

## Test summary of UN test for Lithium ion battery

Customer Model : KNB-45L  
 Global Code : BJ-C120010AB  
 Product Name : 2UF103450P-B003A  
 Manufacturer : SANYO Electric Co., Ltd. 222-1 Kaminaizen, Sumoto City, Hyogo 656-8555, Japan  
 Tel +81-799-23-3931, email prb-bp-ta@ml.jp.panasonic.com  
 https://industrial.panasonic.com/ww/products/batteries/  
 Test Laboratory : Same as the manufacturer

  
 H. Kuroda Senior Manager  
 Product Development Promotion Department  
 System Development Division  
 SANYO Electric Co., Ltd.

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 25 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 25 cycles, fully charged 4 batteries
T 8	Forced discharge	Pass		First cycle, fully discharged 10 cells	After 50 cycles, fully discharged 10 cells

\*1 The test data may contain additional test result other than above table.

### Lithium ion battery Specification

Item	Value/Description	Note
Watt-hour rating / Rated capacity	14 Wh / 1.88 Ah	
Nominal voltage	7.4 V	
Weight	max.120 g	
Physical description	Battery with outer case	
Lithium equivalent content	1.13 g	

Above test procedures are compliant to the following manual.

(Manual of Tests and Criteria ST/SG/AC.10/11, PartIII, sub-section 38.3, Rev.5A1 for cell, Rev.6A1 for battery)

Judgment for necessity of test items is carried out based on the latest rules, and it is not linked with the version actually tested.

## Certificate of Package Drop Test for Lithium ion battery

Customer Model : KNB-45L  
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 H. Kuroda Senior Manager  
 Product Development Promotion Department  
 System Development Division  
 SANYO Electric Co., Ltd.

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 long side, (3)flat on the short side, (4)on the edge, (5)on the corner

### Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating / Rated capacity	14 Wh / 1.88 Ah	
Nominal voltage	7.4 V	
Lithium equivalent content	1.13 g	

Above test procedures are compliant to the following regulation.  
 (Model Regulations ST/SG/AC.10/1/Rev.21, Special Provision188)

# UN Test Data (Model:2UF103450P-B003A)

**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°C).

**SANYO Internal Procedure:**

As above.

**4.Test Requirements:**

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

**5.Test Date:** 2020/06/16

**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	109.34	109.34	0.00	8.37	8.37	100.0	0	PASS	PASS
	2	109.18	109.19	0.01	8.37	8.37	100.0	0	PASS	
	3	108.71	108.69	0.02	8.37	8.37	100.0	0	PASS	
	4	108.56	108.58	0.02	8.37	8.37	100.0	0	PASS	
After 25 cycles ending in fully charged states	5	109.10	109.10	0.00	8.38	8.38	100.0	0	PASS	
	6	108.91	108.91	0.00	8.38	8.38	100.0	0	PASS	
	7	108.81	108.80	0.01	8.38	8.38	100.0	0	PASS	
	8	108.84	108.84	0.00	8.38	8.38	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:2UF103450P-B003A)

**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  $72\pm 2^{\circ}\text{C}$ , followed by storage for at least six hours at a test temperature equal to  $-40\pm 2^{\circ}\text{C}$ .The maximum time interval 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 ( $20\pm 5^{\circ}\text{C}$ ). 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,no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

**5.Test Date:** 2020/06/23-2020/06/29

**6.Test Data**

Battery No.	Mass(g)		Mass loss (%) (= $<0.1\%$ )	Voltage(V)		Voltage Retention(% )( $\geq 90\%$ )	Other event	Result	Judgement	
	Before test	After test		Before test	After test					
At first cycle,in fully charged states	1	109.35	109.26	0.08	8.36	8.29	99.2	0	PASS	PASS
	2	109.20	109.11	0.08	8.37	8.29	99.0	0	PASS	
	3	108.71	108.61	0.09	8.36	8.29	99.2	0	PASS	
	4	108.58	108.49	0.08	8.37	8.29	99.0	0	PASS	
After 25 cycles ending in fully charged states	5	109.12	109.06	0.05	8.37	8.29	99.0	0	PASS	
	6	108.91	108.83	0.07	8.37	8.30	99.2	0	PASS	
	7	108.82	108.78	0.04	8.37	8.29	99.0	0	PASS	
	8	108.84	108.74	0.09	8.37	8.29	99.0	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:2UF103450P-B003A)

**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 the frequency 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. For large batteries, the peak acceleration of 2 gn is maintained.

**SANYO Internal Procedure:**

As above.

**4.Test Requirements:**

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

**5.Test Date:** 2020/06/29-2020/06/30

**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	109.26	109.30	0.04	8.29	8.29	100.0	0	PASS	PASS
	2	109.11	109.09	0.02	8.29	8.29	100.0	0	PASS	
	3	108.61	108.63	0.02	8.29	8.29	100.0	0	PASS	
	4	108.49	108.50	0.01	8.29	8.29	100.0	0	PASS	
After 25 cycles ending in fully charged states	5	109.06	109.04	0.02	8.29	8.29	100.0	0	PASS	
	6	108.83	108.86	0.03	8.30	8.30	100.0	0	PASS	
	7	108.78	108.75	0.03	8.29	8.29	100.0	0	PASS	
	8	108.74	108.72	0.02	8.29	8.29	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:2UF103450P-B003A)

**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 shall be subjected to a half-sine shock of peak acceleration of 150 gn and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 gn and pulse duration of 11 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 and 11 milliseconds for large batteries.

