Panasonic

E1724292 Feb.15.2017

Certificate of UN test for Lithium ion battery

H. Kuroda

H.Kuroda General Manager
Technology Planning Department
Rechargeable Battery Business Division
SANYO Electric Co., Ltd.

Customer Model : 45N1056
Global Code : BJ-A360011AA
Product Name : 3NCR18650-2-B00RA

We declare that this battery passed UN test.

Manual of Tests and Criteria (38.3 Lithium batteries)		Test results	Note	Number of test batteries/cells	
No.	Test item				
T 1	Altitude simulation	Pass		First cycle fully charged 4 batteries	After 50 cycles fully charged 4 batteries
T 2	Thermal test	Pass			
T 3	Vibration	Pass			
T 4	Shock	Pass			
T 5	External short circuit	Pass			
T 6	Crush	Pass		First cycle 50% charged 5 cells	
T 7	Overcharge	Pass		First cycle,Fully charged 4 batteries	After 50 cycles,Fully charged 4 batteries
T 8	Forced discharge	Pass		First cycle,fully discharged 10 cells	After 50 cycles,fully discharged 10 cells

*The test data may contain additional test result other than above table.

Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating	63 Wh	
Nominal voltage	10.8 V	
Lithium equivalent content	5.22 g	

Above test procedures are compliant to the following manual.
(Manual of Tests and Criteria ST/AC.10/11, PartIII, sub-section 38.3, Rev.5A1 for cell, Rev.5A1 for battery)

Panasonic

E1724292 Feb.15.2017

Certificate of Package Drop Test for Lithium ion battery

H. Kuroda

H.Kuroda General Manager
Technology Planning Department
Rechargeable Battery Business Division
SANYO Electric Co., Ltd.

Customer Model : 45N1056
Global Code : BJ-A360011AA
Product Name : 3NCR18650-2-B00RA

We declare that this battery passed UN test.

Test item	Test results	Note
Package Drop Test	Pass	The package shall be dropped from 1.2m high on to a concrete surface (flat and horizontal) with five orientations (drop once a sample) ; (1)flat on the bottom, (2)flat on the top, (3)flat on the long side, (4)flat on the short side, (5)on the corner

Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating	63 Wh	
Nominal voltage	10.8 V	
Lithium equivalent content	5.22 g	

Above test procedures are compliant to the following regulation.
(Model Regulations ST/SG/AC.10/1/Rev.18, Special Provion188)

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: Altitude simulation (T1)

2.Test Purpose: This test simulates air transport under low-pressure conditions.

3.Test Procedure:

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

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2011/4/13

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention(%)(=>90%	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	310.070	310.100	0.01	12.47	12.45	99.8	0	PASS	PASS
	2	310.180	310.200	0.01	12.48	12.47	99.9	0	PASS	
	3	309.880	309.910	0.01	12.45	12.43	99.8	0	PASS	
	4	309.760	309.790	0.01	12.48	12.46	99.8	0	PASS	
After 50 cycles ending in fully charged states	5	310.240	310.290	0.02	12.46	12.44	99.8	0	PASS	
	6	310.100	310.130	0.01	12.46	12.44	99.8	0	PASS	
	7	310.060	310.090	0.01	12.47	12.45	99.8	0	PASS	
	8	310.170	310.200	0.01	12.47	12.45	99.8	0	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: Thermal Test (T2)

2.Test Purpose: This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

3.Test Procedure:

Test cells and batteries are to be stored for at least six hours at a test temperature equal to 75±2℃, followed by storage for at least six hours at a test temperature equal to -40±2℃.The maximum time internal between test temperature extremes is 30 minutes.This procedure is to be repeated 10 times, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ±5℃). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2011/5/4

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention(%)(=>90%	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	310.100	310.110	0.00	12.45	12.35	99.2	0	PASS	PASS
	2	310.200	310.220	0.01	12.47	12.36	99.1	0	PASS	
	3	309.910	309.910	0.00	12.43	12.34	99.3	0	PASS	
	4	309.790	309.760	0.01	12.46	12.36	99.2	0	PASS	
After 50 cycles ending in fully charged states	5	310.290	310.270	0.01	12.44	12.35	99.3	0	PASS	
	6	310.130	310.080	0.02	12.44	12.35	99.3	0	PASS	
	7	310.090	310.070	0.01	12.45	12.36	99.3	0	PASS	
	8	310.200	310.210	0.00	12.45	12.36	99.3	0	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: Vibration (T3)

2.Test Purpose: This test simulates vibration during transport.

3.Test Procedure:

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 1gn is maintained until 18 Hz is reached.

The amplitude is then maintained at 0.8 mm(1.6 mm total excursion) and thefrequency increased until a peak acceleration of 8gn occurs (approximately 50Hz).A peak acceleration of 8 gn is then maintained until the frequency is increased to 200Hz.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2011/5/5

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention(%)(=>90%	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	310.110	310.160	0.02	12.35	12.35	100.0	0	PASS	PASS
	2	310.220	310.270	0.02	12.36	12.36	100.0	0	PASS	
	3	309.910	309.930	0.01	12.34	12.34	100.0	0	PASS	
	4	309.760	309.810	0.02	12.36	12.36	100.0	0	PASS	
After 50 cycles ending in fully charged states	5	310.270	310.310	0.01	12.35	12.34	99.9	0	PASS	
	6	310.080	310.060	0.01	12.35	12.35	100.0	0	PASS	
	7	310.070	310.120	0.02	12.36	12.36	100.0	0	PASS	
	8	310.210	310.270	0.02	12.36	12.36	100.0	0	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: Shock (T4)

2.Test Purpose: This test simulates possible impacts during transport.

