



Test Report issued under the responsibility of:



**TEST REPORT**  
**IEC 60086-4**  
**Primary batteries**  
**Part 4: Safety of lithium batteries**

Report Number .....: 50282247 001

Date of issue .....: 2019-09-30

Total number of pages.....: 21 pages

Name of Testing Laboratory  
preparing the Report.....: TÜV Rheinland (Shenzhen) Co., Ltd.

Applicant's name .....: Wuhan Zhongyuan Changjiang Technology Development Co.,  
Ltd.

Address .....: No.231,Xingsan Road, Sha Mao Street, Hannan District, Wuhan,  
Hubei Province, P. R. China

**Test specification:**

Standard .....: IEC 60086-4:2014 (Fourth Edition)

Test procedure.....: CB Scheme

Non-standard test method.....: N/A

Test Report Form No .....: IEC60086\_4B

Test Report Form(s) Originator.....: Intertek Semko AB

Master TRF .....: Dated 2015-03

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|   |  |  |
|---|--|--|
| <b>Test item description</b> .....  | Lithium Thionyl Chloride Battery   |  |
| <b>Trade Mark</b> .....   |         |  |
| <b>Manufacturer</b> .....   | Wuhan Zhongyuan Changjiang Technology Development Co., Ltd.                              |  |
| <b>Address</b> .....  | No.231,Xingsan Road, Sha Mao Street, Hannan District, Wuhan, Hubei Province, P. R. China |  |
| <b>Model/Type reference</b> .....   | ER18505  |  |
| <b>Ratings</b> .....  | 3.6V, 4000mAh  |  |
| <b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b> |  |  |
| <input checked="" type="checkbox"/>   | <b>CB Testing Laboratory:</b>  | <b>TÜV Rheinland (Shenzhen) Co., Ltd.</b>  |
|   | <b>Testing location/ address</b> .....   | 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 |
| <input type="checkbox"/>  | <b>Associated CB Testing Laboratory:</b>   |  |
|   | <b>Testing location/ address</b> .....   |  |
|   | <b>Tested by (name, function, signature)</b> .....                                       | Harris Yin   |
|   | <b>Approved by (name, function, signature)</b> ...:                                      | Daniel Dai   |
| <b>Testing procedure: TMP/CTF Stage 1:</b>  |  |  |
|   | <b>Testing location/ address</b> .....   |  |
|   | <b>Tested by (name, function, signature)</b> .....                                       |  |
|   | <b>Approved by (name, function, signature)</b> ...:                                      |  |
| <b>Testing procedure: WMT/CTF Stage 2:</b>  |  |  |
|   | <b>Testing location/ address</b> .....   |  |
|   | <b>Tested by (name + signature)</b> .....  |  |
|   | <b>Witnessed by (name, function, signature)</b> ..:                                      |  |
|   | <b>Approved by (name, function, signature)</b> ...:                                      |  |
| <b>Testing procedure: SMT/CTF Stage 3 or 4:</b>   |  |  |
|   | <b>Testing location/ address</b> .....   |  |
|   | <b>Tested by (name, function, signature)</b> .....                                       |  |
|   | <b>Witnessed by (name, function, signature)</b> ..:                                      |  |
|   | <b>Approved by (name, function, signature)</b> ...:                                      |  |
|   | <b>Supervised by (name, function, signature)</b> :                                       |  |

|  |  |
|--|--|
| <b>List of Attachments (including a total number of pages in each attachment):</b><br>Attachment 1: Photo Documentation (2 pages)  |  |
| <b>Summary of testing:</b>   |  |
| <b>Tests performed (name of test and test clause):</b><br>6.4.1 Test A: Altitude<br>6.4.2 Test B: Thermal cycling<br>6.4.3 Test C: Vibration<br>6.4.4 Test D: Shock<br>6.5.1 Test E: External short-circuit<br>6.5.3 Test F: Crush<br>6.5.4 Test H: Forced discharge<br>6.5.5 Test I: Abnormal charging<br>6.5.6 Test J: Free fall<br>6.5.7 Test K: Thermal abuse<br>6.5.8 Test L: Incorrect installation<br>6.5.9 Test M: Overdischarge<br>7.2 Safety precautions (Ingestion gauge) | <b>Testing location:</b><br><b>TÜV Rheinland (Shenzhen) Co., Ltd.</b><br>East of F/1, F/2-F/4, Building 1, Cybio Technology<br>Building No. 6 Langshan No.2 Road, North Hi-tech<br>Industry Park 518057 Shenzhen Nanshan District<br>CHINA |
| <b>Summary of compliance with National Differences:</b><br><br>N/A<br><br><input checked="" type="checkbox"/> <b>The product fulfils the requirement of <u>EN60086-4: 2015</u></b>   |  |

