TEST REPORT
UL 2054
UL Standard for Safety for Household and Commercial Batteries

Reference No. .....:	AOC250522013S
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Manufacturer's name ..... :	Shenzhenshiyimeidianzikejiyouxiangongsi
Address ..... :	Bantianjiedaowuheshequdaguangkancun sanxiang17hao502 shenzhen guangdong
Test specification	
Standard ..... :	UL 2054 Issue: 2004/10/29 Ed:2 Rev:2011/09/14 UL Standard for Safety Household and Commercial Batteries
Test procedure ..... :	Type test
Test Conclusion..... :	The Battery is tested with appliance component according to UL 2054, recorded in this report, per UL 2054 Issue: 2004/10/29 Ed:2
Non-standard test method..... :	N/A
Test Report Form No. ..... :	UL 2054 V1.0
Test Report Form(s) Originator.... :	AOCE
Master TRF ..... :	2020-11-06
Test item description .....:	Li-ion Rechargeable Battery
Trade Mark ..... :	N/A
Model and/or type reference ..... :	160240
Rating(s) ..... :	3.7Vdc, 1500mAh, 5.55Wh

Particulars: test item vs. test requirements	
Charging current of battery.....	1500mA
Charging voltage of battery	4.2V
Charging cut-off current of battery.....	50mA
Discharge current of battery	1500mA
Discharge cutoff voltage of battery.....	3.0V
Max. Ambient temperature	Charge: 0-45°C Discharge: -5-60°C
Cell number and construction of battery.....	one cell
Test case verdicts	
Test case does not apply to the test object	N/A
Test item does meet the requirement.....	P(ass)
Test item does not meet the requirement.....	F(ail)
Testing	
Date of receipt of test item	2025-04-15
Date(s) of performance of test.....	2025-04-15 – 2025-05-22

General remarks:

This test report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item tested.

Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods.

"(see remark #)" refers to a remark appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

The samples are executed necessary charging and discharging procedures according the Chapter 38.3.3 of this standard in the test site.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

Summary of testing:

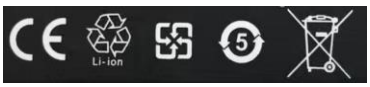
Tests performed (name of test and test clause):

9	Short-Circuit Test
10	Abnormal Charging Test
11	Abusive Overcharge Test
12	Forced-Discharge Test
13	Limited Power Source Test
13A	Battery Pack Component Temperature Test
13B	Battery Pack Surface Temperature Test
19	250N Steady Force Test
20	Mold Stress Relief Test
21	Drop Impact Test

Copy of marking plate:

Note 1: The making will be silk-screen printed on the product.

Li-ion Rechargeable Battery
160240
3.7Vdc, 1500mAh, 5.55Wh



Manufacturer: Shenzhenshiyimeidianzikejiyouxiangongsi
Made in China

General Product Information:

N/A

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Clause	Requirement + Test	Result - Remark	Verdict
INTRODUCTION			
1	**Scope**		P
2	**General**		P
2.1	Lithium cells		P
	In lieu of the requirements outlined in Table 6.1 cells constructed of lithium metal, lithium alloy or lithium ion, that are used in batteries, shall meet the requirements in the Standard for Lithium Batteries, UL 1642.	Cell tested with appliance per UL1642	P
2.2	Units of measurement		P
2.3	Terminology		P
2.4	Components		P
3	**Glossary**		P
CONSTRUCTION			
4	**General**		P
4.1	Casing and enclosure		P
4.2	Electrolyte	Tested with appliance, see appendix for details	P
4.3	External battery pack connectors	External battery pack connectors comply with V-0.	P
4.4	Printed wiring boards	V-0 min.	P
4.5	Lithium Ion Systems Only		P
PERFORMANCE			
5	**General**		**P**
5.1	Batteries are to be tested as described in Sections 9 through 24. Section 12, Forced-Discharge Test, is applicable only to cells intended to be used in multicell series applications, such as battery packs. The Battery Enclosure Tests, Sections 18 – 21 (including the 250 N Steady Force, Mold Stress Relief, and Drop Impact Tests) are intended only for batteries that have a plastic outer enclosure.	Complied.	P
5.2	With the exception of the Projectile Test of Section 22, cells and/or batteries shall not explode or catch fire as a result of the tests in this standard. For the Shock Test, Section 16, Vibration Test, Section 17, 250 N Steady Force Test, Section 19, Mold Stress Relief Test, Section 20, Drop Impact Test, Section 21, and the Temperature Cycling Test,	No explode or catch fire, no Vent or leakage during tests	P

