IEC IECEE CB SCHEME

**Ref. Certif. No.**

JPTUV-088458

**IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME**

**SYSTEME CEI D'ACCEPTATION MUTUELLE DE CERTIFICATS D ESSAIS DES EQUIPEMENTS ELECTRIQUES (IECEE) METHODE OC**

# CB TEST CERTIFICATE

# CERTIFICAT D'ESSAI OC

| | |
|---|---|
| Product<br>Produit | Cylindrical Lithium ion Cell |
| Name and address of the applicant<br>Nom et adresse du demandeur | |
| Name and address of the manufacturer<br>Nom et adresse du fabricant | |
| Name and address of the factory<br>Nom et adresse de l'usine | |
| Ratings and principal characteristics<br>Valeurs nominales et charactéristiques principales | 3.6V, 2500mAh |
| Trademark (if any)<br>Marque de fabrique (si elle existe) | |
| Type of Manufacturer's Testing Laboratories used<br>Type de programme du laboratoire d'essais constructeur | N/A |
| Model / Type Ref.<br>Ref. de type | SZNS18650-2500 |
| Additional information (if necessary may also be reported on page 2)<br>Les informations complémentaires (si nécessaire, peuvent être indiqués sur la 2ème page) | |
| A sample of the product was tested and found to be in conformity with<br>Un échantillon de ce produit a été essayé et a été considéré conforme à la | IEC 62133:2012<br>See Test Report for National Differences |
| As shown in the Test Report Ref. No. which forms part of this Certificate<br>Comme indiqué dans le Rapport d'essais numéro de référence qui constitue partie de ce Certificat | 50137388 001 |

This CB Test Certificate is issued by the National Certification Body
Ce Certificat d'essai OC est établi par l'Organisme National de Certification

TÜVRheinland®

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Date: 13.06.2018

Signature:

Dipl. Ing. Univ. S. O. Steinke

Test Report issued under the responsibility of:

TÜVRheinland®

# TEST REPORT
## IEC 62133
## 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

| | |
|---|---|
| **Report Number. .....:** | **50137388 001** |
| **Date of issue .....:** | 2018-06-13 |
| **Total number of pages.....** | 27 pages |
| **Applicant's name.....:** | |
| **Address .....:** | |
| **Test specification:** | |
| **Standard .....:** | IEC 62133: 2012 (Second Edition) |
| **Test procedure .....:** | CB Scheme |
| **Non-standard test method.....:** | N/A |
| **Test Report Form No.....:** | IEC62133B |
| **Test Report Form(s) Originator ....:** | UL(Demko) |
| **Master TRF .....:** | Dated 2013-03 |



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.**

| | |
|---|---|
| **Test item description .....:** | Cylindrical Lithium-ion Cell |
| **Trade Mark .....:** | N/A |
| **Manufacturer.....:** | **Same as applicant** |
| **Address .....:** | Same as applicant |
| **Model/Type reference .....:** | SZNS18650-2500 |
| **Ratings .....:** | 3.6V, 2500mAh |

| Testing procedure and testing location: | | |
|---|---|---|
| ☒ CB Testing Laboratory: | TÜV Rheinland (Shenzhen) Co., Ltd. | |
| Testing location/ address .....: | East of F/1, F/2~F/4, Building 1, Cybio Technology Building No. 6 Langshan No.2 Road, North Hi-tech Industry Park 518057 Shenzhen Nanshan District CHINA | |
| ☐ Associated CB Testing Laboratory: | | |
| Testing location/ address .....: | | |
| Tested by (name + signature).....: | Jeffrey Qin | Jeffrey Qin |
| Approved by (name + signature) .....: | Daniel Dai | Daniel Dai |
| ☐ Testing procedure: TMP | | |
| Testing location/ address .....: | | |
| Tested by (name + signature).....: | | |
| Approved by (name + signature) .....: | | |
| ☐ Testing procedure: WMT | | |
| Testing location/ address .....: | | |
| Tested by (name + signature).....: | | |
| Witnessed by (name + signature) ....: | | |
| Approved by (name + signature) .....: | | |
| ☐ Testing procedure: SMT | | |
| Testing location/ address .....: | | |
| Tested by (name + signature).....: | | |
| Approved by (name + signature) .....: | | |
| Supervised by (name + signature)...: | | |

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

Attachment 1: Photo documentation (1 page).

**Summary of testing:**

| **Tests performed (name of test and test clause):** | **Testing location:** |
|---|---|
| cl.5.6.2 Design recommendation(Lithium system);<br>cl.8.1 Charging procedure for test purposes (for Cells and Batteries);<br>cl.8.2.1 Continuous charging at constant voltage (Cells);<br>cl.8.3.1 External short circuit (Cells);<br>cl.8.3.3 Free fall (Cells);<br>cl.8.3.4 Thermal abuse (Cells);<br>cl.8.3.5 Crush (Cells);<br>cl.8.3.7 Forced discharge (Cells);<br>cl.8.3.8 Transport tests (Cells);<br>cl.8.3.9 Forced internal short circuit (Cells).<br><br>Charging method declared by the manufacturer in specifications:<br>1). Charging the cell with 500mA constant current and 4.2V constant voltage until current reduces to 25mA at ambient 20°C±5°C for clause 8.2.1, 8.3.3, 8.3.7 and 8.3.8;<br>2). Charging procedure of clause 8.1.2 applied for clause 8.3.1, 8.3.4, 8.3.5 and 8.3.9.<br><br>Tests are made with the number of cells specified in IEC 62133: 2012 (Second Edition) Table 2. | **TÜV Rheinland (Shenzhen) Co., Ltd.**<br>East of F/1, F/2~F/4, Building 1, Cybio Technology Building No. 6 Langshan No.2 Road, North Hi-tech Industry Park 518057 Shenzhen Nanshan District CHINA |

