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CNAS L3192

# UN38.3 测试报告

# UN38.3 Test Report

| | |
|---|---|
| Sample Description & Model | Li-$MnO_2$ Button Battery CR2032 (3.0V 210mAh Lithium metal content: 0.06g) |
| Applicant | EEMB Energy Power CO.,Ltd |
| Manufacturer | Hubei Zhongju(EEMB) Energy Power CO.,Ltd. |

PONY 谱尼测试
Pony Testing International Group

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| 苏州实验室：(0512)62997900 | 新疆实验室：(0991)6684186 | 宁波实验室：(0574)87977185 | 成都实验室：(028)87702708 |

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## I、SAMPLE DESCRIPTION

| | | | | | | |
|---|---|---|---|---|---|---|
| Sample description | | $Li\text{-}MnO_2$ Button Battery | | Sample model | CR2032 | |
| Applicant | | EEMB Energy Power Co.,Ltd. | | | | |
| Manufacturer | Name | Hubei Zhongju (EEMB) Energy Power Co.,Ltd. | | | | |
| | Address | (Slantwise Opposite the Dongfeng Primary School) Jiangxu Road, Economic Development Zone, Hanchuan, Hubei, 432300, China. | | | | |
| | Tel | 86-27-59233285 | | | | |
| | E-mail | Global@eemb.com | | Web | www.eemb.com | |
| Nominal voltage | | 3.0V | Rated capacity | 210mAh | Limited charge voltage | --- |
| Charge current | | --- | Maximum continuous charge current | --- | End charge current | --- |
| Cut-off voltage | | 2.0V | Maximum discharge current | 3mA | Mass | 3.0g |
| Cell number | | 1PCS | Cell model | CR2032 | Cell capacity | --- |
| Manufacturer of cell | | Hubei Zhongju (EEMB) Energy Power Co.,Ltd. | | | | |
| Electrochemistry System | | Li-Mn | | | | |
| Entrust date | | 2019-11-12 | | Finished date | 2019-12-16 | |

## II、TEST METHOD

UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.6/Amend.1), Part III sub-section.

## III、TEST ITEM & CONCLUSION

| ITEM | SAMPLE NUMBER | STANDARD | CONCLUSION |
|---|---|---|---|
| Altitude simulation | N1~N20 | UN38.3 ST/SG/AC.10/11/Rev.6/ Amend.1 | PASS |
| Thermal test | | | PASS |
| Vibration | | | PASS |
| Shock | | | PASS |
| External short circuit | | | PASS |
| Crush | N21~N30 | | PASS |
| Overcharge | --- | | N/A (Not applicable) |
| Forced discharge | N31~N40 | | PASS |

The Samples has passed the test items of UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.6/ Amend.1), Part III sub-section.

Appraiser: Xiao Fengyuan Checker: Jinshifang Approver:

Issue Date: 2019-12-16

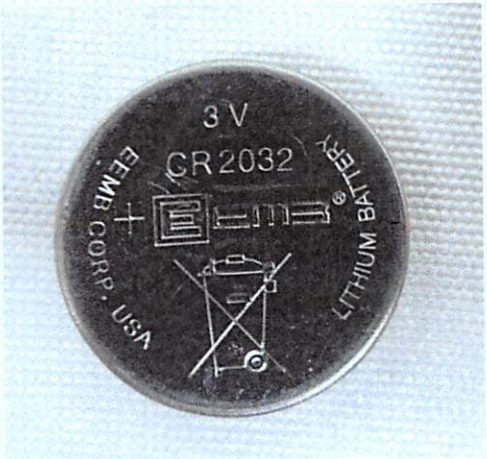
**Notes:**

N1~N10, N21~N25: Cells in undischarged states;

N11~N20, N26~N40: Cells in fully discharged states.

## IV、PHOTO OF THE SAMPLE

Sample No.: T02754721




Authenticate the photo on original report only

## V、TEST METHOD

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.