**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.



**Label**

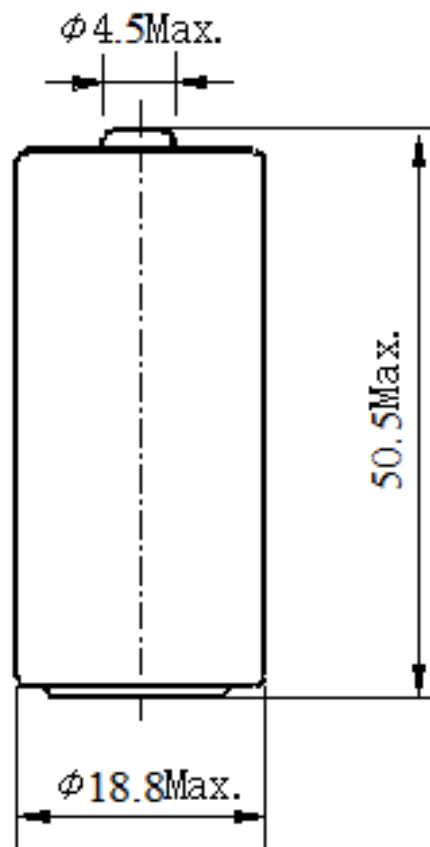
|  |  |
|--|--|
| <b>Test item particulars</b> .....   |  |
| <b>Classification of installation and use</b> .....  | To be defined in final product   |
| <b>Supply Connection</b> .....   | DC terminal  |
| <b>Weight of Battery</b> .....   | Approx. 30.0g  |
| <b>Possible test case verdicts:</b>  |  |
| - test case does not apply to the test object .....  |  |
| - test object does meet the requirement .....  |  |
| - test object does not meet the requirement .....  |  |
| <b>Testing</b> .....   |  |
| <b>Date of receipt of test item</b> .....  |  |
| <b>Date (s) of performance of tests</b> .....  |  |
| <b>General remarks:</b>  |  |
| "(See Enclosure #)" refers to additional information appended to the report.<br>"(See appended table)" refers to a table appended to the report.   |  |
| Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.  |  |
| <b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC60086-02:</b>   |  |
| 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..... | <input type="checkbox"/> <b>Yes</b><br><input checked="" type="checkbox"/> <b>Not applicable</b> |
| <b>When differences exist; they shall be identified in the General product information section.</b>  |  |
| <b>Name and address of factory (ies)</b> .....   |  |

**General product information:**

This product is a lithium thionyl chloride battery with a single primary lithium thionyl chloride cell, and has no over-discharge, overcurrent and short-circuits proof circuit.

The main features of the battery are shown as below:

| Model   | Nominal capacity | Nominal voltage | Maximum discharge current | Discharge cut-off voltage | Dimensions                                 |
|---------|------------------|-----------------|---------------------------|---------------------------|--|
| ER18505 | 4000mAh          | 3.6V            | 120mA                     | 2.0V                      | Max Diameter: 18.5mm<br>Max Height: 50.5mm |

Construction:


Battery (unit: mm)

Circuit diagram:

N/A

| IEC 60086-4 |  |   |            |
|-------------|--|---|------------|
| Clause      | Requirement + Test   | Result - Remark                                   | Verdict    |
| <b>4</b>    | <b>REQUIREMENTS FOR SAFETY</b>   |   | <b>P</b>   |
| <b>4.1</b>  | <b>Design consideration</b>  |   | <b>P</b>   |
|             | a) Abnormal temperature rise above the critical value  |   | <b>P</b>   |
|             | b) Control of temperature increases in the battery   |   | <b>P</b>   |
|             | c) Lithium cells and batteries shall be designed to relieve excessive internal pressure or to preclude a violent rupture under conditions of transport, intended use and reasonably foreseeable misuse.  | Venting mechanism exists on the cylindrical cell. | <b>P</b>   |
| <b>4.2</b>  | <b>Quality plan</b>  |   | <b>P</b>   |
|             | The manufacturer shall prepare and implement a quality plan defining the procedures for the inspection of materials, components, cells and batteries during the course of manufacture, to be applied to the total process of producing a specific type of battery. Manufactures should understand their process capabilities and should institute the necessary process controls as they relate to product safety. | ISO 9001: 2015 certificate provided.              | <b>P</b>   |
| <b>5</b>    | <b>SAMPLING</b>  |   | <b>P</b>   |
| <b>5.1</b>  | <b>General</b>   |   | <b>P</b>   |
| <b>5.2</b>  | <b>Test samples</b>  | (See table 1)                                     | <b>P</b>   |
| <b>6</b>    | <b>TESTING AND REQUIREMENTS</b>  |   | <b>P</b>   |
| <b>6.1</b>  | <b>General</b>   |   | <b>P</b>   |
| 6.1.1       | Test application   | (See 6.2)   | <b>P</b>   |
|             | s: cell or single cell battery .....   | Single cell battery                               | <b>P</b>   |
|             | m: multi cell battery .....  |   | <b>N/A</b> |
| 6.1.3       | Ambient temperature .....  | 20°C±5°C  | <b>P</b>   |
| 6.1.4       | Parameter measurement tolerances   | Complied.   | <b>P</b>   |
| 6.1.5       | Predischarge   |   | <b>P</b>   |
| 6.1.6       | Additional cells   |   | <b>P</b>   |
| <b>6.2</b>  | <b>Evaluation of test criteria</b>   |   | <b>P</b>   |
| 6.2.1       | Short-circuit  |   | <b>P</b>   |
| 6.2.2       | Excessive temperature rise   |   | <b>P</b>   |
| 6.2.3       | Leakage  |   | <b>P</b>   |
| 6.2.4       | Venting  |   | <b>P</b>   |
| 6.2.5       | Fire   |   | <b>P</b>   |
| 6.2.6       | Rupture  |   | <b>P</b>   |
| 6.2.7       | Explosion  |   | <b>P</b>   |

