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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 type="checkbox"/> Lithium-ion battery <input checked="" type="checkbox"/> Lithium-ion single cell battery	
Model name	<b>FT40</b>
Cell Model name	<b>ICP404981L1</b>
Nominal voltage	<b>3.8 V</b>
Electric power capacity	<b>8.5 Wh</b>

Conducted By: Dae Ho Nam

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	우민제	
Approved	김병수	

**SolutionPartner**

# UN Test Report

## - FT40(Min.8.5Wh, 3.8V) -

### 목 차

1. UN Transportation Regulation Test
2. Test Procedure
3. Test Result
4. Sample Image

2014. 06. 18

 **LG Chem**

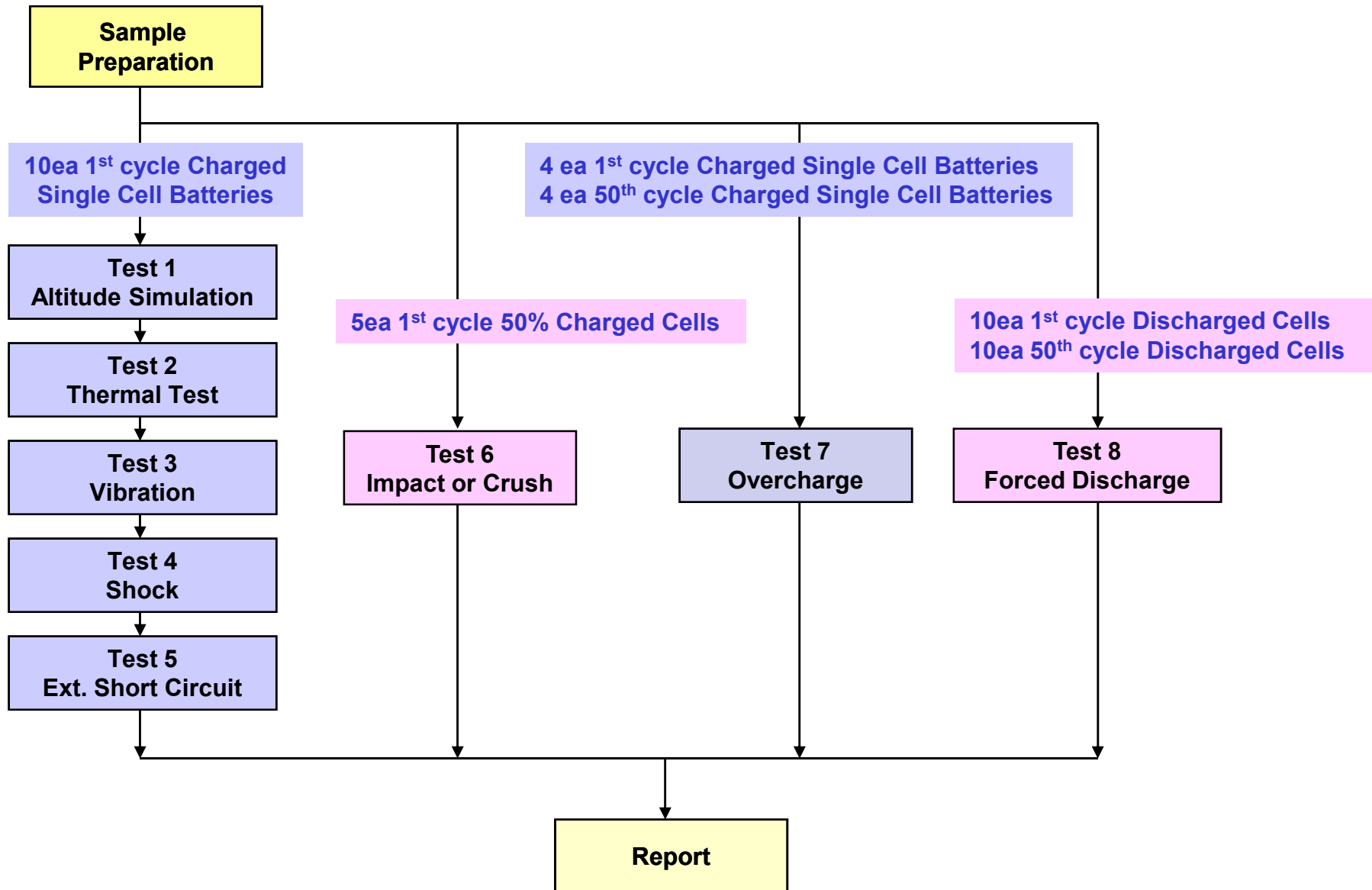
# 1. UN Transportation Regulation Test

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 $1g \leq M \leq 75g$ , 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 10 cycle 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	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 within 7 days after the test
Test 8. Forced Discharge	Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current	