**Summary of compliance with National Differences:**

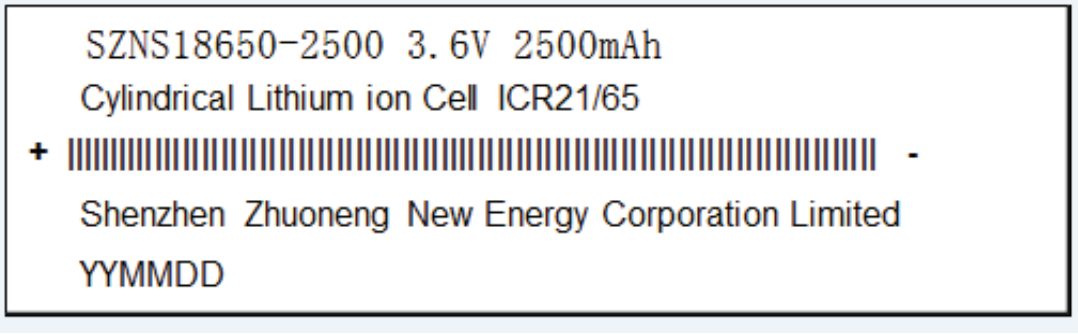
BE, BY, CN, DE, DK, FI, FR, GB, HU, JP, KR, NL, NO, SA, SE, SG, SI, US

BE=Belgium, BY=Belarus, CN=China, DE=Germany, DK=Denmark, FI=Finland, FR=France, GB=United Kingdom, HU=Hungary, JP=Japan, KR=Republic of Korea, NL=The Netherlands, NO=Norway, SA=Saudi Arabia, SE=Sweden, SG=Singapore, SI=Slovenia, US=United States of America

☒**The product fulfils the requirements of EN62133: 2013**

**Copy of marking plate:**

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



| | |
|---|---|
| **Test item particulars .....:** | |
| **Classification of installation and use .....:** | N/A |
| **Supply connection .....:** | DC Connector |
| **Recommend charging method declared by the manufacturer.....:** | Charging the cell with 500mA constant current and 4.2V constant voltage until the current reduces to 25mA at ambient 20°C±5°C |
| **Discharge current (0,2 $I_t$ A) .....:** | 500mA |
| **Specified final voltage .....:** | 2.75V |
| **Chemistry .....:** | ☐ nickel systems .....☒ lithium systems |
| **Recommend of charging limit for lithium system** | |
| **Upper limit charging voltage per cell .....:** | 4.25V |
| **Maximum charging current.....:** | 2500mA |
| **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 ..... :** | Nov 01, 2014<br>Apr. 15, 2018 |
| **Date (s) of performance of tests..... :** | Nov 01, 2014– Nov 10, 2014<br>Apr. 15, 2018 – Apr. 28, 2018 |

**General remarks:**

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
**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**
☒ **Not applicable**

**When differences exist; they shall be identified in the General product information section.**

| | |
|---|---|
| **Name and address of factory (ies).....:** | **Same as applicant** |

**General product information:**

The cell consists of the positive electrode plate, negative electrode plate, separator, electrolyte, case and assembled sealing cap. The positive and negative electrode plates are housed in the case in the state being separated by the separator, and the assembled sealing cap is fit to the case.

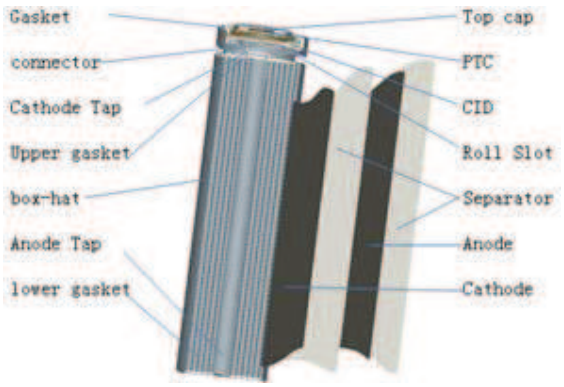
The main features of the cell are shown as below (clause 8.1.1):

| Model | Nominal capacity | Nominal voltage | Nominal Charge Current | Nominal Discharge Current | Maximum Charge Current | Maximum Discharge Current | Maximum Charge Voltage | Cut-off Voltage |
|---|---|---|---|---|---|---|---|---|
| SZNS18650-2500 | 2500mAh | 3.6V | 500mA | 500mA | 2500mA | 2500mA | 4.2V | 2.75V |

The main features of the cell are shown as below (clause 8.1.2):

| Model | Upper limit charge voltage | Taper-off current | Lower charge temperature | Upper charge temperature |
|---|---|---|---|---|
| SZNS18650-2500 | 4.25V | 125mA | 0°C | 45°C |

Construction:




