

UN38.3 Test Summary

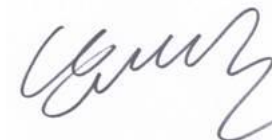
The following product has been evaluated according to the 5th revised edition Amendment 2 of the UN Manual of Tests and Criteria.
We, LG Chem, Ltd., hereby certify that this battery meets the requirements of the regulation for transportation of lithium-ion cells, batteries and single cell batteries.




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| Description | | List of Test Completed | |
| Test Report Number | QAE-EF02-140826-PKL14L2P21 | Test 1. Altitude Simulation | Pass |
| Date of test report | 2014.08.26 | Test 2. Thermal Test | Pass |
| Model name | L14L2P21 | Test 3. Vibration | Pass |
| Type | Pouch | Test 4. Shock | Pass |
| Nominal voltage | 7.4 V | Test 5. External Short Circuit | Pass |
| Capacity | 30.0 Wh | Test 6. Impact or Crush | Pass |
| Weight | 161.0 g | Test 7. Overcharge | Pass |
| Dimensions | 202.00mm X 112.00mm X 6.70mm | Test 8. Forced Discharge | Pass |

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| | | |
|----------|----------------------------|---|
| 문서번호 | QAE-EF02-140826-PKL14L2P21 | |
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UN Test Report