\* 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	4.322	38.525	4.321	38.524	99.99	0.002	Pass	4.267	38.524	98.75	0.000	Pass	4.267	38.522	100.00	0.006	Pass	4.267	38.522	99.99	0.001	Pass
2	4.321	38.527	4.320	38.523	99.98	0.010	Pass	4.269	38.518	98.82	0.013	Pass	4.268	38.517	99.97	0.004	Pass	4.268	38.515	99.99	0.004	Pass
3	4.321	38.528	4.320	38.523	99.97	0.012	Pass	4.267	38.521	98.78	0.007	Pass	4.266	38.520	99.98	0.003	Pass	4.265	38.519	99.99	0.001	Pass
4	4.321	38.522	4.320	38.519	99.99	0.007	Pass	4.262	38.517	98.65	0.005	Pass	4.262	38.517	99.99	0.002	Pass	4.261	38.516	99.98	0.002	Pass
5	4.322	38.524	4.321	38.523	99.98	0.003	Pass	4.267	38.522	98.75	0.003	Pass	4.267	38.519	99.99	0.008	Pass	4.266	38.516	99.99	0.006	Pass
6	4.322	38.528	4.322	38.525	99.99	0.008	Pass	4.266	38.524	98.72	0.003	Pass	4.265	38.522	99.97	0.005	Pass	4.265	38.519	100.00	0.007	Pass
7	4.321	38.523	4.321	38.522	99.99	0.003	Pass	4.263	38.521	98.66	0.001	Pass	4.263	38.519	99.99	0.007	Pass	4.261	38.519	99.96	0.000	Pass
8	4.322	38.522	4.321	38.519	99.97	0.007	Pass	4.269	38.519	98.81	0.001	Pass	4.268	38.519	99.96	0.001	Pass	4.266	38.516	99.96	0.006	Pass
9	4.322	38.523	4.321	38.523	99.97	0.001	Pass	4.270	38.522	98.81	0.001	Pass	4.269	38.521	100.00	0.003	Pass	4.268	38.519	99.97	0.005	Pass
10	4.322	38.528	4.321	38.523	99.99	0.012	Pass	4.270	38.520	98.81	0.010	Pass	4.270	38.518	100.00	0.003	Pass	4.268	38.518	99.96	0.001	Pass
<b>Ave.</b>	4.322	38.525	4.321	38.522	99.98	0.006	-	4.267	38.521	98.76	0.004	-	4.266	38.519	99.99	0.004	-	4.266	38.518	99.98	0.003	-

<b>Requirement</b>	<ul style="list-style-type: none"> <li>- Measuring mass before/after each test (If <math>M &gt; 75g</math>, less than 0.1%, <math>1g \leq M \leq 75</math>, less than 0.2%, <math>M &lt; 1g</math>, less than 0.5%)</li> <li>- Measuring voltage before/after each test (more than 90%, only charged samples)</li> <li>- No leakage, no venting, no disassembly, no rupture, no fire</li> </ul>
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# 3-2. T5/T7 Test Result

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

A. 1st cycle fully charged state

1	4.267	70.86	Pass
2	4.268	81.41	Pass
3	4.265	80.31	Pass
4	4.261	67.16	Pass
5	4.266	69.66	Pass
6	4.265	71.46	Pass
7	4.261	81.17	Pass
8	4.266	74.80	Pass
9	4.268	65.53	Pass
10	4.268	77.22	Pass
<b>MAX.</b>	4.268	81.41	-

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

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

A. 1st cycle fully state

Charge	11	4.322	23.04	Pass
	12	4.322	23.21	Pass
	13	4.322	22.65	Pass
	14	4.322	22.66	Pass
	<b>MAX.</b>	4.322	23.21	-