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	Section 24 the samples shall also not vent or leak. For these tests unacceptable leakage is deemed to have occurred when the resulting mass loss exceeds the values shown in Table 5.1, Venting and Leakage Mass Loss Criteria.		
5.3	Deleted August 12, 2008		--
5.4	Certain end product devices require that the power output of a battery be limited. The Limited Power Source Test described in Section 13 is to be used to determine whether a cell or battery is suitable in such applications where fire hazards may otherwise exist.		P
6	**Samples**		**P**
6.1	Unless otherwise indicated, fresh cells or batteries in the fully charged state are to be used for the tests described in Sections 9 – 24. The test program and number of samples to be used in each test is shown in Tables 6.1 and 6.2, for cell testing and battery pack testing, respectively.		P
6.2	When a battery pack is tested in accordance with Table 6.2, the cells comprising that battery pack shall also be tested in accordance with Table 6.1 if they have not already been.		P
6.3	All batteries shall be fully charged in accordance with the manufacturer's specifications prior to testing except for the samples to be subjected to the Abnormal Charging and Abusive Overcharge Tests, which shall be discharged to the manufacturer specified end point voltage using the manufacturer specified current prior to testing.		P
7	**Important test considerations**		**P**
8	**Temperature measurements**		**P**

ELECTRICAL TEST			
9	**Short-Circuit Test**		**P**
9.1	Cells shall comply with 9.1 – 9.6.		N/A
9.2	Each fully charged test sample cell, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of 80 ±20 m ohm. The temperature of the battery case is to be recorded during the test. The	UL 1642 approved battery cell used in the battery.	

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	battery is to discharge until a fire or explosion is obtained, or until it has reached a discharged state of less than 0.2 volts and/or the case temperature has returned to ±10°C (±18°F) of ambient temperature.		
9.3	Tests are to be conducted at 20 ±5°C (68 ±9°F), and at 55 ±2°C (131 ±4°F). The cells are to reach equilibrium at 20 ±5°C (68 ±9°F) or 55 ±2°C (131 ±4°F) as applicable, before the terminals are connected.		N/A
9.4	A cell is to be tested individually unless the cell manufacturer indicates that it is intended for use in series or parallel. For series or parallel use, additional tests on five sets of batteries are to be conducted using the maximum number of cells to be covered for each configuration as specified by the manufacturer.		N/A
9.5	A cell is to be tested without the assistance of protective devices unless such protective devices are integral to the cell construction. When a protective device actuates during the test, the test shall be repeated with the cell connected to the maximum load that does not cause the protective device to open.		N/A
9.6	The samples shall not explode or catch fire. The temperature of the exterior cell or battery casing shall not exceed 150°C (302°F) for lithium chemistries.		N/A
9.7	Battery packs shall comply with 9.8 – 9.12. *Exception: Battery packs consisting of a single cell, in which the cell has already been subjected to the tests in 9.1 – 9.6 need not be subjected to the tests in 9.8 – 9.12.*		P
9.8	Each fully charged test sample battery pack, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of 80 ±20 m ohm. The temperature of the battery case is to be recorded during the test. The battery is to discharge until a fire or explosion is obtained, or until it is completely discharged and/or the cell case temperature has returned to ±10°C (±18°F) of ambient temperature.		P
9.9	Tests are to be conducted at 20 ±5°C (68 ±9°F) and at 55 ±5°C (131 ±4°F). The batteries are to reach equilibrium at 20 ±5°C (68 ±9°F) or 55 ±5°C (131 ±4°F), as		P

