Lithium-ion Battery UN38.3 Test Report

Recommendations on the TRANSPORT OF DANGEROUS GOODS

(Manual of Tests and Criteria, Fifth revised edition, Amend.2)

Customer: Lenovo
Model: L15M3PB2
Rating: 11.25V, TYP 4000mAh / 45Wh
MIN 3900mAh / 44Wh

<table>
<thead>
<tr>
<th>Approved By</th>
<th>Checked By</th>
<th>Prepared By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Lu</td>
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Form No.: W11-002-B03
This test report is valid only to the items, Invalid for separation using.
1. Purpose of the Test:

To test each cell/battery is of the type proved to meet the requirements in United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.2, Section 38.3.

2. Test Quantity:

2.1 Four batteries, at first cycle, in fully charged states. (For T.1~T.5)
2.2 Four batteries, after 50 cycles ending in fully charged states. (For T.1~T.5)
2.3 Five component cells, at first cycle at 50% of the design rated capacity. (For T.6)
2.4 Four batteries, at first cycle, in fully charged states. (For T.7)
2.5 Four batteries, after 50 cycles ending in fully charged states. (For T.7)
2.6 Ten component cells, at first cycle in fully discharged states. (For T.8)
2.7 Ten component cells, after 50 cycles ending in fully discharged states. (For T.8)

3. Test Procedure:

3.1 All detailed test procedures must be based on United Nations Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, Fifth revised edition, Amend.2, Section 38.3.

3.2 Test flow shall be followed as below.

- Test 1: Altitude Simulation (Battery)
- Test 2: Thermal Test (Battery)
- Test 3: Vibration (Battery)
- Test 4: Shock (Battery)
- Test 5: External Short Circuit (Battery)
- Test 6: Impact / Crush (Component Cell)
- Test 7: Overcharge (Battery)
- Test 8: Forced Discharge (Component Cell)

Test Start

Test End
4. Test Result:

4.1 T.1 ~ T.4 Test result: Passed
4.1.1 All batteries could meet the requirement of Table 38.3.1 Mass loss limit (M<1g: 0.5%; 1g≤M≤75g: 0.2%; M>75g: 0.1%) and residual OCV not less than 90% after the test.
4.1.2 No leakage, no venting, no disassembly, no rupture and no fire.

4.2 T.5 Test result: Passed
4.2.1 All batteries could meet the requirement, external temperature did not exceed 170°C.
4.2.2 All batteries were no disassembly, no rupture and no fire during the test and within six hours after the test.

4.3 T.6 Test result: Passed
4.3.1 All component cells could meet the requirement, external temperature did not exceed 170°C.
4.3.2 All component cells were no disassembly and no fire during the test and within six hours after the test.

4.4 T.7 Test result: Passed
4.4.1 All batteries could meet no disassembly and no fire during the test and within seven days after the test.

4.5 T.8 Test result: Passed
4.5.1 All component cells could meet the requirement, no disassembly and no fire during the test and within seven days after the test.

Conclusion: The samples had passed the test items of UN38.3.
5. Test Equipment:

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<th>Used</th>
<th>Instrument ID</th>
<th>Instrument Name</th>
<th>Type</th>
<th>Range of use</th>
<th>Manufacturer</th>
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<td>MX100-E1D</td>
<td>1-100 V, 0.5 to 150 °C</td>
<td>Yokogawa</td>
<td>2015/10/1</td>
<td>2016/10/1</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** DC Voltage: 0.1-1000 V; AC Voltage: 0.5-700 V at 60 Hz, 1 kHz; Resistance: 10Q-10MQ; DC Current: 0.1mA-3A; AC Current: 0.01-3A at 60 Hz, 0.01-1A, at 1 kHz.
### T.1 Altitude Simulation

- **Start time:** 2015/05/05 09:30
- **Finish time:** 2015/05/10 15:40

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ambient temp.: 23.9 °C</th>
<th>Operator</th>
<th>Stepby</th>
</tr>
</thead>
</table>

### T.2 Thermal Test

- **Start time:** 2015/05/05 16:00
- **Finish time:** 2015/05/10 08:30

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ambient temp.: 24.7 °C</th>
<th>Operator</th>
<th>Stepby</th>
</tr>
</thead>
</table>

### T.3 Vibration

- **Start time:** 2015/05/13 08:40
- **Finish time:** 2015/05/13 18:50

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ambient temp.: 23.9 °C</th>
<th>Operator</th>
<th>Stepby</th>
</tr>
</thead>
</table>

### T.4 Shock

- **Start time:** 2015/05/14 08:50
- **Finish time:** 2015/05/14 09:40

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ambient temp.: 23.7 °C</th>
<th>Operator</th>
<th>Stepby</th>
</tr>
</thead>
</table>

---

**Note:** This test report is valid only to the items, invalid for separation using.
### T.6 External Short Circuit

<table>
<thead>
<tr>
<th>Start time: 2015/10/14 10:00</th>
<th>Finish time: 2015/10/14 17:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temp.: 24.6 °C</td>
<td>Operator: Stepby</td>
</tr>
<tr>
<td>Sample 01</td>
<td>Sample 02</td>
</tr>
<tr>
<td>After</td>
<td>0.000</td>
</tr>
<tr>
<td>Resistance (&lt;100mΩ)</td>
<td>51.3</td>
</tr>
<tr>
<td>Max Temp. (&lt; 170°C)</td>
<td>55.7</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
</tbody>
</table>

### T.6 Impact / Crush

UN38.3-ST/SG/AC.10/11/Rev.6/Amp00.2

- Impact-Cylindrical cells not less than 18.0 mm in diameter
- Crush- Prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter

<table>
<thead>
<tr>
<th>Start time: 2015/10/08 09:00</th>
<th>Finish time: 2015/10/08 16:15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temp.: 24.6 °C</td>
<td>Operator: Stepby</td>
</tr>
<tr>
<td>Sample 01C</td>
<td>Sample 02C</td>
</tr>
<tr>
<td>Initial OCV (V)</td>
<td>3.716</td>
</tr>
<tr>
<td>Max Temp. (&lt; 170°C)</td>
<td>24.8</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
</tbody>
</table>

### T.7 Overcharge

<table>
<thead>
<tr>
<th>Start time: 2015/10/19 09:00</th>
<th>Finish time: 2015/10/27 09:20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temp.: 24.6 °C</td>
<td>Operator: Stepby</td>
</tr>
<tr>
<td>Sample 09</td>
<td>Sample 10</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
</tbody>
</table>

### T.8 Forced Discharge

<table>
<thead>
<tr>
<th>Start time: 2015/10/23 10:30</th>
<th>Finish time: 2015/10/30 16:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temp.: 24.6 °C</td>
<td>Operator: Stepby</td>
</tr>
<tr>
<td>Sample 06C</td>
<td>Sample 07C</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
<tr>
<td>Sample No.</td>
<td>Sample 14C</td>
</tr>
<tr>
<td>Initial OCV (V)</td>
<td>3.297</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
<tr>
<td>Sample No.</td>
<td>Sample 22C</td>
</tr>
<tr>
<td>Initial OCV (V)</td>
<td>3.310</td>
</tr>
<tr>
<td>Results</td>
<td>P</td>
</tr>
</tbody>
</table>
7. Equipment for Test:

- Pretest
- T.1 Altitude Simulation
- T.2 Thermal Test
- T.5 External Short Circuit
- T.4 Shock
- T.3 Vibration
- T.6 Impact / Crush
- T.8 Forced Discharge
- T.7 Overcharge