Test Condition
- Max. Charge Current : 2310mA - CC/CV 2I <sub>max</sub> (4620mA) 8.7V cut-off 24Hr

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

B. 50th cycle fully state

Charge	15	4.321	22.80	Pass
	16	4.320	22.92	Pass
	17	4.321	22.64	Pass
	18	4.321	22.92	Pass
	<b>MAX.</b>	4.321	22.92	-

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

# 3-3. T6/T8 Test Result (ICP404981L1)

Crush (T6)				
Direction	NO.	Initial OCV(V)	Max. Temp (°C)	Result
<b>A. 1st cycle 50% charged state</b>				
Flat	C-1	3.857	23.40	Pass
	C-2	3.855	24.00	Pass
	C-3	3.859	23.50	Pass
	C-4	3.861	23.80	Pass
	C-5	3.857	24.20	Pass
<b>MAX.</b>		3.861	24.20	-

Test Condition
- Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation

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	
<b>A. 1st cycle fully Discharged state</b>				
C-6	3.329	79.92	Pass	
C-7	3.330	87.88	Pass	
C-8	3.328	65.57	Pass	
C-9	3.330	80.70	Pass	
C-10	3.341	81.30	Pass	
C-11	3.332	77.48	Pass	
C-12	3.331	78.31	Pass	
C-13	3.326	74.98	Pass	
C-14	3.325	67.44	Pass	
C-15	3.321	76.24	Pass	
<b>MAX.</b>		3.341	87.88	-

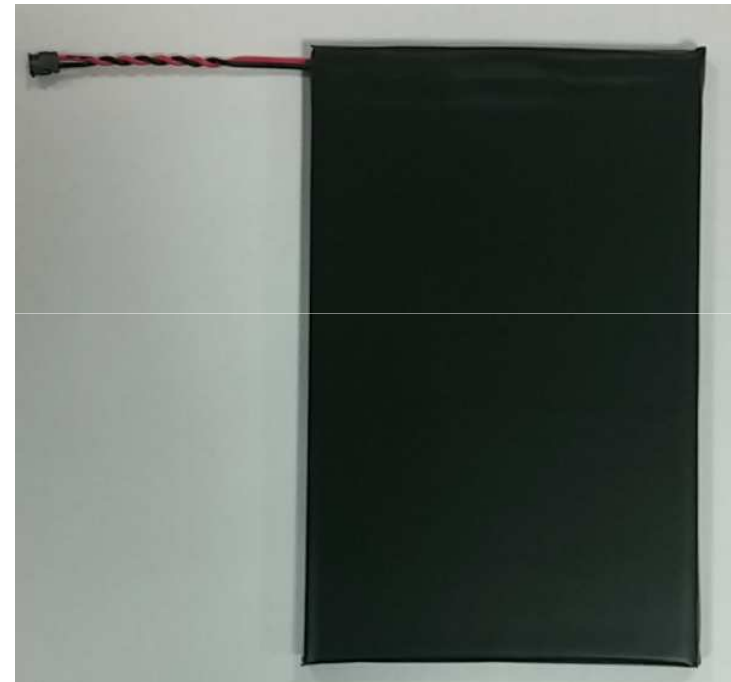
<b>B. 50th cycle fully discharged state</b>				
C-16	3.480	82.54	Pass	
C-17	3.491	90.38	Pass	
C-18	3.482	68.07	Pass	
C-19	3.460	79.98	Pass	
C-20	3.458	77.48	Pass	
C-21	3.476	68.07	Pass	
C-22	3.475	83.20	Pass	
C-23	3.459	83.80	Pass	
C-24	3.460	79.98	Pass	
C-25	3.458	90.50	Pass	
<b>MAX.</b>		3.491	90.50	-

Test Condition
- Discharge at max. discharge current (with 12V DC power supply) : 2310mA Duration time: rated capacity (60.0min)

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

## 4. Sample Image

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<input type="checkbox"/> Lithium-ion cell <input type="checkbox"/> Lithium-ion battery <input checked="" type="checkbox"/> Lithium-ion single cell battery	
Model name	<b>FT40</b>
Cell Model name	<b>ICP404981L1</b>
Nominal voltage	<b>3.8 V</b>
Electric power capacity	<b>8.5 Wh</b>