| IEC 60086-4 |  |  |          |
|-------------|--|--|----------|
| Clause      | Requirement + Test   | Result - Remark                                      | Verdict  |
| <b>6.3</b>  | <b>Tests and requirements – Overview</b>   | (See table 4 in the standard)                        | <b>P</b> |
| <b>6.4</b>  | <b>Tests for intended use See the standard</b>   |  | <b>P</b> |
| 6.4.1       | Test A: Altitude .....   | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.4.2       | Test B: Thermal cycling .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.4.3       | Test C: Vibration .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.4.4       | Test D: Shock .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| <b>6.5</b>  | <b>Tests for reasonably foreseeable misuse</b>   |  | <b>P</b> |
| 6.5.1       | Test E: External short-circuit .....   | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.2       | Test F: Impact .....   | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.3       | Test G: Crush .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.4       | Test H: Forced discharge .....   | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.5       | Test I: Abnormal charging .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.6       | Test J: Free fall .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.7       | Test K: Thermal abuse .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.8       | Test L: Incorrect installation .....   | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| 6.5.9       | Test M: Overdischarge .....  | (See appended Table 1 and Table 6.4.1 – 6.5.9)       | <b>P</b> |
| <b>6.6</b>  | <b>Information to be given in the relevant specification</b>   |  | <b>P</b> |
|             | a) Predischarge current or resistive load and end-point voltage specified by the manufacturer .....  | 10mA current, discharge to 2.0V.                     | <b>P</b> |
|             | b) Shape: prismatic, flexible, coin or cylindrical<br>Diameter: not more than 20 mm or greater than 20 mm. ....  | Cylindrical battery.<br>Diameter: not more than 20mm | <b>P</b> |
|             | c) Maximum continuous discharge current specified by the manufacturer for test H; .....<br>NOTE Forced discharge of a cell can occur when it is connected in series with other cells and when it is not protected with a bypass diode. | 120mA as specified by manufacturer applied.          | <b>P</b> |
|             | d) Rated capacity specified by the manufacturer for test H.....  | 4000mAh.   | <b>P</b> |



