OCV before test (Vdc)** | **Resistance of circuit (mΩ)** | **Maximum case temperature rise ΔT (K)** | **Component single fault condition** | **Results** |
| - | - | - | - | - | - | - |
| **Supplementary information: None** | | | | | | |

| 7.3.5 | TABLE: Crush (cells) | | | P |
|---|---|---|---|---|
| **Sample no.** | **OCV before test (Vdc)** | **OCV at removal of crushing force (Vdc)** | **Maximum force applied to the cell during crush (kN)** | **Results** |
| **Samples charged at charging temperature upper limit** | | | | |
| Q43N29 | 4,227 | 4,221 | 12,901 | Pass |
| Q43N30 | 4,232 | 4,228 | 12,901 | Pass |
| Q43N31 | 4,231 | 4,226 | 12,910 | Pass |
| Q43N32 | 4,221 | 4,214 | 12,901 | Pass |
| Q43N33 | 4,230 | 4,226 | 12,910 | Pass |
| **Samples charged at charging temperature lower limit** | | | | |
| Q43N34 | 4,205 | 4,201 | 12,910 | Pass |
| Q43N35 | 4,197 | 4,193 | 12,910 | Pass |
| Q43N36 | 4,203 | 4,197 | 12,901 | Pass |
| Q43N37 | 4,211 | 4,205 | 12,910 | Pass |
| Q43N38 | 4,207 | 4,199 | 12,901 | Pass |
| **Supplementary information:**<br>- No fire or explosion<br>- Others (please explain) | | | | |

| 7.3.6 | TABLE: Over-charging of battery | | | N/A |
|---|---|---|---|---|
| **Constant charging current (A) .....:** | | | | — |
| **Supply voltage (Vdc) .....:** | | | | — |
| **Sample no.** | **OCV before charging (Vdc)** | **Total charging time (minute)** | **Maximum outer case temperature (°C)** | **Results** |
| - | - | - | - | - |
| **Supplementary information: None** | | | | |

| IEC 62133-2 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |

| 7.3.7 | TABLE: Forced discharge (cells) | | | P |
|---|---|---|---|---|
| **Sample no.** | **OCV before application of reverse charge (Vdc)** | **Measured reverse charge $I_t$ (A)** | **Lower limit discharge voltage (Vdc)** | **Results** |
| Q43N39 | 3,012 | 2,0 | 2,75 | Pass |
| Q43N40 | 3,017 | 2,0 | 2,75 | Pass |
| Q43N41 | 3,022 | 2,0 | 2,75 | Pass |
| Q43N42 | 3,014 | 2,0 | 2,75 | Pass |
| Q43N43 | 3,016 | 2,0 | 2,75 | Pass |
| **Supplementary information:**<br>- No fire or explosion<br>- Others (please explain) | | | | |

| 7.3.8.1 | TABLE: Vibration | | | | | N/A |
|---|---|---|---|---|---|---|
| **Sample no.** | **OCV before test (Vdc)** | **OCV after test (Vdc)** | **Mass before test (g)** | **Mass after test (g)** | **Results** | |
| - | - | - | - | - | - | |
| **Supplementary information: None** | | | | | | |

| 7.3.8.2 | TABLE: Mechanical shock | | | | | N/A |
|---|---|---|---|---|---|---|
| **Sample no.** | **OCV before test (Vdc)** | **OCV after test (Vdc)** | **Mass before test (g)** | **Mass after test (g)** | **Results** | |
| - | - | - | - | - | - | |
| **Supplementary information: None** | | | | | | |

