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CERTIFICATE OF COMPLIANCE

The following product has been evaluated according to the 5th revised edition Amendment2 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 and batteries and single cell batteries.

<input type="checkbox"/> Lithium-ion cell <input checked="" type="checkbox"/> Lithium-ion battery <input type="checkbox"/> Lithium-ion single cell battery	
Model name	L16L4PB1
Cell Model name	P4043B0A1
Nominal voltage	7.72 V
Electric power capacity	48 Wh
Lithium equivalent content	1.865 g

Conducted By: Min Je Woo

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문서번호	QDI-160928-B-L16L4PB1	
Prepared	최명훈	Choi
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UN38.3 Test Report

- L16L4PB1 (Nom.48Wh, 7.72V) -

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1. UN38.3 Test Condition

Rev.5 / Amd.2

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 $1g \leq M \leq 75g$, 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 (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	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 = 1228 mA Voltage = 8.8 V	Current = 308 mA
Discharge	CC	Current = 1228 mA	Voltage = 6.4 V

2. Cycle Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 1228 mA Voltage = 8.8 V	Current = 308 mA
Discharge	CC	Current = 1228 mA	Voltage = 6.4 V

3. Test Condition

	Mode	Condition
Test 7. Overcharge	CC / CV	Max. Charge Current = 3377 mA CC/CV 2Imax (6.754A) 22V cut-off 24Hr
Test 8. Forced Discharge	CC	Max. Discharge Current = 3070 mA Duration Time = 60 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	8.774	193.89	8.763	193.88	99.87	0.005	Pass	8.678	193.87	99.03	0.005	Pass	8.574	193.85	98.80	0.010	Pass	8.421	193.84	98.22	0.005	Pass
2	8.759	193.78	8.748	193.77	99.87	0.005	Pass	8.667	193.76	99.07	0.005	Pass	8.567	193.75	98.85	0.005	Pass	8.418	193.73	98.26	0.010	Pass
3	8.758	193.73	8.743	193.71	99.83	0.010	Pass	8.661	193.69	99.06	0.010	Pass	8.557	193.68	98.80	0.005	Pass	8.411	193.67	98.29	0.005	Pass
4	8.741	193.99	8.729	193.97	99.86	0.010	Pass	8.650	193.95	99.09	0.010	Pass	8.547	193.93	98.81	0.010	Pass	8.396	193.93	98.23	0.000	Pass

B. 50th cycle fully charged state

5	8.752	194.03	8.736	194.00	99.82	0.007	Pass	8.653	193.98	99.05	0.010	Pass	8.558	193.96	98.90	0.010	Pass	8.409	193.95	98.26	0.005	Pass
6	8.767	194.05	8.755	194.04	99.86	0.006	Pass	8.668	194.02	99.01	0.010	Pass	8.565	194.01	98.81	0.005	Pass	8.418	194.00	98.28	0.005	Pass
7	8.768	193.94	8.758	193.92	99.89	0.006	Pass	8.678	193.90	99.09	0.010	Pass	8.580	193.88	98.87	0.010	Pass	8.431	193.88	98.26	0.000	Pass
8	8.765	193.82	8.749	193.82	99.82	0.015	Pass	8.663	193.80	99.02	0.010	Pass	8.562	193.77	98.83	0.015	Pass	8.409	193.75	98.21	0.010	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	8.421	54.18	Pass
2	8.418	55.17	Pass
3	8.411	54.27	Pass
4	8.396	54.42	Pass

B. 50th cycle fully charged state

5	8.409	54.69	Pass
6	8.418	54.20	Pass
7	8.431	54.14	Pass
8	8.409	53.66	Pass

Over Charge (T7)

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

9	8.743	26.00	Pass
10	8.742	24.53	Pass
11	8.743	24.65	Pass
12	8.750	24.71	Pass

Over Charge (T7)

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

13	8.723	25.79	Pass
14	8.726	24.69	Pass
15	8.725	26.18	Pass
16	8.722	25.26	Pass

3-3. T6/T8 Test Result (P4043B0A1)

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

A. 1st cycle 50% charged state

C-1	3.849	23.13	Pass
C-2	3.866	23.24	Pass
C-3	3.874	23.12	Pass
C-4	3.867	23.21	Pass
C-5	3.846	23.10	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	3.012	46.88	Pass
C-7	3.016	45.91	Pass
C-8	3.021	44.73	Pass
C-9	3.019	47.16	Pass
C-10	3.051	48.71	Pass
C-11	3.048	47.87	Pass
C-12	3.042	47.58	Pass
C-13	3.035	47.96	Pass
C-14	3.048	46.81	Pass
C-15	3.017	47.55	Pass

B. 50th cycle fully discharged state

C-16	3.115	44.86	Pass
C-17	3.192	45.29	Pass
C-18	3.152	44.54	Pass
C-19	3.142	44.63	Pass
C-20	3.186	45.71	Pass
C-21	3.122	45.85	Pass
C-22	3.216	46.82	Pass
C-23	3.208	45.44	Pass
C-24	3.195	44.96	Pass
C-25	3.186	46.87	Pass

4. Sample Image

