

UN Test Report

Name of Sample	Lithium Ion Battery UF553450Z-H031A
Consignor	SANYO Electric Co., Ltd.
Manufacturer	SANYO Electric Co., Ltd.
Test Method	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Criterion	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Appearance	Silver Rectangular Parallelepiped Cell
Test Date	T1:2010/11/25 - 2010/11/25 T2:2010/11/25 - 2010/12/01 T3:2010/12/03 - 2010/12/03 T4:2010/12/06 - 2010/12/06 T5:2010/12/22 - 2010/12/23 T6:2013/11/18 - 2013/11/18 T8:2010/12/15 - 2010/12/23
Test Items	Altitude simulation, Thermal test, Vibration test, Shock test, External short circuit, Overcharged
Conclusion	The sample has passed the items of UN38.3.
Remark	Certification by Original Cell Model
Consignor Address	222-1, Kaminaizen, Sumoto, Hyogo, Japan

Battery Pack Engineering Department
Energy Solutions Business Division
SANYO Electric Co., Ltd.

N. Kuroda
Approval

M. Saito
Check

T. Takada
Writing

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Test summary of UN test for Lithium ion cell

Customer Model : UF553450ZP
 Global Code : BJ-GA00128AA
 Product Name : UF553450Z-H031A
 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

M. Takahashi General Manager
 Energy Solutions Business Division
 SANYO Electric Co., Ltd.



We declare that this cell passed UN test.

Manual of Tests and Criteria (38.3 Lithium batteries)		Test results	Note	Number of test cells	
No.	Test item				
T 1	Altitude simulation	Pass		First cycle fully charged 10 cells	
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	-	For battery only	For battery only	
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 cell Specification

Item	Value/Description	Note
Watt-hour rating	4.3 Wh	
Nominal voltage	3.7 V	
Weight	max.22.6 g	
Physical description	Prismatic cell	
Lithium equivalent content	0.35 g	

Above test procedures are compliant to the following manual.

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

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 Cell

Customer Model : UF553450ZP
Global Code : BJ-GA00128AA
Product Name : UF553450Z-H031A

H.Kuroda Senior Manager
Battery Pack Engineering Department
Energy Solutions Business Division
SANYO Electric Co., Ltd.



We declare that this cell 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) ;

Lithium ion cell Specification

Item	Nominal value	Note
Watt-hour rating	4.3 Wh	
Nominal voltage	3.7 V	
Lithium equivalent content	0.35 g	

Above test procedures are compliant to the following regulation.
(Model Regulations ST/SG/AC.10/1/Rev.20, Special Provision188)

UN Test Data (Model:UF553450Z-H031A)

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 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

4.Test Requirements:
No mass(M) loss(1g≤M≤75g : less than 0.2% , M>75g : less than 0.1%),no leakage,no venting,no disassembly,no rupt and no fire,and the voltage retention is not less than 90%.

5.Test Date: 2010/11/25

6.Test Data

Cell No.	Mass(g)		Mass loss (%)	Voltage(V)		Voltage retention (%)	Other event	Result	Judgement
	Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	21.117	21.116	0.00	4.187	4.181	99.9	0	PASS
	2	21.126	21.126	0.00	4.188	4.183	99.9	0	PASS
	3	21.156	21.156	0.00	4.188	4.183	99.9	0	PASS
	4	21.113	21.112	0.00	4.187	4.182	99.9	0	PASS
	5	21.139	21.139	0.00	4.187	4.182	99.9	0	PASS
	6	21.156	21.156	0.00	4.186	4.181	99.9	0	PASS
	7	21.111	21.110	0.00	4.187	4.183	99.9	0	PASS
	8	21.120	21.119	0.00	4.186	4.182	99.9	0	PASS
	9	21.145	21.145	0.00	4.187	4.182	99.9	0	PASS
	10	21.123	21.122	0.00	4.187	4.182	99.9	0	PASS

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

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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 $72 \pm 2\text{ }^{\circ}\text{C}$, followed by storage for at least six hours at a test temperature equal to $-40 \pm 2\text{ }^{\circ}\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ($20 \pm 5\text{ }^{\circ}\text{C}$).

For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

4.Test Requirements:

No mass(M) loss($1\text{g} \leq M \leq 75\text{g}$: less than 0.2% , $M > 75\text{g}$: less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

5.Test Date: 2010/11/25 - 2010/12/01

6.Test Data

Cell No.		Mass(g)		Mass loss (%)	Voltage(V)		Voltage retention (%)	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	21.116	21.114	0.01	4.181	4.139	99.0	0	PASS	PASS
	2	21.126	21.124	0.01	4.183	4.140	99.0	0	PASS	
	3	21.156	21.153	0.01	4.183	4.139	98.9	0	PASS	
	4	21.112	21.110	0.01	4.182	4.139	99.0	0	PASS	
	5	21.139	21.138	0.00	4.182	4.139	99.0	0	PASS	
	6	21.156	21.155	0.00	4.181	4.138	99.0	0	PASS	
	7	21.110	21.107	0.01	4.183	4.139	98.9	0	PASS	
	8	21.119	21.117	0.01	4.182	4.140	99.0	0	PASS	
	9	21.145	21.143	0.01	4.182	4.139	99.0	0	PASS	
	10	21.122	21.119	0.01	4.182	4.140	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