In order to quantify the mass loss, the following procedure is provided:

$$Mass\ loss(\%) = (M_1-M_2) / M_1 \times 100$$

Where $M_1$ is the mass before the test and $M_2$ is the mass after the test. When mass loss does not exceed the values in Table below, it shall be considered as "no mass loss".

| Mass M of cell or battery | Mass loss limit |
|---|---|
| M＜1g | 0.5% |
| 1g≤M≤75g | 0.2% |
| M＞75g | 0.1% |

### T.1 Altitude simulation

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

### T.2 Thermal test

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.3 Vibration

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 $g_n$ is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 $g_n$ occurs (approximately 50 Hz).

A peak acceleration of 8 $g_n$ is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 $g_n$ is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 $g_n$ occurs (approximately 25 Hz). A peak acceleration of 2 $g_n$ is then maintained until the frequency is increased to 200 Hz.

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery after testing in its perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.4 Shock

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 $g_n$ and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 $g_n$ and pulse duration of 11 milliseconds.

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 millisecondsfor small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

| Battery | Minimum peak acceleration | Pulse duration |
|---|---|---|
| Small batteries | 150 $g_n$ or result of formula<br>Acceleration($g_n$)= $\sqrt{\left(\frac{100850}{mass*}\right)}$<br>Whichever is smaller | 6 ms |
| Large batteries | 50 $g_n$ or result of formula<br>Acceleration($g_n$)= $\sqrt{\left(\frac{30000}{mass*}\right)}$<br>Whichever is smaller | 11 ms |

* Mass is expressed in kilograms.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.5 External short circuit

The cell or battery to be tested shall be shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57±4℃, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57±4℃ shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57±4℃, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value. The short circuit and cooling down phases shall be conducted at least at ambient temperature.

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

T.6 Impact / Crush

Impact (applicable to cylindrical cells not less than 18 mm in diameter)

The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18 mm in diameter)

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

(a) The applied force reaches 13 kN ± 0.78 kN;

(b) The voltage of the cell drops by at least 100 mV; or

(c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

T.7 Overcharge

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) When the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) When the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature; the duration of the test shall be 24 hours.