Cell: D(max.): H(max.)=18.4mm: 65.0mm

Circuit diagram:
None, cell only

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| **4** | **Parameter measurement tolerances** | | **P** |
| | Parameter measurement tolerances | | P |
| **5** | **General safety considerations** | | **P** |
| 5.1 | General | | P |
| 5.2 | Insulation and wiring | | P |
| | 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 | No metal case exists. | N/A |
| | Insulation resistance (MΩ) ..... : | | — |
| | Internal wiring and insulation are sufficient to withstand maximum anticipated current, voltage and temperature requirements | | P |
| | Orientation of wiring maintains adequate creepage and clearance distances between conductors | | P |
| | Mechanical integrity of internal connections accommodates reasonably foreseeable misuse | | P |
| 5.3 | Venting | | 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 | Venting mechanism facilitated on cells. | P |
| | Encapsulation used to support cells within an outer casing does not cause the battery to overheat during normal operation nor inhibit pressure relief | | P |
| 5.4 | Temperature/voltage/current management | | N/A |
| | Batteries are designed such that abnormal temperature rise conditions are prevented | | N/A |
| | Batteries are designed to be within temperature, voltage and current limits specified by the cell manufacturer | | N/A |
| | Batteries are provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the temperature, voltage and current limits specified | | N/A |
| 5.5 | Terminal contacts | | P |
| | Terminals have a clear polarity marking on the external surface of the battery | See page 4 | P |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | The size and shape of the terminal contacts ensure that they can carry the maximum anticipated current | DC connector contacts complied with the requirements. | P |
| | External terminal contact surfaces are formed from conductive materials with good mechanical strength and corrosion resistance | | P |
| | Terminal contacts are arranged to minimize the risk of short circuits | | P |
| 5.6 | Assembly of cells into batteries | Cell only | N/A |
| 5.6.1 | If there is more than one battery housed in a single battery case, cells used in the assembly of each battery have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer | | N/A |
| | Each battery has an independent control and protection | | N/A |
| | Manufacturers of cells make recommendations about current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly | | N/A |
| | Batteries that are designed for the selective discharge of a portion of their series connected cells incorporate separate circuitry to prevent the cell reversal caused by uneven discharges | | N/A |
| | Protective circuit components are added as appropriate and consideration given to the end-device application | | N/A |
| | When testing a battery, the manufacturer of the battery provides a test report confirming the compliance according to this standard | | N/A |
| 5.6.2 | Design recommendation for lithium systems only | Cell only | N/A |
| | For the battery consisting of a single cell or a single cellblock:<br>- Charging voltage of the cell does not exceed the upper limit of the charging voltage specified in Clause 8.1.2, Table 4; or | | N/A |
| | - Charging voltage of the cell does not exceed the different upper limit of the charging voltage determined through Clause 8.1.2, NOTE 1. | | N/A |
| | For the battery consisting of series-connected plural single cells or series-connected plural cellblocks:<br>- The voltages of any one of the single cells or single cellblocks does not exceed the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, by monitoring the voltage of every single cell or the single cellblocks; or | | N/A |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | - The voltages of any one of the single cells or single cellblocks does not exceed the different upper limit of the charging voltage, determined through Clause 8.1.2, NOTE 1, by monitoring the voltage of every single cell or the single cellblocks | | N/A |
| | For the battery consisting of series-connected plural single cells or series-connected plural cellblocks:<br>- Charging is stopped when the upper limit of the charging voltage, specified in Clause 8.1.2, Table 4, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks; or | | N/A |
| | - Charging is stopped when the upper limit of the different charging voltage, determined through Clause 8.1.2, NOTE 1, is exceeded for any one of the single cells or single cellblocks by measuring the voltage of every single cell or the single cellblocks | | N/A |
| 5.7 | Quality plan | | P |
| | 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 | Complied.<br>ISO 9001: 2008 certificate provided. | P |
| **6** | **Type test conditions** | | **P** |
| | Tests were made with the number of cells or batteries specified in Table 1 for nickel-cadmium and nickel-metal hydride systems and Table 2 for lithium systems, using cells or batteries that are not more than six months old | Complied.<br>Lithium system. | P |
| | Unless noted otherwise in the test methods, testing was conducted in an ambient of 20°C ± 5°C. | Tests are carried out at 20°C ± 5°C. | P |
| **7** | **Specific requirements and tests (nickel systems)** | | **N/A** |
| 7.1 | Charging procedure for test purposes | Lithium system. | N/A |
| 7.2 | Intended use | | N/A |
| 7.2.1 | Continuous low-rate charging (cells) | | N/A |
| | Results: No fire. No explosion | | N/A |
| 7.2.2 | Vibration | | N/A |
| | Results: No fire. No explosion. No leakage | (See Table 7.2.2) | N/A |
| 7.2.3 | Moulded case stress at high ambient temperature | | N/A |
| | Oven temperature (°C)..... : | | — |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Results: No physical distortion of the battery casing resulting in exposure if internal components | | N/A |
| 7.2.4 | Temperature cycling | | N/A |
| | Results: No fire. No explosion. No leakage. | | N/A |
| 7.3 | Reasonably foreseeable misuse | | N/A |
| 7.3.1 | Incorrect installation cell | | N/A |
| | The test was carried out using:<br>- Four fully charged cells of the same brand, type, size and age connected in series, with one of them reversed; or | | N/A |
| | - A stabilized dc power supply. | | N/A |
| | Results: No fire. No explosion..... : | (See Table 7.3.1) | N/A |
| 7.3.2 | External short circuit | | N/A |
| | The cells or batteries were tested until one of the following occurred:<br>- 24 hours elapsed; or | | N/A |
| | - The case temperature declined by 20% of the maximum temperature rise | | N/A |
| | Results: No fire. No explosion..... : | (See Table 7.3.2) | N/A |
| 7.3.3 | Free fall | | N/A |
| | Results: No fire. No explosion. | | N/A |
| 7.3.4 | Mechanical shock (crash hazard) | | N/A |
| | Results: No fire. No explosion. No leakage. | | N/A |
| 7.3.5 | Thermal abuse | | N/A |
| | Oven temperature (°C)..... : | | — |
| | Results: No fire. No explosion. | | N/A |
| 7.3.6 | Crushing of cells | | N/A |
| | The crushing force was released upon:<br>- The maximum force of 13 kN ± 1 kN has been applied; or | | N/A |
| | - An abrupt voltage drop of one-third of the original voltage has been obtained | | N/A |
