

# UN38.3 Test Summary

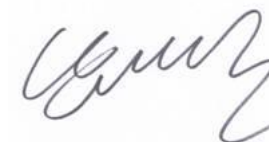
The following product has been evaluated according to the 5th revised edition Amendment 2 of the UN Manual of Tests and Criteria.  
We, LG Chem, Ltd., hereby certify that this battery meets the requirements of the regulation for transportation of lithium-ion cells, batteries and single cell batteries.




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Description		List of Test Completed	
Test Report Number	QAE-EF02-150320-CY18650F1L	Test 1. Altitude Simulation	Pass
Date of test report	2015.03.20	Test 2. Thermal Test	Pass
Model name	INR18650F1L	Test 3. Vibration	Pass
Type	Cylindrical	Test 4. Shock	Pass
Nominal voltage	3.63V	Test 5. External Short Circuit	Pass
Capacity	3350 mAh	Test 6. Impact or Crush	Pass
Weight	Max 49.0 g	Test 7. Overcharge	N/A
Dimensions	Max 18.4mm X 65.2mm	Test 8. Forced Discharge	Pass

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# UN Test Report

## - INR18650F1L (Nom. 3350 mAh) -

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2015. 03. 20

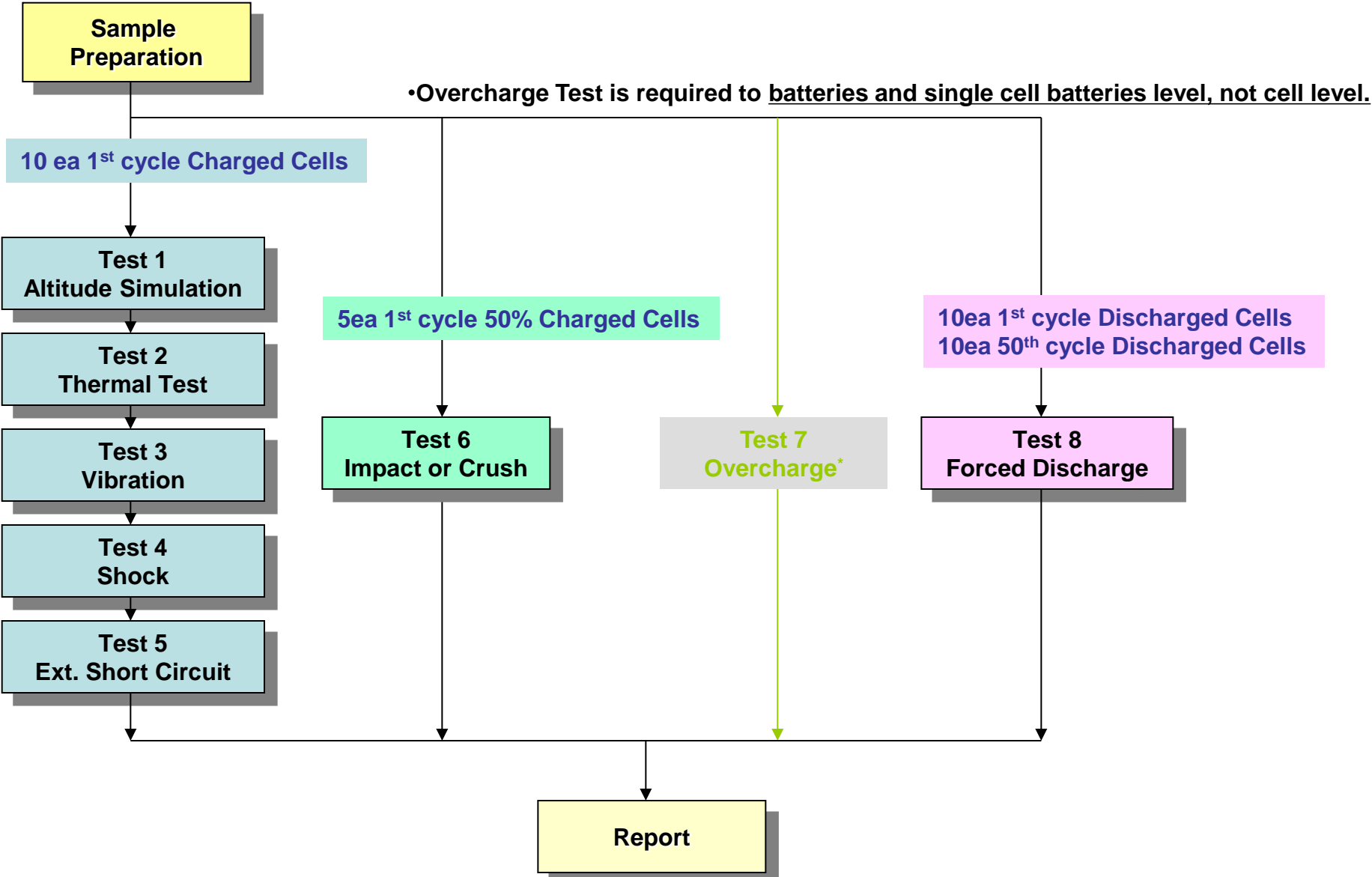
# 1. UN Transportation Regulation Test

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≤M≤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	
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	- No disassembly, no fire within 6 hours after the test - Temp. monitoring (max. 170℃)
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	Only for battery, not cell.	- Overcharge Test is required to pack battery level, not cell level.
Test 8. Forced Discharge	Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current	- No disassembly, no fire within 7 days after the test

