

UN38.3 Test Summary

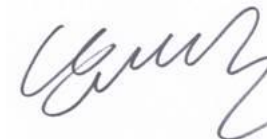
The following product has been evaluated according to the 5th revised edition Amendment 2 of the UN Manual of Tests and Criteria.
We, LG Chem, Ltd., hereby certify that this battery meets the requirements of the regulation for transportation of lithium-ion cells, batteries and single cell batteries.




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Description		List of Test Completed	
Test Report Number	QAE-EF02-150402-PKL15L4A01	Test 1. Altitude Simulation	Pass
Date of test report	2015.04.02	Test 2. Thermal Test	Pass
Model name	L15L4A01	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	213.0 g	Test 7. Overcharge	Pass
Dimensions	275.81mm X 36.65mm X 20.55mm	Test 8. Forced Discharge	Pass

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UN Test Report

-L15L4A01(Nom.32Wh, 14.4V)-

목 차

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2015. 04. 02

1. UN Transportation Regulation Test

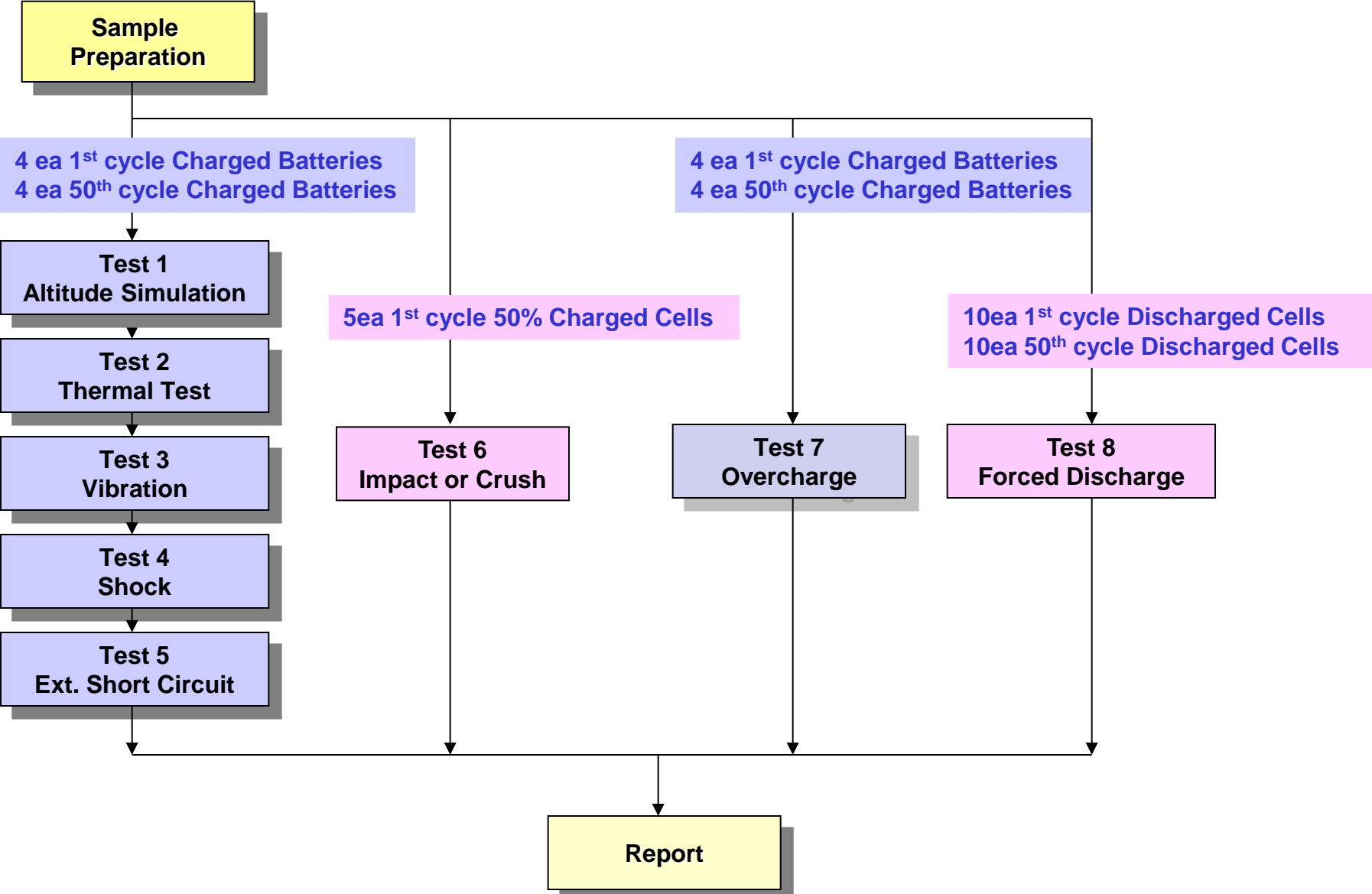
Rev.5 / Amd.2

Test	Condition	Requirements
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20+/-5℃	- 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
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	- No disassembly, no rupture, no fire within 6 hours after the test - Temp. monitoring (max. 170℃)
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℃	- No disassembly, no fire within 6 hours after the test - Temp. monitoring (max. 170℃)
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	- No disassembly, no fire within 7 days after the test
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 charged state