| | The cell is prismatic type and a second set of samples was tested, rotated 90° around longitudinal axis compared to the first set | | N/A |
| | Results: No fire. No explosion..... : | (See Table 7.3.6) | N/A |
| 7.3.7 | Low pressure | | N/A |
| | Chamber pressure (kPa)..... : | | — |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | Results: No fire. No explosion. No leakage. | | N/A |
| 7.3.8 | Overcharge | | N/A |
| | Results: No fire. No explosion..... : | (See Table 7.3.8) | N/A |
| 7.3.9 | Forced discharge | | N/A |
| | Results: No fire. No explosion..... : | (See Table 7.3.9) | N/A |
| **8** | **Specific requirements and tests (lithium systems)** | | **P** |
| 8.1 | Charging procedures for test purposes | | P |
| 8.1.1 | First procedure:<br>This charging procedure applied to tests other than those specified in 8.1.2 | | P |
| 8.1.2 | Second procedure:<br>This charging procedure applied to the tests of 8.3.1, 8.3.2, 8.3.4, 8.3.5, and 8.3.9 | | P |
| | If a cell's specified upper and/or lower charging temperature exceeds values for the upper and/or lower limit test temperatures of Table 4, the cells were charged at the specified values plus 5 °C for the upper limit and minus 5 °C for the lower limit | Charge temperature 0-45°C declared.<br>-5°C used for lower limit test. | P |
| | A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... : | | P |
| | For a different upper limit charging voltage (i.e. other than for lithium cobalt oxide systems at 4,25 V), the applied upper limit charging voltage and upper limit charging temperatures were adjusted accordingly | Lithium cobalt oxide systems. | N/A |
| | A valid rationale was provided to ensure the safety of the cell (see Figure A.1) ..... : | | N/A |
| 8.2 | Intended use | | P |
| 8.2.1 | Continuous charging at constant voltage (cells) | Tested complied. | P |
| | Results: No fire. No explosion..... : | (See Table 8.2.1) | P |
| 8.2.2 | Moulded case stress at high ambient temperature (battery) | | N/A |
| | Oven temperature (°C) ..... : | | — |
| | Results: No physical distortion of the battery casing resulting in exposure if internal components | | N/A |
| 8.3 | Reasonably foreseeable misuse | | P |
| 8.3.1 | External short circuit (cell) | | P |
| | The cells were tested until one of the following occurred:<br>- 24 hours elapsed; or | | N/A |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| | - The case temperature declined by 20% of the maximum temperature rise | | P |
| | Results: No fire. No explosion..... : | (See Table 8.3.1) | P |
| 8.3.2 | External short circuit (battery) | | N/A |
| | The cells were tested until one of the following occurred:<br>- 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 |
| | Results: No fire. No explosion..... : | (See Table 8.3.2) | N/A |
| 8.3.3 | Free fall | | P |
| | Results: No fire. No explosion. | No fire. No explosion. | P |
| 8.3.4 | Thermal abuse (cells) | | P |
| | The cells were held at 130°C ± 2°C for:<br>- 10 minutes; or | Tested complied. | P |
| | - 30 minutes for large cells (gross mass of more than 500 g as defined in IEC 62281) | | N/A |
| | Oven temperature (°C)..... : | 130°C | — |
| | Gross mass of cell (g) ..... : | <500g, small cell. | — |
| | Results: No fire. No explosion. | No fire. No explosion. | P |
| 8.3.5 | Crush (cells) | | P |
| | The crushing force was released upon:<br>- The maximum force of 13 kN ± 1 kN has been applied; or | Tested complied. | P |
| | - An abrupt voltage drop of one-third of the original voltage has been obtained; or | | N/A |
| | - 10% of deformation has occurred compared to the initial dimension | | N/A |
| | Results: No fire. No explosion..... : | (See Table 8.3.5) | P |
| 8.3.6 | Over-charging of battery | | N/A |
| | Test was continued until the temperature of the outer casing:<br>- 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 Table 8.3.6) | N/A |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 8.3.7 | Forced discharge (cells) | | P |
| | Results: No fire. No explosion..... : | (See Table 8.3.7) | P |
| 8.3.8 | Transport tests | | P |
| | Manufacturer's documentation provided to show compliance with UN Recommendations on Transport of Dangerous Goods | Tested complied. | P |
| 8.3.9 | Design evaluation – Forced internal short circuit (cells) | Tested complied. | P |
| | The cells complied with national requirement for .....: | France, Japan, Korea and Switzerland. | — |
| | The pressing was stopped upon:<br>- 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 | 800N | P |
| | Results: No fire ..... : | (See Table 8.3.9) | P |
| **9** | **Information for safety** | | **P** |
| | The manufacturer of secondary cells ensures that information is provided about current, voltage and temperature limits of their products. | Information for safety mentioned in manufacturer's specifications. | P |
| | The manufacturer of batteries ensures that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate hazards. | | N/A |
| | Systems analyses performed by device manufacturers to ensure that a particular battery design prevents hazards from occurring during use of a product | | N/A |
| | As appropriate, information relating to hazard avoidance resulting from a system analysis is provided to the end user ..... : | | N/A |
| **10** | **Marking** | | **P** |
| 10.1 | Cell marking | | P |
| | Cells marked as specified in the applicable cell standards: IEC 61951-1, IEC 61951-2 or IEC 61960. | See marking plate on page 4. | P |
| 10.2 | Battery marking | | N/A |
| | Batteries marked in accordance with the requirements for the cells from which they are assembled. | | N/A |
| | Batteries marked with an appropriate caution statement. | | N/A |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| 10.3 | Other information | | P |
| | Storage and disposal instructions marked on or supplied with the battery. | Information for disposal instructions mentioned in manufacturer's specifications. | P |
| | Recommended charging instructions marked on or supplied with the battery. | Information for recommended charging instructions mentioned in manufacturer's specifications. | P |
| **11** | **Packaging** | | **P** |
| | 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 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 | Complied. | P |
| A.3.1 | General | Charging voltage is 4.2V | P |
| A.3.2 | Upper limit charging voltage | | P |
| A.3.2.1 | General | | P |
| A.3.2.2 | Explanation of safety viewpoint | | N/A |
| A.3.2.3 | Safety requirements, when different upper limit charging voltage is applied | 4.25V applied. | N/A |
| A.4 | Consideration of temperature and charging current | | P |
| A.4.1 | General | | P |
| A.4.2 | Recommended temperature range | See A.4.2.2. | P |
| A.4.2.1 | General | | P |
| A.4.2.2 | Safety consideration when a different recommended temperature range is applied | Charging temperature declared by client is: 0-45°C | P |
| A.4.3 | High temperature range | Not higher than the temperature range specific in this standard. | N/A |
| A.4.3.1 | General | | N/A |
| A.4.3.2 | Explanation of safety viewpoint | | N/A |
| A.4.3.3 | Safety considerations when specifying charging conditions in high temperature range | | N/A |
| A.4.3.4 | Safety consideration when specifying new upper limit in high temperature range | | N/A |

