
Lithium Battery UN38.3 Test Report

Report No.: A001B20171130001

Samples Li-ion Battery

Model 053040

Applicant

Issue Date Dec. 06, 2017

深圳市鑫宇环检测有限公司

Attestation of Global Compliance (Shenzhen) Co., Ltd.

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1. Sample Description					
Samples Name	Li-ion Battery		Model Name	053040	
Applicant					
Manufacturer					
Battery Type	Rechargeable Single Cell Battery	Nominal Voltage	3.7V	Rated Capacity	300mAh (1.110Wh)
Limited Charge Voltage	4.2V	Charge Current	60mA	Max. Continuous Charge Current	150mA
End Charge Current	3mA	Cut-off Voltage	3.0V	Max. Discharge Current	300mA
Cells Number	1pcs	Cell Model	053040SL	Cell Rated Capacity	300mAh
Manufacturer of Cell					
Use	3C	Client Date	Nov. 16, 2017	Completing Date	Dec. 06, 2017

2. Standard

《United Nations Recommendations On The Transport Of Dangerous Goods, Manual Of Tests And Criteria》
 (ST/SG/AC.10/11/Rev.5/Amend.1&Amend.2)

3. Test Item And Conclusion

Item	Samples Number	Standard	Conclusion
Altitude simulation	Z1~Z10	UN 38.3	Pass
Thermal test			Pass
Vibration			Pass
Shock			Pass
External Short Circuit			Pass
Crush	Z11~Z15		Pass
Overcharge	Z16~Z19 X1~X4		Pass
Forced discharge	Z20~Z29 X5~X14		Pass

The submitted battery and component cell were complied with UN Manual of Tests and Criteria, Part III, sub-section 38.3.

Tested by	<i>Xuejiapia</i>	Reviewed by	<i>Zhachunming</i>	Approved by	<i>Wuhui</i>
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Notes :

Z1~Z10, Z16~Z19: Batteries at first cycle in fully charged states;

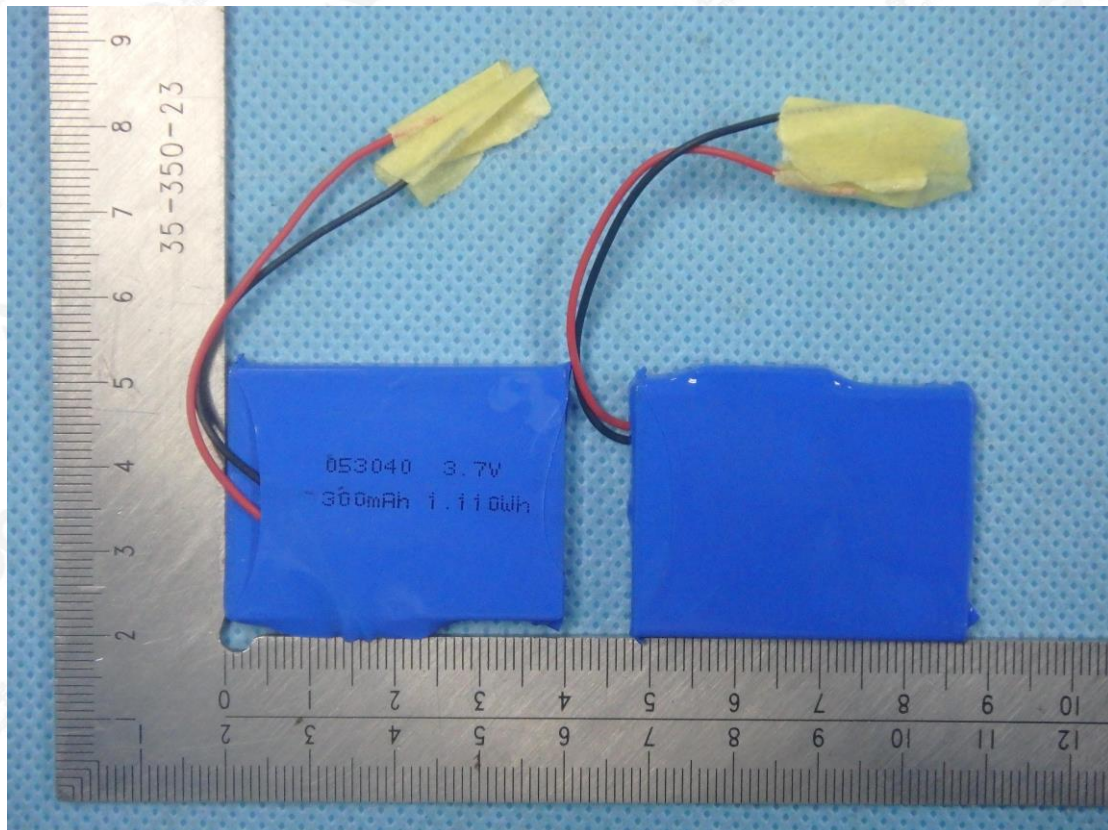
Z11~Z15: Cells at first cycle at 50% of the design rated capacity;