The formulas below are provided to calculate the appropriate minimum peak accelerations.

Battery	Minimum peak acceleration (gn)
Small batteries	150gn or result of formula : $\sqrt{(100850/mass^*)}$ whichever is smaller
Large batteries	150gn or result of formula : $\sqrt{(30000/mass^*)}$ whichever is smaller

\*Mass is expressed in kilograms.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

**SANYO Internal Procedure:**

As above.

**4.Test Requirements:**

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

**5.Test Date:** 2020/07/01

**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	109.30	109.28	0.02	8.29	8.29	100.0	0	PASS	PASS
	2	109.09	109.10	0.01	8.29	8.29	100.0	0	PASS	
	3	108.63	108.62	0.01	8.29	8.29	100.0	0	PASS	
	4	108.50	108.55	0.05	8.29	8.29	100.0	0	PASS	
After 25 cycles ending in fully charged states	5	109.04	109.05	0.01	8.29	8.29	100.0	0	PASS	
	6	108.86	108.85	0.01	8.30	8.30	100.0	0	PASS	
	7	108.75	108.78	0.03	8.29	8.29	100.0	0	PASS	
	8	108.72	108.74	0.02	8.29	8.29	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:2UF103450P-B003A)

**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 heated for a period of time necessary to reach a homogeneous stabilized temperature of  $57\pm4$  °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at  $57\pm4$ °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to  $57 \pm 4$  °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

The short circuit and cooling down phases shall be conducted at least at ambient temperature.

**SANYO Internal Procedure:**

As above.

**4.Test Requirements:**

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

**5.Test Date:** 2020/07/02-2020/07/06

**6.Test Data**

Battery No.		Maximum temperature (°C)	Other event	Result	Judgement
At first cycle, in fully charged states	1	57.1	0	PASS	PASS
	2	56.9	0	PASS	
	3	47.2	0	PASS	
	4	57.0	0	PASS	
After 25 cycles ending in fully charged states	5	57.3	0	PASS	
	6	57.2	0	PASS	
	7	56.8	0	PASS	
	8	56.9	0	PASS	

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

# UN Test Data (Model:2UF103450P-B003A)

## 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  $\pm$  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: 2013/11/18**

## 6. Test Data:

Cell No.	Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, 50% charged states	1	20.2	0	PASS
	2	20.1	0	PASS
	3	20.3	0	PASS
	4	20.0	0	PASS
	5	20.1	0	PASS
				PASS

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



# UN Test Data (Model:2UF103450P-B003A)

**1.Test Item:**Overcharged (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:	16.8 V
Charge Current:	3.60 A

**4.Test Requirements:**

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

**5.Test Date:** 2020/06/16-2020/6/30

**6.Test Data**

Battery No.	Event	Result	Judgement
At first cycle in fully charged states	1	0	PASS
	2	0	PASS
	3	0	PASS
	4	0	PASS
After 25 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:2UF103450P-B003A)

**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:** 2011/09/28 - 2011/10/05

**6.Test Data**

Cell No.	Maximum Temperature(°C)	Other event	Result	Judgement	
At first cycle, in fully discharged states	1	78.7	0	PASS	PASS
	2	86.2	0	PASS	
	3	84.0	0	PASS	
	4	87.7	0	PASS	
	5	76.4	0	PASS	
	6	75.4	0	PASS	
	7	79.3	0	PASS	
	8	76.6	0	PASS	
	9	82.0	0	PASS	
	10	85.2	0	PASS	
After 50 cycles ending, in fully discharged states	11	106.2	0	PASS	
	12	109.5	0	PASS	
	13	106.1	0	PASS	
	14	103.2	0	PASS	
	15	102.0	0	PASS	
	16	108.9	0	PASS	
	17	103.1	0	PASS	
	18	105.1	0	PASS	
	19	103.1	0	PASS	
	20	101.7	0	PASS	

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

# UN Test Data ( Model: 2UF103450P-B003A )

**1.Test Item:** Drop Test

**2.Test Purpose:** This test simulates the drop of the packaging during transport.

**3.Test Procedure:**

Number of Test Samples (Per design type, Manufacturer ) and Drop Orientation For other than flat drops the centre of gravity must be vertically over the point of impact. Where more than one orientation is possible for a given drops, the orientation most likely to result in failure of the packaging must be used.

Packaging	Number of test samples	Drop orientation
Boxes of natural wood Plywood boxes Reconstituted wood boxes Fibreboard boxes Plastic boxes Steel or aluminum boxes Composite Packagings which are in the shape of a box.	Five (one for each drop)	First drop: flat on the bottom Second drop: flat on the long side Third drop: flat on the short side Fourth drop: on a long edge Fifth drop: on a corner

**SANYO Internal Procedure:**

Packaging: Fiberboard boxes. Number of test samples: Five(one for each drop). It may do the drop of five orientations with one sample if the packing does not have the big damage.

Drop orientation: As above.

**4.Test Requirements:**

A Package passes the test if it meets the following criteria:

Each package is capable of withstanding a 1.2 meter drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents.

**5.Test Date:** 2017/01/21

**6.Test Results:** PASS(Drop height 1.2m)

Packaging size:
207 * 354 * 151 mm
Packaging weight(Before) :
7.37 kg
Packaging weight(After) :
7.37 kg
Quantity in a packaging:
60 qty
Mass of each cell or battery in a package:*
113 g

\* Remark: It maybe difference to the original type's mass in test data page in condition of extension type. Based on UN38.3 reuquirement, extension type can use original type's UN testing data because it was not considered as a new type.