| IEC 62133: 2012 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result - Remark | Verdict |
| A.4.4 | Low temperature range | Charging low temperature declared by client is: 0°C. | 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 low temperature range | | P |
| A.4.4.4 | Safety considerations when specifying a new lower limit in the low temperature range | -5°C. | P |
| A.4.5 | Scope of the application of charging current | | P |
| A.5 | Sample preparation | | P |
| A.5.1 | General | | P |
| A.5.2 | Insertion procedure for nickel particle to generate internal short | | P |
| | The insertion procedure carried out at 20°C±5°C and under -25 °C of dew point | | P |
| A.5.3 | Disassembly of charged cell | | P |
| A.5.4 | Shape of nickel particle | | P |
| A.5.5 | Insertion of nickel particle to cylindrical cell | | P |
| A.5.5.1 | Insertion of nickel particle to winding core | | P |
| A.5.5.2 | Mark the position of nickel particle on the both end of winding core of the separator | | P |
| A.5.6 | Insertion of nickel particle to prismatic cell | | N/A |

| | TABLE: Critical components information | | | | P |
|---|---|---|---|---|---|
| **Object/part no.** | **Manufacturer/ trademark** | **Type/model** | **Technical data** | **Standard** | **Mark(s) of conformity [1)]** |
| Cell | Shenzhen ZhuoNeng New Energy Technology CO., LTD | SZNS18650-2500mAh | 3.6V, 2500mAh | IEC 62133: 2012 | Test with appliance |
| Anode | KeLong | KL206 | Particle size D50 : 12.0±2.0μm<br>BET surface area: 0.5$m^2$/g<br>Tap density: 2.2g/$cm^3$ | -- | -- |
| Cathode | BeiTeRui | ZN-3A | Particle size D50 : 17.0±2.0μm<br>BET surface area: 5.0±0.3$m^2$/g<br>Tap density: 1.1g/$cm^3$ | -- | -- |
| Separator | TianFeng | 60*17S3 | Width: 60±0.5mm<br>Thickness:0.017±0.001mm<br>Porosity(%):40-47;<br>Shutdown temp:135°C | -- | -- |
| Electrolyte | Shanshan | 13750 | Density: 1.262±0.005g/$cm^3$<br>Conductivity: 10.72±0.5mS/cm | -- | -- |
| Outer case | JinYang | 17.66*63 | Height: 68.3±0.05mm<br>Inner diameter: 17.66±0.05mm | -- | -- |
| PTC | CHANGZHOU WUJIN ZHONGRUI ELECTRONICS CO LTD | PTC18R | Vmax:15V; Ih:2.5A; It:5.0A<br>Tmoa:85°C | UL 1434 | UL E340030 |
| **Supplementary information:**<br>**[1)] Provided evidence ensures the agreed level of compliance.** | | | | | |

| 7.2.1 | TABLE: Continuous low rate charge (cells) | | | | N/A |
|---|---|---|---|---|---|
| **Model** | **Recommended charging method, (CC, CV, or CC/CV)** | **Recommended charging voltage $V_c$, (Vdc)** | **Recommended charging current $I_{rec}$, (A)** | **OCV at start of test, (Vdc)** | **Results** |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.2.2 | TABLE: Vibration | | N/A |
|---|---|---|---|
| **Model** | **OCV at start of test, (Vdc)** | **Results** | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.3.1 | TABLE: Incorrect installation (cells) | N/A |
|---|---|---|

| Model | OCV of reversed cell, (Vdc) | Results |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.3.2 | TABLE: External short circuit | N/A |
|---|---|---|

| Model | Ambient (at 20°C ± 5ºC or 55°C ± 5°C) | OCV at start of test, (Vdc) | Resistance of circuit, (Ω) | Maximum case temperature rise ΔT, (°C) | Results |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |
| | | | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.3.6 | TABLE: Crush | | N/A |
|---|---|---|---|
| **Model** | **OCV at start of test, (Vdc)** | **OCV at removal of crushing force, (Vdc)** | **Results** |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.3.8 | TABLE: Overcharge | | | N/A |
|---|---|---|---|---|
| **Model** | **OCV prior to charging, (Vdc)** | **Maximum charge current, (A)** | **Time for charging, (hours)** | **Results** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 7.3.9 | TABLE: Forced discharge (cells) | | | N/A |
|---|---|---|---|---|
| **Model** | **OCV before application of reverse charge, (Vdc)** | **Measured reverse charge $I_t$, (A)** | **Time for reversed charge, (minutes)** | **Results** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Supplementary information:**

