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CERTIFICATE OF COMPLIANCE

The following product has been evaluated according to the 6th revised edition of the UN Manual of Tests and Criteria.

We, LG Chem, Ltd., hereby certify that this battery meets the requirements of the regulation for transportation of lithium-ion cells, batteries and single cell batteries.

| | |
|--|--------------------|
| <input type="checkbox"/> Lithium-ion cell <input checked="" type="checkbox"/> Lithium-ion battery <input type="checkbox"/> Lithium-ion single cell battery | |
| Model name | L18L3PD1 |
| Cell Model name | ICP478873L1 |
| Nominal voltage | 11.58V |
| Electric power capacity | 57.00Wh |

Approved By: Xuyuan



Assistant Manager

DQA Team

LG Chem, Ltd.

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| | | |
|-----------------|-----------------------|-----|
| Document Number | QDI-180803-B-L18L3PD1 | |
| Prepared | qianjunli | 钱俊丽 |
| Approved | Xuyuan | 徐园 |

UN38.3 Test Report

- L18L3PD1 (Nom. 57.00Wh, 11.58V) -

Index

1. UN38.3 Test Condition
2. Test Result
3. Sample Image

2018. 08. 03

1. UN38.3 Test Condition

| Test item | Test Condition | Requirements | Etc. |
|--------------------------------|---|--|---|
| Test 1. Altitude Simulation | Storing at (low pressure) 11.6kPa for 6hr at 20+/-5°C | | T1~T5 : Sequence Tests <pre> graph TD T1[Test 1 Altitude Simulation] --> T2[Test 2 Thermal Test] T2 --> T3[Test 3 Vibration] T3 --> T4[Test 4 Shock] T4 --> T5[Test 5 Ext. Short Circuit] </pre> |
| Test 2. Thermal Test | [72±2°C, 6hr ↔ -40±2°C, 6hr, interval max. 30min] x 10cycle Storing at 20±5°C for 24h | | |
| Test 3. Vibration | [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 | <ul style="list-style-type: none"> - After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) <ol style="list-style-type: none"> 1) If M<1g, less than 0.5%, 2) If 1g≤M≤75g, less than 0.2%, 3) If M>75g, less than 0.1% | |
| Test 4. Shock | Half sine shock 1) Peak acceleration - For cells & single cell batteries : 150gn - For batteries (whichever is smaller) : 150gn or $\sqrt{\frac{100850}{Mass(kg)}} gn$ 2) Pulse duration : 6msec 3) 6 direction (±x, y, z) x 3 cycle | | |
| Test 5. External Short Circuit | 1) Samples to be heated to 57±4°C in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4°C 3) 1hr continue after returning to 57±4°C | <ul style="list-style-type: none"> - No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp ≤ 170°C | |
| Test 6. Impact | Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height | <ul style="list-style-type: none"> - No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C | for cylindrical cells (not less than 18mm diameter) |
| Test 6. Crush | Crushing rate : 1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation | | for cylindrical cells (less than 18mm diameter) for prismatic, pouch, coin/button cells |
| Test 7. Overcharge | Current = Manufacturer's recommended max. continuous charge current X 2 Voltage 1.If charge voltage ≤ 18V, V (min.) = 2 x (max. charge voltage) or 22V. 2.If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage) | <ul style="list-style-type: none"> - No disassembly, no fire within 7 days after the test | Only for Single Cell Battery / Battery |
| Test 8. Forced Discharge | Discharge at max. discharge current (connecting in series with 12V DC power supply), Duration time = rated capacity/initial test current | <ul style="list-style-type: none"> - No disassembly, no fire within 7 days after the test | Resistance of Electric Loader 1/Ω = (max. discharge current) / (12 + Initial OCV) |

2-1. T1-T4 Test Result

| Before | | | Altitude (T1) | | | | | Thermal (T2) | | | | | Vibration (T3) | | | | | Shock (T4) | | | | |
|--------|-----|------|---------------|------|--------------|--------------|--------|--------------|------|--------------|--------------|--------|----------------|------|--------------|--------------|--------|------------|------|--------------|--------------|--------|
| NO. | OCV | Mass | OCV | Mass | After OCV(%) | Mass Loss(%) | Result | OCV | Mass | After OCV(%) | Mass Loss(%) | Result | OCV | Mass | After OCV(%) | Mass Loss(%) | Result | OCV | Mass | After OCV(%) | Mass Loss(%) | Result |

A. 1st cycle fully charged state

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---------|--------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|
| 1 | 13.0278 | 233.21 | 13.0244 | 233.16 | 99.97 | 0.021 | Pass | 12.8102 | 233.11 | 98.36 | 0.021 | Pass | 12.8076 | 233.12 | 99.98 | 0.000 | Pass | 12.8064 | 233.14 | 99.99 | 0.000 | Pass |
| 2 | 13.0280 | 233.63 | 13.0246 | 233.59 | 99.97 | 0.017 | Pass | 12.8121 | 233.54 | 98.37 | 0.021 | Pass | 12.8092 | 233.55 | 99.98 | 0.000 | Pass | 12.8083 | 233.56 | 99.99 | 0.000 | Pass |
| 3 | 13.0118 | 234.90 | 13.0077 | 234.85 | 99.97 | 0.021 | Pass | 12.7697 | 234.81 | 98.17 | 0.017 | Pass | 12.7661 | 234.81 | 99.97 | 0.000 | Pass | 12.7639 | 234.83 | 99.98 | 0.000 | Pass |
| 4 | 13.0243 | 233.12 | 13.0213 | 233.08 | 99.98 | 0.017 | Pass | 12.8070 | 233.03 | 98.35 | 0.021 | Pass | 12.8041 | 233.04 | 99.98 | 0.000 | Pass | 12.8031 | 233.05 | 99.99 | 0.000 | Pass |

