Intertek

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# **Test Verification of Conformity**

On the basis of the tests undertaken, the sample(s) of the below product have been found to comply with the requirements of the referenced specifications at the time the tests were carried out.

Applicant Name & Address	:	DIJIYA ENERGY SAVING TECH. INC. No.6, Xingye St., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
Product(s) Tested	:	Rechargeable Li-ion Battery
Ratings and principal characteristics	:	3.2 V, 18000 mAh
Model(s)	:	DJY-18106150AP-18
Brand name	:	DIJIYA
Factory information:	:	DIJIYA ENERGY SAVING TECH. INC. No.6, Xingye St., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
Relevant Standard(s)/Specification(s)	:	According to United Nations Recommendations on the Transport of Dangerous Goods(Rev.5/Amend.2) Section 38.3 Lithium Batteries.
Verification Issuing Office Name & Address	:	Intertek Testing Services Taiwan Ltd. 5F, No. 423, Ruiguang Road, Neihu District, Taipei 114, Taiwan
Date of Test(s)	:	November 4, 2015 ~ November 25, 2015
Verification/Report Number(s)	:	151000355TWN-001
Sample Description:	:	The product listed in this test report is a rechargeable lithium- ion battery. The technical informational is shown in the General information on page 2. Refer to Appendix for the photos of tested samples.

Prepared by:

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Mark Chou Project engineer Reviewed by:

o Kiro Mojo Kuo Project engineer

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## **General information:**

The tested product is a rechargeable lithium-ion battery for use in a general environment. The EUT is considered as the built-in type product.

Model DJY-18106150AP-18 is equipped with 1 cell (1S1P).

#### The cell source used in model Model DJY-18106150AP-18

Manufacturer/ trademark	Type/Model	Technical Data
DIJIYA	DJY-18106150AP-18	3.2V, 18 Ah Rechargeable lithium ion cell. (prismatic type)

## The charging / discharging specification are listed as below:

Maximum Continue Charging Voltage/ Current: 3.75 Vdc / 54 A. Maximum Continue Discharge Current: 54 A

Max. mass of equipment (g): 545.22 g Overall dimensions of EUT: approx. 151.06 mm by 106.05 mm by 18.75 mm

#### Sample preparation:

Sample No.	State
1 ~ 10	1st Cycled, fully charged
11 ~ 15	1st Cycled at 50% rated
	capacity
16 ~ 25	1st Cycled, fully discharged
26 ~ 35	After 50 Cycled, fully
	discharged

Note:

- 1) The testing results relate only to the items tested.
- 2) The test report shall not be reproduced except in full, without written approval of the laboratory.
- 3) The test report only allows to be revised within three years from its original issued date unless further standard or the requirement was noticed.
- 4) When determining the test conclusion, the Measurement Uncertainty of test has been considered.



Clause	Requirement – Test		Result – Remark	Verdict
Clause	Requirement – rest		Result – Remark	Veruici
38.3.1	Purpose			_
38.3.2	Scope		See below	
38.3.2.1	Lithium cells or batteries t		The EUT is cell type	P
	<ul> <li>(a) A change of more than</li> <li>(b) A change would mater</li> <li>results shall be considere</li> <li>be subjected to the require</li> </ul>	ially affect the test d a new type and shall		N/A
	In the event that a lithium not meet one or more of t steps shall be taken to co deficiencies that caused t cell or battery type is reter	he test requirements, rrect the deficiency or he failure before such		N/A
38.3.2.2	Definitions		See below	—
	Mass loss limit Mass M of cell or battery	Mass loss limit	The EUT is 545.22 g	_
	M < 1 g	0.5 %		
	1 g ≤ M ≤ 75 g	0.2 %		
	M > 75 g	0.1 %		
38.3.3	Number and condition of each type to be tested		Considered	—
	When batteries that have passed all applicable tests are electrically connected to form a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of more than 6 200 Watt- hours, that battery assembly does not need to be tested if it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries in the assembly and any overheat or overcharge of the battery assembly.			
38.3.4.1	Test 1: Altitude simulation	1	See below	P
38.3.4.1.1	Purpose: This test simulates air tran pressure conditions	nsport under low-		—
38.3.4.1.2		nall be stored at a ess for at least six hours		-
38.3.4.1.3	Requirement: Cells and batteries meet to is no mass loss, no leaka disassembly, no rupture a open circuit voltage of each after testing is not less that immediately prior to this p requirement relating to vo to test cells and batteries states.	ge, no venting, no ind no fire and if the ch test cell or battery an 90% of its voltage rocedure. The Itage is not applicable	The EUT meets the requirement after test (See table T1)	Ρ