Conducted By: Dae Ho Nam

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문서번호	QAE-EF02-140618-PKFT40	
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Reviewed	남대호	
	우민제	
Approved	김병수	

**SolutionPartner**

# UN Test Report

## - FT40(Min.8.5Wh, 3.8V) -

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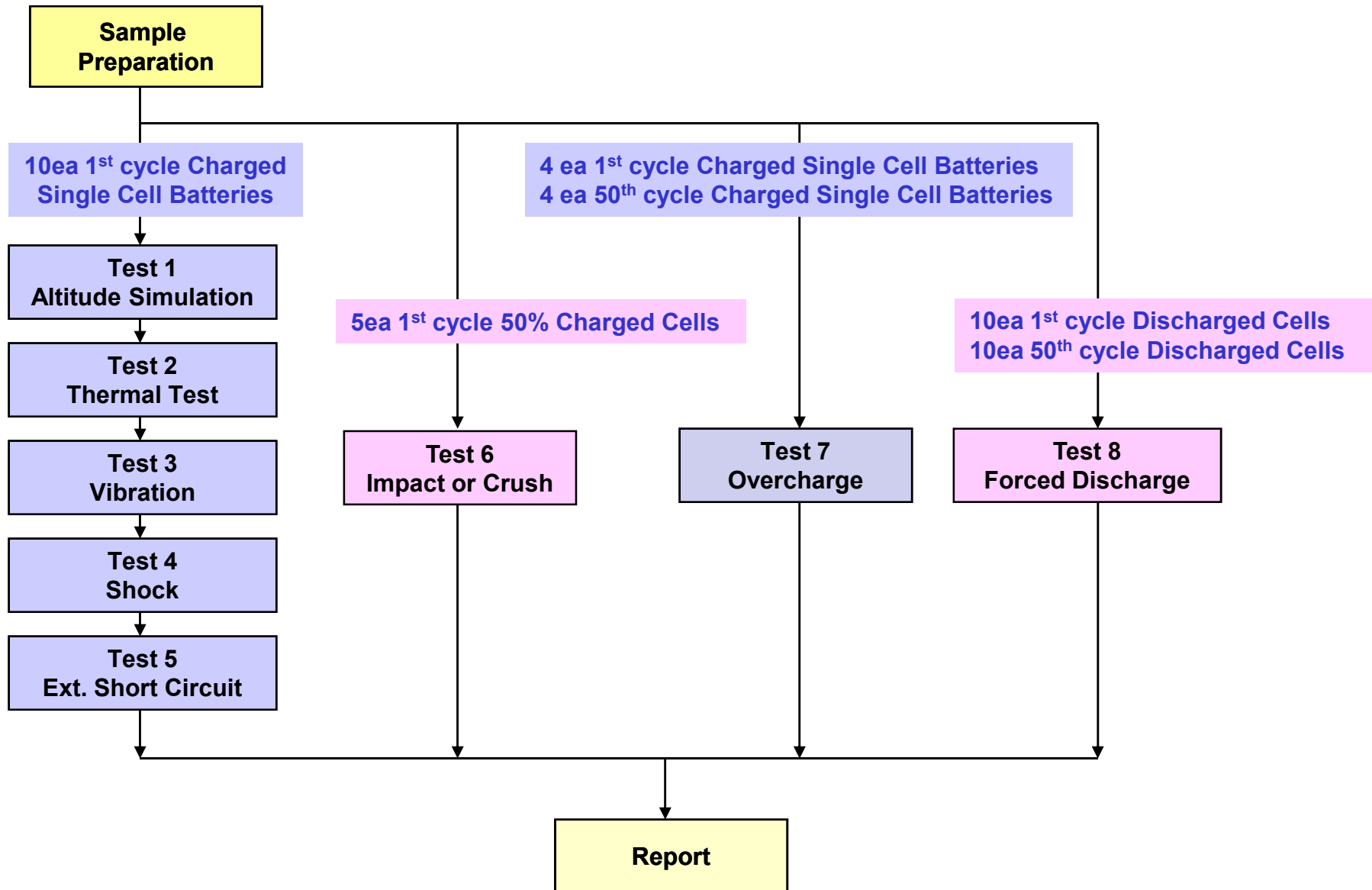
# 1. UN Transportation Regulation Test