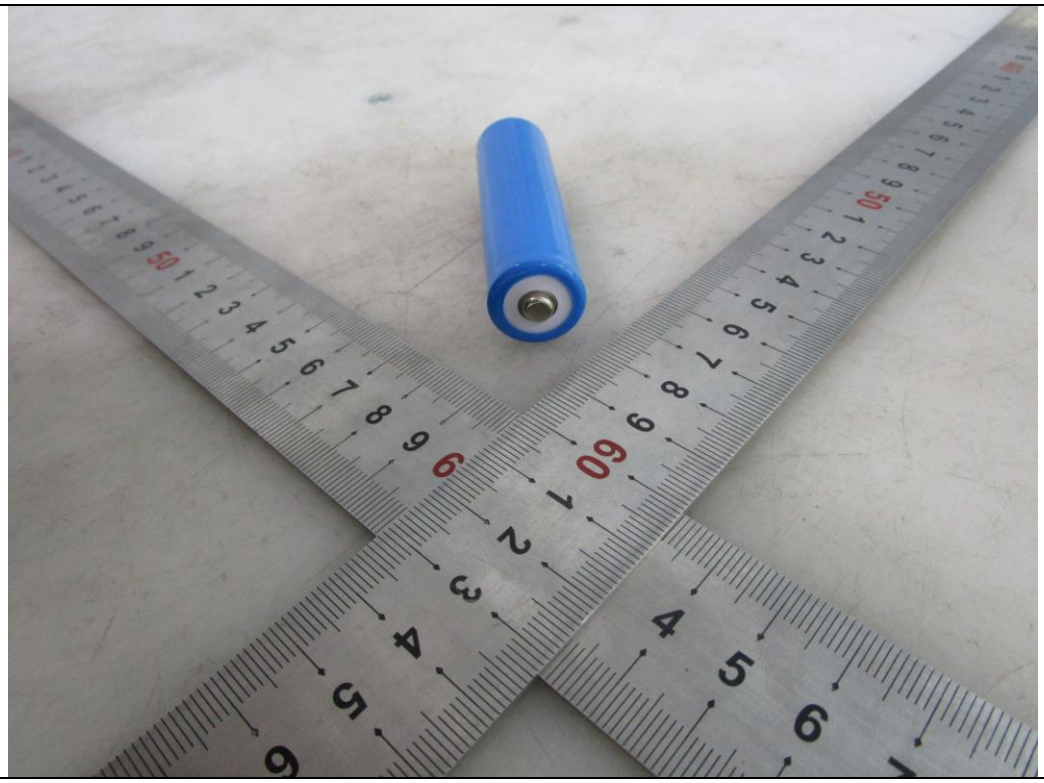
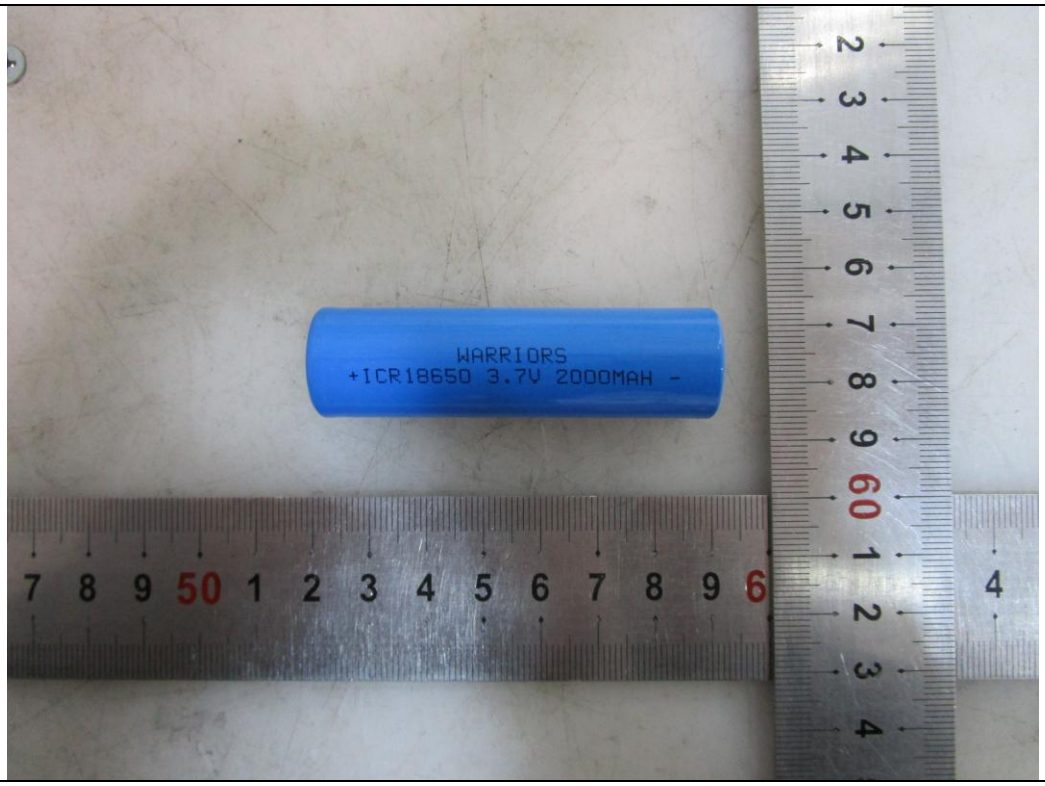
| 7.3.9 | TABLE: Forced internal short circuit (cells) | | | | | N/A |
|---|---|---|---|---|---|---|
| **Sample no.** | **Chamber ambient T (°C)** | **OCV before test (Vdc)** | **Particle location [1)]** | **Maximum applied pressure (N)** | **Results** | |
| **Samples charged at charging temperature upper limit** | | | | | | |
| - | - | - | - | - | - | |
| **Samples charged at charging temperature lower limit** | | | | | | |
| - | - | - | - | - | - | |
| **Supplementary information: None** | | | | | | |