| IEC 60086-4 |  |  |          |
|-------------|--|--|----------|
| Clause      | Requirement + Test   | Result - Remark  | Verdict  |
|             | e) Abnormal charging current declared by the manufacturer for test I .....:<br><br>NOTE Abnormal charging of a cell can occur when it is connected in series with other cells and one cell is reversed or when it is connected in parallel with a power supply and the protective devices do not operate correctly.<br><br>and | 10mA as specified by manufacturer applied.   | P        |
|             | f) Normal reverse current declared by the manufacturer which can be applied to the battery during its operating life.....:<br><br>NOTE Normal reverse current flow through a cell can occur when it is connected in parallel with a power supply and the protected devices are operating properly.                             | Not applicable declared by manufacturer, reverse current is not allowed for the battery. | N/A      |
| <b>7</b>    | <b>INFORMATION FOR SAFETY</b>  |  | <b>P</b> |
| <b>7.1</b>  | <b>Safety precautions during design of equipment</b>   |  | P        |
| 7.1.1       | General  |  | P        |
| 7.1.2       | Charge protection  |  | P        |
| 7.1.3       | Parallel connection  |  | P        |
| <b>7.2</b>  | <b>Safety precautions during handling of batteries</b>   | Safety precautions are shown in battery specification and user manual.                   | P        |
| <b>7.3</b>  | <b>Packaging</b>   |  | P        |
| <b>7.4</b>  | <b>Handling of battery cartons</b>   |  | P        |
| <b>7.5</b>  | <b>Transport</b>   | Complied. UN 38.3 test report and certificate for safe transport provided.               | P        |
| 7.5.1       | General  |  | P        |
| 7.5.2       | Air transport  |  | P        |
| 7.5.3       | Sea transport  |  | P        |
| 7.5.4       | Land transport   |  | P        |
| <b>7.6</b>  | <b>Display and storage</b>   |  | P        |
| <b>7.7</b>  | <b>Disposal</b>  |  | P        |
| <b>8</b>    | <b>INSTRUCTIONS FOR USE</b>  |  | <b>P</b> |
| <b>9</b>    | <b>MARKING</b>   |  | <b>P</b> |
| <b>9.1</b>  | <b>General</b>   |  | P        |
| <b>9.2</b>  | <b>Small batteries</b>   | Not small batteries  | P        |
| <b>9.3</b>  | <b>Safety pictograms</b>   | Cautionary advice marked on label instead of safety pictograms.                          | N/A      |

| IEC 60086-4 |                    |                 |         |
|-------------|--------------------|-----------------|---------|
| Clause      | Requirement + Test | Result - Remark | Verdict |

| TABLE 1 and 6.4.1 – 6.5.9 |                                 |                   |                    | P   |
|---------------------------|---------------------------------|-------------------|--------------------|-----|
| <b>Tests A-E</b>          | Cells and single cell batteries | Undischarged      | 10                 | P   |
|                           |                                 | Fully discharged  | 10                 | P   |
|                           | Multi cell batteries            | Undischarged      | 4                  | N/A |
|                           |                                 | Fully discharged  | 4                  | N/A |
| <b>Test F or G</b>        | Cells and single cell batteries | Undischarged      | 5                  | P   |
|                           |                                 | Fully discharged  | 5                  | P   |
|                           | Multi cell batteries            | Undischarged      | 5 component cells  | N/A |
|                           |                                 | Fully discharged  | 5 component cells  | N/A |
| <b>Test H</b>             | Cells and single cell batteries | Fully discharged  | 10                 | P   |
|                           | Multi cell batteries            |                   | 10 component cells | N/A |
| <b>Test I to K</b>        | Cells and single cell batteries | Undischarged      | 5                  | P   |
|                           | Multi cell batteries            |                   | 5                  | N/A |
| <b>Test L</b>             | Cells and single cell batteries | Undischarged      | 5 (+15)            | P   |
|                           | Multi cell batteries            |                   | N/A                | N/A |
| <b>Test M</b>             | Cells and single cell batteries | 50% predischarged | 5 (+15)            | P   |
|                           | Multi cell batteries            |                   | N/A                | N/A |
|                           | Cells and single cell batteries | 75% predischarged | 5 (+15)            | P   |
|                           | Multi cell batteries            |                   | N/A                | N/A |

|  | <b>TABLE: Critical components information</b>               |                                |   |                   | <b>P</b>                                  |
|--|---|--------------------------------|---|-------------------|---|
| <b>Object / part No.</b>                                     | <b>Manufacturer/ trademark</b>                              | <b>Type / model</b>            | <b>Technical data</b>                                       | <b>Standard</b>   | <b>Mark(s) of conformity<sup>1)</sup></b> |
| Cell   | Wuhan Zhongyuan Changjiang Technology Development Co., Ltd. | ER18505                        | 3.6V, 4000mAh   | IEC 60086-4: 2014 | Tested with appliance                     |
| -Electrolyte   | Lanxess GmbH  | Battery level thionyl chloride | Purity≥99.9%  | --                | --  |
| -Separator   | Nan Jing Zhong Cai  | 20μm×1945mm×155mm              | Glass fiber, single layer, Shutdown temperature: 150°C      | --                | --  |
| -Positive electrode  | Lanxess GmbH  | Battery level thionyl chloride | Purity≥99.9%  | --                | --  |
| -Negative electrode  | Tian Jin Zhong Neng   | Purity lithium metal           | Purity≥99.9%, Thickness: 1.4mm, Width: 35mm, Length: 47.5mm | --                | --  |
| Battery Case   | Guang zhou Jin Qiang  | 304 stainless steel            | Max diameter 18.5mm, max height 50.5mm                      | --                | --  |
| Supplementary information:                                   |   |                                |   |                   |   |
| 1) Provided evidence ensures the agreed level of compliance. |   |                                |   |                   |   |