- L14L2P21 (Nom.30Wh, 7.4V) -

목 차

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2014. 08. 26

1. UN Transportation Regulation Test

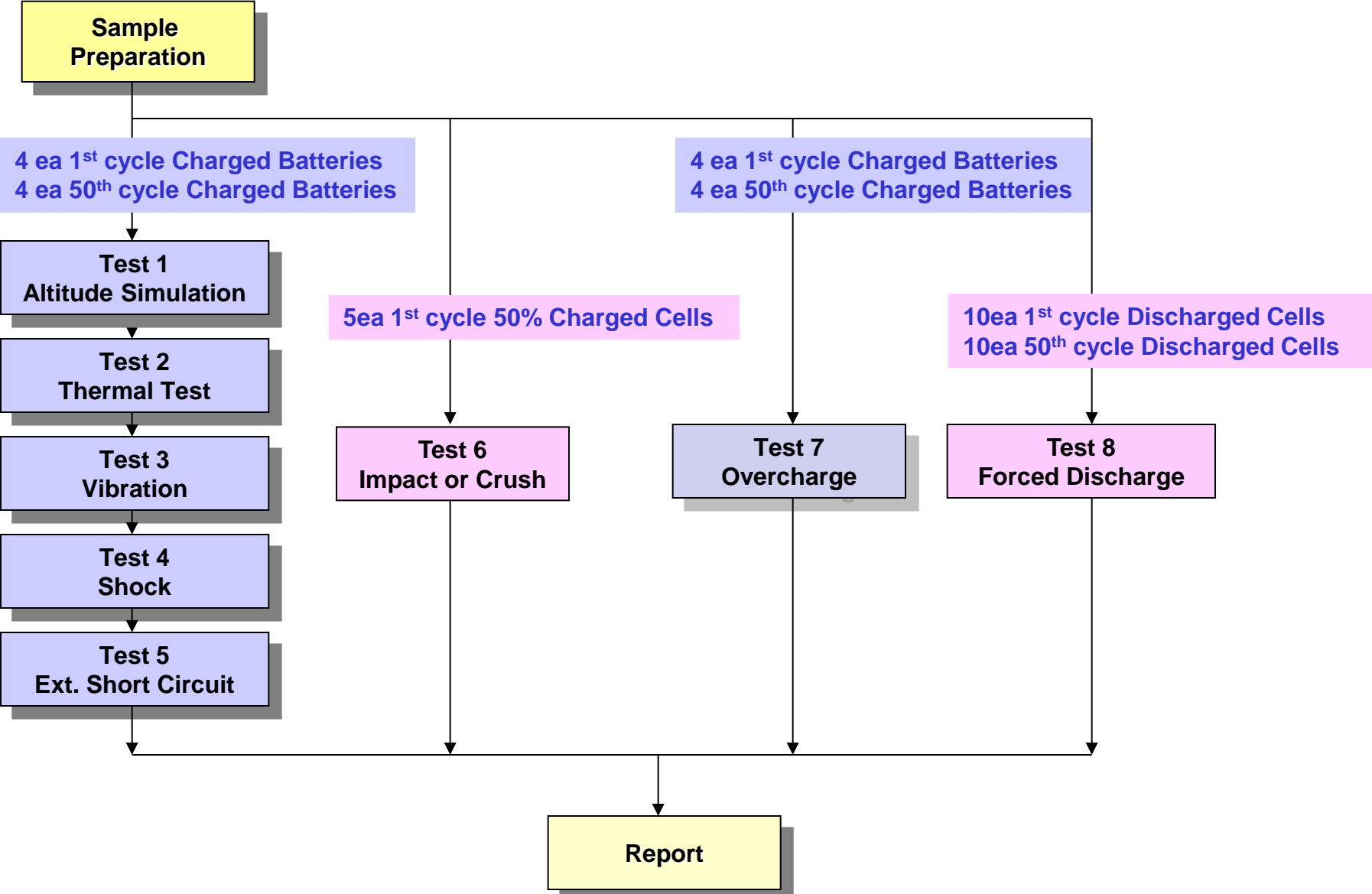
Rev.5 / Amd.2

| Test | Condition | Requirements |
|---|---|--|
| Test 1. Altitude Simulation | Storing at (low pressure)11.6kPa for 6hr at 20+/-5℃ | <ul style="list-style-type: none"> - Measuring mass before/ after each test (If $M < 1g$, less than 0.5%, If $1g \leq M \leq 75g$, less than 0.2%, If $M > 75g$, less than 0.1%) - Measuring voltage before/ after each test (more than 90%) - No leakage, no venting, no disassembly, no rupture, no fire - No disassembly, no rupture, no fire within 6 hours after the test - Temp. monitoring (max. 170℃) - No disassembly, no fire within 6 hours after the test - Temp. monitoring (max. 170℃) - No disassembly, no fire within 7 days after the test |
| Test 2. Thermal Test | [72±2℃,6hr ↔ -40±2℃,6hr,interval max. 30min] x 10cycle Storing at 20±5℃ 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 | |
| Test 4. Shock | Half sine shock (peak acceleration : 150gn, pulse duration : 6msec) x 6 (±x, y, z), direction x 3 cycle | |
| Test 5. External Short Circuit | 100mΩ ext. short-circuit at 55±2℃ 1hr continue after returning at 55±2℃ | |
| Test 6. Impact for cylindrical cells (> 18mm diameter) | Φ=15.8mm bar, 9.1kg mass, 61±2.5cm height | |
| Test 6. Crush for cylindrical cells (≤ 18mm diameter) for prismatic, pouch, coin/button cells | Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation | |
| 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 V (min.) = 22V. 2.If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage) | |
| Test 8. Forced Discharge | Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current | |

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

* 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.10/11/Rev.5/Amd.2)

2. Test Procedure



3-1. T1-T4 Test Result

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

A. 1st cycle fully state

| | | | | | | | | | | | | | | | | | | | | | | | |
|--------|------|-------|---------|-------|---------|-------|-------|------|-------|---------|-------|-------|------|-------|---------|--------|-------|------|-------|---------|--------|-------|------|
| Charge | 1 | 8.381 | 160.190 | 8.370 | 160.180 | 99.87 | 0.007 | Pass | 8.261 | 160.162 | 98.70 | 0.011 | Pass | 8.258 | 160.160 | 99.96 | 0.001 | Pass | 8.258 | 160.155 | 100.00 | 0.003 | Pass |
| | 2 | 8.340 | 160.778 | 8.326 | 160.761 | 99.84 | 0.011 | Pass | 8.216 | 160.759 | 98.67 | 0.001 | Pass | 8.216 | 160.757 | 100.00 | 0.001 | Pass | 8.214 | 160.751 | 99.98 | 0.004 | Pass |
| | 3 | 8.350 | 160.346 | 8.336 | 160.329 | 99.83 | 0.010 | Pass | 8.229 | 160.327 | 98.72 | 0.001 | Pass | 8.227 | 160.325 | 99.98 | 0.001 | Pass | 8.225 | 160.314 | 99.98 | 0.007 | Pass |
| | 4 | 8.341 | 160.274 | 8.327 | 160.261 | 99.83 | 0.008 | Pass | 8.224 | 160.257 | 98.76 | 0.003 | Pass | 8.222 | 160.257 | 99.98 | 0.000 | Pass | 8.220 | 160.244 | 99.98 | 0.008 | Pass |
| | Ave. | 8.353 | 160.397 | 8.340 | 160.383 | 99.84 | 0.009 | - | 8.233 | 160.376 | 98.71 | 0.004 | - | 8.231 | 160.375 | 99.98 | 0.001 | - | 8.229 | 160.366 | 99.98 | 0.005 | - |

