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November 14, 2013

CERTIFICATE OF COMPLIANCE

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 cell meets the requirements of the regulation for transportation of lithium-ion cells and batteries.

Customer Model Name : **L13L4A61**
Cell Model Name : **ICR18650S3 (2P*2S)**
Type of Cell : **Cylindrical**
Nominal capacity : **32 Wh**
Document No. : **QAE-EF02-131114-PKL13L4A61**

Conducted By: Dae Ho Nam

Handwritten signature of Dae Ho Nam in black ink.

Manager

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Test Result

For more information, please refer to Document: QAE-EF02-131114-PKL13L4A61

<input type="checkbox"/> Lithium-ion cell	<input checked="" type="checkbox"/> Lithium-ion battery
Pack Model name	L13L4A61
Cell Model name	ICR18650S3
Nominal voltage	7.2 V
Nominal capacity	32 Wh
Lithium equivalent content	2.46g

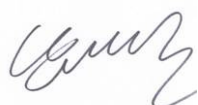
No.	Test Item	Criteria	Result	Remark
Test 1	Altitude simulation	- No leakage (If $M < 1g$, less than 0.5%, If $1g \leq M \leq 75g$, less than 0.2%, If $M > 75g$, less than 0.1%), venting, disassembly, rupture and no fire. -Measuring mass before/after each test. -Measuring voltage before/after each test. (more than 90%)	Pass	
Test 2	Thermal test		Pass	
Test 3	Vibration		Pass	
Test 4	Shock		Pass	
Test 5	External Short Circuit	-No disassembly, rupture and fire within six hours of this test. -Max. temperature should not exceed 170°C.	Pass	
Test 6	Crush	-No disassembly and fire within six hours of this test. -Max. temperature should not exceed 170°C.	Pass	
Test 7	Overcharge	-No disassembly and fire within seven days of the test.	Pass	Battery only
Test 8	Forced discharge	-No disassembly and fire within seven days of the test.	Pass	

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/Amendment1)

We certify that this cell is proved to meet the requirements of each applicable test in the UN Manual of Test and Criteria, Part III, sub-section 38.3

