Lithium-ion Battery UN38.3 Test Report

Recommendations on the TRANSPORT OF DANGEROUS GOODS
(Manual of Tests and Criteria, Sixth revised edition)

Customer: Lenovo
Model: L18M3PG2
Rating: 11.52V, Typical Capacity 4955mAh/ 57Wh
Rated Capacity 4830mAh/ 55Wh
Issue date: 2018/09/19

<table>
<thead>
<tr>
<th>Approved By</th>
<th>Checked By</th>
<th>Prepared By</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

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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, Sixth revised edition, 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 discharge 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, Sixth revised edition, Section 38.3.
3.2 Test flow shall be followed as below.

```
Test Start
  ↓
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 End
```

This test report is valid only to the items, Invalid for separation using.
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℃.
   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℃.
   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:

<table>
<thead>
<tr>
<th>Used</th>
<th>Instrument ID</th>
<th>Instrument Name</th>
<th>Type</th>
<th>Range of Use</th>
<th>Manufacturer</th>
<th>Calibration Date Last</th>
<th>Calibration Date Next</th>
<th>Remarks</th>
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<td>0-16V 0-8A</td>
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### Test Instruments Reference List

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<th>Used Instrument ID</th>
<th>Instrument Name</th>
<th>Type</th>
<th>Range of use</th>
<th>Manufacturer</th>
<th>Calibration Date Last</th>
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<td>V ML-918 Forced Discharge</td>
<td>Overcharge &amp; Forced discharge tester</td>
<td>T901</td>
<td>3-30 Vdc; Charge: 0.05-20A, Discharge: 0.02-10A</td>
<td>SMP</td>
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</table>

### Note 1
DC Voltage: 0.1-1000V, AC Voltage: 0.5-700V at 60Hz, 1kHz, Resistance: 10Ω-10MO, DC Current: 0.1mA-3A, AC Current: 0.01-3A at 60Hz, 0.01-1A at 1kHz.
6. T.1~T.8 Detail Reports:

![Image of the test report with tables and charts]

**UN 38.3 Test Datasheet**

- **Customer:** Lenovo
- **Model Name:** L18MSPG2
- **Pack PIN:** 529QA224H (A026)
- **Test Duration:** 2018/02/20-2018/02/28
- **Review:** Esmond

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<th>Sample State</th>
<th>Sample No.</th>
<th>Sample State</th>
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<tbody>
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<td>05-08</td>
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<tr>
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<td>1 Cycle, Fully charged</td>
<td>13-16</td>
<td>56 Cycles, Fully charged</td>
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<td>v</td>
<td>z</td>
<td>25 Cycles, Fully charged</td>
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<td>56 Cycles, Fully charged</td>
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</table>

**T.1 Altitude Simulation**

- **Start time:** 2018/02/09 09:20
- **Finish time:** 2018/02/14 15:48
- **Ambient temp.:** 20.3°C

**OCV (V)**

- **Before:** 12.723
- **After:** 12.723

**Residual OCV %**

- **Before:** 99.92%
- **After:** 99.93%

**Mass (g)**

- **Before:** 226.201
- **After:** 226.181

**Mass loss %**

- **Before:** 0.06%
- **After:** 0.06%

**T.2 Thermal Test**

- **Start time:** 2018/02/11 09:40
- **Finish time:** 2018/02/11 15:00
- **Ambient temp.:** 24.3°C

**OCV (V)**

- **Before:** 12.755
- **After:** 12.755

**Residual OCV %**

- **Before:** 98.62%
- **After:** 98.73%

**Mass (g)**

- **Before:** 227.576
- **After:** 227.808

**Mass loss %**

- **Before:** 0.01%
- **After:** 0.01%

**T.3 Vibration**

- **Start time:** 2018/02/11 19:00
- **Finish time:** 2018/02/11 11:10
- **Ambient temp.:** 20.7°C

**OCV (V)**

- **Before:** 12.574
- **After:** 12.574

**Residual OCV %**

- **Before:** 99.78%
- **After:** 99.78%

**Mass (g)**

- **Before:** 227.967
- **After:** 227.967

**Mass loss %**

- **Before:** 0.00%
- **After:** 0.00%

**T.4 Shock**

- **Start time:** 2018/02/12 11:30
- **Finish time:** 2018/02/12 14:40
- **Ambient temp.:** 24.4°C

**OCV (V)**

- **Before:** 12.916
- **After:** 12.907

**Residual OCV %**

- **Before:** 99.99%
- **After:** 99.99%

**Mass (g)**

- **Before:** 226.917
- **After:** 226.917

**Mass loss %**

- **Before:** 0.00%
- **After:** 0.00%
7. Test Sample:

Form No.: W11-002-B04

This test report is valid only to the items, Invalid for separation using.