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UN Test Report

- INR18650HG2 (Nom. 3000 mAh)-

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2019. 12. 27



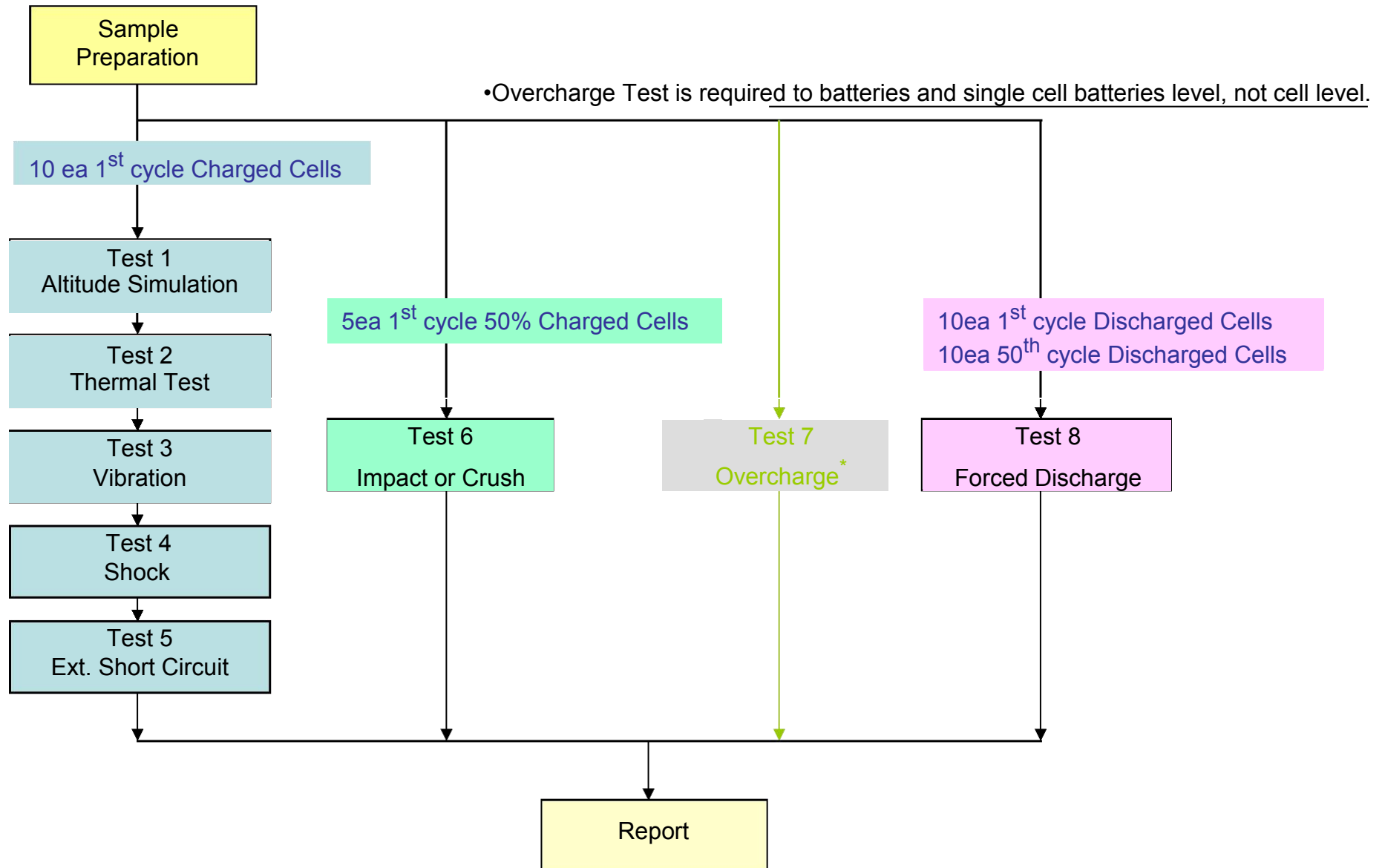
1. UN Transportation Regulation Test

Test	Condition	Requirements
Test 1. Altitude Simulation	Storing at (low pressure) 11.6kPa for 6hr at 20+/- 5°C	Measuring mass before/ after each test (If M<1g, less than 0.5%, If 1g≤M≤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°C, 6hr ↔ 40±2°C, 6hr, interval max. 30min] x 10 cycle 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 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	No disassembly, no rupture, no fire within 6 hours after the test Temp. monitoring (max. 170°C)
Test 5. External Short Circuit	100m ext. short circuit at 55±2°C 1hr continue after returning at 55±2°C	
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°C)
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	Only for battery, not cell.	Overcharge Test is required to pack battery level, not cell level.
Test 8. Forced Discharge	Discharge at max. discharge current (with 12V DC power supply), Duration time = rated capacity/initial test current	No disassembly, no fire within 7 days after the test