3.Test Procedure:

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 pack acceleration of 150 g_n and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

However, large cells and large batteries shall be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds. Each cell or battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

SANYO Internal Procedure:

As above.

4.Test Requirements:

No mass loss(less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

The requirement relating to voltage is not applicable to test batteries at fully discharged states.

5.Test Date: 2011/5/5

6.Test Data

Battery No.		Mass(g)		Mass loss (%) (=<0.1%)	Voltage(V)		Voltage Retention(%)(=>90%)	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	310.160	310.150	0.00	12.35	12.35	100.0	0	PASS	PASS
	2	310.270	310.230	0.01	12.36	12.35	99.9	0	PASS	
	3	309.930	309.960	0.01	12.34	12.34	100.0	0	PASS	
	4	309.810	309.880	0.02	12.36	12.35	99.9	0	PASS	
After 50 cycles ending in fully charged states	5	310.310	310.320	0.00	12.34	12.34	100.0	0	PASS	
	6	310.060	310.080	0.01	12.35	12.34	99.9	0	PASS	
	7	310.120	310.170	0.02	12.36	12.35	99.9	0	PASS	
	8	310.270	310.220	0.02	12.36	12.36	100.0	0	PASS	

Notes: L-Leakage, V-Venting, D-Disassembly, R-Rupture, F-Fire,
0-No leakage, no venting, no disassembly, no rupture & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: External short circuit (T5)

2.Test Purpose: This test simulates an external short circuit.

3.Test Procedure:

The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 55±2℃ and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1ohm at 55±2℃.This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55±2℃. The cell or battery must be observed for a further six hours for the test to be concluded.

SANYO Internal Procedure:

As above.

4.Test Requirements:

External temperature of test batteries does not exceed 170℃ and there is no disassembly,no rupture and no fire within six hours of this test.

5.Test Date: 2011/5/6

6.Test Data

Battery No.		Maximum temperature (°C)	Other event	Result	Judgement
At first cycle,in fully charged states	1	54.7	0	PASS	PASS
	2	54.3	0	PASS	
	3	54.6	0	PASS	
	4	54.3	0	PASS	
After 50 cycles ending in fully charged states	5	54.8	0	PASS	
	6	54.3	0	PASS	
	7	54.6	0	PASS	
	8	54.4	0	PASS	

Notes: D-Disassembly, R-Rupture, F-Fire, 0-No disassembly, no rupture & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item:Crush (T6)

Applicable to prismatic, pouch, coin/button cells and cylindrical cells not more than 20 mm in diameter

2.Test Purpose: These tests simulate mechanical abuse from a crush that may result in an internal short circuit.

3.Test Procedure:

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

(a) The applied force reaches 13 kN ± 0.78 kN;

(b) The voltage of the cell drops by at least 100 mV; or

(c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

4.Test Requirements:

External temperature of test cells and component cell does not exceed 170°C and there is no disassembly,no rupture and no fire during the test and within six hours after the test.

5.Test Date: 2013/10/31

6.Test Data:

Cell No.		Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, 50% charged states	1	20.6	0	PASS	PASS
	2	21.2	0	PASS	
	3	21.1	0	PASS	
	4	21.2	0	PASS	
	5	21.2	0	PASS	

Notes: D-Disassembly, F-Fire, 0-No disassembly & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item: Overcharge (T7)

2.Test Purpose: This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

3.Test Procedure:

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 voltage 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.

SANYO Internal Procedure:

Min.Charge Voltage:	22 V
Charge Current:	7.14 A

4.Test Requirements:

There is no disassembly and no fire within seven days of the test.

5.Test Date: 2011/4/22

6.Test Data

Battery No.		Event	Result	Judgement
At first cycle in fully charged states	1	0	PASS	PASS
	2	0	PASS	
	3	0	PASS	
	4	0	PASS	
After 50 cycles ending in fully charged states	5	0	PASS	
	6	0	PASS	
	7	0	PASS	
	8	0	PASS	

Notes: D-Disassembly, F-Fire, 0-No disassembly & no fire

UN Test Data (Model: 3NCR18650-2-B00RA)

1.Test Item:Forced discharge (T8)

2.Test Purpose:

This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.

3.Test Procedure:

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V 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).

4.Test Requirements:

No disassembly and no fire during the test and within seven days after the test.

5.Test Date: 2011/06/20- 2011/06/27

6.Test Data

Cell No.		Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, in fully discharged states	1	75.1	0	PASS	PASS
	2	75.1	0	PASS	
	3	74.4	0	PASS	
	4	72.3	0	PASS	
	5	71.8	0	PASS	
	6	70.3	0	PASS	
	7	71.0	0	PASS	
	8	72.9	0	PASS	
	9	70.9	0	PASS	
	10	72.6	0	PASS	
After 50 cycles ending, in fully discharged states	11	87.5	0	PASS	
	12	90.4	0	PASS	
	13	85.6	0	PASS	
	14	86.9	0	PASS	
	15	87.8	0	PASS	
	16	85.1	0	PASS	
	17	85.8	0	PASS	
	18	87.4	0	PASS	
	19	87.8	0	PASS	
	20	90.1	0	PASS	

Notes: D-Disassembly, R-Rupture, F-Fire, 0-No disassembly, no rupture & no fire