



Date:December 20,2011

### Sanyo Test Report

Name of Sample	Lithium Ion Battery 4UPF356790-1-T0835
Consignor	SANYO Energy(Beijing) CO.,LTD
Manufacturer	SANYO Energy(Beijing) CO.,LTD
Test Method	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Criterion	United Nations "Recomenndations on the TRANSPORT OF DANGEROUS GOODS"
Appearance	Black rectangular parallelepiped
Test Date	2011/11/21 - 2011/12/06
Sample Number	24
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 Similar Model: 4UPF356790-1-T0835 Ratio of (4UPF356790-1-T0835)/(4UPF356790-1-T0835) [+]=100%, [-]=100%, [Electrolyte]=100%
Consignor Address	No.86 Sunwu Road, Xukou, Wuzhong District, Suzhou City, Jiangsu Province 215164, China

Sanyo Electric Co., LTD.

Sanyo Energy(Suzou) Co.,Ltd.

Approval

Check

Writing

**CONFIDENTIAL**

B: Checklist for Judging New Type Battery or not

Confirmation of presence of change in “The element which is given influence”

(Change ⇒ ○、No change ⇒ —)

When there is no change in all items, it is NOT considered to be a New Type Battery.

Model which UN regulation test has completed	4UPF356790-1-T0835
Target model which is not a new type	4UPF356790-1-T0835


Test Item (Function)	The element which is given influence	Presence of change
T1:Altitude Simulation (Decompression load)	<ul style="list-style-type: none"> <li>▪Crimped part, Gasket (Cell)</li> <li>▪Gas Release Vent, Cell Case (Cell)</li> <li>▪Pack (Plastic) Case</li> <li>▪Holding Member(Insulator, Insulation Tape, Both Sides Tape)</li> <li>▪Coating materials</li> </ul>	—
T2:Thermal Shock (Repetition of high temp. and low temp.)	<ul style="list-style-type: none"> <li>▪Crimped part, Gasket (Cell)</li> <li>▪Gas Release Vent, Cell Case (Cell)</li> <li>▪Finished state of Wound Electrodes (Cell)</li> <li>▪Pack (Plastic) Case</li> <li>▪Holding Member(Insulator, Insulation Tape, Both Sides Tape)</li> <li>▪Coating materials</li> </ul>	—
T3:Vibration (Vibration load)	<ul style="list-style-type: none"> <li>▪Finished state of Wound Electrodes (Cell)</li> <li>▪Electric wiring member</li> <li>▪Electronic Parts on a circuit board</li> <li>▪Cell Holding Member (Adhesive, Both Sides Tape, Lib of Plastic Case )</li> </ul>	—
T4: Shock(Shock load)	<ul style="list-style-type: none"> <li>▪Wiring Member</li> <li>▪Electronic Parts on a circuit board</li> <li>▪Cell Holding Member(Adhesive, Both Sides Tape, Lib of Plastic Case )</li> <li>▪Finished state of Wound Electrodes (Cell)</li> </ul>	—
T5:External Short Circuit(Short current)	<ul style="list-style-type: none"> <li>▪Over-voltage Protection</li> <li>▪Current Control Device</li> <li>▪Safety Device of cell (Cell)</li> <li>▪Lead Tab</li> </ul>	—
T6(Cell):Impact(Crash load)	<ul style="list-style-type: none"> <li>▪Separator (Cell)</li> <li>▪Insulation State in a cell (Cell)</li> </ul>	—
T7(Pack):Overcharge(Charge load)	<ul style="list-style-type: none"> <li>▪Overcharge Protection</li> <li>▪Thermal Device</li> <li>▪Safety Device of cell (Cell)</li> </ul>	—
Judgment result	New Type or not	New <del>(Not new)</del>

Sanyo Electric Co., LTD.

Sanyo Energy(Suzou) Co.,Ltd.



approval



Check



Writing

## Certificate of UN test for Lithium ion battery

Customer Model : AP12B3F  
 Sanyo Model : 4UPF356790-1-T0835  
 Sanyo Product Code : F12272112

Sanyo Energy(Suzhou)Co., Ltd.



Morina Kenichi Senior Manager

We declare that this battery passed UN test.

Manual of Tests and Criteria (38.3 Lithium batteries)		Test results	Note	Number of test batteries	
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	Impact	Pass		First cycle 50% charged 5 cells for cylindrical cell, 10 cells for prismatic cell,	
T 7	Overcharge	Pass	For battery only	First cycle fully charged 4 batteries	After 50 cycles, fully charged 4 batteries
T 8	Forced discharge	-	For cell only	For cell only.	

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

## Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating / Rated capacity	34 Wh / 2.31 Ah	
Nominal voltage	14.8 V	
Lithium equivalent content	2.77 g	

Above test procedures are compliant to the following manual.

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

## Certificate of Package Drop Test for Lithium ion battery

Customer Model : AP12B3F  
 Sanyo Model : 4UPF356790-1-T0835  
 Sanyo Product Code : F12272112



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 a corner

## Lithium ion battery Specification

Item	Nominal value	Note
Watt-hour rating / Rated capacity	34 Wh / 2.31 Ah	
Nominal voltage	14.8 V	
Lithium equivalent content	2.77 g	

Above test procedures are compliant to the following regulation.  
 (Model Regulations ST/SG/AC.10/1/Rev.16, Special Provision188)

UN Test Data (Model:4UPF356790-1-T0835)

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(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:** 2011/11/21