5. Tests through T1 T5 shall be conducted in sequence with the same samples.

6. 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	4.180	44.878	4.180	44.878	100.00	0.000	Pass	4.129	44.877	98.78	0.002	Pass	4.129	44.875	100.00	0.004	Pass	4.129	44.875	100.00	0.000	Pass
2	4.180	44.866	4.180	44.865	100.00	0.002	Pass	4.129	44.864	98.78	0.002	Pass	4.129	44.863	100.00	0.002	Pass	4.129	44.863	100.00	0.000	Pass
3	4.180	44.938	4.180	44.937	100.00	0.002	Pass	4.130	44.935	98.80	0.004	Pass	4.130	44.934	100.00	0.002	Pass	4.130	44.934	100.00	0.000	Pass
4	4.180	44.795	4.180	44.794	100.00	0.002	Pass	4.130	44.792	98.80	0.004	Pass	4.130	44.792	100.00	0.000	Pass	4.130	44.792	100.00	0.000	Pass
5	4.180	44.945	4.180	44.944	100.00	0.002	Pass	4.129	44.942	98.78	0.004	Pass	4.129	44.942	100.00	0.000	Pass	4.129	44.942	100.00	0.000	Pass
6	4.180	44.816	4.180	44.815	100.00	0.002	Pass	4.131	44.813	98.83	0.004	Pass	4.131	44.813	100.00	0.000	Pass	4.130	44.812	99.98	0.002	Pass
7	4.180	44.993	4.180	44.992	100.00	0.002	Pass	4.130	44.992	98.80	0.000	Pass	4.130	44.992	100.00	0.000	Pass	4.130	44.990	100.00	0.004	Pass
8	4.180	44.926	4.180	44.925	100.00	0.002	Pass	4.131	44.924	98.83	0.002	Pass	4.131	44.924	100.00	0.000	Pass	4.131	44.923	100.00	0.002	Pass
9	4.180	44.929	4.180	44.928	100.00	0.002	Pass	4.130	44.927	98.80	0.002	Pass	4.130	44.926	100.00	0.002	Pass	4.130	44.926	100.00	0.000	Pass
10	4.180	44.869	4.180	44.868	100.00	0.002	Pass	4.131	44.867	98.83	0.002	Pass	4.130	44.867	99.98	0.000	Pass	4.130	44.867	100.00	0.000	Pass
Ave.	4.180	44.896	4.180	44.895	100.00	0.002		4.130	44.893	98.80	0.003		4.130	44.893	100.00	0.001		4.130	44.892	100.00	0.001	

Requirement

Measuring mass before/after each test (If $M > 75g$, less than 0.1%, $1g \leq M \leq 75$, less than 0.2%, $M < 1g$, less than 0.5%)
 Measuring voltage before/after each test (more than 90%, only charged samples)
 No leakage, no venting, no disassembly, no rupture, no fire

3-2. T5/T6/T8 Test Result

EXT.Short Circuit (T5)			
NO.	Initial OCV(V)	Max. Temp (°C)	Result
A. 1st cycle fully charged state			
1	4.129	88.39	Pass
2	4.129	95.36	Pass
3	4.130	79.10	Pass
4	4.130	87.97	Pass
5	4.129	86.86	Pass
6	4.130	96.57	Pass
7	4.130	92.04	Pass
8	4.131	89.95	Pass
9	4.130	95.19	Pass
10	4.130	93.19	Pass
MAX.	4.131	96.57	

Test Condition
100m ext. short circuit at 55±2°C

Requirement
Temperature < 170 (°C) No disassembly, no rupture, no fire within 6 hours after the test

Impact (T6)				
Direction	NO.	Initial OCV(V)	Max. Temp (°C)	Result
A. 1st cycle 50% charged state				
Flat	11	3.643	23.29	Pass
	12	3.646	23.24	Pass
	13	3.643	32.05	Pass
	14	3.645	35.23	Pass
	15	3.642	23.89	Pass
MAX.		3.646	35.23	

Test Condition
Φ=15.8mm bar, 9.1kg mass, 61±2.5cm height

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
A. 1st cycle fully discharged state			
16	2.848	87.99	Pass
17	2.847	86.58	Pass
18	2.866	92.50	Pass
19	2.853	91.33	Pass
20	2.848	87.78	Pass
21	2.851	90.97	Pass
22	2.839	91.64	Pass
23	2.826	84.84	Pass
24	2.832	87.53	Pass
25	2.880	94.42	Pass
MAX.	2.880	94.42	

B. 50th cycle fully discharged state			
26	3.120	119.24	Pass
27	3.120	114.17	Pass
28	3.124	118.38	Pass
29	3.121	113.94	Pass
30	3.120	107.10	Pass
31	3.122	112.09	Pass
32	3.123	118.47	Pass
33	3.121	111.64	Pass
34	3.123	116.38	Pass
35	3.123	108.95	Pass
MAX.	3.124	119.24	

Test Condition
Discharge at max. discharge current (with 12V DC power supply) : 20000mA Duration time: rated capacity (9min)

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