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

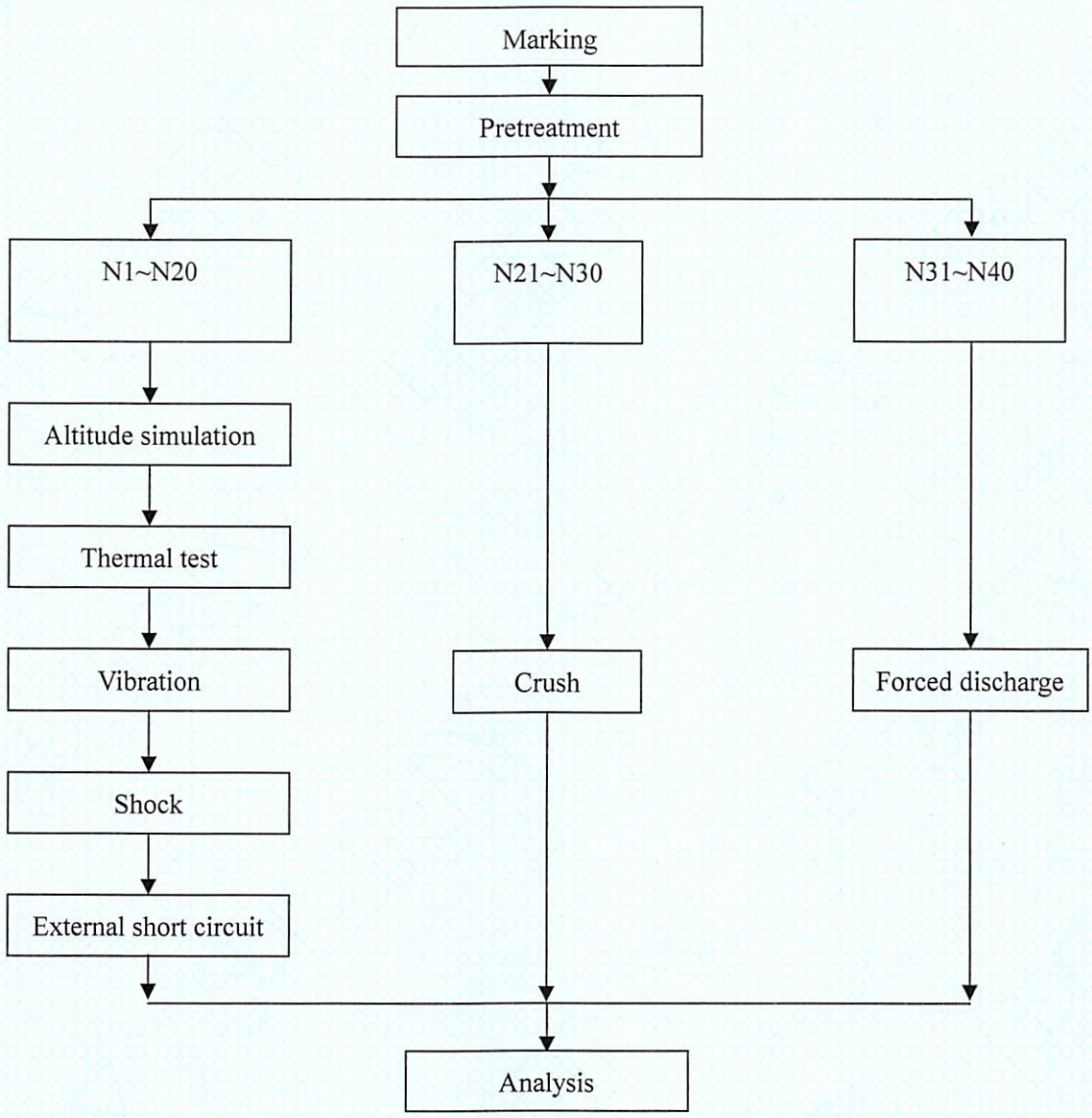
T.8 Forced discharge

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

## VI、TEST PROCEDURE




## VII、TEST APPARATUS

IE-0121 High precision battery test system
IE-0434 Vacuum drying oven
IE-0090 Multimeter
IE-0824 Tableland air pressure gauge
IE-0259 Electronic balance
IE-0219 Rapid temperature change test chamber
IE-0281 Temperature controlled short circuit testing machine
IE-0503 Electric vibration test system
IE-0287 Vertical impact crash test platform
IE-0185 The digital thermometer (TC)
IE-0198 Battery crush testing machine
IE-0544 High speed programmable power supply

## VIII、DATA

1. Altitude simulation

| No. | Pre-test | | After test | | Mass loss (%) | Voltage loss (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) |
|---|---|---|---|---|---|---|---|
| | Mass (g) | Voltage (V) | Mass (g) | Voltage (V) | | | |
| N1 | 3.001 | 3.486 | 3.001 | 3.485 | 0.000 | 0.029 | N |
| N2 | 2.945 | 3.487 | 2.945 | 3.483 | 0.000 | 0.115 | N |
| N3 | 2.989 | 3.488 | 2.989 | 3.487 | 0.000 | 0.029 | N |
| N4 | 2.958 | 3.482 | 2.958 | 3.481 | 0.000 | 0.029 | N |
| N5 | 2.908 | 3.481 | 2.908 | 3.480 | 0.000 | 0.029 | N |
| N6 | 2.959 | 3.484 | 2.959 | 3.482 | 0.000 | 0.057 | N |
| N7 | 2.991 | 3.480 | 2.991 | 3.480 | 0.000 | 0.000 | N |
| N8 | 3.003 | 3.486 | 3.003 | 3.485 | 0.000 | 0.029 | N |
| N9 | 2.946 | 3.492 | 2.946 | 3.487 | 0.000 | 0.143 | N |
| N10 | 2.998 | 3.478 | 2.998 | 3.478 | 0.000 | 0.000 | N |
| N11 | 2.924 | --- | 2.924 | --- | 0.000 | --- | N |
| N12 | 2.943 | --- | 2.943 | --- | 0.000 | --- | N |
| N13 | 2.930 | --- | 2.930 | --- | 0.000 | --- | N |
| N14 | 2.976 | --- | 2.976 | --- | 0.000 | --- | N |
| N15 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N16 | 2.991 | --- | 2.991 | --- | 0.000 | --- | N |
| N17 | 2.995 | --- | 2.995 | --- | 0.000 | --- | N |
| N18 | 2.926 | --- | 2.926 | --- | 0.000 | --- | N |
| N19 | 2.951 | --- | 2.951 | --- | 0.000 | --- | N |
| N20 | 2.950 | --- | 2.950 | --- | 0.000 | --- | N |

