# UN38.3 Test Summary

The following product has been evaluated according to the 5th revised edition Amendment 1 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-EF02-131017-PKL13L4A01 | Test 1. Altitude Simulation | Pass |
| Date of test report | 2013.10.17 | Test 2. Thermal Test | Pass |
| Model name | L13L4A01 | Test 3. Vibration | Pass |
| Type | Cylindrical | Test 4. Shock | Pass |
| Nominal voltage | 14.4 V | Test 5. External Short Circuit | Pass |
| Capacity | 32.0 Wh | Test 6. Impact or Crush | Pass |
| Weight | 215.0 g | Test 7. Overcharge | Pass |
| Dimensions | 270.00mm X 22.10mm X 20.70mm | Test 8. Forced Discharge | Pass |

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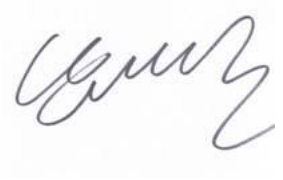

| 문서번호 | QAE-EF02-131017-PKL13L4A01 | |
|---|---|---|
| Prepared | 김홍일 | |
| | 남익현 | |
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SolutionPartner

# UN Test Report
## - L13L4A01(32Wh, 14.4V) -

목 차



**2013. 10. 17**

LG Chem
Mobile Energy Division

# 1. UN Transportation Regulation Test

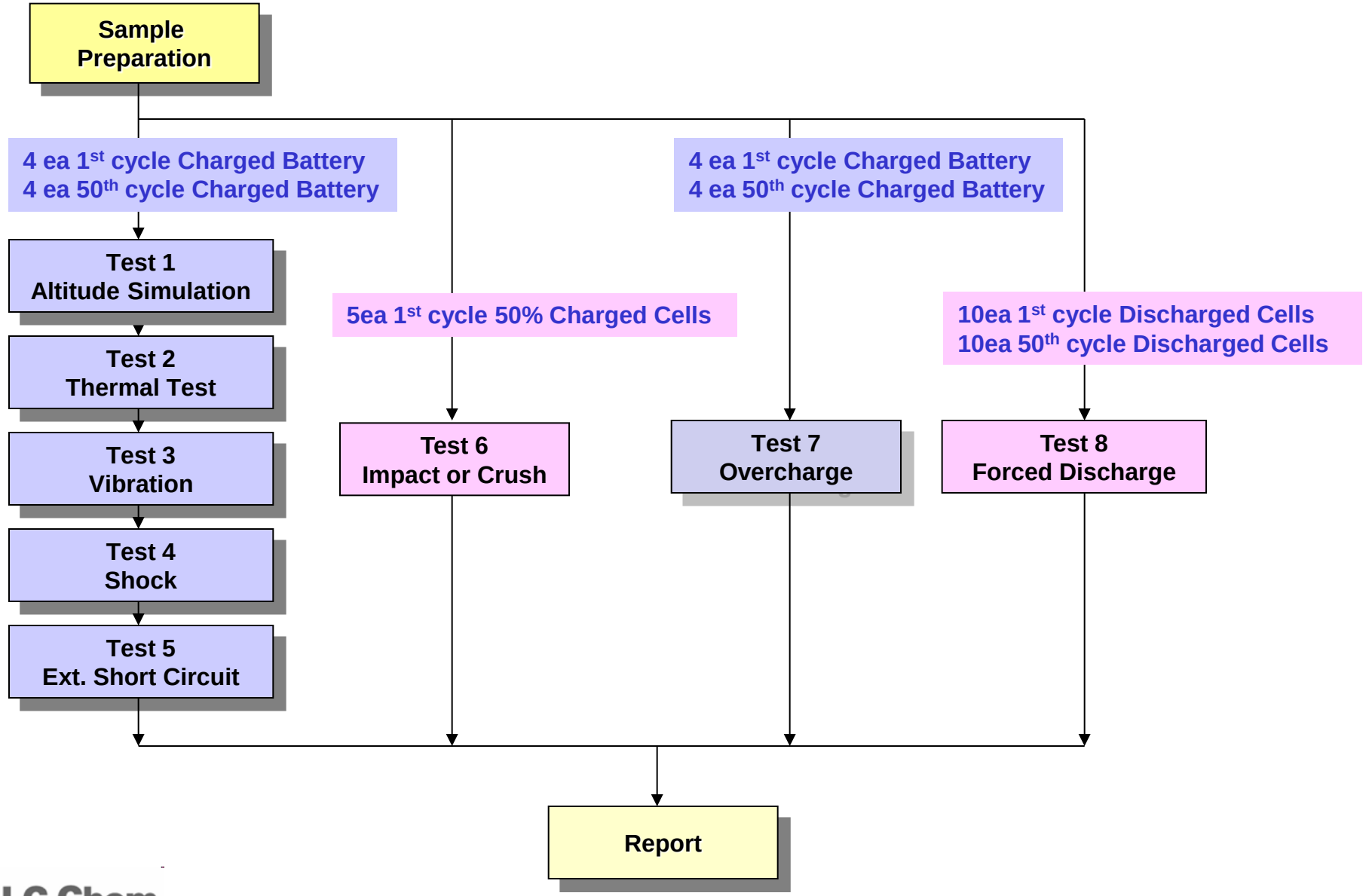
Rev.5 / Amd.1

| Test | Condition | Requirements |
|---|---|---|
| Test 1. Altitude Simulation | Storing at (low pressure)11.6kPa for 6hr at 20+/-5℃ | - Measuring mass before/ after each test (If M>5g, less than 0.1%)<br>- Measuring voltage before/ after each test (more than 90%)<br>- No leakage, no venting, no disassembly, no rupture, no fire |
| Test 2. Thermal Test | [72±2℃,6hr ↔ -40±2℃,6hr,interval max. 30min] x 10cycle<br>Storing at 20±5℃ for 24h | |