Z20~Z29: Cells at first cycle in fully discharged states;

X1~X4: Batteries after 50 cycles ending in fully charged states;

X5~X14: Cells after 50 cycles ending in fully discharged states.

4. Photos Of Sample



Authenticate the photo on original report only

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5. Test Method And Verdict

Clause	Requirements	Result	Verdict
38.3.4	Procedure		
38.3.4.1	Test 1: Altitude simulation	No leakage, no venting, no disassemble, no rupture and no fire. The data see Table1.	P
	Test cells and batteries shall be stored at a pressure of 11.6kPa or less for at least six hour at ambient temperature (20±5°C)		
38.3.4.2	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassemble, 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.	No leakage, no venting, no disassemble, no rupture and no fire. The data see Table2.	P
	Test 2: Thermal test		
38.3.4.3	Test cells and batteries are to be stored for at least six hours at a test temperature equal to 72±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.	No leakage, no venting, no disassemble, no rupture and no fire. The data see Table3.	P
	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassemble, 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.		
38.3.4.3	Test 3: Vibration	No leakage, no venting, no disassemble, no rupture and no fire. The data see Table3.	P
	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 7Hz and 200Hz and back to 7Hz 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 7Hz a peak acceleration of 1g _n is maintained until 18Hz is reached. The amplitude is then maintained at 0.8mm (1.6mm total excursion) and the frequency increased until a peak acceleration of 8g _n occurs (approximately 50Hz). A peak acceleration of 8g _n is then maintained until the frequency is increased to 200Hz.		

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Clause	Requirements	Result	Verdict
	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassemble, 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.		
38.3.4.4	Test 4: Shock	No leakage, no venting, no disassemble, no rupture and no fire. The data see Table 4.	P
	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 $150g_n$ 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 $50g_n$ 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.		
	Cells and batteries meet this requirement if there is no mass loss, no leakage, no venting, no disassemble, 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.		
38.3.4.5	Test 5: External Short Circuit	No disassemble, no rupture and no fire. The data see Table 5.	P
	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 $0.1\ \text{ohm}$ 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.		
	Cells and batteries meet this requirement if their external temperature does not exceed 170°C and there is no disassemble, no rupture and no fire within six hours of this test.		

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Clause	Requirements	Result	Verdict		
38.3.4.6	Test 6: Impact / Crush				
	<p>Impact (applicable to cylindrical cells not less than 18mm in diameter) The Samples cell or component cell is to be placed on a flat smooth surface. A 15.8mm±0.1mm diameter, at least 6cm 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 Samples. A 9.1kg±0.1kg mass is to be dropped from a height of 61±2.5cm at the intersection of the bar and Samples 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</p> <p>The test Samples is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm±0.1mm diameter curved surface lying across the centre of the test Samples. Each Samples is to be subjected to only a single impact.</p>	N/A	N/A		
	Cells and component cells meet this requirement if their external temperature does not exceed 170°C and there is no disassemble and no fire during the test and within six hours after this test.				
38.3.4.6	<p>Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18mm in diameter) A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.</p> <p>(a) The applied force reaches 13kN±0.78kN; (b) The voltage of the cell drops by at least 100mV; or (c) The cell is deformed by 50% or more of its original thickness.</p> <p>Once the maximum pressure has been obtained, the voltage drops by 100mV 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.</p> <p>Each test cell or component cell is to be subjected to one crush only. The test Samples shall be observed for a further 6h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.</p>	No disassemble, and no fire. The data see Table 6.	P		
	Cells and component cells meet this requirement if their external temperature does not exceed 170°C and there is no disassemble and no fire during the test and within six hours after this test.				

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Clause	Requirements	Result	Verdict
38.3.4.7	Test 7: Overcharge	No disassemble, and no fire. The data see Table 7.	P
	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.		
	Rechargeable batteries meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		
38.3.4.8	Test 8: Forced discharge	No disassemble and no fire. The data see Table 8.	P
	Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V 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)		
	Primary or rechargeable cells meet this requirement if there is no disassemble and no fire during the test and within seven days after the test.		