2. Thermal test

| No. | Pre-test | | After test | | Mass loss (%) | Voltage loss (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) |
|---|---|---|---|---|---|---|---|
| | Mass (g) | Voltage (V) | Mass (g) | Voltage (V) | | | |
| N1 | 3.001 | 3.485 | 2.998 | 3.489 | 0.100 | -0.115 | N |
| N2 | 2.945 | 3.483 | 2.945 | 3.520 | 0.000 | -1.062 | N |
| N3 | 2.989 | 3.487 | 2.989 | 3.521 | 0.000 | -0.975 | N |
| N4 | 2.958 | 3.481 | 2.956 | 3.518 | 0.068 | -1.063 | N |
| N5 | 2.908 | 3.480 | 2.907 | 3.509 | 0.034 | -0.833 | N |
| N6 | 2.959 | 3.482 | 2.959 | 3.503 | 0.000 | -0.603 | N |
| N7 | 2.991 | 3.480 | 2.991 | 3.524 | 0.000 | -1.264 | N |
| N8 | 3.003 | 3.485 | 3.002 | 3.510 | 0.033 | -0.717 | N |
| N9 | 2.946 | 3.487 | 2.946 | 3.507 | 0.000 | -0.574 | N |
| N10 | 2.998 | 3.478 | 2.998 | 3.511 | 0.000 | -0.949 | N |
| N11 | 2.924 | --- | 2.924 | --- | 0.000 | --- | N |
| N12 | 2.943 | --- | 2.943 | --- | 0.000 | --- | N |
| N13 | 2.930 | --- | 2.930 | --- | 0.000 | --- | N |
| N14 | 2.976 | --- | 2.975 | --- | 0.034 | --- | N |
| N15 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N16 | 2.991 | --- | 2.991 | --- | 0.000 | --- | N |
| N17 | 2.995 | --- | 2.994 | --- | 0.033 | --- | N |
| N18 | 2.926 | --- | 2.926 | --- | 0.000 | --- | N |
| N19 | 2.951 | --- | 2.951 | --- | 0.000 | --- | N |
| N20 | 2.950 | --- | 2.949 | --- | 0.034 | --- | N |

3. Vibration

| No. | Pre-test | | After test | | Mass loss (%) | Voltage loss (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) |
|---|---|---|---|---|---|---|---|
| | Mass (g) | Voltage (V) | Mass (g) | Voltage (V) | | | |
| N1 | 2.998 | 3.489 | 2.998 | 3.486 | 0.000 | 0.086 | N |
| N2 | 2.945 | 3.520 | 2.945 | 3.520 | 0.000 | 0.000 | N |
| N3 | 2.989 | 3.521 | 2.989 | 3.523 | 0.000 | -0.057 | N |
| N4 | 2.956 | 3.518 | 2.956 | 3.518 | 0.000 | 0.000 | N |
| N5 | 2.907 | 3.509 | 2.907 | 3.510 | 0.000 | -0.028 | N |
| N6 | 2.959 | 3.503 | 2.959 | 3.506 | 0.000 | -0.086 | N |
| N7 | 2.991 | 3.524 | 2.991 | 3.524 | 0.000 | 0.000 | N |
| N8 | 3.002 | 3.510 | 3.002 | 3.510 | 0.000 | 0.000 | N |
| N9 | 2.946 | 3.507 | 2.946 | 3.507 | 0.000 | 0.000 | N |
| N10 | 2.998 | 3.511 | 2.998 | 3.510 | 0.000 | 0.028 | N |
| N11 | 2.924 | --- | 2.924 | --- | 0.000 | --- | N |
| N12 | 2.943 | --- | 2.943 | --- | 0.000 | --- | N |
| N13 | 2.930 | --- | 2.930 | --- | 0.000 | --- | N |
| N14 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N15 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N16 | 2.991 | --- | 2.991 | --- | 0.000 | --- | N |
| N17 | 2.994 | --- | 2.994 | --- | 0.000 | --- | N |
| N18 | 2.926 | --- | 2.926 | --- | 0.000 | --- | N |
| N19 | 2.951 | --- | 2.951 | --- | 0.000 | --- | N |
| N20 | 2.949 | --- | 2.948 | --- | 0.034 | --- | N |