| Test 3. Vibration | [7Hz↔200Hz↔7Hz, in 15min] x 12 times x 3 direction<br>1) sinusoidal waveform with a logarithmic sweep<br>2) 7Hz 18Hz (maintaining 1gn) app. 50Hz (until 8gn)<br>200Hz (maintaining 8gn), 1.6mm total excursion | |
| Test 4. Shock | Half sine shock<br>(peak acceleration : 150gn, pulse duration : 6msec) x 6 (±x, y, z)<br>direction x 3 cycle | |
| Test 5. External Short Circuit | 100mΩ ext. short-circuit at 55±2℃<br>1hr continue after returning at 55±2℃ | - No disassembly, no rupture, no fire (after 6 hours)<br>- Temp. monitoring (max. 170℃) |
| Test 6. Impact<br>for cylindrical cells ( > 20mm diameter) | Φ=15.8mm bar, 9.1kg mass, 61±2.5cm height | - No disassembly, no rupture, no fire (after 6 hours)<br>- Temp. monitoring (max. 170℃) |
| Test 6. Crush<br>for cylindrical cells ( ≤ 20mm diameter)<br>for prismatic, pouch, coin/button cells | Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or<br>50% deformation | |
| Test 7. Overcharge | Current = Manufacturer's recommended max. continuous charge current X 2<br>Voltage<br>1.If charge voltage ≤ 18V,<br>V (min.) = 2 x (max. charge voltage) or V (min.) = 22V.<br>2.If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage) | - No disassembly, no fire (after 7 days) |
| Test 8. Forced Discharge | Discharge at max. discharge current<br>(with 12V DC power supply),<br>Duration time = rated capacity/initial test current | - Appearance picture before/ after test (after 7 days)<br>- Temp. monitoring (max. 170℃) |

* 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.10/11/Rev.5/Amd.1)