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 $1g \leq M \leq 75g$ , 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℃	- No disassembly, no rupture, no fire within 6 hours after the test - Temp. monitoring (max. 170℃)
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	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 within 7 days after the test
Test 8. Forced Discharge	Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current	

\* 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	4.322	38.525	4.321	38.524	99.99	0.002	Pass	4.267	38.524	98.75	0.000	Pass	4.267	38.522	100.00	0.006	Pass	4.267	38.522	99.99	0.001	Pass
2	4.321	38.527	4.320	38.523	99.98	0.010	Pass	4.269	38.518	98.82	0.013	Pass	4.268	38.517	99.97	0.004	Pass	4.268	38.515	99.99	0.004	Pass
3	4.321	38.528	4.320	38.523	99.97	0.012	Pass	4.267	38.521	98.78	0.007	Pass	4.266	38.520	99.98	0.003	Pass	4.265	38.519	99.99	0.001	Pass
4	4.321	38.522	4.320	38.519	99.99	0.007	Pass	4.262	38.517	98.65	0.005	Pass	4.262	38.517	99.99	0.002	Pass	4.261	38.516	99.98	0.002	Pass
5	4.322	38.524	4.321	38.523	99.98	0.003	Pass	4.267	38.522	98.75	0.003	Pass	4.267	38.519	99.99	0.008	Pass	4.266	38.516	99.99	0.006	Pass
6	4.322	38.528	4.322	38.525	99.99	0.008	Pass	4.266	38.524	98.72	0.003	Pass	4.265	38.522	99.97	0.005	Pass	4.265	38.519	100.00	0.007	Pass
7	4.321	38.523	4.321	38.522	99.99	0.003	Pass	4.263	38.521	98.66	0.001	Pass	4.263	38.519	99.99	0.007	Pass	4.261	38.519	99.96	0.000	Pass
8	4.322	38.522	4.321	38.519	99.97	0.007	Pass	4.269	38.519	98.81	0.001	Pass	4.268	38.519	99.96	0.001	Pass	4.266	38.516	99.96	0.006	Pass
9	4.322	38.523	4.321	38.523	99.97	0.001	Pass	4.270	38.522	98.81	0.001	Pass	4.269	38.521	100.00	0.003	Pass	4.268	38.519	99.97	0.005	Pass
10	4.322	38.528	4.321	38.523	99.99	0.012	Pass	4.270	38.520	98.81	0.010	Pass	4.270	38.518	100.00	0.003	Pass	4.268	38.518	99.96	0.001	Pass
<b>Ave.</b>	4.322	38.525	4.321	38.522	99.98	0.006	-	4.267	38.521	98.76	0.004	-	4.266	38.519	99.99	0.004	-	4.266	38.518	99.98	0.003	-

<b>Requirement</b>	<ul style="list-style-type: none"> <li>- Measuring mass before/after each test (If <math>M &gt; 75g</math>, less than 0.1%, <math>1g \leq M \leq 75</math>, less than 0.2%, <math>M &lt; 1g</math>, less than 0.5%)</li> <li>- Measuring voltage before/after each test (more than 90%, only charged samples)</li> <li>- No leakage, no venting, no disassembly, no rupture, no fire</li> </ul>
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# 3-2. T5/T7 Test Result

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

A. 1st cycle fully charged state

1	4.267	70.86	Pass
2	4.268	81.41	Pass
3	4.265	80.31	Pass
4	4.261	67.16	Pass
5	4.266	69.66	Pass
6	4.265	71.46	Pass
7	4.261	81.17	Pass
8	4.266	74.80	Pass
9	4.268	65.53	Pass
10	4.268	77.22	Pass
<b>MAX.</b>	4.268	81.41	-

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

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

A. 1st cycle fully state

Charge	11	4.322	23.04	Pass
	12	4.322	23.21	Pass
	13	4.322	22.65	Pass
	14	4.322	22.66	Pass
	<b>MAX.</b>	4.322	23.21	-

Test Condition
- Max. Charge Current : 2310mA - CC/CV 2I <sub>max</sub> (4620mA) 8.7V cut-off 24Hr