4. Shock

| No. | Pre-test | | After test | | Mass loss (%) | Voltage loss (%) | Whether leakage, venting, disassembly, rupture, fire (Y/N) |
|---|---|---|---|---|---|---|---|
| | Mass (g) | Voltage (V) | Mass (g) | Voltage (V) | | | |
| N1 | 2.998 | 3.486 | 2.998 | 3.480 | 0.000 | 0.172 | N |
| N2 | 2.945 | 3.520 | 2.945 | 3.513 | 0.000 | 0.199 | N |
| N3 | 2.989 | 3.523 | 2.989 | 3.519 | 0.000 | 0.114 | N |
| N4 | 2.956 | 3.518 | 2.955 | 3.518 | 0.034 | 0.000 | N |
| N5 | 2.907 | 3.510 | 2.907 | 3.510 | 0.000 | 0.000 | N |
| N6 | 2.959 | 3.506 | 2.959 | 3.503 | 0.000 | 0.086 | N |
| N7 | 2.991 | 3.524 | 2.991 | 3.524 | 0.000 | 0.000 | N |
| N8 | 3.002 | 3.510 | 3.002 | 3.506 | 0.000 | 0.114 | N |
| N9 | 2.946 | 3.507 | 2.946 | 3.502 | 0.000 | 0.143 | N |
| N10 | 2.998 | 3.510 | 2.998 | 3.508 | 0.000 | 0.057 | N |
| N11 | 2.924 | --- | 2.924 | --- | 0.000 | --- | N |
| N12 | 2.943 | --- | 2.943 | --- | 0.000 | --- | N |
| N13 | 2.930 | --- | 2.930 | --- | 0.000 | --- | N |
| N14 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N15 | 2.975 | --- | 2.975 | --- | 0.000 | --- | N |
| N16 | 2.991 | --- | 2.991 | --- | 0.000 | --- | N |
| N17 | 2.994 | --- | 2.994 | --- | 0.000 | --- | N |
| N18 | 2.926 | --- | 2.926 | --- | 0.000 | --- | N |
| N19 | 2.951 | --- | 2.951 | --- | 0.000 | --- | N |
| N20 | 2.948 | --- | 2.948 | --- | 0.000 | --- | N |

5. External short circuit

| No. | Peak temperature (℃) | Whether disassembly, rupture, fire (Y/N) |
|---|---|---|
| N1 | 58.2 | N |
| N2 | 58.1 | N |
| N3 | 57.9 | N |
| N4 | 58.3 | N |
| N5 | 57.8 | N |
| N6 | 57.9 | N |
| N7 | 58.0 | N |
| N8 | 58.1 | N |
| N9 | 58.2 | N |
| N10 | 58.1 | N |
| N11 | 57.4 | N |
| N12 | 57.3 | N |
| N13 | 57.4 | N |
| N14 | 57.2 | N |
| N15 | 57.2 | N |
| N16 | 57.3 | N |
| N17 | 57.2 | N |
| N18 | 57.3 | N |
| N19 | 57.2 | N |
| N20 | 57.2 | N |

6. Crush

| No. | Peak temperature (℃) | Whether disassembly, fire (Y/N) |
|---|---|---|
| N21 | 25.1 | N |
| N22 | 24.9 | N |
| N23 | 25.3 | N |
| N24 | 24.9 | N |
| N25 | 25.6 | N |
| N26 | 24.2 | N |
| N27 | 24.4 | N |
| N28 | 23.9 | N |
| N29 | 24.1 | N |
| N30 | 24.2 | N |

7. Overcharge

N/A

8. Forced discharge

| No. | Whether disassembly, fire (Y/N) |
|---|---|
| N31 | N |
| N32 | N |
| N33 | N |
| N34 | N |
| N35 | N |
| N36 | N |
| N37 | N |
| N38 | N |
| N39 | N |
| N40 | N |

*** End of report ***