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

| 8.2.1 | TABLE: Continuous charging at constant voltage (cells) | | | P |
|---|---|---|---|---|
| **Model** | **Recommended charging voltage $V_c$, (Vdc)** | **Recommended charging current $I_{rec}$, (A)** | **OCV at start of test, (Vdc)** | **Results** |
| #1 | 4.2 | 0.5 | 4.16 | P |
| #2 | 4.2 | 0.5 | 4.17 | P |
| #3 | 4.2 | 0.5 | 4.16 | P |
| #4 | 4.2 | 0.5 | 4.16 | P |
| #5 | 4.2 | 0.5 | 4.17 | P |

**Supplementary information:**

- No fire or explosion
- No leakage

| 8.3.1 | TABLE: External short circuit (cell) | | | | P |
|---|---|---|---|---|---|
| **Model** | **Ambient, (°C)** | **OCV at start of test, (Vdc)** | **Resistance of circuit, (mΩ)** | **Maximum case temperature rise ΔT, ~~(°C)~~** | **Results** |
| **Samples charged at charging temperature upper limit (45°C)** | | | | | |
| #1 | 18.8 | 4.16 | 80 | 36.5 | P |
| #2 | 18.8 | 4.16 | 80 | 39.9 | P |
| #3 | 18.8 | 4.17 | 80 | 38.6 | P |
| #4 | 18.8 | 4.16 | 80 | 38.8 | P |
| #5 | 18.8 | 4.16 | 80 | 35.8 | P |
| **Samples charged at charging temperature lower limit (-5°C)** | | | | | |
| #6 | 18.8 | 4.16 | 80 | 28.9 | P |
| #7 | 18.8 | 4.16 | 80 | 30.4 | P |
| #8 | 18.8 | 4.17 | 80 | 31.2 | P |
| #9 | 18.8 | 4.16 | 80 | 33.2 | P |
| #10 | 18.8 | 4.16 | 80 | 32.0 | P |

**Supplementary information:**
- No fire or explosion

| 8.3.2 | TABLE: External short circuit (battery) | | | | N/A |
|---|---|---|---|---|---|
| **Model** | **Ambient, (°C)** | **OCV at start of test, (Vdc)** | **Resistance of circuit, (mΩ)** | **Maximum case temperature rise ΔT, ~~(°C)~~** | **Results** |
| **Samples charged at charging temperature upper limit (°C)** | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **Samples charged at charging temperature lower limit (°C)** | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Supplementary information:**
- No fire or explosion

| 8.3.5 | TABLE: Crush | | | | P |
|---|---|---|---|---|---|
| **Model** | **OCV at start of test, (Vdc)** | **OCV at removal of crushing force, (Vdc)** | **Width/ diameter of cell before crush, (mm)** | **Required deformation for crush, (mm)** | **Results** |
| **Samples charged at charging temperature upper limit (45°C)** | | | | | |
| Cell #1 | 4.16 | -- | -- | -- | P |
| Cell #2 | 4.16 | -- | -- | -- | P |
| Cell #3 | 4.17 | -- | -- | -- | P |
| Cell #4 | 4.17 | -- | -- | -- | P |
| Cell #5 | 4.16 | -- | -- | -- | P |
| **Samples charged at charging temperature upper limit (-5°C)** | | | | | |
| Cell #6 | 4.10 | 0.19 | -- | -- | P |
| Cell #7 | 4.10 | 3.97 | -- | -- | P |
| Cell #8 | 4.10 | 0.09 | -- | -- | P |
| Cell #9 | 4.10 | 4.10 | -- | -- | P |
| Cell #10 | 4.10 | 4.09 | -- | -- | P |

**Note:**
**A 13kN force applied at the longitudinal side of cylindrical cells.**
**Supplementary information:**
- No fire or explosion

| 8.3.6 | TABLE: Over-charging of battery | | | | N/A |
|---|---|---|---|---|---|
| Constant charging current (A).....: | | | | | — |
| Supply voltage (Vdc).....: | | | | | — |
| **Model** | **OCV before charging, (Vdc)** | **Resistance of circuit, (mΩ)** | **Maximum outer casing temperature, (°C)** | **Results** | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Supplementary information:**

- No fire or explosion

| 8.3.7 | TABLE: Forced discharge (cells) | | | | P |
|---|---|---|---|---|---|
| **Model** | **OCV before application of reverse charge, (Vdc)** | **Measured Reverse charge $I_t$, (A)** | **Time for reversed charge, (minutes)** | **Results** | |
| #1 | 3.39 | 2.5 | 90 | P | |
| #2 | 3.40 | 2.5 | 90 | P | |
| #3 | 3.39 | 2.5 | 90 | P | |
| #4 | 3.40 | 2.5 | 90 | P | |
| #5 | 3.39 | 2.5 | 90 | P | |