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

B. 50th cycle fully state

Charge	15	4.321	22.80	Pass
	16	4.320	22.92	Pass
	17	4.321	22.64	Pass
	18	4.321	22.92	Pass
	<b>MAX.</b>	4.321	22.92	-

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

# 3-3. T6/T8 Test Result (ICP404981L1)

Crush (T6)				
Direction	NO.	Initial OCV(V)	Max. Temp (°C)	Result
<b>A. 1st cycle 50% charged state</b>				
Flat	C-1	3.857	23.40	Pass
	C-2	3.855	24.00	Pass
	C-3	3.859	23.50	Pass
	C-4	3.861	23.80	Pass
	C-5	3.857	24.20	Pass
<b>MAX.</b>		3.861	24.20	-

Test Condition
- Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation

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	
<b>A. 1st cycle fully Discharged state</b>				
C-6	3.329	79.92	Pass	
C-7	3.330	87.88	Pass	
C-8	3.328	65.57	Pass	
C-9	3.330	80.70	Pass	
C-10	3.341	81.30	Pass	
C-11	3.332	77.48	Pass	
C-12	3.331	78.31	Pass	
C-13	3.326	74.98	Pass	
C-14	3.325	67.44	Pass	
C-15	3.321	76.24	Pass	
<b>MAX.</b>		3.341	87.88	-

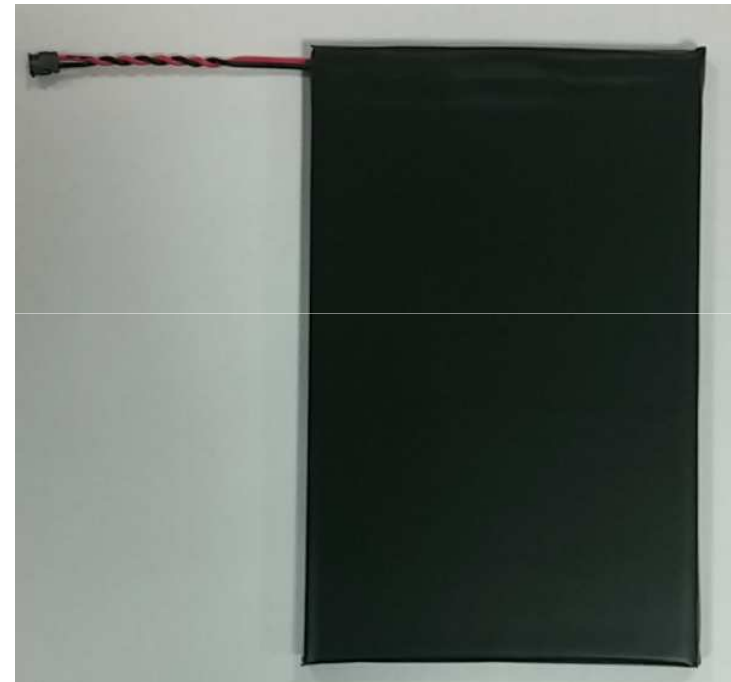
<b>B. 50th cycle fully discharged state</b>				
C-16	3.480	82.54	Pass	
C-17	3.491	90.38	Pass	
C-18	3.482	68.07	Pass	
C-19	3.460	79.98	Pass	
C-20	3.458	77.48	Pass	
C-21	3.476	68.07	Pass	
C-22	3.475	83.20	Pass	
C-23	3.459	83.80	Pass	
C-24	3.460	79.98	Pass	
C-25	3.458	90.50	Pass	
<b>MAX.</b>		3.491	90.50	-

Test Condition
- Discharge at max. discharge current (with 12V DC power supply) : 2310mA Duration time: rated capacity (60.0min)

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

## 4. Sample Image

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**Manufacturer:**

LG Chemical, Ltd.

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Email: [kimhwans@lgchem.com](mailto:kimhwans@lgchem.com)

## Test Laboratory:

LG Chem, Ltd.

Address: 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea

Telephone: 82-42-870-6195

Website: [www.lgchem.com](http://www.lgchem.com)

Email: [kkammy@lgchem.com](mailto:kkammy@lgchem.com)