Series No: 2018-08-00005

Getac

Battery UN38.3 Test Report

Model: A31-M15

(11.4V==3740mAh/42Wh)

PN: 541389780001

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Date: 2018/08/22

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NO	TEST ITEM	TEST TIME	RESULT
1	Altitude simulation	2018/8/6	PASS
2	Thermal test	2018/8/7~2018/8/14	PASS
3	Vibration	2018/8/15~2018/8/16	PASS
4	Shock	2018/8/17	PASS
5	External short circuit	2018/8/21	PASS
6	Crush	2018/8/9~2018/8/11	PASS
7	Overcharge	2018/8/7~2018/8/15	PASS
8	Forced discharge	2018/8/9~2018/8/16	PASS

Standard: **UN manual of tests and Criteria section 6th 38.3 Test (ST/SG/AC.10/11/Rev.6)**

When a cell or battery type is to be tested under this sub-section, the number and condition of cells and batteries of each type to be tested are as follows:

(a) When testing rechargeable cells and batteries under tests T.1 to T.5, the following shall be tested in the quantity indicated:

(i) ten cells at first cycle, in fully charged states;

(ii) four small batteries at first cycle, in fully charged states;

(iii) four small batteries after fifty cycles ending in fully charged states.

(b) When testing rechargeable cells under test T.6, the following shall be tested in the quantity indicated:

(i) for component cells of rechargeable batteries, five cells at first cycle at 50% of the design rated capacity.

(c) When testing rechargeable batteries or rechargeable single cell batteries under test T.7, the following shall be tested in the quantity indicated:

(i) four small batteries at first cycle, in fully charged states;

(ii) four small batteries after fifty cycles ending in fully charge states.

Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test.

(d) When testing rechargeable component cells under test T.8, the following shall be tested in the quantity indicated:

(i) ten rechargeable component cells, at first cycle in fully discharged states;

(ii) ten rechargeable component cells after fifty cycles ending in fully discharge states.

Remark:

Rechargeable single cell batteries:

Sample #1~#10 **ten single cell batteries, at first cycle, in fully charge states;**

Sample #11~#14 **four single cell batteries, at first cycle, in fully charge states;**

Sample #15~#18 **four single cell batteries, after fifty cycles ending in fully charge states;**

Component Cell #1~#5 **five cells, at first cycle, at 50% of design rate capacity;**

Component Cell #6~#15 **ten cells, at first cycle, in fully discharged states;**

Component Cell #16~#25 **ten cells, after fifty cycles ending in fully discharge states.**

Rechargeable batteries:

Sample #1~#4 **four batteries, at first cycle, in fully charge states;**

Sample #5~#8 **four batteries, after fifty cycles ending in fully charge states;**

Sample #9~#12 **four batteries, at first cycle, in fully charge states;**

Sample #13~#16 **four batteries, after fifty cycles ending in fully charge states;**

Component Cell #1~#5 **five cells, at first cycle, at 50% of design rate capacity;**

Component Cell #6~#15 **ten cells, at first cycle, in fully discharged states;**

Component Cell #16~#25 **ten cells, after fifty cycles ending in fully discharge states.**

1. Altitude simulation

1. **Test Equipment:**

   BE-DY-27/1170001, KEITHLEY2700/0280002, MAX-C20002/0040060

2. **Purpose:**

   This test simulates air transport under low-pressure condition.

3. **Test Conditions:**

   Test 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. **Requirement:**

   Batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test 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 battery at fully discharged states.

5. **Test table:**

Sample	Before test		After test		Mass Loss/%	Residual OCV/%	Other Event
	Voltage (V)	Weight(g)	Voltage (V)	Weight(g)			
#1	12.878	171.87	12.871	171.84	0.02	99.95	OK
#2	12.876	171.84	12.869	171.82	0.01	99.95	OK
#3	12.876	171.67	12.868	171.65	0.01	99.94	OK
#4	12.874	171.70	12.866	171.68	0.01	99.94	OK
#5	12.877	172.04	12.869	172.01	0.02	99.94	OK
#6	12.872	171.70	12.865	171.69	0.01	99.95	OK
#7	12.878	172.00	12.871	171.97	0.02	99.95	OK
#8	12.872	171.98	12.864	171.95	0.02	99.94	OK

Note: OK- No Leakage, No Venting, No Disassembly, No rupture & No Fire;

NG- Leakage, Venting, Disassembly, rupture & Fire.