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6. Data

Table 1	Altitude simulation						P
No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassemble, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
Z1	15.974	4.18	15.973	4.17	0.006	0.24	N
Z2	16.112	4.18	16.112	4.17	0.000	0.24	N
Z3	16.007	4.19	16.007	4.18	0.000	0.24	N
Z4	15.869	4.19	15.869	4.18	0.000	0.24	N
Z5	15.926	4.18	15.926	4.17	0.000	0.24	N
Z6	16.214	4.18	16.213	4.17	0.006	0.24	N
Z7	16.097	4.17	16.097	4.16	0.000	0.24	N
Z8	16.053	4.18	16.053	4.17	0.000	0.24	N
Z9	15.895	4.19	15.895	4.18	0.000	0.24	N
Z10	15.967	4.18	15.967	4.17	0.000	0.24	N

Table 2	Thermal test						P
No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassemble, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
Z1	15.973	4.17	15.969	4.15	0.025	0.48	N
Z2	16.112	4.17	16.108	4.15	0.025	0.48	N
Z3	16.007	4.18	16.003	4.16	0.025	0.48	N
Z4	15.869	4.18	15.866	4.15	0.019	0.72	N
Z5	15.926	4.17	15.922	4.15	0.025	0.48	N
Z6	16.213	4.17	16.209	4.15	0.025	0.48	N
Z7	16.097	4.16	16.093	4.14	0.025	0.48	N
Z8	16.053	4.17	16.048	4.15	0.031	0.48	N
Z9	15.895	4.18	15.891	4.15	0.025	0.72	N
Z10	15.967	4.17	15.964	4.15	0.019	0.48	N

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Table 3	Vibration						P
No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassemble, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
Z1	15.969	4.15	15.968	4.15	0.006	0.00	N
Z2	16.108	4.15	16.108	4.15	0.000	0.00	N
Z3	16.003	4.16	16.003	4.15	0.000	0.24	N
Z4	15.866	4.15	15.865	4.15	0.006	0.00	N
Z5	15.922	4.15	15.921	4.15	0.006	0.00	N
Z6	16.209	4.15	16.209	4.14	0.000	0.24	N
Z7	16.093	4.14	16.092	4.13	0.006	0.24	N
Z8	16.048	4.15	16.048	4.15	0.000	0.00	N
Z9	15.891	4.15	15.891	4.15	0.000	0.00	N
Z10	15.964	4.15	15.964	4.15	0.000	0.00	N

Table 4	Shock						P
No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassemble, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
Z1	15.968	4.15	15.968	4.15	0.000	0.00	N
Z2	16.108	4.15	16.108	4.15	0.000	0.00	N
Z3	16.003	4.15	16.003	4.15	0.000	0.00	N
Z4	15.865	4.15	15.865	4.15	0.000	0.00	N
Z5	15.921	4.15	15.921	4.15	0.000	0.00	N
Z6	16.209	4.14	16.209	4.14	0.000	0.00	N
Z7	16.092	4.13	16.092	4.13	0.000	0.00	N
Z8	16.048	4.15	16.048	4.15	0.000	0.00	N
Z9	15.891	4.15	15.891	4.15	0.000	0.00	N
Z10	15.964	4.15	15.964	4.15	0.000	0.00	N

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Table 5	External short circuit	P
No.	Peak temperature (°C)	Whether disassemble, rupture, fire (Y/N)
Z1	56.1	N
Z2	56	N
Z3	56.5	N
Z4	56.2	N
Z5	56.4	N
Z6	55.9	N
Z7	55.8	N
Z8	56.3	N
Z9	56.7	N
Z10	56.6	N

Table 6	Crush	P
No.	Peak temperature (°C)	Whether disassemble, fire (Y/N)
Z11	19.8	N
Z12	18.7	N
Z13	18.5	N
Z14	19	N
Z15	18.3	N

Table 7	Overcharge	P
No.	Whether disassemble, fire (Y/N)	
Z16	N	
Z17	N	
Z18	N	
Z19	N	
X1	N	
X2	N	
X3	N	
X4	N	

