

Lithium Battery UN38.3

Test Report

1: SAMPLE DESCRIPTION

Sample Name : Rechargeable Lithium-ion Battery
Brand Name : BASSO / TJEP
Model Name : PBP2A66D1 (TJEP#100290)
Nominal Voltage : 7.2V
Rated Capacity : 2.5Ah / 18Wh

2: STANDARD

RECOMMENDATIONS ON TRANSPORT OF DANGEROUS GOODS, MANUAL OF TEST AND CRITERIA, SECTON 38.3 LITHIUM BATTERIES (ST/SG/AC.10/11/Rev 6 38.3)

3: TEST ITEM

- | | |
|---------------------------|---------------------------------|
| 1. Altitude simulation | 2. Thermal test |
| 3. Vibration | 4. Shock |
| 5. External short circuit | 6. Impact (Cell only) |
| 7. Overcharge | 8. Forced discharge (Cell only) |

4: CONCLUSION

ITEM	SAMPLE NUMBER	STANDARD	CONCLUSION
Altitude simulation	1~8	UN38.3-T1	Pass
Thermal test		UN38.3-T2	Pass
Vibration		UN38.3-T3	Pass
Shock		UN38.3-T4	Pass
External short circuit		UN38.3-T5	Pass
Impact	-----	UN38.3-T6	ND
Overcharge	1~8	UN38.3-T7	Pass
Forced discharge	-----	UN38.3-T8	ND

The submitted samples were complied with the stated requirements of ST/SG/AC.10/11/Rev 6 38.3.

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5: PHOTO OF THE SAMPLE

PBP2A66D1



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6: TEST METHOD

Each cell and battery type must be subjected to test 1 to 8. Test 1 to 5 must be conducted in sequence on the same cell or battery. Test 6 and 8 should be conducted using not otherwise tested cells or batteries. Test 7 may be conducted using undamaged batteries previously used in Test 1 to 5 for purposes of testing on cycled batteries.

In order to quantify the mass loss, the following procedure is provided:

$$\text{Mass loss(\%)} = (M1-M2) / M1 \times 100$$

Where M1 is the mass before the test and M2 is the mass after the test. When mass loss does not exceed the value in table blow, it shall be considered as “no mass loss”.

Mass <i>M</i> of cell or battery	Mass loss limit
$M < 1 \text{ g}$	0.5%
$1 \text{ g} \leq M \leq 75 \text{ g}$	0.2%
$M > 75 \text{ g}$	0.1%

In test 1 to 4, cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

1. Altitude simulation

Test batteries or cells shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20±5°C).

2. Thermal test

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72±2°C, followed by storage for at least six hours at a test temperature equal to - 40±2°C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all cells and batteries are to be stored for 24 hours at ambient temperature (20±5°C). For large cell and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

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3. Vibration

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 g is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g occurs (approximately 50 Hz). A peak acceleration of 8 g is then maintained until the frequency is increased to 200 Hz.

4. Shock

Test cells and batteries shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations. Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g _n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass^*}\right)}$ whichever is smaller	6 ms
Large batteries	50 g _n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{30000}{mass^*}\right)}$ whichever is smaller	11 ms

* Mass is expressed in kilograms.

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5. External short circuit

The cell and battery to be tested shall be temperature stabilized so that its external case temperature reaches $57\pm4^{\circ}\text{C}$ and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at $57\pm4^{\circ}\text{C}$. This short circuit condition is continued for at least one hours after the cell or battery external case has temperature returned to $57\pm4^{\circ}\text{C}$. The cell or battery must be observed for a further six hours for the test to be conclude. Cells and batteries meet this requirement if their temperature does not exceed 170°C and there is no disassembly, no rupture and no fire within six hours of this test.

6. Impact

The test sample cell or component cell is to be placed on a flat surface. A 15.8 mm diameter bar is to be placed across the center of the sample. A 9.1 kg mass is to be dropped from a height of 61 ± 2.5 cm onto the sample. A cylindrical or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm diameter curved surface lying across the center of the test sample. A prismatic cell is also to be rotated 90 degrees around its longitudinal axis so that both the wide and narrow side will be subjected to the impact. Each sample is to be subjected to only a single impact; Separate samples are to be used for each impact. Cells and component cells meet this requirement if their external temperature does not exceed 170°C and there is no disassembly and no fire within six hours of this test.

7. Overcharge

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

- (a) When the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge of the battery or 22V.
- (b) When the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature; the duration of the test shall be 24 hours.

