

UN38.3 Test Summary

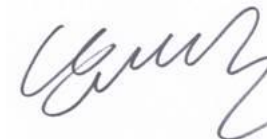
The following product has been evaluated according to the 6th revised edition of the UN Manual of Tests and Criteria.
We, LG Chem, Ltd., hereby certify that this battery meets the requirements of the regulation for transportation of lithium-ion cells, batteries and single cell batteries.

Manufacture's contact information	LG Chem, Ltd. 128 Yeoui-Daero, Yeongdeungpo-gu, SEOUL, 150-721, REPUBLIC OF KOREA Telephone : +86-10-7742-5427 E-mail : kkammy@lgchem.com Website : www.lgchem.com		
Test Laboratory information	LG Chem, Ltd. / RESEARCH PARK 188 Munjiro, Yuseong-gu, Daejeon, 305-738, REPUBLIC OF KOREA Telephone : +82-10-3099-3724 E-mail : juhongpark@lgchem.com Website : www.lgchem.com		
	LG Chem (Nanjing) I&E Materials Co., Ltd NO.17 Hengyi Road, Nanjing Economic & Technological Development Zone, Nanjing, Jiangsu, China Telephone : +86-025-85603000-8288 E-mail : xuyuannj@lgchem.com Website : www.lgchem.com		
Description		List of Test Completed	
Test Report Number	QDI-170407-B-L16L4P91	Test 1. Altitude Simulation	Pass
Date of test report	2017.04.07	Test 2. Thermal Test	Pass
Model name	L16L4P91	Test 3. Vibration	Pass
Type	Pouch	Test 4. Shock	Pass
Nominal voltage	7.72 V	Test 5. External Short Circuit	Pass
Capacity	42.0 Wh	Test 6. Impact or Crush	Pass
Weight	166.0 g	Test 7. Overcharge	Pass
Dimensions	247.00mm X 93.00mm X 4.85mm	Test 8. Forced Discharge	Pass

Reviewed By: Joohong Park
 IT & New Application Part Leader
 Global Standard Certification Team
 LG Chem, Ltd.
 E-mail: juhongpark@lgchem.com



Approved By: DaeHo Nam
 Team Leader
 Global Standard Certification Team
 LG Chem, Ltd.
 E-mail: kkammy@lgchem.com



Document Number	QDI-170407-B-L16L4P91	
Prepared	MyeongHoon Choi	<i>Choi</i>
Reviewed	MinJe Woo	<i>[Signature]</i>
Approved	DaeHo Nam	<i>[Signature]</i>

UN38.3 Test Report

- L16L4P91 (Nom.42Wh, 7.72V) -

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2017. 04. 07

* Add model name "L16L4P91"



1. UN38.3 Test Condition

Rev.6

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure) 11.6kPa for 6hr at 20+/-5℃	<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% 	<p>T1~T5 : Sequence Tests</p> <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℃, 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 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℃ in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4℃ 3) 1hr continue after returning to 57±4℃		
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℃ 	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. General Information

1. Standard charge / discharge Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 3696 mA Voltage = 8.8 V	Current = 264 mA
Discharge	CC	Current = 1056 mA	Voltage = 6.0 V

2. Cycle Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 3696 mA Voltage = 8.8 V	Current = 264 mA
Discharge	CC	Current = 1056 mA	Voltage = 6.0 V

3. Test Condition

	Mode	Condition
Test 7. Overcharge	CC / CV	Max. Charge Current = 4066 mA CC/CV 2Imax (8132mA) 17.6 V cut-off 24Hr
Test 8. Forced Discharge	CC	Max. Discharge Current = 3239.0 mA Duration Time = 48.9 min

3-1. T1-T4 Test Result

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

A. 1st cycle fully charged state

1	8.787	165.92	8.786	165.92	99.99	0.001	Pass	8.671	165.90	98.69	0.010	Pass	8.666	165.90	99.94	0.001	Pass	8.664	165.90	99.98	0.001	Pass
2	8.748	165.91	8.745	165.90	99.97	0.003	Pass	8.646	165.89	98.87	0.005	Pass	8.637	165.89	99.90	0.004	Pass	8.636	165.88	99.99	0.003	Pass
3	8.743	165.91	8.742	165.90	99.99	0.007	Pass	8.627	165.90	98.68	0.001	Pass	8.618	165.89	99.90	0.003	Pass	8.615	165.89	99.97	0.001	Pass
4	8.753	165.96	8.751	165.96	99.98	0.002	Pass	8.627	165.95	98.58	0.002	Pass	8.624	165.94	99.97	0.005	Pass	8.622	165.93	99.98	0.008	Pass

B. 50th cycle fully charged state

5	8.754	165.94	8.745	165.94	99.90	0.001	Pass	8.632	165.93	98.71	0.007	Pass	8.629	165.91	99.97	0.010	Pass	8.626	165.91	99.97	0.001	Pass
6	8.759	165.95	8.756	165.95	99.97	0.004	Pass	8.644	165.93	98.72	0.008	Pass	8.641	165.93	99.97	0.005	Pass	8.639	165.91	99.98	0.010	Pass
7	8.770	165.94	8.765	165.93	99.94	0.007	Pass	8.665	165.92	98.86	0.004	Pass	8.664	165.92	99.99	0.002	Pass	8.656	165.91	99.91	0.004	Pass
8	8.761	165.99	8.756	165.98	99.94	0.009	Pass	8.627	165.97	98.53	0.005	Pass	8.618	165.96	99.90	0.005	Pass	8.615	165.96	99.97	0.002	Pass

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

1	8.664	56.32	Pass
2	8.636	55.09	Pass
3	8.615	55.57	Pass
4	8.622	55.32	Pass

B. 50th cycle fully charged state

5	8.626	56.29	Pass
6	8.639	54.74	Pass
7	8.656	55.45	Pass
8	8.615	56.27	Pass

Over Charge (T7)

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

9	8.647	24.13	Pass
10	8.643	24.88	Pass
11	8.647	25.00	Pass
12	8.635	24.07	Pass

Over Charge (T7)

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

13	8.627	24.01	Pass
14	8.629	24.66	Pass
15	8.629	24.89	Pass
16	8.628	24.35	Pass

3-3. T6/T8 Test Result (P3245B3A1)

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

A. 1st cycle 50% charged state

C-1	3.869	23.95	Pass
C-2	3.869	23.55	Pass
C-3	3.867	23.94	Pass
C-4	3.869	22.78	Pass
C-5	3.870	22.65	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	3.141	44.99	Pass
C-7	3.136	53.66	Pass
C-8	3.097	57.28	Pass
C-9	3.147	48.88	Pass
C-10	3.105	47.65	Pass
C-11	3.098	55.22	Pass
C-12	3.106	55.99	Pass
C-13	3.066	41.89	Pass
C-14	3.064	42.07	Pass
C-15	3.071	45.71	Pass

B. 50th cycle fully discharged state

26	3.134	44.22	Pass
27	3.072	45.56	Pass
28	3.092	43.04	Pass
29	3.102	55.55	Pass
30	3.126	49.53	Pass
31	3.148	47.81	Pass
32	3.102	55.92	Pass
33	3.086	44.99	Pass
34	3.066	43.57	Pass
35	3.100	55.29	Pass

