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.

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Description		List of Test Completed	
Test Report Number	QDI-170818-C-INR18650M29	Test 1. Altitude Simulation	Pass
Date of test report	2017.08.18	Test 2. Thermal Test	Pass
Model name	INR18650M29	Test 3. Vibration	Pass
Type	Cylindrical	Test 4. Shock	Pass
Nominal voltage	3.67V	Test 5. External Short Circuit	Pass
Capacity	2750 mAh	Test 6. Impact or Crush	Pass
Weight	43.602 g	Test 7. Overcharge	N/A
Dimensions	18.4mm X 65.2mm	Test 8. Forced Discharge	Pass

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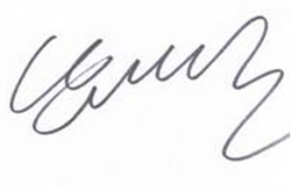

Document Number	QDI-170818-C-INR18650M29	
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UN38.3 Test Report
- INR18650M29 (Min. 2750mAh, 3.67V)-

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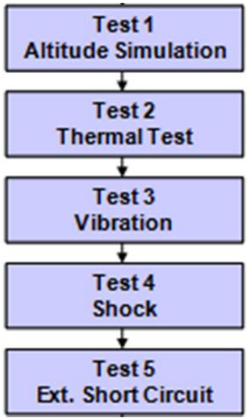
2017. 08. 18

LG Chem

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℃	- After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) 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%)	T1~T5 : Sequence Tests 
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 껍$\frac{100850}{Mass(kg)}$ 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℃	- No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp ≤ 170℃	
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height	- 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)	- 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	- 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 = 1375 mA Voltage = 4.2 V	Current = 50 mA
Discharge	CC	Current = 550 mA	Voltage = 2.5 V

2. Cycle Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 1500 mA Voltage = 4.2 V	Current = 100 mA
Discharge	CC	Current = 4000 mA	Voltage = 2.75 V

3. Test Condition

	Mode	Condition
Test 8. Forced Discharge	CC	Max. Discharge Current = 10000 mA Duration Time = 16.5 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	4.173	43.377	4.172	43.375	99.98	0.005	Pass	4.128	43.373	98.95	0.005	Pass	4.127	43.371	99.98	0.005	Pass	4.127	43.369	100.00	0.005	Pass
2	4.174	43.482	4.173	43.481	99.98	0.002	Pass	4.129	43.477	98.95	0.009	Pass	4.128	43.474	99.98	0.007	Pass	4.128	43.472	100.00	0.005	Pass
3	4.173	43.403	4.173	43.401	100.00	0.005	Pass	4.128	43.398	98.92	0.007	Pass	4.127	43.397	99.98	0.002	Pass	4.127	43.396	100.00	0.002	Pass
4	4.174	43.405	4.173	43.402	99.98	0.007	Pass	4.128	43.400	98.92	0.005	Pass	4.128	43.397	100.00	0.007	Pass	4.127	43.395	99.98	0.005	Pass
5	4.173	43.416	4.172	43.414	99.98	0.005	Pass	4.128	43.400	98.95	0.032	Pass	4.127	43.396	99.98	0.009	Pass	4.127	43.393	100.00	0.007	Pass
6	4.173	43.398	4.173	43.396	100.00	0.005	Pass	4.128	43.393	98.92	0.007	Pass	4.128	43.390	100.00	0.007	Pass	4.127	43.389	99.98	0.002	Pass
7	4.174	43.602	4.173	43.600	99.98	0.005	Pass	4.127	43.596	98.90	0.009	Pass	4.127	43.594	100.00	0.005	Pass	4.126	43.592	99.98	0.005	Pass
8	4.174	43.429	4.173	43.427	99.98	0.005	Pass	4.129	43.423	98.95	0.009	Pass	4.128	43.421	99.98	0.005	Pass	4.128	43.419	100.00	0.005	Pass
9	4.173	43.367	4.172	43.366	99.98	0.002	Pass	4.128	43.363	98.95	0.007	Pass	4.127	43.360	99.98	0.007	Pass	4.127	43.359	100.00	0.002	Pass
10	4.173	43.389	4.173	43.387	100.00	0.005	Pass	4.128	43.383	98.92	0.009	Pass	4.128	43.380	100.00	0.007	Pass	4.127	43.378	99.98	0.005	Pass

3-2. T5/T6/T8 Test Result

EXT. Short Circuit (T5)

A. 1st cycle fully charged state

NO.	Initial OCV(V)	Max. Temp (℃)	Result
1	4.127	125.39	Pass
2	4.128	120.21	Pass
3	4.127	125.09	Pass
4	4.127	122.44	Pass
5	4.127	119.28	Pass
6	4.127	124.88	Pass
7	4.126	108.51	Pass
8	4.128	126.56	Pass
9	4.127	120.82	Pass
10	4.127	121.66	Pass

Impact (T6)

A. 1st cycle 50% charged state

NO.	Initial OCV(V)	Max. Temp (℃)	Result
11	3.696	25.26	Pass
12	3.700	27.00	Pass
13	3.701	28.10	Pass
14	3.698	25.84	Pass
15	3.700	24.39	Pass

Forced Discharge (T8)

A. 1st cycle fully discharged state / B. 50th cycle fully discharged state

NO.	Initial OCV(V)	Max. Temp (℃)	Result	NO.	Initial OCV(V)	Max. Temp (℃)	Result
16	3.319	43.55	Pass	26	3.052	44.81	Pass
17	3.323	42.40	Pass	27	3.045	44.76	Pass
18	3.323	44.14	Pass	28	3.056	43.59	Pass
19	3.347	42.90	Pass	29	3.050	43.08	Pass
20	3.315	44.04	Pass	30	3.051	44.90	Pass
21	3.338	43.80	Pass	31	3.050	43.72	Pass
22	3.325	44.75	Pass	32	3.081	42.12	Pass
23	3.325	43.95	Pass	33	3.063	43.94	Pass
24	3.330	44.80	Pass	34	3.048	44.39	Pass
25	3.342	42.14	Pass	35	3.051	43.72	Pass

4. Sample Image