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Clause	Requirement + Test	Result - Remark	Verdict
	applicable, before the terminals are connected.		
9.10	Battery pack constructions are to be subjected to a single fault across any protective device in the load circuit of the battery under test. When protective devices actuate during the test, the test shall be repeated with the battery pack connected to the maximum load that does not cause the protective devices to open.		P
9.11	One of the above five test sample battery packs, tested at 20 ±5°C (68 ±9°F) shall be evaluated with the following additional conditions in place. The terminals are to be subjected to a short circuit condition with a minimum length of 16 AWG (1.3 mm2) bare copper wire. The test is to be conducted on a tissue paper covered soft wood surface and the sample battery pack and bare conductor is to be covered with a single layer of cheesecloth.		P
9.12	For all samples tested, the samples shall not explode or catch fire and the tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the cell casing. The temperature of the internal cell casings shall not exceed 150°C (302°F) for lithium chemistries. For battery pack samples tested in accordance with 9.11, the cheesecloth and tissue paper shall not catch fire.	No explode or catch fire, no leakage.	P
10	**Abnormal Charging Test**		**P**
10.1	Primary batteries (for example: cells, single cell batteries, or battery packs) shall comply with 10.2 –10.5.		N/A
10.2	Batteries discharged to the manufacturer's rated capacity are to be used for this test. The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).	Secondary batteries	N/A
10.3	Each fully discharged test sample battery is to be subjected to a constant charging current of three times the current, Ic, specified by the manufacturer by connecting it in opposition to a dc-power supply. The test time is to be calculated using the formula: $t_c = \frac{2.5\,C}{3\,(I_c)}$ The minimum charging time is to be 7 hours.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.4	When a protective device that has been investigated for the purpose, actuates during the test, the test shall be repeated with the battery supply connected to the maximum load that does not cause the protective device to open. A protective device that has not been investigated for the purpose shall be short-circuited.		N/A
10.5	The samples shall not explode or catch fire. For battery pack samples, tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the battery casing.		N/A
10.6	Secondary cells shall comply with 10.7 – 10.9.		N/A
10.7	The cells are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F). Each battery shall be discharged at a constant current of 0.2 C/1 hour, to a manufacturer specified discharge endpoint voltage.	Secondary batteries	N/A
10.8	The cells are to be charged with a constant maximum specified charger output voltage and a current limit of three times the maximum current Ic, specified by the manufacturer. Charging duration is the time required to reach the manufacturer's specified end-of-charge condition plus seven additional hours.		N/A
10.9	A cell is to be tested without the assistance of protective devices, unless such protective devices are either integral to the cell constructions or have been investigated for the purpose. A re-settable protective device that actuates during the test shall be allowed to reset and the test shall be resumed, cycling as often as necessary to complete the test. When a protective device operates during the test (whether re-settable or not) the test is repeated with the same charging time, but with the cell connected to the maximum load that does not cause the protective devices to operate. A protective device that is not integral to the cell and that has not been investigated for the purpose is to be short-circuited.		N/A
10.9.1	The samples shall not explode or catch fire.		N/A
10.10	Secondary battery packs shall comply with 10.11 – 10.13.		P
10.11	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F). A thermocouple is to be attached to the cells of each test sample battery. Each battery shall be discharged at a constant current of 0.2C/1		P

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	hour, to a manufacturer specified discharge endpoint voltage.		
10.12	Each of the test sample batteries are to be subjected to the following overcharge conditions, in sequential order. a) The battery is to be initially charged using a constant current charging mode with a current limit of three times the maximum current Ic, specified by the manufacturer until the maximum specified charger output voltage is reached. At that point, the battery is to be charged with a constant maximum specified charger output voltage and a current limit of three times the maximum current Ic. Charging duration is the time required to reach the manufacturer's specified end-of-charge condition plus seven additional hours. The temperature on the cell casing shall be monitored. A re-settable protective device such as a PTC that actuates during the test shall be allowed to reset and the test shall be resumed, cycling as often as necessary, but no less than 10 times, to complete the test. Automatic reset devices are allowed to cycle during the test. When an overcurrent protective device operates during the test, the test is repeated with the same charging time, but with the battery connected to the maximum load that does not cause the protective devices to operate. b) The charge condition in accordance with (a) shall be conducted with each single component fault that is likely to occur in the charging circuit and which would result in overcharging of the battery.		P
10.13	The samples shall not explode or catch fire. For battery pack samples, tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the cell casing.		P
11	**Abusive Overcharge Test**		**P**
11.1	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).		P
11.2	Sample batteries are to be subjected to a constant charging current at 10 times the C5 amp rate, using a supply voltage sufficient to maintain the 10 times C5 amp rate throughout the duration of the test. During the test, the temperature is to be measured on the internal cell casing of each sample. The test is to continue until the cell or battery explodes, vents, or a single operation protective device operates, and the temperature of the internal cell casing reaches steady state conditions or returns to ambient. If a PTC or other re-settable protection device operates during the test, it is to be reset a minimum of 10 times		P