# 2. Test Procedure



# 3-1. T1-T4 Test Result

| | Before | | | Altitude (T1) | | | | | Thermal (T2) | | | | | Vibration (T3) | | | | | Shock (T4) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pack 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** | 16.748 | 215.92 | 16.718 | 215.90 | 99.83 | 0.011 | **Pass** | 16.479 | 215.89 | 98.57 | 0.001 | **Pass** | 16.475 | 215.88 | 99.97 | 0.006 | **Pass** | 16.469 | 215.87 | 99.96 | 0.005 | **Pass** |
| | **2** | 16.741 | 215.44 | 16.711 | 215.42 | 99.83 | 0.010 | **Pass** | 16.474 | 215.41 | 98.58 | 0.007 | **Pass** | 16.468 | 215.39 | 99.97 | 0.008 | **Pass** | 16.465 | 215.37 | 99.98 | 0.008 | **Pass** |
| | **3** | 16.749 | 215.33 | 16.731 | 215.32 | 99.89 | 0.005 | **Pass** | 16.471 | 215.30 | 98.44 | 0.007 | **Pass** | 16.469 | 215.29 | 99.99 | 0.007 | **Pass** | 16.467 | 215.27 | 99.99 | 0.009 | **Pass** |
| | **4** | 16.748 | 215.53 | 16.727 | 215.51 | 99.87 | 0.010 | **Pass** | 16.489 | 215.50 | 98.57 | 0.008 | **Pass** | 16.485 | 215.48 | 99.98 | 0.006 | **Pass** | 16.481 | 215.47 | 99.97 | 0.003 | **Pass** |
| | **Ave.** | 16.746 | 215.55 | 16.722 | 215.54 | 99.85 | 0.009 | - | 16.478 | 215.52 | 98.54 | 0.006 | - | 16.474 | 215.51 | 99.98 | 0.007 | - | 16.470 | 215.49 | 99.97 | 0.007 | - |
| **B. 50th cycle fully state** | | | | | | | | | | | | | | | | | | | | | | | |
| **Charge** | **5** | 16.747 | 215.02 | 16.726 | 214.99 | 99.87 | 0.011 | **Pass** | 16.479 | 214.99 | 98.52 | 0.002 | **Pass** | 16.474 | 214.98 | 99.97 | 0.005 | **Pass** | 16.473 | 214.97 | 99.99 | 0.003 | **Pass** |
| | **6** | 16.744 | 215.95 | 16.711 | 215.93 | 99.80 | 0.008 | **Pass** | 16.450 | 215.91 | 98.44 | 0.010 | **Pass** | 16.446 | 215.90 | 99.98 | 0.008 | **Pass** | 16.443 | 215.88 | 99.98 | 0.006 | **Pass** |
| | **7** | 16.742 | 215.13 | 16.716 | 215.11 | 99.85 | 0.007 | **Pass** | 16.469 | 215.09 | 98.53 | 0.011 | **Pass** | 16.467 | 215.08 | 99.98 | 0.005 | **Pass** | 16.464 | 215.06 | 99.98 | 0.011 | **Pass** |
| | **8** | 16.726 | 215.15 | 16.694 | 215.14 | 99.81 | 0.008 | **Pass** | 16.442 | 215.14 | 98.49 | 0.000 | **Pass** | 16.437 | 215.13 | 99.97 | 0.002 | **Pass** | 16.437 | 215.11 | 100.00 | 0.011 | **Pass** |
| | **Ave.** | 16.740 | 215.31 | 16.712 | 215.29 | 99.83 | 0.008 | - | 16.460 | 215.28 | 98.49 | 0.006 | - | 16.456 | 215.09 | 99.98 | 0.005 | - | 16.454 | 215.25 | 99.99 | 0.008 | - |

| | |
|---|---|
| **Requirement** | - Measuring mass before/after each test (If M>5g, less than 0.1%)<br>- Measuring voltage before/after each test (more than 90%, only charged samples)<br>- No leakage, no venting, no disassembly, no rupture, no fire |

# 3-2. T5/T7 Test Result

## EXT.Short Circuit (T5)

A. 1st cycle fully state

| | Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
|---|---|---|---|---|
| Charge | 1 | 16.469 | 55.52 | Pass |
| | 2 | 16.465 | 55.08 | Pass |
| | 3 | 16.467 | 55.37 | Pass |
| | 4 | 16.481 | 55.21 | Pass |
| | MAX. | 16.481 | 55.52 | - |