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 hour 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 shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 g_n 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 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

4.Test Requirements:

No mass(M) loss(1g≤M≤75g : less than 0.2% , M>75g : less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

5.Test Date: 2010/12/03

6.Test Data

Cell No.		Mass(g)		Mass loss (%)	Voltage(V)		Voltage retention (%)	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	21.114	21.114	0.00	4.139	4.138	100.0	0	PASS	PASS
	2	21.124	21.123	0.00	4.140	4.139	100.0	0	PASS	
	3	21.153	21.153	0.00	4.139	4.139	100.0	0	PASS	
	4	21.110	21.110	0.00	4.139	4.139	100.0	0	PASS	
	5	21.138	21.137	0.00	4.139	4.139	100.0	0	PASS	
	6	21.155	21.154	0.00	4.138	4.138	100.0	0	PASS	
	7	21.107	21.107	0.00	4.139	4.139	100.0	0	PASS	
	8	21.117	21.117	0.00	4.140	4.139	100.0	0	PASS	
	9	21.143	21.142	0.00	4.139	4.139	100.0	0	PASS	
	10	21.119	21.119	0.00	4.140	4.137	99.9	0	PASS	

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

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

4.Test Requirements:

No mass(M) loss(1g≤M≤75g : less than 0.2% , M>75g : less than 0.1%),no leakage,no venting,no disassembly,no rupture and no fire,and the voltage retention is not less than 90%.

5.Test Date: 2010/12/06

6.Test Data

Cell No.		Mass(g)		Mass loss (%)	Voltage(V)		Voltage retention (%)	Other event	Result	Judgement
		Before test	After test		Before test	After test				
At first cycle,in fully charged states	1	21.114	21.114	0.00	4.138	4.138	100.0	0	PASS	PASS
	2	21.123	21.123	0.00	4.139	4.138	100.0	0	PASS	
	3	21.153	21.152	0.00	4.139	4.139	100.0	0	PASS	
	4	21.110	21.110	0.00	4.139	4.139	100.0	0	PASS	
	5	21.137	21.137	0.00	4.139	4.139	100.0	0	PASS	
	6	21.154	21.153	0.00	4.138	4.137	100.0	0	PASS	
	7	21.107	21.107	0.00	4.139	4.139	100.0	0	PASS	
	8	21.117	21.117	0.00	4.139	4.139	100.0	0	PASS	
	9	21.142	21.141	0.00	4.139	4.139	100.0	0	PASS	
	10	21.119	21.119	0.00	4.137	4.136	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:UF553450Z-H031A)

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 °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 55 ± 2 °C. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55 ± 2 °C.

4.Test Requirements:

External temperature of test cells and batteries 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: 2010/12/22 - 2010/12/23

6.Test Data

Cell No.	Maximum temperature (°C)	Other event	Result	Judgement	
At first cycle,in fully charged states	1	112. 6	0	PASS	PASS
	2	109. 3	0	PASS	
	3	111. 0	0	PASS	
	4	110. 1	0	PASS	
	5	113. 0	0	PASS	
	6	111. 8	0	PASS	
	7	114. 6	0	PASS	
	8	111. 3	0	PASS	
	9	112. 1	0	PASS	
	10	113. 9	0	PASS	

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

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UN Test Data (Model:UF553450Z-H031A)

UN評価合格
三洋電機株式会社

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: 2013/11/18

6.Test Data:

Cell No.		Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, 50% charged states	1	20. 3	0	PASS	PASS
	2	20. 2	0	PASS	
	3	20. 0	0	PASS	
	4	20. 3	0	PASS	
	5	20. 2	0	PASS	

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

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

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

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

Cell No.		Maximum Temperature(°C)	Other event	Result	Judgement
At first cycle, in fully discharged states	1	76. 4	0	PASS	PASS
	2	70. 5	0	PASS	
	3	76. 0	0	PASS	
	4	76. 8	0	PASS	
	5	80. 1	0	PASS	
	6	76. 1	0	PASS	
	7	78. 6	0	PASS	
	8	80. 8	0	PASS	
	9	75. 5	0	PASS	
	10	77. 5	0	PASS	
After 50 cycles ending, in fully discharged states	11	80. 5	0	PASS	
	12	83. 1	0	PASS	
	13	83. 3	0	PASS	
	14	78. 4	0	PASS	
	15	77. 8	0	PASS	
	16	80. 3	0	PASS	
	17	81. 4	0	PASS	
	18	82. 0	0	PASS	
	19	84. 9	0	PASS	
	20	84. 7	0	PASS	

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



UN Test Data (Model:UF553450Z-H031A)

- 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
Inner boxes of coat board Sleeve pad A of ABF Sleeve pad C of ABF Printed carton of ABF 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: 2010/10/04
6.Test Results: PASS(Drop height 1.2m)

Packaging size:
221 *277 *215 mm
Packaging weight(Before) :
8.52kg
Packaging weight(After) :
8.52kg
Quantity in a packaging:
400qty
Mass of each cell or battery in a package:*
18.8g

* 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.