**Supplementary information:**

- No fire or explosion

| 8.3.8 T-5 | TABLE: External short circuit (cell) | | | | P |
|---|---|---|---|---|---|
| **Model** | **Ambient, (°C)** | **OCV at start of test, (Vdc)** | **Resistance of circuit, (mΩ)** | **Maximum case temperature rise ΔT, ~~(°C)~~** | **Results** |
| | | | | | |
| #1 | 54.0 | 4.16 | 80 | 23.9 | P |
| #2 | 54.0 | 4.16 | 80 | 24.7 | P |
| #3 | 54.0 | 4.16 | 80 | 25.8 | P |
| #4 | 54.0 | 4.16 | 80 | 27.8 | P |
| #5 | 54.0 | 4.16 | 80 | 22.1 | P |
| | | | | | |
| #6 | 56.5 | 4.16 | 80 | 22.0 | P |
| #7 | 56.5 | 4.16 | 80 | 26.1 | P |
| #8 | 56.5 | 4.17 | 80 | 28.0 | P |
| #9 | 56.5 | 4.16 | 80 | 25.4 | P |
| #10 | 56.5 | 4.16 | 80 | 28.4 | P |

**Supplementary information:**

The external short-circuit test of 10 pcs samples performed after the test of Altitude, Thermal cycling, Vibration and Shock in sequence.

- No fire or explosion

| 8.3.9 | TABLE: Forced internal short circuit (cells) | | | | P |
|---|---|---|---|---|---|
| **Model** | **Chamber ambient, (°C)** | **OCV at start of test, (Vdc)** | **Particle location [1)]** | **Maximum applied pressure, (N)** | **Results** |
| #1 | 10 | 4.167 | 1 | 800 | P |
| #2 | 10 | 4.171 | 1 | 800 | P |
| #3 | 10 | 4.172 | 1 | 800 | P |
| #4 | 10 | 4.173 | 2 | 800 | P |
| #5 | 10 | 4.169 | 2 | 800 | P |
| #6 | 45 | 4.170 | 1 | 800 | P |
| #7 | 45 | 4.170 | 1 | 800 | P |
| #8 | 45 | 4.171 | 1 | 800 | P |
| #9 | 45 | 4.168 | 2 | 800 | P |
| #10 | 45 | 4.169 | 2 | 800 | P |

**Supplementary information:**

[1)] Identify one of the following:

1: Nickel particle inserted between positive and negative (active material) coated area.

2: Nickel particle inserted between positive aluminium foil and negative active material coated area.

- No fire or explosion
- No leakage
- Leakage
- Fire
- Explosion
- Bulge
- Others (please explain)

**-- End of Report --**

| National Difference | | | |
|---|---|---|---|
| Consumer Goods | Requirement + Test | Result - Remark | Verdict |

| ATTACHMENT TO TEST REPORT IEC 62133 (ED 2.0)<br>SINGAPORE NATIONAL DIFFERENCES | |
|---|---|
| **Differences according to**.....: | Consumer Protection (Consumer Goods Safety Requirements) Regulations [CGSR] as detailed in Appendix F Additional Safety Requirements Imposed by SPRING Singapore as the Safety Authority |
| **Attachment Form No**.....: | SG_ND_IEC62133B |
| **Attachment Originator** .....: | TÜV Rheinland (Shenzhen) Co., Ltd. |
| **Master Attachment**.....: | Date 2015-08 |

| | | | |
|---|---|---|---|
| Portable power banks[1] | **1 Portable power banks shall comply with the requirements of the following safety standards:**<br><br>1.1 IEC 62133:2012 Secondary cells and batteries containing alkaline or non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications; and<br>1.2 IEC 60950-1:2005+A1:2009+A2:2013 Information technology equipment – Safety – Part 1: General requirements<br>OR<br>1.3 Any other industry standard specific to power banks<br><br>**2 Portable power banks shall be supplied with the following safety information:**<br>2.1 'Minimum Instructions for use' as specified below<br>2.2 Instructions on how to charge the portable power bank<br>2.3 Information on the minimum and maximum operating temperatures of the portable power bank | | N/A |

| National Difference | | | |
|---|---|---|---|
| Consumer Goods | Requirement + Test | Result - Remark | Verdict |
| | **Minimum Instructions[2] for Use for Portable Power Banks** to be provided with portable power banks to the customer<br>a) The power bank will generate heat when charging. Always charge in a well ventilated area. Do not charge under pillows, blankets or on flammable surfaces.<br>b) Keep the power bank away from heat sources, direct sunlight, combustible gas, humidity, water or other liquids.<br>c) Do not disassemble, open, microwave, incinerate, paint or insert foreign objects into the power bank.<br>d) Do not subject the power bank to mechanical shock such as crushing, bending, puncturing or shredding. Avoid dropping or placing heavy object on the power bank.<br>e) Do not short-circuit the power bank or store it in a receptacle where it may be short-circuited by other metallic or conductive objects.<br>f) Do not operate the power bank if it has been wet or otherwise damaged, to prevent against electric shock, explosion and/or injury. Contact the dealer or authorized agent.<br>g) Power bank usage by children should be supervised.<br>h) Please read the operating instructions (including charging instructions and information on the minimum and maximum operating temperatures), supplied with this power bank. | | N/A |