Uni	ted Nations Recommendations on the Transport of Section 38.3 Lithium Bat		1.2)
Clause	Requirement – Test	Result – Remark	Verdict
38.3.4.2	Test 2: Thermal test	See below	P
38.3.4.2.1	Purpose: This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes		-
38.3.4.2.2	Test procedure: Test cells and batteries are to be stored for at least six hours at a test temperature equal to72 $\pm 2$ °C, followed by storage for at least six hours at a test temperature equal to - 40 $\pm 2$ °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 $\pm 5$ °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.		_
38.3.4.2.3	Requirement: 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.	The EUT meets the requirement after test (See table T2)	Р



UNI	ted Nations Recommendations on the Transport of Section 38.3 Lithium Bat		:nu.∠)
Clause	Requirement – Test	Result – Remark	Verdic
38.3.4.3	Test 3: Vibration	See below	P
38.3.4.3.1	Purpose: This test simulates vibration during transport		—
38.3.4.3.2	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 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 gn 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 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.		
	For large batteries: from 7 Hz to a peak acceleration of 1 gn 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 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz		
38.3.4.3.3	Requirement: Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position 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.	The EUT meets the requirement after test (See table T3)	Ρ



Uni	ted Nations Recommendations on the Transport of Section 38.3 Lithium Bat		d.2)
Clause	Requirement – Test	Result – Remark	Verdict
20.2.4.4	Test 4: Shock	See below	P
38.3.4.4 38.3.4.4.1	Purpose		P —
	This test simulates possible impacts during transport		
38.3.4.4.2	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 halfsine shock of peak acceleration of 150 gn 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 gn 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		
38.3.4.4.3	Requirement: 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.	The EUT meets the requirement after test (See table T4)	Ρ



Unit	United Nations Recommendations on the Transport of Dangerous Goods. (Rev.5/Amend.2)			
	Section 38.3 Lithium Batteries.			

Clause	Requirement – Test	Result – Remark	Verdict	
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38.3.4.5	Test 5: External short circuit	See below	Р
38.3.4.5.1	Purpose:		—
	This test simulates an external short circuit		
38.3.4.5.2	Test procedure:		—
	The cell or battery to be tested shall be		
	temperature stabilized so that its external case		
	temperature reaches $55 \pm 2$ °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 $\pm$ 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		
38.3.4.5.3		The EUT meets the	Р
	Cells and batteries meet this requirement if their	requirement after test	
	external temperature does not exceed 170 °C	(See table T5)	
	and there is no disassembly, no rupture and no		
	fire during the test and within six hours after the		
	test.		

38.3.4.6	Test 6: Impact / Crush	The EUT is cell type	Р
38.3.4.6.1	Purpose: These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit		—
38.3.4.6.2	Test procedure: Impact (applicable to cylindrical cells greater than 18 mm in diameter) The sample cell or component cell is to be placed		_
	on a flat smooth surface. A 15.8 mm $\pm$ 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg $\pm$ 0.1 kg mass is to be dropped from a height of 61 $\pm$ 2.5 cm at the		
	intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.		
	The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm $\pm$ 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.		



United Nations Recommendations on the Transport of Dangerous Goods. (Rev.5/Amend.2) Section 38.3 Lithium Batteries.			
Clause	Requirement – Test	Result – Remark	Verdict
38.3.4 6.3	<ul> <li>Test procedure: Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells not more than 18 mm in diameter)</li> <li>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.</li> <li>(a) The applied force reaches 13 kN ± 0.78 kN; Example: The force shall be applied by a hydraulic ram with a 32 mm diameter piston until a pressure of 17 MPa is reached on the hydraulic ram.</li> <li>(b) The voltage of the cell drops by at least 100 mV; or</li> <li>(c) The cell is deformed by 50% or more of its original thickness.</li> <li>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.</li> <li>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.</li> <li>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</li> </ul>	The EUT is prismatic type.	
38.3.4 6.4	that have not previously been subjected to other tests Requirement: Cells and component cells meet this requirement if their external temperature does not exceed 170	See Table T6	P



