UN Test Report
- ASM P/N 42T4788, ASM P/N 42T4898 (Nom. 57Wh, 10.8V) -

목 차

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2009. 09. 24

LG Chem
Mobile Energy Division
# 1. UN Transportation Regulation Test

<table>
<thead>
<tr>
<th>Test</th>
<th>Condition</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1. Altitude Simulation</td>
<td>Storing at (low pressure) 11.6kPa for 6hr at 20±/-5°C</td>
<td></td>
</tr>
<tr>
<td>Test 2. Thermal Test</td>
<td>[75±2°C, 6hr ↔ -40±2°C, 6hr, interval max. 30min] x 10cycle Storing at 20±5°C for 24h</td>
<td>- Measuring mass before/after each test (If M&gt;5g, less than 0.1%)</td>
</tr>
<tr>
<td>Test 3. Vibration</td>
<td>[7Hz ↔ 200Hz ↔ 7Hz, in 15min] x 12 times x 3 direction 1) sinusoidal waveform with a logarithmic sweep 2) 7Hz 18Hz (maintaining 1gn) app. 50Hz (until 8gn) 200Hz (maintaining 8gn), 1.6mm total excursion</td>
<td>- Measuring voltage before/after each test (more than 90%) - No leakage, no venting, no disassembly, no rupture, no fire</td>
</tr>
<tr>
<td>Test 4. Shock</td>
<td>Half sine shock (peak acceleration: 150gn, pulse duration: 6msec) x 6 (±x, y, z) direction x 3 cycle</td>
<td>- No disassembly, no rupture, no fire (after 6 hours) - Temp. monitoring (max. 170°C)</td>
</tr>
<tr>
<td>Test 5. External Short Circuit</td>
<td>100mΩ ext. short-circuit at 55±2°C 1hr continue after returning at 55±2°C</td>
<td>- No disassembly, no fire (after 7 days)</td>
</tr>
<tr>
<td>Test 6. Impact</td>
<td>Φ=15.8mm bar, 9.1kg mass, 61±2.5cm height</td>
<td></td>
</tr>
<tr>
<td>Test 7. Overcharge</td>
<td>Current = Manufacturer's recommended max. continuous charge current X 2 Voltage 1. If charge voltage ≤ 18V, V (min.) = 2 x (max. charge voltage) or V (min.) = 22V. 2. If charge voltage &gt; 18V, V (min.) = 1.2 x (max. charge voltage)</td>
<td>- No disassembly, no fire (after 7 days)</td>
</tr>
<tr>
<td>Test 8. Forced Discharge</td>
<td>Only for Cell, not battery.</td>
<td>- No disassembly, no fire (after 7 days)</td>
</tr>
</tbody>
</table>

* Tests through T1-T5 shall be conducted in sequence with the same battery.

* We declare that the above-mentioned test is the result of being checked according to UN Test (Manual of Test and Criteria ST/SG/AC.10/27/Add.2)
2. Test Procedure

Sample Preparation

Test 1 Altitude Simulation

Test 2 Thermal Test

Test 3 Vibration

Test 4 Shock

Test 5 Ext. Short Circuit

10 ea 1st cycle 50% Charged
10 ea 50th cycle Discharged

For cylindrical cells, 5 test cells are required.

Test 6 Impact

Test 7 Overcharge

10 ea 1st cycle Discharged
10 ea 50th cycle Discharged

Test 8 Forced Discharge *

Report

• Forced discharge test is required to cell level, not pack battery level.
# 3-1. T1-T4 Test Result

<table>
<thead>
<tr>
<th>Charge</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>Altitude (T1)</td>
</tr>
<tr>
<td>Pack NO.</td>
<td>OCV</td>
</tr>
<tr>
<td>1</td>
<td>11.999</td>
</tr>
<tr>
<td>2</td>
<td>11.967</td>
</tr>
<tr>
<td>3</td>
<td>11.959</td>
</tr>
<tr>
<td>4</td>
<td>11.995</td>
</tr>
<tr>
<td>Ave.</td>
<td>11.980</td>
</tr>
</tbody>
</table>