Charge	1	16.778	212.77	16.753	212.75	99.85	0.009	Pass	16.509	212.73	98.54	0.009	Pass	16.496	212.71	99.92	0.009	Pass	16.483	212.71	99.92	0.000	Pass
	2	16.733	213.24	16.703	213.21	99.82	0.014	Pass	16.462	213.21	98.56	0.000	Pass	16.449	213.19	99.92	0.009	Pass	16.448	213.18	99.99	0.005	Pass
	3	16.721	212.51	16.693	212.49	99.83	0.009	Pass	16.546	212.48	99.12	0.005	Pass	16.544	212.48	99.99	0.000	Pass	16.538	212.46	99.96	0.009	Pass
	4	16.741	212.75	16.722	212.74	99.89	0.005	Pass	16.477	212.73	98.53	0.005	Pass	16.477	212.73	100.00	0.000	Pass	16.465	212.72	99.93	0.005	Pass
	Ave.	16.743	212.82	16.718	212.80	99.85	0.009	-	16.499	212.79	98.69	0.005	-	16.492	212.78	99.96	0.005	-	16.484	212.77	99.95	0.005	-

B. 50th cycle fully charged state

Charge	5	16.767	212.53	16.761	212.51	99.96	0.009	Pass	16.519	212.50	98.56	0.005	Pass	16.510	212.49	99.95	0.005	Pass	16.506	212.47	99.98	0.009	Pass
	6	16.763	213.09	16.754	213.07	99.95	0.009	Pass	16.506	213.07	98.52	0.000	Pass	16.498	213.06	99.95	0.005	Pass	16.491	213.05	99.96	0.005	Pass
	7	16.758	213.40	16.749	213.39	99.95	0.005	Pass	16.503	213.38	98.53	0.005	Pass	16.496	213.36	99.96	0.009	Pass	16.486	213.36	99.94	0.000	Pass
	8	16.753	213.19	16.737	213.18	99.90	0.005	Pass	16.499	213.17	98.58	0.005	Pass	16.497	213.16	99.99	0.005	Pass	16.486	213.16	99.93	0.000	Pass
	Ave.	16.760	213.05	16.750	213.04	99.94	0.007	-	16.507	213.03	98.55	0.004	-	16.500	213.02	99.96	0.006	-	16.492	213.01	99.95	0.004	-

Requirement

- Measuring mass before/after each test (If $M > 75g$, less than 0.1%, $1g \leq M \leq 75$, 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
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A. 1st cycle fully charged state

Charge	1	16.483	55.93	Pass
	2	16.448	55.27	Pass
	3	16.538	54.98	Pass
	4	16.465	54.95	Pass
	MAX.	16.538	55.93	-

Test Condition

- 100mΩ ext. short-circuit at 55±2°C

Over Charge (T7)

	NO.	Initial OCV(V)	Max. Temp (°C)	Result
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A. 1st cycle fully charged state

Charge	9	16.741	24.27	Pass
	10	16.743	25.04	Pass
	11	16.740	24.62	Pass
	12	16.747	24.59	Pass
	MAX.	16.747	25.04	-

Test Condition

- Max. Charge Current : 1075mA
- CC/CV 2I_{max}(2150mA) 22.0V cut-off 24Hr

EXT.Short Circuit (T5)

	NO.	Initial OCV(V)	Max. Temp (°C)	Result
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B. 50th cycle fully charged state

Charge	5	16.506	56.31	Pass
	6	16.491	55.96	Pass
	7	16.486	55.75	Pass
	8	16.486	55.54	Pass
	MAX.	16.506	56.31	-

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
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B. 50th cycle fully charged state

Charge	13	16.722	23.51	Pass
	14	16.724	24.33	Pass
	15	16.729	23.48	Pass
	16	16.727	25.23	Pass
	MAX.	16.729	25.23	-

Requirement

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

3-3. T6/T8 Test Result (ICR18650S3)

Impact (T6)

Direction	NO.	Initial OCV(V)	Max. Temp (°C)	Result
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A. 1st cycle 50% charged state

Flat	C-1	3.647	17.86	Pass
	C-2	3.647	18.66	Pass
	C-3	3.647	19.22	Pass
	C-4	3.647	19.82	Pass
	C-5	3.647	19.49	Pass
MAX.		3.647	19.49	-

Test Condition

-- $\Phi=15.8\text{mm}$ bar, 9.1kg mass, $61\pm 2.5\text{cm}$ height

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
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A. 1st cycle fully discharged state

C-6	3.435	95.86	Pass
C-7	3.435	91.43	Pass
C-8	3.436	104.99	Pass
C-9	3.436	98.50	Pass
C-10	3.436	93.10	Pass
C-11	3.437	99.91	Pass
C-12	3.437	97.06	Pass
C-13	3.435	97.02	Pass
C-14	3.436	103.25	Pass
C-15	3.435	99.42	Pass
MAX.	3.437	104.99	-

B. 50th cycle fully discharged state

C-16	3.435	94.44	Pass
C-17	3.436	93.95	Pass
C-18	3.436	98.90	Pass
C-19	3.435	102.69	Pass
C-20	3.436	95.74	Pass
C-21	3.436	95.66	Pass
C-22	3.436	93.42	Pass
C-23	3.437	98.34	Pass
C-24	3.437	96.99	Pass
C-25	3.436	100.33	Pass
MAX.	3.437	102.69	-

Test Condition

- Discharge at max. discharge current (with 12V DC power supply) : 4300mA
Duration time: rated capacity (31min)

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	492.37g		Passed

B. Sample Description

Dimensions	32.3 x 14.2 x 3.7cm	Net Weight of Batteries	425.64g	Battery Type	Rechargeable Li-ion Battery
Gross weight	492.37g	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	6.486kg		Passed

B. Sample Description

Dimensions	33.9 x 29.8 x 30.9cm	Net Weight of Batteries	5.250 kg	Battery Type	Rechargeable Li-ion Battery
Gross weight	6.486kg	Battery number	25Pcs/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