B. 50th cycle fully charged state

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---------|--------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|---------|--------|-------|-------|------|
| 5 | 13.0157 | 233.42 | 13.0146 | 233.39 | 99.99 | 0.013 | Pass | 12.8135 | 233.35 | 98.45 | 0.017 | Pass | 12.8107 | 233.37 | 99.98 | 0.000 | Pass | 12.8098 | 233.38 | 99.99 | 0.000 | Pass |
| 6 | 13.0158 | 233.18 | 13.0149 | 233.19 | 99.99 | 0.000 | Pass | 12.8116 | 233.13 | 98.44 | 0.026 | Pass | 12.8088 | 233.15 | 99.98 | 0.000 | Pass | 12.8076 | 233.15 | 99.99 | 0.000 | Pass |
| 7 | 13.0145 | 233.82 | 13.0137 | 233.80 | 99.99 | 0.009 | Pass | 12.8124 | 233.76 | 98.45 | 0.017 | Pass | 12.8097 | 233.78 | 99.98 | 0.000 | Pass | 12.8086 | 233.78 | 99.99 | 0.000 | Pass |
| 8 | 13.0156 | 232.85 | 13.0143 | 232.85 | 99.99 | 0.000 | Pass | 12.8097 | 232.80 | 98.43 | 0.021 | Pass | 12.8076 | 232.81 | 99.98 | 0.000 | Pass | 12.8063 | 232.81 | 99.99 | 0.000 | Pass |

2-2. T5/T7 Test Result

EXT.Short Circuit (T5)

| NO. | Initial OCV(V) | Max. Temp (°C) | Result |
|-----|----------------|----------------|--------|
|-----|----------------|----------------|--------|

A. 1st cycle fully charged state

| | | | |
|---|---------|-------|------|
| 1 | 12.8064 | 57.68 | Pass |
| 2 | 12.8083 | 57.11 | Pass |
| 3 | 12.7639 | 56.79 | Pass |
| 4 | 12.8031 | 56.20 | Pass |

B. 50th cycle fully charged state

| | | | |
|---|---------|-------|------|
| 5 | 12.8098 | 57.71 | Pass |
| 6 | 12.8076 | 56.84 | Pass |
| 7 | 12.8086 | 56.84 | Pass |
| 8 | 12.8063 | 56.16 | Pass |

Overcharge (T7)

| NO. | Initial OCV(V) | Max. Temp (°C) | Result |
|-----|----------------|----------------|--------|
|-----|----------------|----------------|--------|

A. 1st cycle fully charged state

| | | | |
|----|---------|-------|------|
| 9 | 12.9787 | 22.10 | Pass |
| 10 | 12.9727 | 21.90 | Pass |
| 11 | 12.5645 | 21.80 | Pass |
| 12 | 13.0073 | 21.64 | Pass |

B. 50th cycle fully charged state

| | | | |
|----|---------|-------|------|
| 13 | 12.9950 | 21.50 | Pass |
| 14 | 12.9986 | 21.50 | Pass |
| 15 | 13.0016 | 21.35 | Pass |
| 16 | 12.9721 | 21.29 | Pass |

2-3. T6/T8 Test Result (ICP478873L1)

| Crush (T6) | | | |
|------------|----------------|----------------|--------|
| NO. | Initial OCV(V) | Max. Temp (°C) | Result |

A. 1st cycle 50% charged state

| | | | |
|-----|-------|-------|------|
| C-1 | 3.864 | 22.06 | Pass |
| C-2 | 3.861 | 22.98 | Pass |
| C-3 | 3.860 | 22.79 | Pass |
| C-4 | 3.864 | 22.06 | Pass |
| C-5 | 3.863 | 22.34 | Pass |

| Forced Discharge (T8) | | | | | | | |
|-----------------------|----------------|----------------|--------|-----|----------------|----------------|--------|
| NO. | Initial OCV(V) | Max. Temp (°C) | Result | NO. | Initial OCV(V) | Max. Temp (°C) | Result |

A. 1st cycle fully discharged state

| | | | |
|------|-------|-------|------|
| C-6 | 3.017 | 41.15 | Pass |
| C-7 | 3.027 | 42.45 | Pass |
| C-8 | 3.045 | 44.61 | Pass |
| C-9 | 3.050 | 44.41 | Pass |
| C-10 | 3.013 | 43.02 | Pass |
| C-11 | 3.025 | 41.41 | Pass |
| C-12 | 3.023 | 43.56 | Pass |
| C-13 | 3.018 | 43.82 | Pass |
| C-14 | 3.010 | 40.69 | Pass |
| C-15 | 3.035 | 43.95 | Pass |

B. 50th cycle fully discharged state

| | | | |
|------|-------|-------|------|
| C-16 | 3.080 | 41.19 | Pass |
| C-17 | 3.077 | 40.98 | Pass |
| C-18 | 3.057 | 44.85 | Pass |
| C-19 | 3.062 | 43.64 | Pass |
| C-20 | 3.100 | 44.92 | Pass |
| C-21 | 3.099 | 44.23 | Pass |
| C-22 | 3.068 | 40.18 | Pass |
| C-23 | 3.097 | 40.41 | Pass |
| C-24 | 3.081 | 44.53 | Pass |
| C-25 | 3.067 | 40.82 | Pass |

3. Sample Image