| D.2 | TABLE: Internal AC resistance for coin cells | | | N/A |
|---|---|---|---|---|
| **Sample no.** | **Ambient T (°C)** | **Store time (h)** | **Resistance Rac (Ω)** | **Results [1)]** |
| - | - | - | - | - |
| **Supplementary information: None** | | | | |

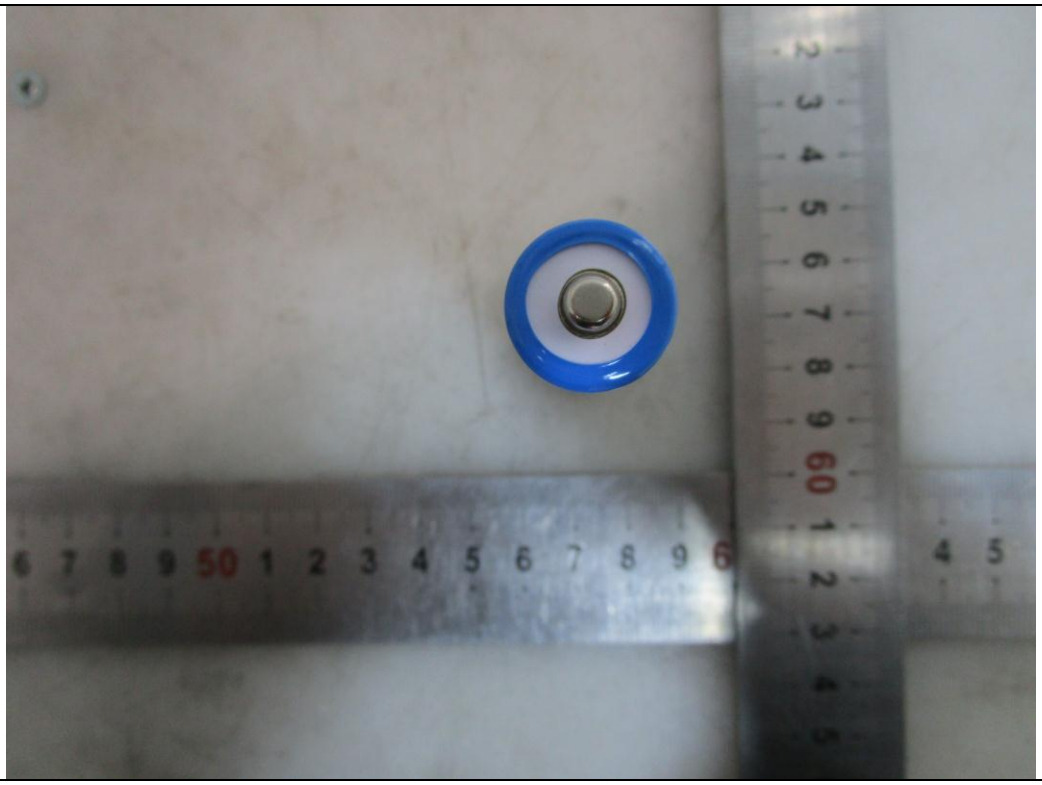
**List of test equipment used:**
**(Note: This is an example of the required attachment. Other forms with a different layout but containing similar information are also acceptable.)**