### Test Condition

- 100mΩ ext. short-circuit at 55±2℃

## EXT.Short Circuit (T5)

B. 50th cycle fully state

| | Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
|---|---|---|---|---|
| Charge | 5 | 16.473 | 54.42 | Pass |
| | 6 | 16.443 | 54.47 | Pass |
| | 7 | 16.464 | 54.40 | Pass |
| | 8 | 16.437 | 54.24 | Pass |
| | MAX. | 16.473 | 54.47 | - |

### Requirement

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

## Over Charge (T7)

A. 1st cycle fully state

| | Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
|---|---|---|---|---|
| Charge | 9 | 16.757 | 25.00 | Pass |
| | 10 | 16.722 | 25.06 | Pass |
| | 11 | 16.716 | 25.33 | Pass |
| | 12 | 16.778 | 25.51 | Pass |
| | MAX. | 16.778 | 25.51 | - |

### Test Condition

- Max. Charge Current : 6486 mA
- CC/CV 2Imax(12972mA) 16.8 V cut-off 24Hr

## Over Charge (T7)

B. 50th cycle fully state

| | Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
|---|---|---|---|---|
| Charge | 13 | 16.634 | 25.26 | Pass |
| | 14 | 16.701 | 25.37 | Pass |
| | 15 | 16.701 | 25.29 | Pass |
| | 16 | 16.792 | 25.28 | Pass |
| | MAX. | 16.792 | 25.37 | - |

### Requirement

- No disassembly, no fire within 7 day

# 3-3. T6 Test Result (ICR18650S3)

| Crush (T6) | | | | |
|---|---|---|---|---|
| | Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
| **A. 1st cycle 50% charged state** | | | | |
| **Direction** | | | | |
| Flat | 1 | 3.660 | 27.83 | Pass |
| | 2 | 3.659 | 27.92 | Pass |
| | 3 | 3.662 | 27.77 | Pass |
| | 4 | 3.657 | 26.30 | Pass |
| | 5 | 3.658 | 27.47 | Pass |
| MAX. | | 3.662 | 27.92 | - |

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

| Requirement |
|---|
| - Temperature < 170 (℃) |
| - No disassembly, no rupture, no fire within 6 hours |

| Forced Discharge (T8) | | | |
|---|---|---|---|
| Pack NO. | Initial OCV(V) | Max. Temp (℃) | Result |
| **A. 1st cycle fully Discharged state** | | | |
| 1 | 3.435 | 95.86 | Pass |
| 2 | 3.435 | 91.43 | Pass |
| 3 | 3.436 | 104.99 | Pass |
| 4 | 3.436 | 98.50 | Pass |
| 5 | 3.436 | 93.10 | Pass |
| 6 | 3.437 | 99.91 | Pass |
| 7 | 3.437 | 97.06 | Pass |
| 8 | 3.435 | 97.02 | Pass |
| 9 | 3.436 | 103.25 | Pass |
| 10 | 3.435 | 99.42 | Pass |
| MAX. | 3.437 | 104.99 | - |
| **B. 50th cycle fully discharged state** | | | |
| 1 | 3.435 | 94.44 | Pass |
| 2 | 3.436 | 93.95 | Pass |
| 3 | 3.436 | 98.90 | Pass |
| 4 | 3.435 | 102.69 | Pass |
| 5 | 3.436 | 95.74 | Pass |
| 6 | 3.436 | 95.66 | Pass |
| 7 | 3.436 | 93.42 | Pass |
| 8 | 3.437 | 98.34 | Pass |
| 9 | 3.437 | 96.99 | Pass |
| 10 | 3.436 | 100.33 | Pass |
| MAX. | 3.437 | 102.69 | - |

| Test Condition |
|---|
| - Discharge at max. discharge current (with 12V DC power supply), Duration time: rated capacity |

| Requirement |
|---|
| - No disassembly, no fire within 7 days |

# 4. Sample Image


# Appendix1. 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(16th) 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(16th) special provisions 188 | 0.504kg | | **Passed** |

**B. Sample Description**

| **Dimensions** | 31.5 X 13.8X 3.6 cm | **Net Weight of Batteries** | 0.436kg | **Battery Type** | Rechargeable Li-ion Battery |
|---|---|---|---|---|---|
| **Gross weight** | 0.504kg | **Battery number** | 2PCS / 1Carton | **** Description** | Use the air PE bag |

**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