6. **Test result: PASS**

2. Thermal test

1. **Test Equipment:**

   TSK-E4C-150+RAMP/0130001, GX-3000-150LTC2/01300031

   KEITHLEY2700/0280002, MAX-C20002/0040060

2. **Purpose:**

   This test assesses battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature change.

3. **Test Conditions:**

Test 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 until 10 total cycles are complete, after which all test batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C.).

4. **Requirement:**

Batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test 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 battery at fully discharged states.

5. **Test table:**

Sample	Before test		After test		Mass Loss/%	Residual OCV/%	Other Event
	Voltage (V)	Weight(g)	Voltage (V)	Weight(g)			
#1	12.871	171.84	12.682	171.84	0.00	98.53	OK
#2	12.869	171.82	12.678	171.82	0.00	98.52	OK
#3	12.868	171.65	12.676	171.65	0.00	98.51	OK
#4	12.866	171.68	12.676	171.68	0.00	98.52	OK
#5	12.869	172.01	12.680	172.01	0.00	98.53	OK
#6	12.865	171.69	12.675	171.69	0.00	98.52	OK
#7	12.871	171.97	12.681	171.97	0.00	98.52	OK
#8	12.864	171.95	12.675	171.95	0.00	98.53	OK

Note: OK- No Leakage, No Venting, No Disassembly, No rupture & No Fire;

NG- Leakage, Venting, Disassembly, rupture & Fire.

6. **Test result: PASS**

3. Vibration

1. **Test Equipment:**

EM-2000-LX/0910002, KEITHLEY2700/0280002, MAX-C20002/0040060

2. **Purpose:**

This test simulates vibration during transport.

3. **Test Conditions:**

Batteries are firmly secured to the platform of the vibration machine without distorting the cell such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with algorithmic 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 batteries with a gross mass of not more than 12 kg (small batteries), 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 the maintained until the frequency is increased to 200 Hz.

4. **Requirement:**

Batteries meet this requirement if there is 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 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 battery at fully discharged states.

5. **Test table:**

Sample	Before test		After test		Mass Loss/%	Residual OCV/%	Other Event
	Voltage (V)	Weight(g)	Voltage (V)	Weight(g)			
#1	12.682	171.84	12.657	171.82	0.01	99.80	OK
#2	12.678	171.82	12.653	171.79	0.02	99.80	OK
#3	12.676	171.65	12.652	171.65	0.00	99.81	OK
#4	12.676	171.68	12.652	171.68	0.00	99.81	OK
#5	12.680	172.01	12.656	171.98	0.02	99.81	OK
#6	12.675	171.69	12.650	171.69	0.00	99.80	OK
#7	12.681	171.97	12.656	171.95	0.01	99.80	OK
#8	12.675	171.95	12.651	171.93	0.01	99.81	OK

Note: OK- No Leakage, No Venting, No Disassembly, No rupture & No Fire;

NG- Leakage, Venting, Disassembly, rupture & Fire.

6. **Test result: PASS**

4. Shock

1. **Test Equipment:**

ASQ-700/0900001, KEITHLEY2700/0280002, MAX-C20002/0040060

2. **Purpose:**

This test assesses the robustness of batteries against cumulative shocks.

3. **Test Conditions:**

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

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula $Acceleration(g_n) = \sqrt{\left(\frac{100850}{mass*}\right)}$ whichever is smaller	6 ms

∗ Mass is expressed in kilograms

The relationship between minimum peak acceleration and mass is illustrated in Figure 38.3.4.1 for small batteries.