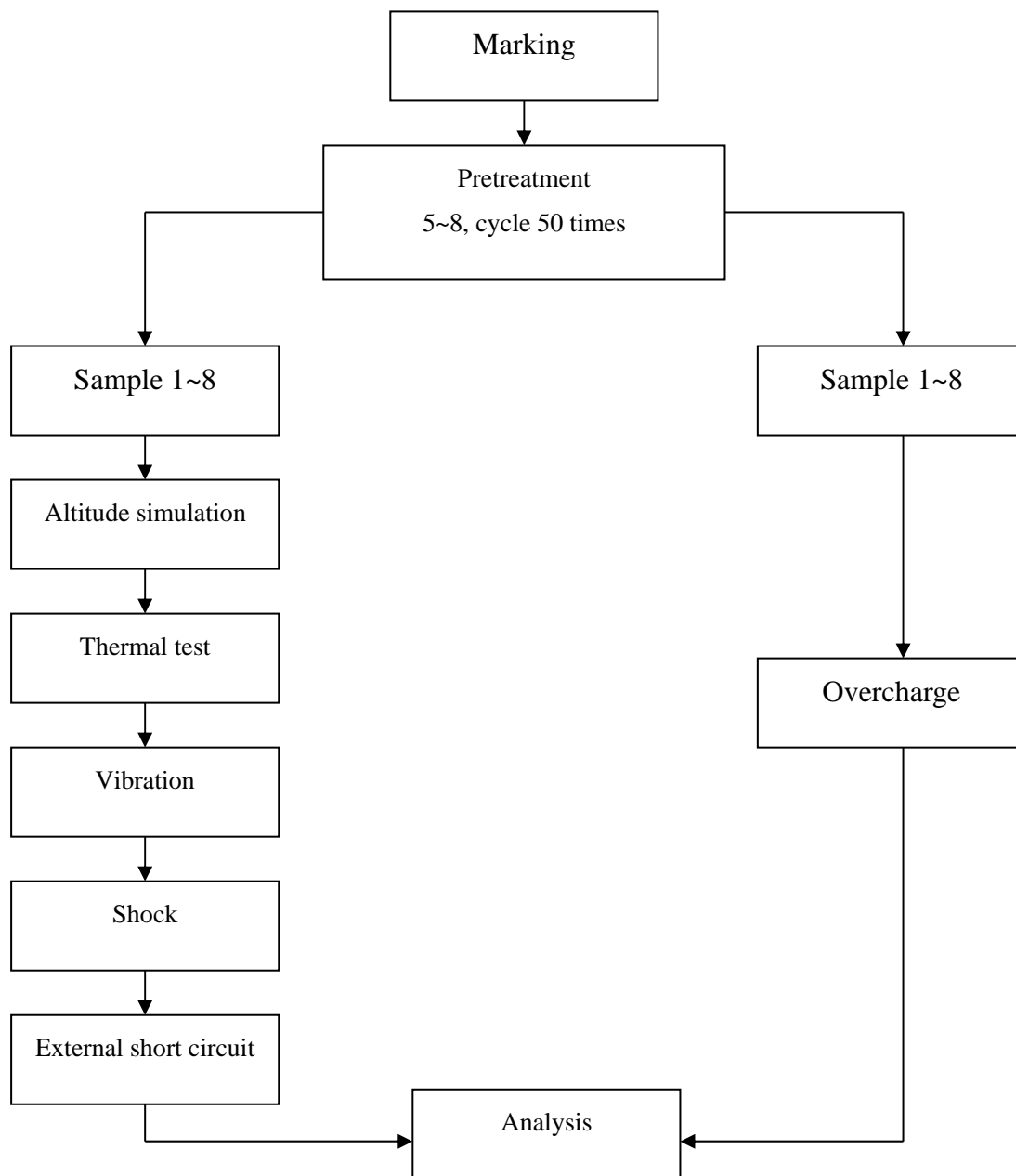
Rechargeable batteries meet this requirement if there is no disassembly and no fire within seven days of the test.

8. Forced discharge

Each cell shall be forced discharged at ambient temperature by connecting its in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer. The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in Ampere).

Primary or rechargeable cells meet this requirement if there is no disassembly and fire within seven days of the test.

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7: TEST PROCEDUR

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8: DATA**Result of T1-T5(Fresh/50cycle)**

No.	Before		After T1,T2,T3 and T4				After T5		
	Weight (Kg)	OCV (V)	Mass Loss(%)	Date OCV(%)	Visual (Type)	Result (PASS/FAIL)	Max Temp. (°C)	Visual (Type)	Result (PASS/FAIL)
Fresh (fully charged)									
1	191.91	8.344	0.05	97.90	OK	PASS	57.3	OK	PASS
2	191.93	8.344	0.05	97.91	OK	PASS	57.6	OK	PASS
3	192.36	8.344	0.05	97.87	OK	PASS	57.5	OK	PASS
4	191.84	8.345	0.05	97.78	OK	PASS	57.6	OK	PASS

50cycled (fully charged)									
5	192.12	8.342	0.03	98.04	OK	PASS	57.4	OK	PASS
6	192.18	8.342	0.03	98.07	OK	PASS	57.5	OK	PASS
7	192.07	8.344	0.03	98.05	OK	PASS	57.6	OK	PASS
8	192.34	8.345	0.03	98.01	OK	PASS	57.6	OK	PASS

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Result of T7

No.	Before	After T7		
	OCV (V)	Max Temp(°C)	Visual (Type)	Result (PASS/FAIL)
Fresh (fully charged)				
1	8.344	22.1	OK	PASS
2	8.345	22.5	OK	PASS
3	8.343	22.5	OK	PASS
4	8.344	22.4	OK	PASS




50cycled (fully charged)				
5	8.342	22.3	OK	PASS
6	8.342	22.3	OK	PASS
7	8.344	22.5	OK	PASS
8	8.341	22.4	OK	PASS

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9: TEST PHOTO

		
Altitude Simulation test – T1	Thermal test – T2	Thermal test – T2
		
Vibration test – T3 – AXIS X	Vibration test – T3 – AXIS Y	Vibration test – T3 – AXIS Z
		
Shock test – T4 – AXIS +X	Shock test – T4 – AXIS -X	Shock test – T4 – AXIS +Y
		
Shock test – T4 – AXIS -Y	Shock test – T4 – AXIS +Z	Shock test – T4 – AXIS -Z

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External Short – T5	Overcharge test– T7	Overcharge test – T7

*** End of report ***