UN38.3 Test Summary

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Description		List of Test Completed	
Cell/Battery Type	Rechargeable Lithium Ion battery pack	Revised edition	Revision 7
Physical Description	Prismatic shape(pouch case)	Test 1. Altitude Simulation	Pass
Test Report Number	QDI-210923-B-AP21A8T	Test 2. Thermal Test	Pass
Date of test report	2021.09.23	Test 3. Vibration	Pass
Model name	AP21A8T	Test 4. Shock	Pass
Nominal voltage (V)	15.40	Test 5. External Short Circuit	Pass
Capacity (mAh / Wh)	5716 / 88.02	Test 6. Crush	Pass
Mass (g)	369.719	Test 7. Overcharge	Pass
Reference to assembled battery testing requirements	Not applicable	Test 8. Forced Discharge	Pass

Approved By: Ying Li
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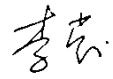

LG Energy Solution

Report number	QDI-210923-B-AP21A8T	
Prepared by	Jie Ma	
Approved by	Ying Li	

UN38.3 Test Report

- AP21A8T (15.40V, 5716mAh/88.02Wh) -

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2021. 09. 23

1. UN38.3 Test Condition

Rev.7

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20+/-5℃	- 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%)	T1~T5 : Sequence Tests Test 1 Altitude Simulation Test 2 Thermal Test Test 3 Vibration Test 4 Shock Test 5 Ext. Short Circuit
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 1) Peak acceleration - For cells & single cell batteries : 150gn - For batteries (whichever is smaller) : 150gn or $\sqrt{\frac{100850}{Mass(kg)}}$ 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℃ in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4℃ 3) 1hr continue after returning to 57±4℃	- No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp ≤ 170℃	
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height	- No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170℃	for cylindrical cells (dia ≥ 18mm)
Test 6. Crush	Crushing rate :1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation		for cylindrical cells (dia< 18mm) 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	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	- No disassembly, no fire within 7 days after the test	Resistance of Electric Loader $Rt = \frac{12V + Vc}{Max\ discharge\ current}$ - Rc-Rw

2-1. Test Result (T1-T4)

Before			T1. Altitude Simulation					T2. Thermal					T3. Vibration					T4. Shock				
NO.	OCV(V)	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	17.0954	358.41	17.0921	358.39	99.98	0.006	Pass	16.7460	358.33	97.98	0.017	Pass	16.7562	358.33	100.00	0.000	Pass	16.7437	358.34	99.93	0.000	Pass
2	17.0950	358.76	17.0915	358.74	99.98	0.006	Pass	16.7467	358.67	97.98	0.020	Pass	16.7573	358.68	100.00	0.000	Pass	16.7447	358.69	99.92	0.000	Pass
3	17.0944	358.88	17.0916	358.86	99.98	0.006	Pass	16.7437	358.82	97.96	0.011	Pass	16.7540	358.80	100.00	0.006	Pass	16.7423	358.83	99.93	0.000	Pass
4	17.0943	358.95	17.0916	358.93	99.98	0.006	Pass	16.7392	358.87	97.94	0.017	Pass	16.7475	358.88	100.00	0.000	Pass	16.7375	358.89	99.94	0.000	Pass
B. 25th cycle fully charged state																						
5	17.0985	358.39	17.0957	358.37	99.98	0.006	Pass	16.7537	358.32	98.00	0.014	Pass	16.7618	358.32	100.00	0.000	Pass	16.7511	358.33	99.94	0.000	Pass
6	17.0905	358.73	17.0878	358.71	99.98	0.006	Pass	16.7526	358.66	98.04	0.014	Pass	16.7602	358.65	100.00	0.003	Pass	16.7486	358.66	99.93	0.000	Pass
7	17.0980	358.65	17.0954	358.63	99.98	0.006	Pass	16.7562	358.57	98.02	0.017	Pass	16.7649	358.57	100.00	0.000	Pass	16.7528	358.58	99.93	0.000	Pass
8	17.1041	358.54	17.1014	358.51	99.98	0.008	Pass	16.7605	358.46	98.01	0.014	Pass	16.7677	358.47	100.00	0.000	Pass	16.7581	358.48	99.94	0.000	Pass

2-2. Test Result (T5/T7)

T5. External Short Circuit			
NO.	Initial OCV(V)	Max. Temp(℃)	Result
A. 1st cycle fully charged state			
1	16.7437	57.23	**Pass**
2	16.7447	58.18	**Pass**
3	16.7423	57.08	**Pass**
4	16.7375	57.30	**Pass**
B. 25th cycle fully charged state			
5	16.7511	57.36	**Pass**
6	16.7486	58.11	**Pass**
7	16.7528	57.23	**Pass**
8	16.7581	57.20	**Pass**

T7. Overcharge			
NO.	Initial OCV(V)	Max. Temp(℃)	Result
A. 1st cycle 50% charged state			
9	17.0951	24.62	**Pass**
10	17.0969	24.55	**Pass**
11	17.0945	24.52	**Pass**
12	17.0946	24.32	**Pass**
B. 25th cycle 50% charged state			
13	17.1077	24.38	**Pass**
14	17.1008	24.01	**Pass**
15	17.0989	24.18	**Pass**
16	17.1050	24.05	**Pass**

2-3. Test Result (T6/T8) - P4264C7A1

T6. Crush

NO.	Initial OCV(V)	Max. Temp(℃)	Result
A. 1st cycle 50% charged state			
C-1	3.8426	19.67	**Pass**
C-2	3.8438	19.62	**Pass**
C-3	3.8430	19.71	**Pass**
C-4	3.8425	19.80	**Pass**
C-5	3.8423	20.05	**Pass**
B. 25th cycle 50% charged state			
C-6	3.8877	23.44	**Pass**
C-7	3.8772	22.14	**Pass**
C-8	3.8828	23.05	**Pass**
C-9	3.8835	22.65	**Pass**
C-10	3.8819	22.94	**Pass**

T8. Forced Discharge

NO.	Initial OCV(V)	Max. Temp(℃)	Result	NO.	Initial OCV(V)	Max. Temp(℃)	Result
A. 1st cycle fully discharged state				**B. 25th cycle fully discharged state**			
C-11	3.4399	69.03	**Pass**	**C-21**	3.4687	72.80	**Pass**
C-12	3.4442	76.11	**Pass**	**C-22**	3.4435	68.72	**Pass**
C-13	3.4394	72.18	**Pass**	**C-23**	3.4334	70.03	**Pass**
C-14	3.4256	75.20	**Pass**	**C-24**	3.4234	72.87	**Pass**
C-15	3.4196	74.06	**Pass**	**C-25**	3.4337	74.75	**Pass**
C-16	3.4246	73.36	**Pass**	**C-26**	3.4524	71.95	**Pass**
C-17	3.4302	73.23	**Pass**	**C-27**	3.4402	73.02	**Pass**
C-18	3.4372	71.10	**Pass**	**C-28**	3.4102	74.07	**Pass**
C-19	3.4439	73.75	**Pass**	**C-29**	3.4358	56.11	**Pass**
C-20	3.4385	68.53	**Pass**	**C-30**	3.4262	44.80	**Pass**

3. Sample Image