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CERTIFICATE OF COMPLIANCE

The following product has been evaluated according to the 6th revised edition 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.



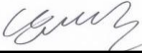
<input type="checkbox"/> Lithium-ion cell <input checked="" type="checkbox"/> Lithium-ion battery <input type="checkbox"/> Lithium-ion single cell battery	
Model name	RESU13
Cell Model name	JH3
Nominal voltage	51.8 V
capacity	252.0 Ah

Reviewed By: Jae Seung Lee

Approved By: DaeHo Nam

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Document Number	QDI-180806-B-RESU13 [UN] CoC & Test Report	
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UN38.3 Test Report

- RESU13 (252.0 Ah, 51.8 V) -

Index

1. UN38.3 Test Condition
2. General Information
3. Test Result
4. Sample Image

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1. UN38.3 Large Battery Test Condition

Rev.6

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20+/-5°C		T1~T5 : Sequence Tests <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°C,12hr ↔ -40±2°C, 12hr,interval max. 30min] x 10cycle , Storing at 20±5°C 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 2gn) 200Hz (maintaining 2gn), 1.6mm total excursion	- After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) 1) If M < 1g, less than 0.5%, 2) If 1g ≤ M ≤ 75g, less than 0.2%, 3) If M > 75g, less than 0.1%	
Test 4. Shock	Half sine shock 1) Peak acceleration - For batteries (whichever is smaller) : 150gn or $\sqrt{\frac{30000}{\text{Mass(kg)}}}$ gn 2) Pulse duration : 6msec 3) 6 direction (±x, y, z) x 3 cycle		
Test 5. External Short Circuit	1) Samples to be heated to 57±4°C in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4°C 3) 1hr continue after returning to 57±4°C or "has decreased by half of the maximum temperature increase observed during the test and remains below that value" If this assessment is not feasible, the exposure time shall be at least 12hours	- No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp ≤ 170°C	
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height		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	- No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C	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)	- No disassembly, no fire within 7 days after the test	Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test
Test 8. Forced Discharge	Discharge at max. discharge current (connecting in series with 12V DC power supply), Duration time = rated capacity/initial test current	- No disassembly, no fire within 7 days after the test	Resistance of Electric Loader 1/Ω = (max. discharge current) / (12 + Initial OCV)

- Tests through T1-T5 shall be conducted in sequence with the same battery.
- Large battery means a lithium metal battery or lithium ion battery with a gross mass of more than 12 kg.

2. General Information

1. Standard charge / discharge Condition

	Mode	Condition	End Condition
Charge	CC / CV	Current = 75.6 A Voltage = 58.8 V	Current = 12.6 A
Discharge	CC	Current = 75.6 A	Voltage = 42.0 V

2. Test Condition

	Mode	Condition
Test 8. Forced Discharge	CC	Max. Discharge Current = 157.5 A Duration Time = 24 min

3-1. T1-T4 Test Result

Before			Altitude (T1)					Thermal (T2)					Vibration (T3)					Shock (T4)				
NO.	OCV	Mass (kg)	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result

A. 1st cycle fully charged state

1	58.252	97.860	58.222	97.860	99.95	0.000	Pass	57.683	97.860	99.07	0.000	Pass	57.659	97.860	99.96	0.000	Pass	57.658	97.860	100.00	0.000	Pass
2	58.251	97.980	58.217	97.980	99.94	0.000	Pass	57.716	97.980	99.14	0.000	Pass	57.690	97.980	99.95	0.000	Pass	57.690	97.980	100.00	0.000	Pass

B. 25th cycle fully charged state

3	58.296	97.950	58.282	97.950	99.98	0.000	Pass	57.892	97.950	99.33	0.000	Pass	57.866	97.950	99.96	0.000	Pass	57.866	97.950	100.00	0.000	Pass
4	58.291	97.960	58.267	97.960	99.96	0.000	Pass	57.982	97.960	99.51	0.000	Pass	57.982	97.960	100.00	0.000	Pass	57.976	97.960	99.99	0.000	Pass

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	57.658	58.50	Pass
2	57.690	57.90	Pass

B. 25th cycle fully charged state

3	57.866	57.65	Pass
4	57.976	58.70	Pass

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

A. 1st cycle fully charged state

5	58.280	21.60	Pass
6	58.205	21.50	Pass

B. 25th cycle fully charged state

7	57.915	21.50	Pass
8	57.910	21.50	Pass

3-3. T6/T8 Test Result (JH3)

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

A. 1st cycle 50% charged state

C-1	3.718	23.54	Pass
C-2	3.720	23.96	Pass
C-3	3.721	24.05	Pass
C-4	3.720	25.08	Pass
C-5	3.719	23.28	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	3.362	58.40	Pass
C-7	3.368	61.20	Pass
C-8	3.204	57.70	Pass
C-9	3.392	59.60	Pass
C-10	3.385	61.60	Pass
C-11	3.373	61.70	Pass
C-12	3.269	60.00	Pass
C-13	3.390	57.70	Pass
C-14	3.381	62.10	Pass
C-15	3.389	60.60	Pass

B. 50th cycle fully discharged state

C-16	3.196	64.30	Pass
C-17	3.342	63.50	Pass
C-18	3.367	61.90	Pass
C-19	3.342	67.40	Pass
C-20	3.162	67.60	Pass
C-21	3.352	66.20	Pass
C-22	3.354	60.40	Pass
C-23	3.371	61.10	Pass
C-24	3.163	60.30	Pass
C-25	3.356	65.90	Pass

4. Sample Image