| Clause | Measurement / testing | Testing / measuring equipment / material used, (Equipment ID) | Range used | Last Calibration date | Calibration due date |
|---|---|---|---|---|---|
| 8.1 | Charging procedure for test purposes | Battery load | 0~5V 0~6A | Dec-1-2017 | Nov-30-2018 |
| | | RH chamber | -70℃~150℃/25-98%RH | May-17-2017 | May-16-2018 |
| 8.2.1 | Continuous charging at constant voltage (cell) | Battery load | 0~5V 0~6A | Dec-1-2017 | Nov-30-2018 |
| 8.3.2 | External short circuit (cell) | Battery safety comprehensive tester | 20℃±5℃ | Dec-1-2017 | Nov-30-2018 |
| 8.3.3 | Free fall | Falling off explosion-proof test box | 1,0m | Mar-9-2018 | Mar-8-2019 |
| 8.3.4 | Thermal abuse (cells) | Vertical explosion-proof high-temperature test chamber | 20℃~130℃ Temperature rise:5,0℃/Min± 2,0℃/Min | Dec-1-2017 | Nov-30-2018 |
| 8.3.5 | Crush (cell) | Explosion-proof squeeze test box | 13kN | Dec-1-2017 | Nov-30-2018 |
| 8.3.7 | Forced discharge (cell) | Battery load | 0~5V 0~6A | Dec-1-2017 | Nov-30-2018 |
| All | Voltage measurement | Numeric multimeter | DC: 0~500V | Feb-5-2018 | Feb-4-2019 |
| All | Temperature measurement | Digital Acquisition Unit | -20～400℃ | Feb-5-2018 | Feb-4-2019 |

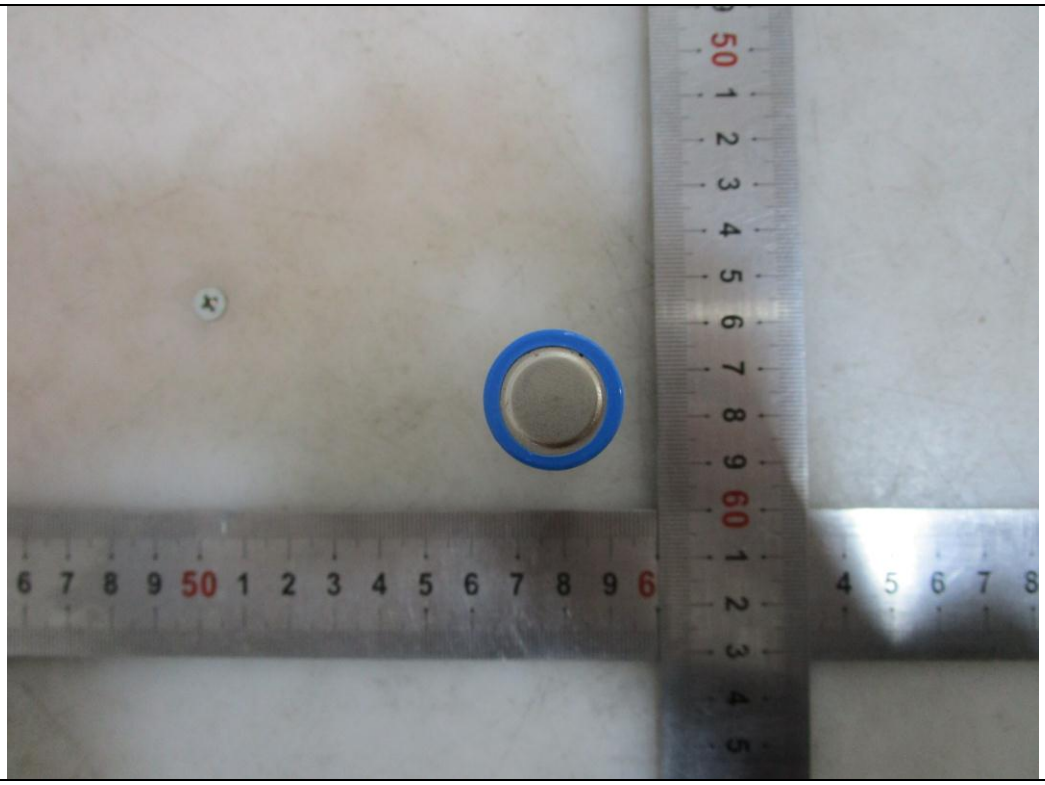
Attachment 1 (Pictures for product)