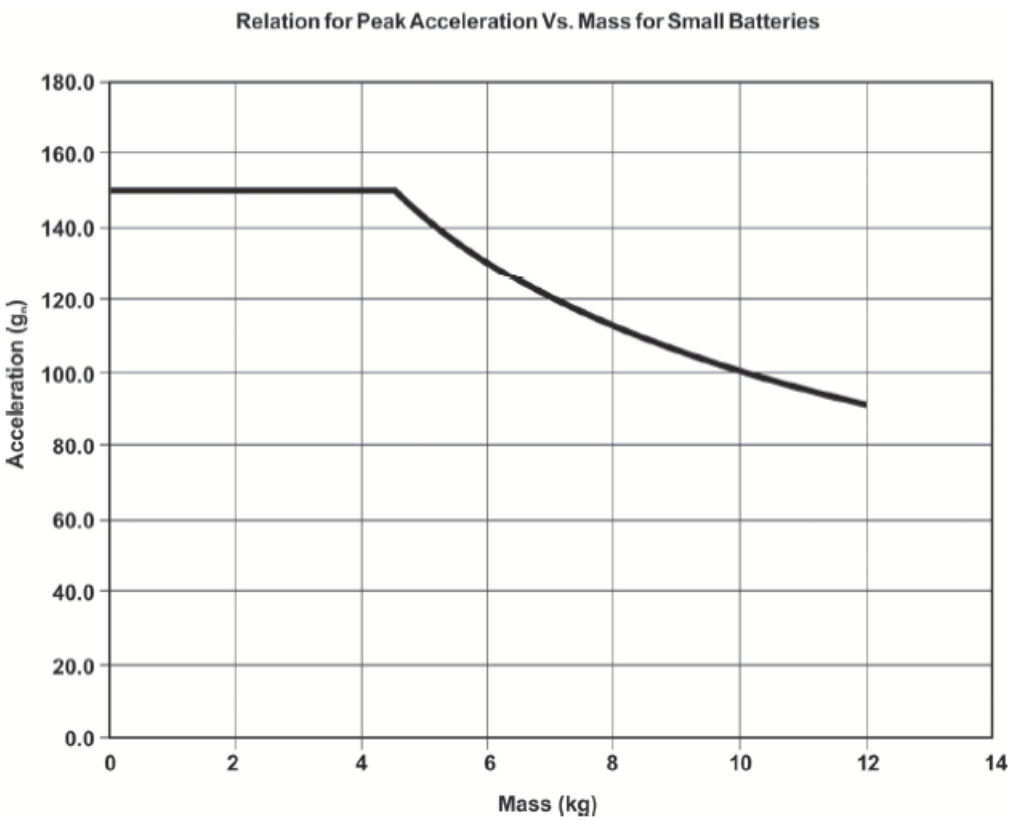


Figure 38.3.4.1: Relation between the Peak Acceleration and the Mass for small batteries (below 12.0 kg).

Each 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 battery for a total of 18 shocks.

4. **Requirement:**

Batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test 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 battery at fully discharged states.

5. **Test table:**

Sample	Before test		After test		Mass Loss/%	Residual OCV/%	Other Event
	Voltage (V)	Weight(g)	Voltage (V)	Weight(g)			
#1	12.657	171.82	12.654	171.82	0.00	99.98	OK
#2	12.653	171.79	12.650	171.79	0.00	99.98	OK
#3	12.652	171.65	12.649	171.65	0.00	99.98	OK
#4	12.652	171.68	12.649	171.68	0.00	99.98	OK
#5	12.656	171.98	12.653	171.98	0.00	99.98	OK
#6	12.650	171.69	12.647	171.69	0.00	99.98	OK
#7	12.656	171.95	12.653	171.95	0.00	99.98	OK
#8	12.651	171.93	12.648	171.93	0.00	99.98	OK

Note: OK- No Leakage, No Venting, No Disassembly, No rupture & No Fire;

NG- Leakage, Venting, Disassembly, rupture & Fire.

6. **Test result: PASS**

5. External short circuit

1. **Test Equipment:**

MHU-225Q/0120004, GX-3000-150LTC2/01300031, KEITHLEY2700+7700/0280003

2. **Purpose:**

This test simulates an external short circuit.

3. **Test Conditions:**

The battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °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 batteries, then the battery at 57 ± 4 °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 battery external case temperature has returned to 57 ± 4 °C.

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

4. **Requirement:**

Batteries meet this requirement if their external temperature 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 table:**

Sample	Max. External Temperature(°C)	Other Event
#1	**56.5**	**OK**
#2	**56.5**	**OK**
#3	**56.7**	**OK**
#4	**56.7**	**OK**
#5	**56.4**	**OK**
#6	**56.5**	**OK**
#7	**56.6**	**OK**
#8	**56.6**	**OK**

Note: OK- No Disassembly, No rupture & No Fire; NG- Disassembly, rupture & Fire.

6. **Test result: PASS**

6. Crush

1. **Test Equipment:**

   BE-6048/1180001, KEITHLEY2700+7700/0280003

2. **Purpose:**

   These tests simulate mechanical abuse from a crush that may result in an internal short circuit.

3. **Test Conditions:**

   Test procedure- Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)

   A 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;

   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.

   (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 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.

Each test 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 component cells that have not previously been subjected to other tests.