B. 50th cycle fully state

| | | | | | | | | | | | | | | | | | | | | | | | |
|--------|------|-------|---------|-------|---------|-------|-------|------|-------|---------|-------|-------|------|-------|---------|--------|-------|------|-------|---------|-------|-------|------|
| Charge | 5 | 8.368 | 160.428 | 8.359 | 160.418 | 99.89 | 0.006 | Pass | 8.247 | 160.398 | 98.66 | 0.012 | Pass | 8.247 | 160.395 | 100.00 | 0.002 | Pass | 8.245 | 160.382 | 99.98 | 0.008 | Pass |
| | 6 | 8.353 | 160.884 | 8.338 | 160.875 | 99.82 | 0.006 | Pass | 8.225 | 160.864 | 98.65 | 0.007 | Pass | 8.224 | 160.856 | 99.99 | 0.005 | Pass | 8.223 | 160.851 | 99.99 | 0.003 | Pass |
| | 7 | 8.358 | 160.389 | 8.347 | 160.376 | 99.87 | 0.008 | Pass | 8.247 | 160.364 | 98.80 | 0.008 | Pass | 8.244 | 160.351 | 99.96 | 0.008 | Pass | 8.242 | 160.341 | 99.98 | 0.006 | Pass |
| | 8 | 8.368 | 160.588 | 8.356 | 160.569 | 99.86 | 0.012 | Pass | 8.251 | 160.555 | 98.74 | 0.009 | Pass | 8.250 | 160.552 | 99.99 | 0.002 | Pass | 8.249 | 160.546 | 99.99 | 0.004 | Pass |
| | Ave. | 8.362 | 160.572 | 8.350 | 160.560 | 99.86 | 0.008 | - | 8.243 | 160.545 | 98.71 | 0.009 | - | 8.241 | 160.539 | 99.98 | 0.004 | - | 8.240 | 160.530 | 99.98 | 0.005 | - |

| | |
|--------------------|--|
| Requirement | <ul style="list-style-type: none"> - Measuring mass before/after each test (If M>75g, less than 0.1%, 1g≤M≤75, less than 0.2%, M<1g, less than 0.5%) - 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)

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

A. 1st cycle fully state

| | | | | |
|--------|------|-------|-------|------|
| Charge | 1 | 8.258 | 55.38 | Pass |
| | 2 | 8.214 | 55.05 | Pass |
| | 3 | 8.225 | 56.53 | Pass |
| | 4 | 8.220 | 55.05 | Pass |
| | MAX. | 8.258 | 56.53 | - |

Test Condition

- 100mΩ ext. short-circuit at 55±2°C

Over Charge (T7)

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

A. 1st cycle fully state

| | | | | |
|--------|------|-------|-------|------|
| Charge | 9 | 8.349 | 23.38 | Pass |
| | 10 | 8.344 | 25.25 | Pass |
| | 11 | 8.347 | 24.62 | Pass |
| | 12 | 8.348 | 23.52 | Pass |
| | MAX. | 8.349 | 25.25 | - |

Test Condition

- Max. Charge Current : 2100mA
 - CC/CV 2Imax(4200mA) 16.8V cut-off 24Hr

EXT.Short Circuit (T5)

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

B. 50th cycle fully state

| | | | | |
|--------|------|-------|-------|------|
| Charge | 5 | 8.245 | 55.18 | Pass |
| | 6 | 8.223 | 56.13 | Pass |
| | 7 | 8.242 | 54.80 | Pass |
| | 8 | 8.249 | 55.30 | Pass |
| | MAX. | 8.249 | 56.13 | - |

Requirement

- Temperature ≤ 170 (°C)
 - No disassembly, no rupture, no fire within 6 hours after the test

Over Charge (T7)

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

B. 50th cycle fully state

| | | | | |
|--------|------|-------|-------|------|
| Charge | 13 | 8.328 | 24.58 | Pass |
| | 14 | 8.326 | 24.23 | Pass |
| | 15 | 8.321 | 24.79 | Pass |
| | 16 | 8.327 | 23.76 | Pass |
| | MAX. | 8.328 | 24.79 | - |

Requirement

- No disassembly, no fire within 7 day after the test

3-3. T6/T8 Test Result (ICP595490L1)

Crush (T6)

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

A. 1st cycle 50% charged state (Direction :Flat)

| | | | | |
|-------------|-----|-------|-------|------|
| Flat | C-1 | 3.772 | 22.67 | Pass |
| | C-2 | 3.771 | 22.71 | Pass |
| | C-3 | 3.776 | 23.15 | Pass |
| | C-4 | 3.774 | 23.26 | Pass |
| | C-5 | 3.771 | 23.35 | Pass |
| MAX. | | 3.776 | 23.71 | - |