Conducted By: Dae Ho Nam



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UN Test Report

- L13L4A61(32Wh, 7.2V) -

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2013. 11. 14

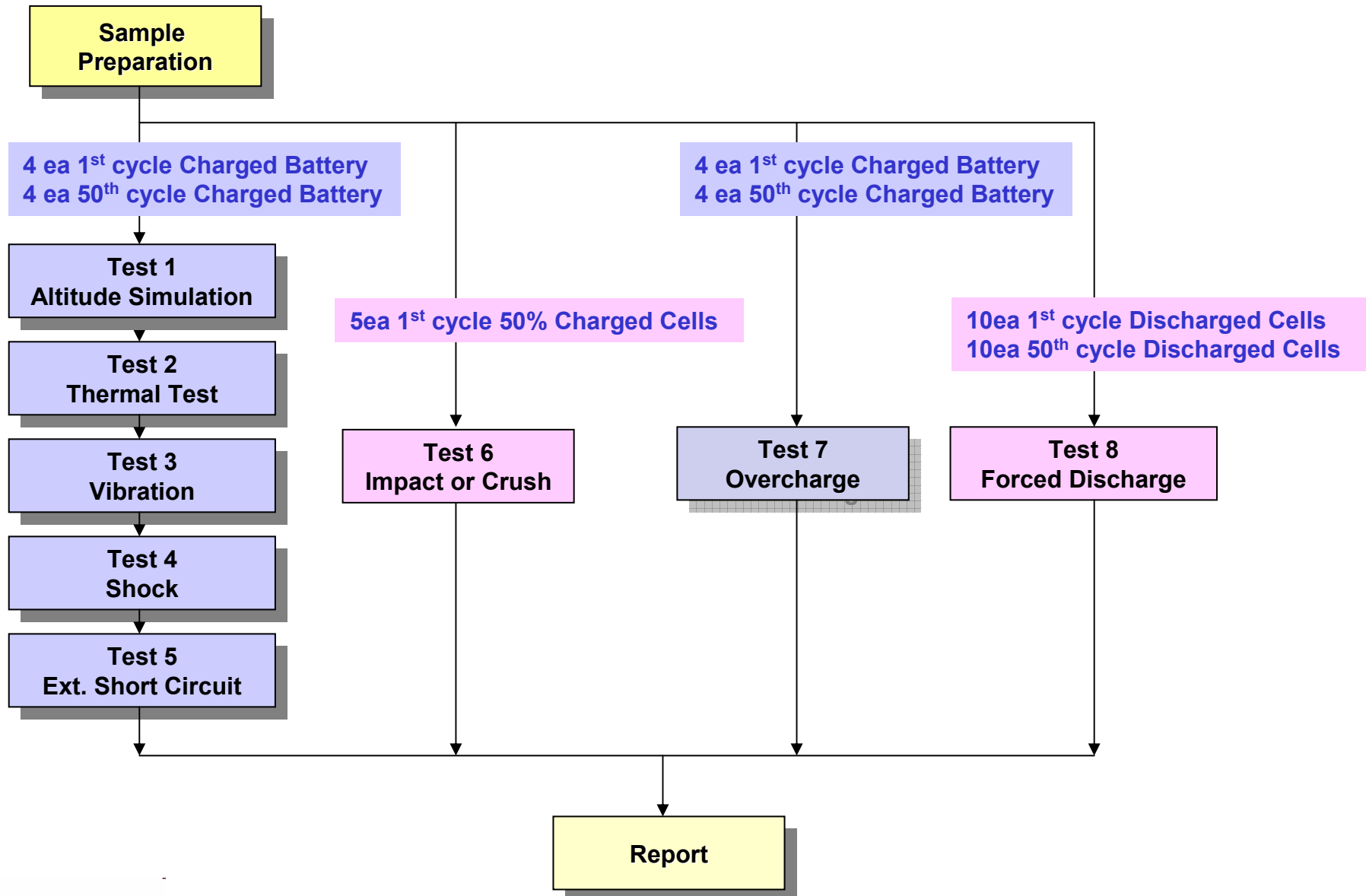
1. UN Transportation Regulation Test

Test	Condition	Requirements
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20+/-5 ℃	
Test 2. Thermal Test	[72±2 ℃,6hr ↔ -40 ±2 ℃,6hr,interval max. 30min] x 10cycle Storing at 20±5 ℃ for 24h	- Measuring mass before/ after each test (If M>5g, less than 0.1%)
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	- Measuring voltage before/ after each test (more than 90%) - No leakage, no venting, no disassembly, no rupture, no fire
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 rupture, no fire (after 6 hours) - Temp. monitoring (max. 170 ℃)
Test 6. Impact 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)
Test 6. Crush for cylindrical cells (≤ 20mm diameter) for prismatic, pouch, coin/button cells	Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation	- Temp. monitoring (max. 170 ℃)
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)	- No disassembly, no fire (after 7 days)
Test 8. Forced Discharge	Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current	- Appearance picture before/ after test (after 7 days) - 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	8.375	208.593	8.362	208.590	99.84	0.001	Pass	8.254	208.579	98.71	0.005	Pass	8.253	208.555	99.99	0.012	Pass	8.251	208.535	99.98	0.010	Pass
	2	8.358	208.437	8.343	208.419	99.82	0.009	Pass	8.227	208.408	98.61	0.005	Pass	8.224	208.392	99.96	0.008	Pass	8.223	208.367	99.99	0.012	Pass
	3	8.358	208.022	8.349	208.009	99.89	0.006	Pass	8.217	207.997	98.42	0.006	Pass	8.216	207.979	99.98	0.009	Pass	8.213	207.977	99.97	0.001	Pass
	4	8.344	208.994	8.329	208.987	99.82	0.003	Pass	8.206	208.980	98.53	0.003	Pass	8.206	208.957	100.00	0.011	Pass	8.204	208.946	99.98	0.005	Pass
	Ave.	8.359	208.512	8.346	208.501	99.84	0.005	-	8.226	208.491	98.57	0.005	-	8.225	208.471	99.98	0.010	-	8.223	208.456	99.98	0.007	-

B. 50th cycle fully state

Charge	5	8.360	208.239	8.348	208.219	99.86	0.010	Pass	8.227	208.210	98.55	0.004	Pass	8.224	208.209	99.97	0.000	Pass	8.222	208.204	99.98	0.002	Pass
	6	8.355	208.103	8.339	208.093	99.81	0.005	Pass	8.222	208.077	98.60	0.008	Pass	8.221	208.062	99.99	0.007	Pass	8.218	208.039	99.97	0.011	Pass
	7	8.353	208.134	8.340	208.130	99.84	0.002	Pass	8.225	208.109	98.62	0.010	Pass	8.222	208.106	99.97	0.001	Pass	8.220	208.098	99.98	0.004	Pass
	8	8.357	208.837	8.345	208.823	99.86	0.007	Pass	8.223	208.814	98.54	0.004	Pass	8.222	208.796	99.98	0.009	Pass	8.222	208.791	100.00	0.002	Pass
	Ave.	8.356	208.328	8.343	208.316	99.84	0.006	-	8.224	208.303	98.58	0.007	-	8.222	208.293	99.98	0.004	-	8.221	208.283	99.98	0.005	-

Requirement

- Measuring mass before/after each test (If M>5g, less than 0.1%)
- 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)				
	Pack NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle fully state

Charge	1	8.251	55.85	Pass
	2	8.223	55.25	Pass
	3	8.213	55.22	Pass
	4	8.204	56.39	Pass
	MAX.	8.251	56.39	-

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

Over Charge (T7)				
	Pack NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle fully state

Charge	9	8.346	23.63	Pass
	10	8.349	23.35	Pass
	11	8.348	23.73	Pass
	12	8.348	24.42	Pass
	MAX.	8.349	24.42	-

Test Condition
- Max. Charge Current : 4000mA - CC/CV 2Imax(8000mA) 16.8V cut-off 24Hr

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

B. 50th cycle fully state

Charge	5	8.222	55.03	Pass
	6	8.218	56.28	Pass
	7	8.220	56.06	Pass
	8	8.222	56.59	Pass
	MAX.	8.222	56.59	-

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

Over Charge (T7)				
	Pack NO.	Initial OCV(V)	Max. Temp (°C)	Result

B. 50th cycle fully state

Charge	13	8.329	23.70	Pass
	14	8.325	23.61	Pass
	15	8.330	23.67	Pass
	16	8.326	24.63	Pass
	MAX.	8.330	24.63	-

Requirement
- No disassembly, no fire within 7 day

3-3. T6 Test Result (INR18650S3)

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

A. 1st cycle 50% charged state

Direction

		Initial OCV(V)	Max. Temp (°C)	Result
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 (°C)
- No disassembly, no rupture, no fire within 6 hours

Forced Discharge (T8)				
	Pack NO.	Initial OCV(V)	Max. Temp (°C)	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