| Picture for overview |
| --- |
|  |
| Picture for cell horizontal |
|   |

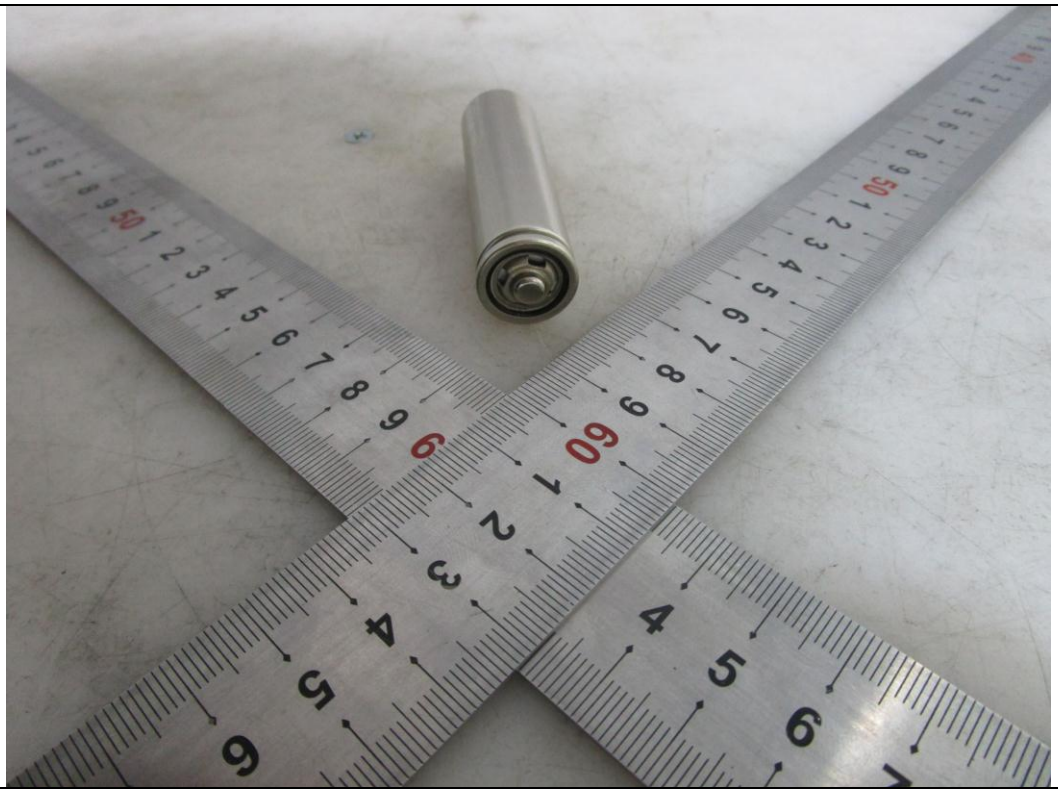
Picture for cell vertical from anode



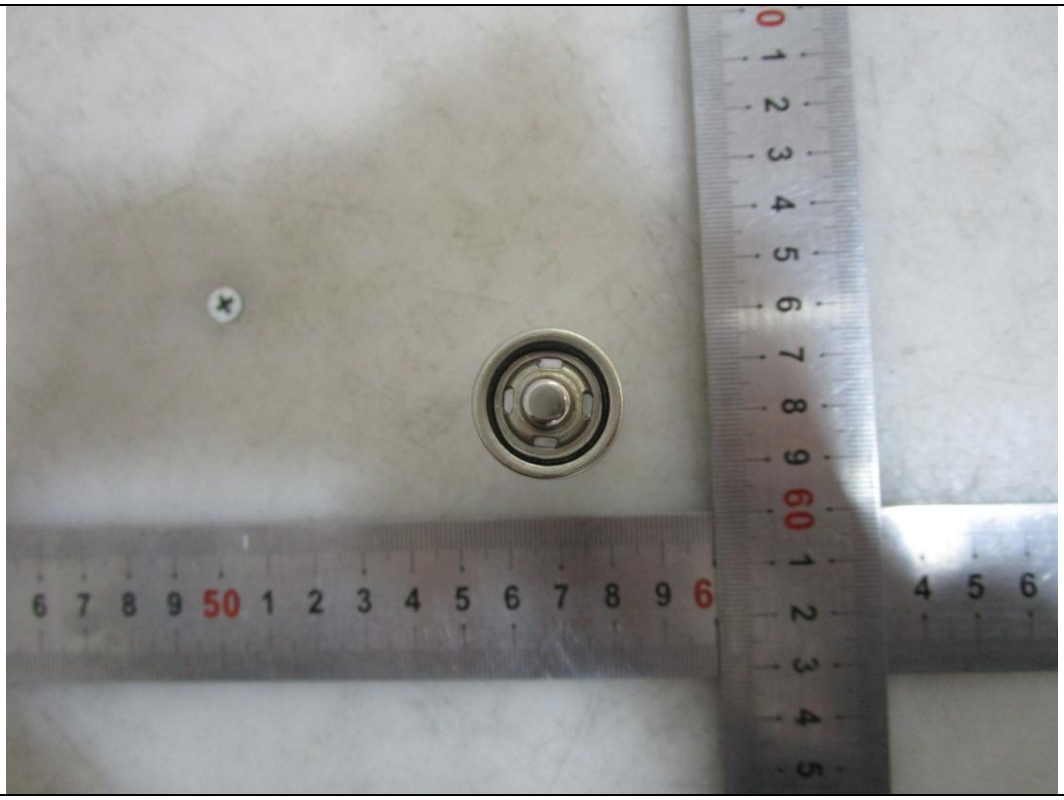
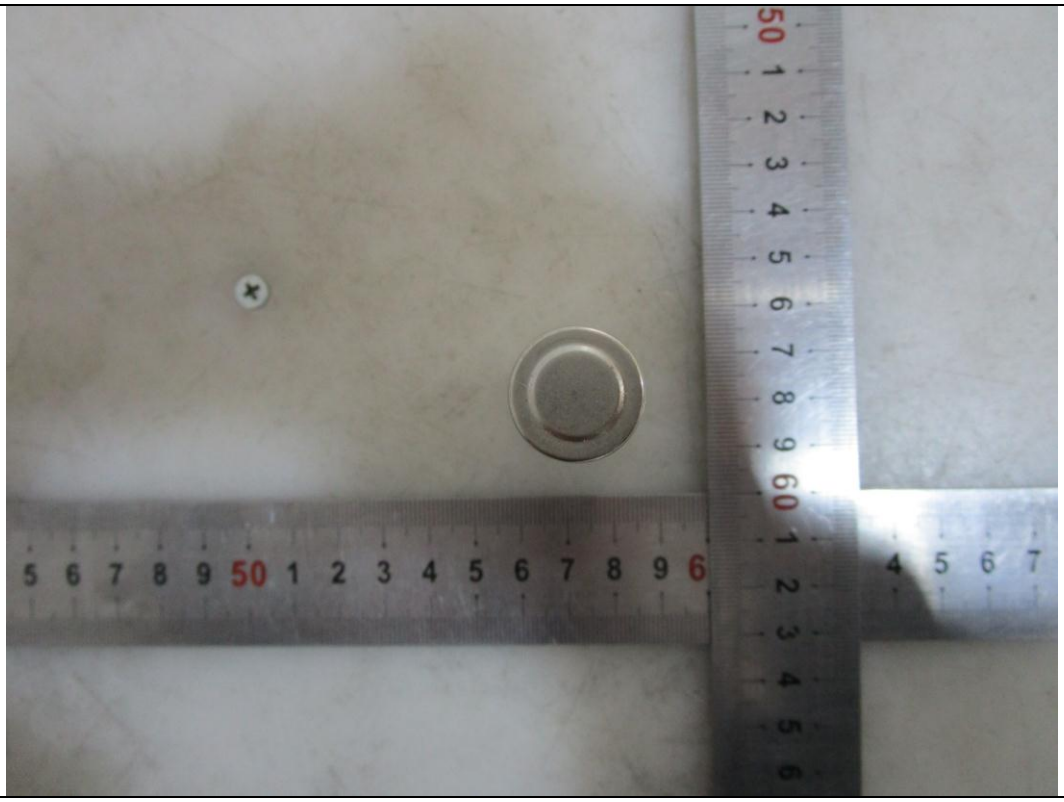
Picture for cell vertical from cathode



Picture for cell overview without plastic case



Picture for cell horizontal without plastic case

| Picture for cell vertical from anode without plastic case |
| --- |
|  |
| Picture for cell vertical from cathode without plastic case |
|  |