6. **Test Data**

Battery 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	321.170	321.100	0.02	16.96	16.93	99.8	0	PASS	PASS
	2	303.490	303.360	0.04	16.95	16.94	99.9	0	PASS	
	3	308.910	308.830	0.03	16.94	16.93	99.9	0	PASS	
	4	319.840	319.750	0.03	16.94	16.92	99.9	0	PASS	
After 50 cycles ending in fully charged states	5	316.070	315.960	0.03	16.94	16.93	99.9	0	PASS	
	6	313.100	313.040	0.02	16.95	16.94	99.9	0	PASS	
	7	317.570	317.480	0.03	16.95	16.94	99.9	0	PASS	
	8	318.950	318.780	0.05	16.97	16.89	99.5	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:4UPF356790-1-T0835)

1. Test Item: Thermal Test (T2)

P.4/8

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 °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 test cells and batteries are to be stored for 24 hours at ambient temperature (20 ±5 °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 (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: 2011/11/25-2011/11/30

6. Test Data

Date:	20	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	321.100	321.010	0.03	16.93	16.66	98.4	0	PASS	PASS
	2	303.360	303.390	0.01	16.94	16.65	98.3	0	PASS	
	3	308.830	308.880	0.02	16.93	16.65	98.3	0	PASS	
	4	319.750	319.690	0.02	16.92	16.64	98.3	0	PASS	
After 50 cycles ending in fully charged states	5	315.960	315.710	0.08	16.93	16.66	98.4	0	PASS	
	6	313.040	312.870	0.05	16.94	16.65	98.3	0	PASS	
	7	317.480	317.210	0.09	16.94	16.67	98.4	0	PASS	
	8	318.780	318.580	0.06	16.89	16.67	98.7	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:4UPF356790-1-T0835)



**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 manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithm between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the direction 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.

**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%.

**5.Test Date:** 2011/12/2-2011/12/5

**6.Test Data**

Battery 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	321.010	321.060	0.02	16.66	16.62	99.8	0	PASS	PASS
	2	303.390	303.410	0.01	16.65	16.62	99.8	0	PASS	
	3	308.880	308.640	0.08	16.65	16.61	99.8	0	PASS	
	4	319.690	319.640	0.02	16.64	16.60	99.8	0	PASS	
After 50 cycles ending in fully charged states	5	315.710	315.630	0.03	16.66	16.61	99.7	0	PASS	
	6	312.870	313.050	0.06	16.65	16.61	99.8	0	PASS	
	7	317.210	317.350	0.04	16.67	16.63	99.8	0	PASS	
	8	318.580	318.710	0.04	16.67	16.63	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:4UPF356790-1-T0835)

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 surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of peak acceleration of 1 g 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 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<sub>n</sub> and 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 9 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: 2011/12/5

6. Test Data

Battery 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	321.060	321.070	0.00	16.62	16.62	100.0	0	PASS	PASS
	2	303.410	303.420	0.00	16.62	16.61	99.9	0	PASS	
	3	308.640	308.710	0.02	16.61	16.61	100.0	0	PASS	
	4	319.640	319.670	0.01	16.60	16.60	100.0	0	PASS	
After 50 cycles ending in fully charged states	5	315.630	315.660	0.01	16.61	16.61	100.0	0	PASS	
	6	313.050	313.080	0.01	16.61	16.61	100.0	0	PASS	
	7	317.350	317.270	0.03	16.63	16.63	100.0	0	PASS	
	8	318.710	318.650	0.02	16.63	16.63	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:4UPF356790-1-T0835)

**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  $55\pm 2^{\circ}\text{C}$  and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1ohm at  $55\pm 2^{\circ}\text{C}$ . This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to  $55\pm 2^{\circ}\text{C}$ . 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  $170^{\circ}\text{C}$  and there is no disassembly, no rupture and no fire within six hours of this test.

**5.Test Date:** 2011/12/6

**6.Test Data**

Battery No.		Maximum temperature ( $^{\circ}\text{C}$ )	Other event	Result	Judgement
At first cycle, in fully charged states	1	53.9	0	PASS	PASS
		53.9	0	PASS	
	3	53.8	0	PASS	
	4	53.8	0	PASS	
After 50 cycles ending in fully charged states	5	54.2	0	PASS	
	6	54.2	0	PASS	
	7	54.2	0	PASS	
	8	54.0	0	PASS	

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

UN Test Data (Model:4UPF356790-1-T0835)



1. **Test Item:** Impact (T6)

2. **Test Purpose:** This test simulates an impact.

3. **Test Procedure:**

The test sample cell or component cell is to be placed on a flat surface. A 15.8mm diameter bar is to be placed across the center of the sample. A 9.1kg mass is to be dropped from a height of 61±2.5cm 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 15.8mm 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 sides 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.

A coin or button cell is to be impacted with the flat surface of the sample parallel to the flat surface and the 15.8mm diameter curved surface lying across its center.

**SANYO Internal Procedure:**

As above.

4. **Test Requirements:**

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

5. **Test Date:** 2011/09/19

6. **Test Data:**

Cell No.	Maximum Temperature(°C)	Other event	Result	Judgement	
At first cycle, 50% charged states	1	74.4	0	PASS	PASS
	2	66.4	0	PASS	
	3	77.4	0	PASS	
	4	66.0	0	PASS	
	5	57.5	0	PASS	
	6	63.7	0	PASS	
	7	96.6	0	PASS	
	8	70.7	0	PASS	
	9	77.5	0	PASS	
	10	78.9	0	PASS	

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

# UN Test Data (Model:4UPF356790-1-T0835)

**1.Test Item:**Overcharge (T7)

P.8/8

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

**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:	1.68 A

**4.Test Requirements:**

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

**5.Test Date:** 2011/12/1

**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 50 cycles ending in fully charged	5	0	PASS
	6	0	PASS
	7	0	PASS
	8	0	PASS

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