\* 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

1	4.165	45.069	4.162	45.069	99.93	0.000	Pass	4.107	45.064	98.69	0.011	Pass	4.107	45.064	99.99	0.000	Pass	4.106	45.064	99.98	0.000	Pass
2	4.166	44.989	4.162	44.989	99.90	0.000	Pass	4.103	44.987	98.58	0.004	Pass	4.103	44.987	100.00	0.000	Pass	4.100	44.987	99.93	0.000	Pass
3	4.166	44.961	4.163	44.961	99.93	0.000	Pass	4.104	44.957	98.58	0.009	Pass	4.104	44.957	100.00	0.000	Pass	4.103	44.957	99.98	0.000	Pass
4	4.166	45.075	4.162	45.073	99.90	0.004	Pass	4.108	45.068	98.70	0.011	Pass	4.108	45.068	100.00	0.000	Pass	4.107	45.068	99.98	0.000	Pass
5	4.166	45.041	4.161	45.041	99.88	0.000	Pass	4.102	45.038	98.58	0.007	Pass	4.102	45.038	100.00	0.000	Pass	4.101	45.038	99.98	0.000	Pass
6	4.166	44.923	4.163	44.923	99.93	0.000	Pass	4.087	44.918	98.17	0.011	Pass	4.087	44.918	100.00	0.000	Pass	4.086	44.918	99.98	0.000	Pass
7	4.167	44.919	4.164	44.919	99.93	0.000	Pass	4.108	44.913	98.66	0.013	Pass	4.108	44.913	100.00	0.000	Pass	4.107	44.913	99.98	0.000	Pass
8	4.165	44.985	4.162	44.985	99.93	0.000	Pass	4.080	44.980	98.03	0.011	Pass	4.079	44.980	99.98	0.000	Pass	4.078	44.980	99.98	0.000	Pass
9	4.166	44.956	4.163	44.956	99.93	0.000	Pass	4.100	44.951	98.49	0.011	Pass	4.099	44.951	99.98	0.000	Pass	4.097	44.951	99.95	0.000	Pass
10	4.165	44.952	4.161	44.952	99.90	0.000	Pass	4.098	44.950	98.49	0.004	Pass	4.098	44.950	100.00	0.000	Pass	4.096	44.950	99.95	0.000	Pass
<b>Ave.</b>	4.166	44.987	4.162	44.987	99.92	0.000	-	4.100	44.983	98.50	0.009	-	4.100	44.983	99.99	0.000	-	4.098	44.983	99.97	0.000	-

### 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/T6/T8 Test Result

EXT.Short Circuit (T5)			
NO.	Initial OCV(V)	Max. Temp (°C)	Result

## A. 1st cycle fully charged state

1	4.106	86.39	Pass
2	4.100	84.61	Pass
3	4.103	84.23	Pass
4	4.107	76.97	Pass
5	4.101	77.52	Pass
6	4.086	87.07	Pass
7	4.107	84.08	Pass
8	4.078	79.65	Pass
9	4.097	78.74	Pass
10	4.096	86.21	Pass
<b>MAX.</b>	4.107	87.07	-

Test Condition
- 100mΩ ext. short-circuit at 55±2°C

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

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

## A. 1st cycle 50% charged state

Flat	11	3.540	44.19	Pass
	12	3.534	49.23	Pass
	13	3.542	19.36	Pass
	14	3.537	19.03	Pass
	15	3.534	46.49	Pass
<b>MAX.</b>		3.542	49.23	-

Test Condition
- Φ=15.8mm bar, 9.1kg mass, 61±2.5cm 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

## A. 1st cycle fully Discharged state

16	3.101	48.09	Pass
17	3.083	52.77	Pass
18	3.071	45.74	Pass
19	3.103	56.20	Pass
20	3.111	52.18	Pass
21	3.109	55.79	Pass
22	3.099	54.21	Pass
23	3.096	52.48	Pass
24	3.105	55.96	Pass
25	3.082	40.02	Pass
<b>MAX.</b>	3.111	56.20	-

## B. 50th cycle fully discharged state

26	3.157	101.65	Pass
27	3.152	104.74	Pass
28	3.155	102.38	Pass
29	3.149	104.38	Pass
30	3.137	108.17	Pass
31	3.146	101.98	Pass
32	3.147	101.16	Pass
33	3.156	104.05	Pass
34	3.142	105.52	Pass
35	3.149	106.34	Pass
<b>MAX.</b>	3.157	108.17	-

Test Condition
- Discharge at max. discharge current (with 12V DC power supply) : 6000mA Duration time: rated capacity (34min)

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

# 4. Sample Image