**Type Designation:** **SZNS18650-2500**

**Report No.:** **50137388 001**

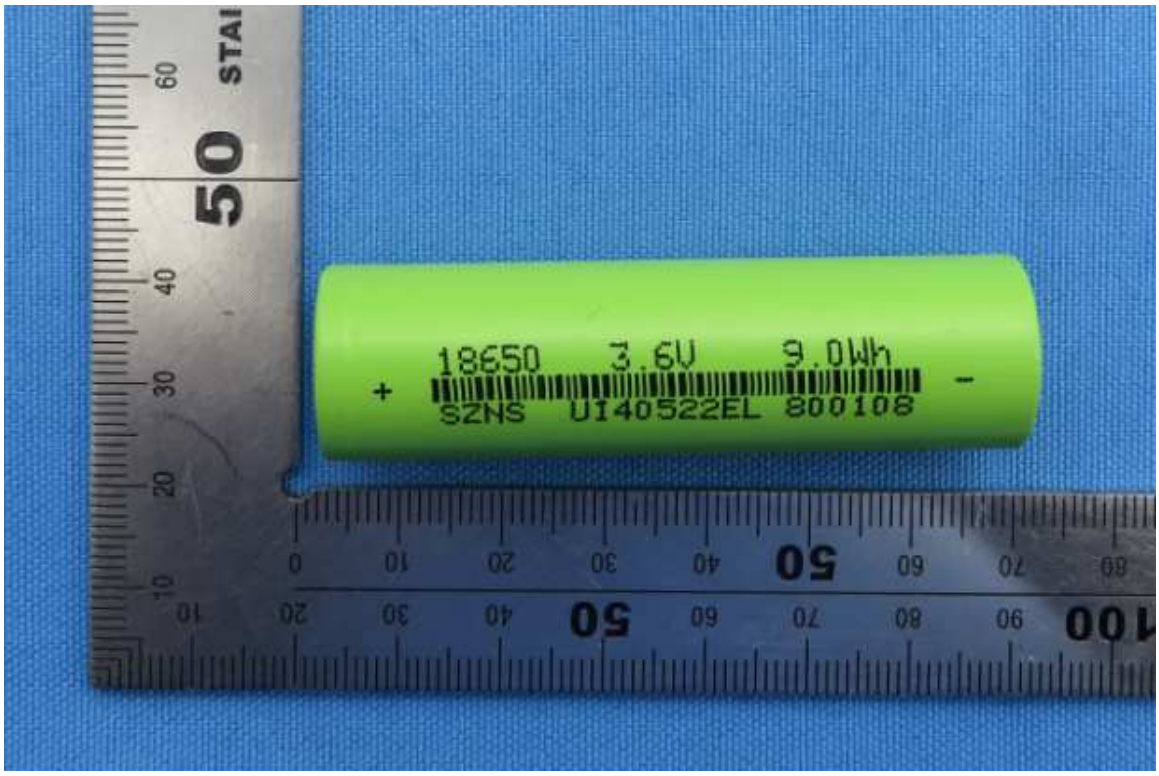


Figure 1 Front view of cell

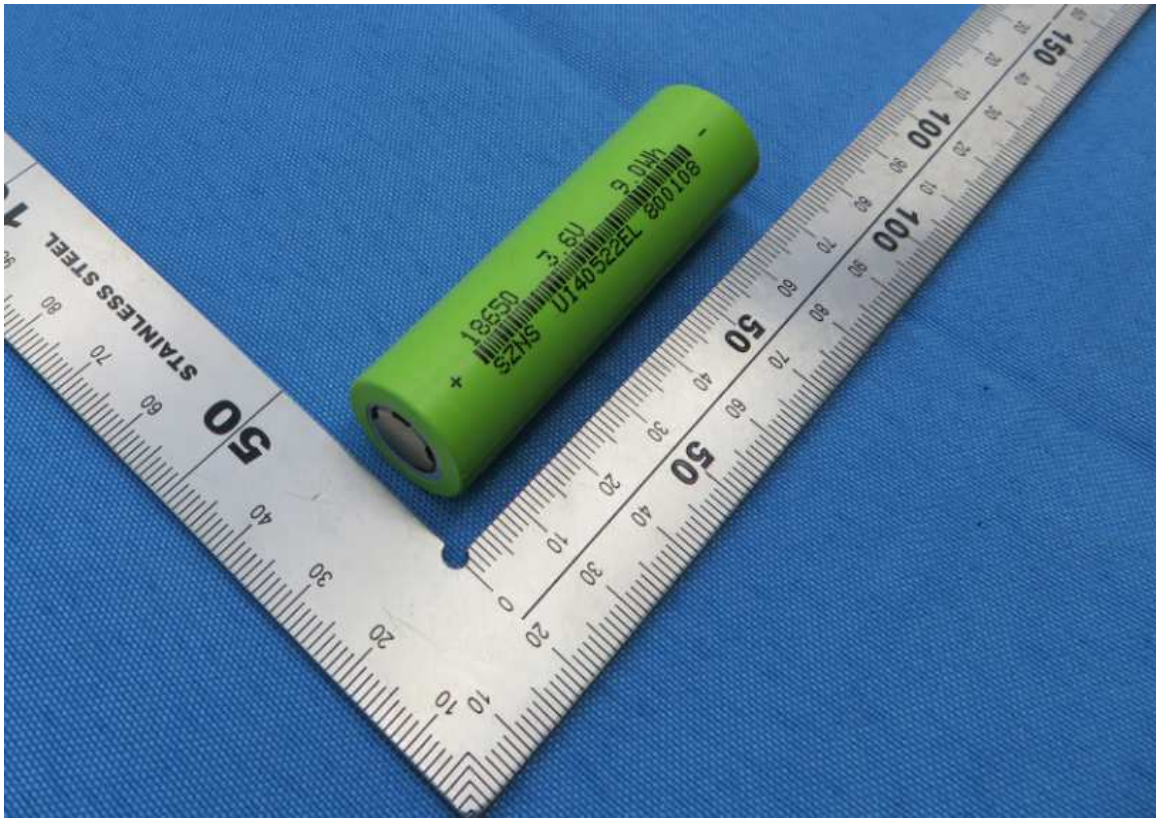


Figure 2 Side view of cell