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Clause	Requirement + Test	Result - Remark	Verdict
	during the test. An automatic reset device is allowed to cycle during the test.		
11.3	During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault condition which is likely to occur in the charging circuit and which would result in overcharging of the battery.		P
11.4	The samples shall not explode or catch fire.		P
11.5	At least one of the five samples shall be subjected to the test outlined in 11.2 and 11.3 with a constant current charge 5 times the C5 rate (for example: at the C rate) with a supply voltage sufficient to maintain that rate throughout the duration of the test.		P
12	**Forced-Discharge Test**		P
12.1	This test is intended for cells that are to be used in multicell applications, such as battery packs. The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).	1S1P	P
12.2	For multi-cell series configurations without parallel strings a fully discharged cell is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged cell is to equal the total number of cells in the pack less one.		P
12.3	For multi-cell series configurations with parallel strings, a fully discharged parallel string is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged parallel string is to equal the total number of cells in the pack less the number of cells in the discharged parallel string.		N/A
12.4	Each of the five battery packs shall be prepared as described in 12.2 or 12.3, as applicable.		P
12.5	Once the completely discharged cells (or string of cells) are connected in series with the specified number of fully charged cells, the resultant battery pack is to be short circuited.		P
12.6	The positive and negative terminals of the sample are to be connected with a copper wire with a resistance load of 80 ±20 m ohms. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state and the cell case temperature has returned to ±10°C (±18°F) of ambient temperature.		P
12.7	During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault		P

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Clause	Requirement + Test	Result - Remark	Verdict
	condition which is likely to occur in the discharge circuit and which would result in excessive discharge of the battery.		
12.8	The samples shall not explode or catch fire.		P
13	**Limited Power Source Test**		N/A
13.1	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).		N/A
13.2	A battery intended to be a limited power source shall comply with one of the following: a) The output is inherently limited in compliance with Table 13.1; or b) A linear or nonlinear impedance limits the output in compliance with Table 13.1. If a positive temperature coefficient device is used, it shall: 1) Comply with the Standard for Thermistor-Type Devices, UL 1434, or 2) Pass the tests specified in the Manufacturing Deviation and Drift Section, the Endurance Section, and the Manufacturing Deviation and Drift Section and the Endurance Section in the Annex for Requirements for Controls Using Thermistors of the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1; or 3) Meet the requirements in the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 for a device for Type 2.AL Action; c) A regulating network or an integrated circuit (IC) current limiter, limits the output in compliance with Table 13.1, both under normal operating conditions and after any simulated single fault in the regulating network or IC current limiter (open circuit or short circuit); or d) An overcurrent protective device is used and the output is limited in compliance with Table 13.2.	c) applied	N/A
13.3	Where an overcurrent protective device is used, it shall be a fuse or a non-adjustable, nonautoreset, electromechanical device.		N/A
13.4	Batteries shall be fully charged when conducting the measurements for Uoc, Isc, and S according to Tables 13.1 and 13.2.		N/A
13.5	The non-capacitive load referenced in Tables 13.1 and 13.2 shall be adjusted to develop maximum measured values of current (Isc) and power (S) that can be obtained over the time limits noted in Tables 13.1 and 13.2. Simulated faults in a regulating network required according to 13.2 item (c) above are applied under these load conditions.		N/A

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13.6	Batteries that meet the limited power source requirements may be marked “Limited Power Source" “LPS" to indicate that they are considered to be a limited power source. Batteries that do not meet these requirements, regardless of terminal design, shall not be marked to indicate that they are a limited power source and are restricted to applications where a limited power source is not required.		N/A
13A	**Battery Pack Component Temperature Test**		**P**
13A.1	A battery pack with enclosure shall be subjected to a normal temperature test under both input (charging) and output (discharging) conditions. As a result of this testing, temperatures on temperature sensitive components shall not exceed the limits outlined in Table 13A.1.		P
13A.2	For the output loading temperature test, a fully charged battery pack shall be subjected to a constant resistive loading across the output terminals of the pack with the output load current set to just below the operating limit of the discharging protection circuit. Temperatures are monitored until thermal stabilization or until the pack is at its specified endpoint voltage, whichever comes first.		P
13A.3	The input loading temperature test shall be conducted on a fully discharged battery pack, discharged at a constant current of 0.2C/1 hour to a manufacturer specified discharge endpoint voltage.		P
13A.4	For the input loading temperature test, a fully discharged sample shall be subjected to a CCCV charging method with the maximum charging voltage not to exceed the manufacturer’s recommended maximum charging voltage limits. During the test, the charging current shall not exceed three times the maximum charge current or the operating limit of the charging protection circuit, whichever is less, during the test. Temperatures are monitored until thermal stabilization or until the pack is at its fully charged state, whichever comes first.		P
13A.5	Temperatures are considered to be stabilized when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase.		P
13A.6	Protective devices within the pack shall not operated during the test.		P
13A.7	Temperatures are monitored on surfaces of components using thermocouples. Thermocouples are to consist of 30 AWG wires. Larger size wires may be used, but		P