Un	ited Nations Recommendations on the Transport of Section 38.3 Lithium Bat		mend.2)
Clause	Requirement – Test	Result – Remark	Verdict
38.3.4.7	Test 7: Overcharge	The EUT is cell type	N/A
38.3.4.7.1	Purpose: This test evaluates the ability of a rechargeable battery to withstand an overcharge condition		_
38.3.4.7.2	<ul> <li>Test procedure</li> <li>The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:</li> <li>(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.</li> <li>(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.</li> <li>Tests are to be conducted at ambient</li> </ul>		
	temperature. The duration of the test shall be 24 hours		
38.3.4.7.3	Requirement: Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.		N/A



Uni	ted Nations Recommendations on the Transport of I Section 38.3 Lithium Bat		d.2)
Clause	Requirement – Test	Result – Remark	Verdict
38.3.4.8	Test 8: Forced discharge	The EUT is cell type	Р
38.3.4.8.1	Purpose: This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition		-
38.3.4.8.2	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).		
38.3.4.8.3	Requirement: Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.		P



United Nations Recommendations on the Transport of Dangerous Goods. (Rev.5/Amend.2) Section 38.3 Lithium Batteries.

Clause

Requirement – Test

Result – Remark

Verdict

Table T1: Altitude simulation				
Sample No.	Residual Voltage < 90 % ? (Yes or No)	Mass Loss > 0.1 % ? (Yes or No)	Observation <sup>1)</sup>	
First cycle	•			
1	NO	NO	NM, NL, NV, NC, NR, NE, NF	
2	NO	NO	NM, NL, NV, NC, NR, NE, NF	
3	NO	NO	NM, NL, NV, NC, NR, NE, NF	
4	NO	NO	NM, NL, NV, NC, NR, NE, NF	
5	NO	NO	NM, NL, NV, NC, NR, NE, NF	
6	NO	NO	NM, NL, NV, NC, NR, NE, NF	
7	NO	NO	NM, NL, NV, NC, NR, NE, NF	
8	NO	NO	NM, NL, NV, NC, NR, NE, NF	
9	NO	NO	NM, NL, NV, NC, NR, NE, NF	
10	NO	NO	NM, NL, NV, NC, NR, NE, NF	

Note:

1) Requirements: NM, NL, NV, NC, NR, NE, NF

2) The EUT mass may be affected by humidity.



United Nations Recommendations on the Transport of Dangerous Goods. (Rev.5/Amend.2) Section 38.3 Lithium Batteries.

Clause

Requirement – Test

Result – Remark

Verdict

Table T2: Thermal test				
Sample No.	Residual Voltage < 90 % ? (Yes or No)	Mass Loss > 0.1 % ? (Yes or No)	Observation <sup>1)</sup>	
First cycle	•			
1	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
2	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
3	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
4	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
5	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
6	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
7	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
8	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
9	NO	NO	NM, NL, NV, NC, NR, NE, N	NF
10	NO	NO	NM, NL, NV, NC, NR, NE, N	NF

# Note:

1) Requirements: NM, NL, NV, NC, NR, NE, NF



Clause	Re	equirement – Test		Resul	t – Remark	Verdic
Table T3:	Vib	ration test				Р
Sample N		Residual Voltage < 90 % ? (Yes or No)	Mass Loss > % ? (Yes or No		Observatio	n <sup>1)</sup>
First cycle	e					
1		NO	NO		NM, NL, NV, NC, N	R, NE, NF
2		NO	NO		NM, NL, NV, NC, N	R, NE, NF
3		NO	NO		NM, NL, NV, NC, N	R, NE, NF
4		NO	NO		NM, NL, NV, NC, N	R, NE, NF
5		NO	NO		NM, NL, NV, NC, N	R, NE, NF
6		NO	NO		NM, NL, NV, NC, N	R, NE, NF
7		NO	NO		NM, NL, NV, NC, N	R, NE, NF
8		NO	NO		NM, NL, NV, NC, N	R, NE, NF
9		NO	NO		NM, NL, NV, NC, N	R, NE, NF
10		NO	NO		NM, NL, NV, NC, N	R, NE, NF

NC: No short-circuit, ND: No distortion, NE: No explosion, NF: No fire, NL: No leakage,

NM: No mass loss, NR: No rupture, NS: No shifting ,NT: No excessive temperature rise, NV: No venting



