



CONFIDENTIAL

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## CERTIFICATE OF COMPLIANCE

The following product has been evaluated according to the 5<sup>th</sup> 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	<b>L16L4PB3</b>
Cell Model name	<b>P4043B0A1</b>
Nominal voltage	<b>7.72 V</b>
Electric power capacity	<b>48 Wh</b>

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# UN38.3 Test Report

## - L16L4PB3 (Nom.48Wh, 7.72V) -

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# 1. UN38.3 Test Condition

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"> <li>- After OCV (%) ≥ 90%</li> <li>- No leakage, no venting, no disassembly, no rupture, no fire</li> <li>- Mass loss limit (leakage)               <ol style="list-style-type: none"> <li>1) If <math>M &lt; 1g</math>, less than 0.5%,</li> <li>2) If <math>1g \leq M \leq 75g</math>, less than 0.2%,</li> <li>3) If <math>M &gt; 75g</math>, less than 0.1%</li> </ol> </li> </ul>	T1~T5 : Sequence Tests <pre>           graph TD             T1[Test 1 Altitude Simulation] --&gt; T2[Test 2 Thermal Test]             T2 --&gt; T3[Test 3 Vibration]             T3 --&gt; T4[Test 4 Shock]             T4 --&gt; 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 1g) 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"> <li>- No disassembly, no fire within 6 hours after the test</li> <li>- Max. Temp ≤ 170℃</li> </ul>	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"> <li>- No disassembly, no fire within 7 days after the test</li> </ul>	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"> <li>- No disassembly, no fire within 7 days after the test</li> </ul>	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 = 4298 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 = 4298 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 = 4298 mA CC/CV 2Imax (8596mA) 17.6 V 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	8.770	191.52	8.763	191.50	99.92	0.009	Pass	8.671	191.48	98.95	0.008	Pass	8.666	191.47	99.94	0.005	Pass	8.665	191.46	99.99	0.009	Pass
2	8.789	191.49	8.785	191.48	99.95	0.009	Pass	8.652	191.46	98.49	0.008	Pass	8.646	191.44	99.93	0.009	Pass	8.635	191.43	99.87	0.008	Pass
3	8.773	191.49	8.765	191.47	99.91	0.008	Pass	8.659	191.46	98.79	0.005	Pass	8.651	191.45	99.91	0.009	Pass	8.625	191.44	99.70	0.004	Pass
4	8.772	191.50	8.766	191.48	99.93	0.009	Pass	8.678	191.47	99.00	0.007	Pass	8.672	191.45	99.93	0.009	Pass	8.647	191.45	99.71	0.004	Pass

**B. 50th cycle fully charged state**

5	8.776	191.48	8.770	191.47	99.93	0.008	Pass	8.640	191.45	98.52	0.009	Pass	8.632	191.44	99.91	0.006	Pass	8.630	191.43	99.98	0.006	Pass
6	8.774	191.49	8.770	191.49	99.95	0.001	Pass	8.649	191.48	98.62	0.004	Pass	8.647	191.46	99.98	0.008	Pass	8.642	191.45	99.94	0.008	Pass
7	8.773	191.51	8.767	191.50	99.93	0.004	Pass	8.656	191.50	98.73	0.001	Pass	8.648	191.48	99.91	0.008	Pass	8.646	191.47	99.98	0.007	Pass
8	8.787	191.47	8.783	191.45	99.95	0.009	Pass	8.651	191.44	98.50	0.006	Pass	8.649	191.43	99.98	0.003	Pass	8.641	191.42	99.91	0.007	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	8.665	55.00	Pass
2	8.635	54.95	Pass
3	8.625	53.56	Pass
4	8.647	53.27	Pass

### B. 50th cycle fully charged state

5	8.630	55.15	Pass
6	8.642	56.05	Pass
7	8.646	56.46	Pass
8	8.641	56.65	Pass

## Over Charge (T7)

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

9	8.744	24.68	Pass
10	8.742	25.94	Pass
11	8.745	24.87	Pass
12	8.747	24.77	Pass

## Over Charge (T7)

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

13	8.629	24.58	Pass
14	8.624	24.80	Pass
15	8.624	25.99	Pass
16	8.629	25.58	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	3.862	22.51	Pass
C-2	3.862	22.38	Pass
C-3	3.862	22.68	Pass
C-4	3.863	22.67	Pass
C-5	3.861	22.44	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	3.256	52.88	Pass
C-7	3.266	48.14	Pass
C-8	3.263	51.26	Pass
C-9	3.265	49.82	Pass
C-10	3.269	48.16	Pass
C-11	3.262	45.59	Pass
C-12	3.258	47.68	Pass
C-13	3.266	48.33	Pass
C-14	3.261	48.44	Pass
C-15	3.262	48.23	Pass

**B. 50th cycle fully discharged state**

C-16	3.263	41.60	Pass
C-17	3.261	42.02	Pass
C-18	3.264	42.49	Pass
C-19	3.268	41.59	Pass
C-20	3.267	40.32	Pass
C-21	3.269	40.19	Pass
C-22	3.267	41.92	Pass
C-23	3.269	41.30	Pass
C-24	3.267	40.31	Pass
C-25	3.262	41.53	Pass

# 4. Sample Image