## A. 1st cycle fully state

### Charge

1. 11.999 332.38 11.997 332.38 99.98 0.000 Pass 11.876 332.38 98.99 0.000 Pass 11.855 332.30 99.82 0.024 Pass 11.855 332.30 100.00 0.000 Pass
2. 11.967 332.49 11.965 332.48 98.98 0.003 Pass 11.871 332.48 99.21 0.000 Pass 11.871 332.42 100.00 0.018 Pass 11.871 332.42 100.00 0.000 Pass
3. 11.959 331.45 11.958 331.44 99.99 0.003 Pass 11.900 331.44 99.51 0.000 Pass 11.846 331.37 99.55 0.021 Pass 11.846 331.37 100.00 0.000 Pass
4. 11.995 332.02 11.994 332.02 99.99 0.000 Pass 11.874 332.02 99.00 0.000 Pass 11.853 331.95 99.82 0.021 Pass 11.853 331.95 100.00 0.000 Pass

### Discharge

5. 10.268 332.01 332.00 - 0.000 Pass 332.00 - 0.000 Pass 331.95 - 0.015 Pass - 331.95 - 0.000 Pass
6. 10.236 332.11 332.11 - 0.000 Pass 332.11 - 0.000 Pass 332.07 - 0.012 Pass - 332.07 - 0.000 Pass
7. 10.269 332.04 332.03 - 0.003 Pass 332.03 - 0.000 Pass 331.98 - 0.015 Pass - 331.98 - 0.000 Pass
8. 10.260 331.38 331.37 - 0.003 Pass 331.37 - 0.000 Pass 331.32 - 0.015 Pass - 331.32 - 0.000 Pass

### Ave.

10.258 331.89 331.878 - 0.002 - 331.88 - 0.000 - 331.83 - 0.014 - 331.83 - 0.000 -

## B. 50th cycle fully state

### Charge

9. 11.991 331.88 11.990 331.85 99.99 0.009 Pass 11.867 331.85 98.97 0.000 Pass 11.845 331.82 99.81 0.009 Pass 11.845 331.82 100.00 0.000 Pass
10. 11.982 331.97 11.982 331.95 100.00 0.006 Pass 11.895 331.95 99.27 0.000 Pass 11.877 331.91 99.85 0.012 Pass 11.877 331.91 100.00 0.000 Pass
11. 11.957 332.39 11.957 332.37 100.00 0.006 Pass 11.870 332.37 99.27 0.000 Pass 11.850 332.33 99.83 0.012 Pass 11.850 332.33 100.00 0.000 Pass
12. 11.952 331.94 11.952 331.91 100.00 0.009 Pass 11.862 331.91 99.25 0.000 Pass 11.841 331.87 99.82 0.012 Pass 11.841 331.87 100.00 0.000 Pass

### Ave.

11.971 332.05 11.970 332.02 100.00 0.008 - 11.874 332.02 99.19 0.000 - 11.853 331.98 99.83 0.011 - 11.853 331.98 100.00 0.000 -

### Discharge

13. 10.738 332.74 332.72 - 0.006 Pass 332.72 - 0.000 Pass 332.68 - 0.012 Pass - 332.68 - 0.000 Pass
14. 10.267 332.14 332.11 - 0.009 Pass 332.11 - 0.000 Pass 332.07 - 0.012 Pass - 332.07 - 0.000 Pass
15. 10.268 332.12 332.12 - 0.006 Pass 332.12 - 0.000 Pass 332.08 - 0.012 Pass - 332.08 - 0.000 Pass
16. 10.732 332.21 332.19 - 0.006 Pass 332.19 - 0.000 Pass 332.15 - 0.012 Pass - 332.15 - 0.000 Pass

### Ave.

10.501 332.31 332.29 - 0.007 - 332.29 - 0.000 - 332.25 - 0.012 - 332.25 - 0.000 -

### Requirement

- Measuring mass before/after each test (If M>5g, less than 0.1%)
- Measuring voltage before/after each test (more than 90%, only charged samples)
- No leakage, no venting, no disassembly, no rupture, no fire
## 3-2. T5/T7 Test Result