Test Condition

- Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation

Requirement

- Temperature ≤ 170 (°C)
- No disassembly, no fire within 6 hours after the test

Forced Discharge (T8)

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

A. 1st cycle fully Discharged state

| | | | |
|-------------|-------|-------|------|
| C-6 | 3.012 | 46.32 | Pass |
| C-7 | 3.010 | 45.74 | Pass |
| C-8 | 3.009 | 44.21 | Pass |
| C-9 | 3.015 | 47.13 | Pass |
| C-10 | 3.009 | 48.21 | Pass |
| C-11 | 3.014 | 47.56 | Pass |
| C-12 | 3.008 | 47.46 | Pass |
| C-13 | 3.014 | 47.20 | Pass |
| C-14 | 3.010 | 46.49 | Pass |
| C-15 | 3.014 | 47.32 | Pass |
| MAX. | 3.015 | 48.21 | - |

B. 50th cycle fully discharged state

| | | | |
|-------------|-------|-------|------|
| C-16 | 3.121 | 44.84 | Pass |
| C-17 | 3.122 | 44.26 | Pass |
| C-18 | 3.118 | 43.21 | Pass |
| C-19 | 3.120 | 44.56 | Pass |
| C-20 | 3.117 | 45.26 | Pass |
| C-21 | 3.123 | 45.52 | Pass |
| C-22 | 3.119 | 46.79 | Pass |
| C-23 | 3.120 | 44.52 | Pass |
| C-24 | 3.122 | 44.62 | Pass |
| C-25 | 3.116 | 42.69 | Pass |
| MAX. | 3.123 | 46.79 | - |

Test Condition

- Discharge at max. discharge current
(with 12V DC power supply) : 3980mA
Duration time: rated capacity (60.5min)

Requirement

- No disassembly, no fire within 7 days after the test

4. Sample Image



Appendix 1. 1.2m Drop Test Report

A. Test Result

| No | Name of Test Items | Standard requirement or The Clause Number of Standard | Test Result | | Conclusion |
|----|----------------------|--|-------------|---|------------|
| 1 | 1.2m Drop Test | * UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Model Regulations(18 th) special provisions 188 | Face | The package is not cracked, the contents are not damaged and not shifted. | Passed |
| | | | Edge | The package is not cracked, the contents are not damaged and not shifted. | |
| | | | Angle | The package is not cracked, the contents are not damaged and not shifted. | |
| 2 | Gross Weight Measure | * UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Model Regulations(18 th) special provisions 188 | 386.3g | | Passed |

B. Sample Description

| | | | | | |
|--------------|--------------|-------------------------|-------------|----------------|---------------------------------|
| Dimensions | 246*138*36mm | Net Weight of Batteries | 320g | Battery Type | Rechargeable Li-Polymer Battery |
| Gross weight | 386.3g | Battery number | 2Pcs/Carton | ** Description | Carton box |

C. Image After Test



* Recommendations on the transport of dangerous goods as below
Each package of cells or batteries, or the completed package must be capable of withstanding a 1.2 m drop test in any orientation without:

- 1) damage to cells or batteries contained therein
- 2) shifting of the contents so as to allow battery to battery (or cell to cell) contact
- 3) release of contents.

** Description: Description about the protection of short-circuit

Appendix 2. 1.2m Drop Test Report

A. Test Result

| No | Name of Test Items | Standard requirement or The Clause Number of Standard | Test Result | | Conclusion |
|----|----------------------|--|-------------|---|------------|
| 1 | 1.2m Drop Test | * UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Model Regulations(18 th) special provisions 188 | Face | The package is not cracked, the contents are not damaged and not shifted. | Passed |
| | | | Edge | The package is not cracked, the contents are not damaged and not shifted. | |
| | | | Angle | The package is not cracked, the contents are not damaged and not shifted. | |
| 2 | Gross Weight Measure | * UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Model Regulations(18 th) special provisions 188 | 6.522 kg | | Passed |

B. Sample Description

| | | | | | |
|--------------|---------------|-------------------------|--------------|----------------|---------------------------------|
| Dimensions | 300*270*320mm | Net Weight of Batteries | 5.116 kg | Battery Type | Rechargeable Li-Polymer Battery |
| Gross weight | 6.522 kg | Battery number | 32Pcs/Carton | ** Description | Carton box |

C. Image After Test



* Recommendations on the transport of dangerous goods as below
Each package of cells or batteries, or the completed package must be capable of withstanding a 1.2 m drop test in any orientation without:

- 1) damage to cells or batteries contained therein
- 2) shifting of the contents so as to allow battery to battery (or cell to cell) contact
- 3) release of contents.

** Description: Description about the protection of short-circuit