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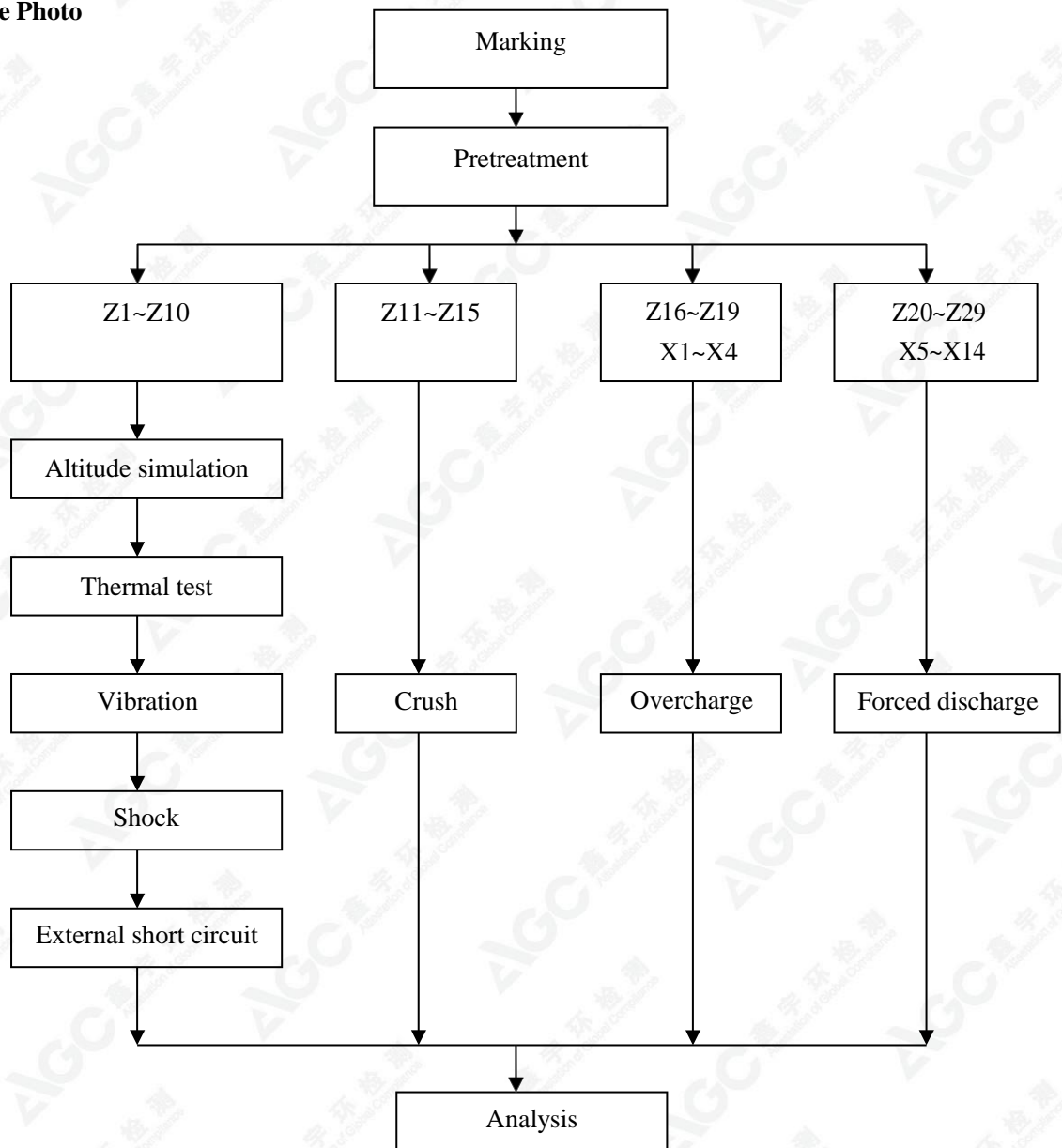


Table 8	Forced discharge	P
No.	Whether disassemble, fire (Y/N)	
Z20		N
Z21		N
Z22		N
Z23		N
Z24		N
Z25		N
Z26		N
Z27		N
Z28		N
Z29		N
X5		N
X6		N
X7		N
X8		N
X9		N
X10		N
X11		N
X12		N
X13		N
X14		N

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7. Procedure Photo



8. Test Apparatus

AGC-BT-E015	Vacuum chamber	AGC-BT-E074	Temperature circulation chamber
AGC-RE-E062	Impact test instrument	AGC-BT-E070	Vibration test instrument
AGC-BT-E009	Battery short circuit testing instrument	AGC-BT-E010	Battery short circuit temperature instrument
AGC-BT-E011	Battery extrusion test instrument	AGC-BT-E045~E052	DC power supply
AGC-BT-E001	Battery test system	AGC-BT-E053~E056	DC power supply
AGC-SA-E018	Temperature recorder	AGC-SA-E075	Electronic balance
AGC-SA-E093	Digital multimeter		

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