Un		lations Recommendations on the Section 38	3.3 Lithium Batt		us Goods. (Rev.5/Amer	10.2)
Clause Requirement – Test			Result – Remark		Verdic	
Table T4	: Sho	ck test				Р
Sample		Residual Voltage < 90 % ? (Yes or No)	Mass Loss > % ? (Yes or N		Observatio	n <sup>1)</sup>
First cycle	е					
1		NO	NO		NM, NL, NV, NC, N	R, NE, NF
2		NO	NO		NM, NL, NV, NC, N	R, NE, NF
3		NO	NO		NM, NL, NV, NC, N	R, NE, NF
4		NO	NO		NM, NL, NV, NC, N	R, NE, NF
5		NO	NO		NM, NL, NV, NC, N	R, NE, NF
6		NO	NO		NM, NL, NV, NC, N	R, NE, NF
7		NO	NO		NM, NL, NV, NC, N	R, NE, NF
8		NO	NO		NM, NL, NV, NC, N	R, NE, NF
9		NO	NO		NM, NL, NV, NC, N	R, NE, NF
10		NO	NO		NM, NL, NV, NC, N	R, NE, NF

1) Requirements: NM, NL, NV, NC, NR, NE, NF



NT, NR, NE, NF

United Nations Recommendations on the Transport of Dangerous Goods. (Rev.5/Amend.2) Section 38.3 Lithium Batteries. Clause Requirement – Test Result - Remark Verdict **Table T5: External Short circuits test** Ρ Measure external External surface Observation<sup>1)</sup> Sample No. resistance (mΩ) temperature ( $^{\circ}$ C) **First cycle** 89.23 63.4 NT, NR, NE, NF 1 91.10 65.7 NT, NR, NE, NF 2

65.5

69.2

68.3

63.2

67.6

65.8

65.8

65.7

10 Note:

3

4

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6

7

8

9

1) Requirement: NT, NR, NE, NF

90.45

89.65

90.93

89.23

91.10

90.45

89.65

90.93



Sample No.	Stop conditions	Observation	
11	а	NT, NE, NF	
12	а	NT, NE, NF	
13	а	NT, NE, NF	
14 a		NT, NE, NF	
15	а	NT, NE, NF	

Stop conditions:

(a) Force reaches 13 kN

(b) Cell voltage drops  $\geq 100 \text{ mV}$ 

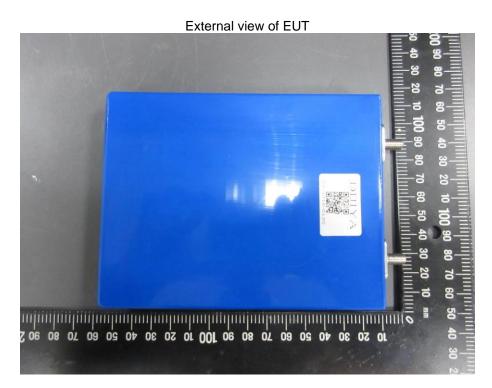
(c) Cell is deformed  $\geq$  50% original thickness



Sample No.	Discharge current Ah	Test during (hr) / Tested and observed during	Observation	
rst cycle				
16	54	20 mins / 7 days	NE, NF	
17	54	20 mins / 7 days	NE, NF	
18	54	20 mins / 7 days	NE, NF	
19	54	20 mins / 7 days	NE, NF	
20	54	20 mins / 7 days	NE, NF	
21	54	20 mins / 7 days	NE, NF	
22	54	20 mins / 7 days	NE, NF	
23	54	20 mins / 7 days	NE, NF	
24	54	20 mins / 7 days	NE, NF	
25	54	20 mins / 7 days	NE, NF	
After 50 cycles				
26	54	20 mins / 7 days	NE, NF	
27	54	20 mins / 7 days	NE, NF	
28	54	20 mins / 7 days	NE, NF	
29	54	20 mins / 7 days	NE, NF	
30	54	20 mins / 7 days	NE, NF	
31	54	20 mins / 7 days	NE, NF	
32	54	20 mins / 7 days	NE, NF	
33	54	20 mins / 7 days	NE, NF	
34	54	20 mins / 7 days	NE, NF	
35	54	20 mins / 7 days	NE, NF	



#### Appendix A Photos



External view of EUT