### EXT.Short Circuit (T5)

<table>
<thead>
<tr>
<th>Pack NO.</th>
<th>Initial OCV(V)</th>
<th>Max. Temp (℃)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1st cycle fully state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11.855</td>
<td>55.48</td>
<td>Pass</td>
</tr>
<tr>
<td>2</td>
<td>11.871</td>
<td>54.28</td>
<td>Pass</td>
</tr>
<tr>
<td>3</td>
<td>11.846</td>
<td>53.56</td>
<td>Pass</td>
</tr>
<tr>
<td>4</td>
<td>11.853</td>
<td>55.64</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>11.871</td>
<td>55.64</td>
<td>-</td>
</tr>
<tr>
<td>B. 50th cycle fully state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>11.845</td>
<td>55.56</td>
<td>Pass</td>
</tr>
<tr>
<td>10</td>
<td>11.877</td>
<td>54.41</td>
<td>Pass</td>
</tr>
<tr>
<td>11</td>
<td>11.850</td>
<td>53.86</td>
<td>Pass</td>
</tr>
<tr>
<td>12</td>
<td>11.841</td>
<td>55.76</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>11.877</td>
<td>55.76</td>
<td>-</td>
</tr>
</tbody>
</table>

### Test Condition
- Temperature < 170 (℃)
- No disassembly, no rupture, no fire within 6 hours

### EXT.Short Circuit (T7)

<table>
<thead>
<tr>
<th>Pack NO.</th>
<th>Initial OCV(V)</th>
<th>Max. Temp (℃)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1st cycle fully state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>11.958</td>
<td>23.87</td>
<td>Pass</td>
</tr>
<tr>
<td>18</td>
<td>11.950</td>
<td>23.72</td>
<td>Pass</td>
</tr>
<tr>
<td>19</td>
<td>11.949</td>
<td>23.53</td>
<td>Pass</td>
</tr>
<tr>
<td>20</td>
<td>11.953</td>
<td>23.46</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>11.958</td>
<td>23.87</td>
<td>-</td>
</tr>
<tr>
<td>B. 50th cycle fully state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>11.949</td>
<td>24.00</td>
<td>Pass</td>
</tr>
<tr>
<td>22</td>
<td>11.938</td>
<td>23.84</td>
<td>Pass</td>
</tr>
<tr>
<td>23</td>
<td>11.948</td>
<td>24.38</td>
<td>Pass</td>
</tr>
<tr>
<td>24</td>
<td>11.949</td>
<td>23.88</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>11.949</td>
<td>24.38</td>
<td>-</td>
</tr>
</tbody>
</table>

### Test Condition
- Max. Charge Current : 3900mA
- CC/CV 2Imax(7800mA) 22V cut-off 24Hr
- No disassembly, no fire within 7 day
### 3-3. T6 Test Result (ICR18650B3)

#### Impact (T6)

<table>
<thead>
<tr>
<th>Pack NO.</th>
<th>Initial OCV(V)</th>
<th>Max. Temp (℃)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1st cycle 50% charge state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>3.790</td>
<td>97.01</td>
<td>Pass</td>
</tr>
<tr>
<td>22</td>
<td>3.790</td>
<td>94.99</td>
<td>Pass</td>
</tr>
<tr>
<td>23</td>
<td>3.788</td>
<td>104.17</td>
<td>Pass</td>
</tr>
<tr>
<td>24</td>
<td>3.788</td>
<td>79.75</td>
<td>Pass</td>
</tr>
<tr>
<td>25</td>
<td>3.790</td>
<td>80.07</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>3.790</td>
<td>104.17</td>
<td>-</td>
</tr>
<tr>
<td>B. 50th cycle fully discharge state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>3.540</td>
<td>60.91</td>
<td>Pass</td>
</tr>
<tr>
<td>27</td>
<td>3.528</td>
<td>67.65</td>
<td>Pass</td>
</tr>
<tr>
<td>28</td>
<td>3.530</td>
<td>55.19</td>
<td>Pass</td>
</tr>
<tr>
<td>29</td>
<td>3.542</td>
<td>65.72</td>
<td>Pass</td>
</tr>
<tr>
<td>30</td>
<td>3.535</td>
<td>62.93</td>
<td>Pass</td>
</tr>
<tr>
<td>MAX.</td>
<td>3.542</td>
<td>67.65</td>
<td>-</td>
</tr>
</tbody>
</table>

**Test Condition**

- Φ=15.8mm bar, 9.1kg mass, 61±2.5cm height

**Requirement**

- Temperature < 170 (℃)
- No disassembly, no rupture, no fire within 6 hours
4. Sample Image