4. **Requirement:**

Component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

5. **Test table:**

Sample (Cell)	Max. External Temperature (°C)	Other Event
#1	**28.8**	**OK**
#2	**28.3**	**OK**
#3	**28.7**	**OK**
#4	**27.8**	**OK**
#5	**28.7**	**OK**

Note: OK- No Disassembly & No Fire; NG- Disassembly & Fire.

6. **Test result: PASS**

7. Overcharge

1. **Test Equipment:**

ITECH IT6952A 60V/25A/600W/0020243~0020250

2. **Purpose:**

This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

3. **Test Conditions:**

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.

4. **Requirement:**

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

5. **Test table:**

Sample	Other Event
#9	**OK**
#10	**OK**
#11	**OK**
#12	**OK**
#13	**OK**
#14	**OK**
#15	**OK**
#16	**OK**

Note: OK- No Disassembly & No Fire; NG- Disassembly & Fire.

6. **Test result: PASS**

8. Forced discharge

1. **Test Equipment:**

   ITECH IT6952A 60V/25A/600W/0020243~0020250

   Chroma 63103/0230171/0230172/0230175/0230176

   Chroma 63102/0230173/0230174/0230177/0230178

2. **Purpose:**

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

3. **Test Conditions:**

   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. **Requirement:**

Rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

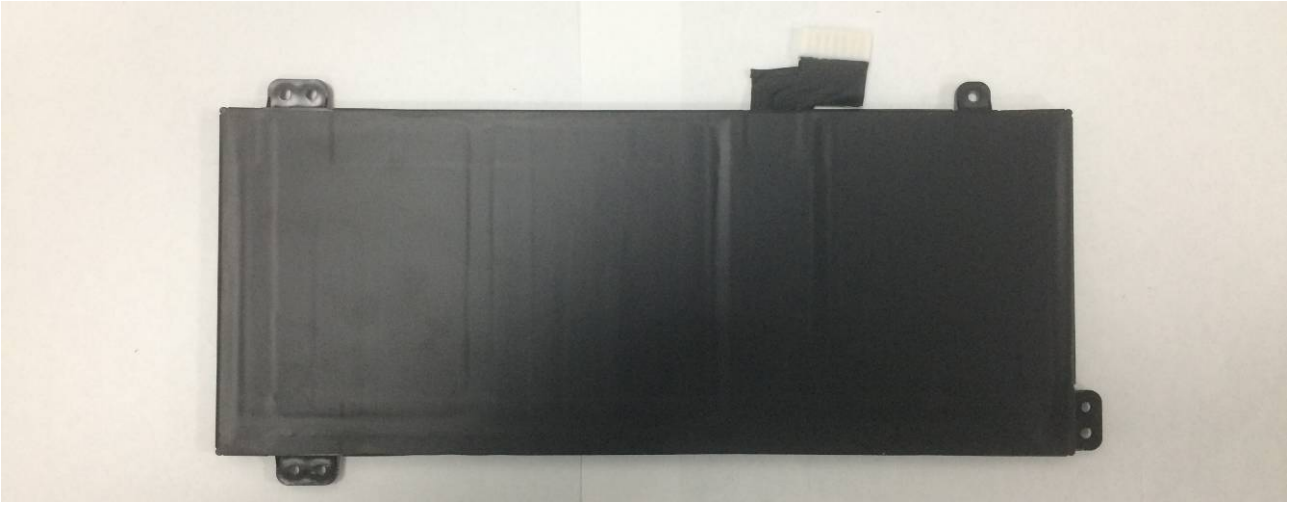
5. **Test table:**

Sample (Cell)	Other Event
#6	OK
#7	OK
#8	OK
#9	OK
#10	OK
#11	OK
#12	OK
#13	OK
#14	OK
#15	OK
#16	OK
#17	OK
#18	OK
#19	OK
#20	OK
#21	OK
#22	OK
#23	OK
#24	OK
#25	OK

Note: OK- No Disassembly & No Fire; NG- Disassembly & Fire.

6. **Test result: PASS**

Test image



Rechargeable Li-ion Battery 型号/Model NO.: A31-M15
(3ICP6/58/75)
Rating: 11.4V ⎓ 3740mAh, 42Wh
锂离子电池组 充电限制电压: 13.05V ⎓ 额定容量: 3650mAh
注意: 禁止拆解、撞击、挤压或投入火中 • 电池浸水后或出现严重鼓胀，请勿继续使用 • 请勿置於高温环境中 •