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	they shall not exceed 24 AWG and shall not be large enough to result in a heat sink condition on the part under test.		
13A.8	During the normal temperature test, temperature measurement T shall not exceed (Tmax + Tamb − Tma)		P
13B	**Battery Pack Surface Temperature Test**		P
13B.1	A battery pack with enclosure shall be subjected to a normal temperature test under both input (charging) and output (discharging) conditions. As a result of this testing, temperatures on external accessible surfaces of the pack shall not exceed the limits outlined in Table 13B.1.		P
13B.2	For the output loading temperature test, a fully charged battery pack shall be subjected to a constant resistive loading across the output terminals of the pack with the output load current set to just below the operating limit of the discharging protection circuit. Temperatures are monitored until thermal stabilization or until the pack is at its specified endpoint voltage, whichever comes first.		P
13B.3	The input loading temperature test shall be conducted on a fully discharged battery pack, discharged at a constant current of 0.2C/1 hour to a manufacturer specified discharge endpoint voltage.		P
13B.4	For the input loading temperature test, a fully discharged sample shall be subjected to a CCCV charging method with the maximum charging voltage not to exceed the manufacturer's recommended maximum charging voltage limits. During the test, the charging current shall not exceed three times the maximum charge current or the operating limit of the charging protection circuit, whichever is less, during the test. Temperatures are monitored until thermal stabilization or until the pack is at its fully charged state, whichever comes first.		P
13B.5	Temperatures are considered to be stabilized when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase.		P
13B.6	Protective devices within the pack shall not operate during the test.		P
13B.7	Temperatures are monitored on the accessible surfaces of the pack enclosure using thermocouples. Thermocouples are to consists of 30 AWG wires. Larger size wires may be used, but they shall not exceed 24 AWG.		P
13B.8	During the normal temperature test, temperature measurement T shall not exceed		P

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Clause	Requirement + Test	Result - Remark	Verdict
	(Tmax + Tamb − Tma)		
MECHANICAL TEST			
14	**Crush Test**		N/A
14.1	The batteries are to be tested in an ambient temperature of 20±5°C (68 ±9°F).	UL 1642 approved battery cell used in the battery.	N/A
14.2	A battery is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cells and the crushing is to be continued until an applied force of 13 ±1.0 kN (3000 ±224 pounds) is reached. Once the maximum force has been obtained, it is to be released.		N/A
14.3	A cylindrical or prismatic battery is to be crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. A prismatic battery is also to be rotated 90 degrees around its longitudinal axis so that both the wide and narrow sides will be subjected to the crushing force. Each sample battery is to be subjected to a crushing force in only one direction. Separate samples are to be used for each test.		N/A
14.4	A coin or button battery is to be crushed with the flat surface of the battery parallel with the flat surfaces of the crushing apparatus.		N/A
14.5	The samples shall not explode or catch fire.		N/A
15	**Impact Test**		
15.1	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).	UL 1642 approved battery cell used in the battery.	N/A
15.2	A test sample battery is to be placed on a flat surface. A 15.8 ±0.1 mm (5/8 ±0.004 inch) diameter bar is to be placed across the center of the sample. A 9.10 ±0.46 kg (20 ±1 pound) weight is to be dropped from a height of 610 ±25 mm (24 ±1 inch) onto the sample.		N/A
15.3	A cylindrical or prismatic battery is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of a 15.8 mm (5/8 inch) diameter curved surface lying across the center of the test sample. A prismatic battery 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 battery is to be subjected to only a single impact. Separate samples are to be used for each test.		N/A
15.4	A coin or button battery is to be impacted with the flat surface of the test sample parallel to the flat surface and the 15.8 mm (5/8 inch)		N/A

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	diameter curved surface lying across its center.		
15.5	The samples shall not explode or catch fire.		N/A
16	**Shock Test**		N/A
16.1	The cell is to be secured to the testing machine by means of a rigid mount which supports all mounting surfaces of the cell. Each cell shall be subjected to a total of three shocks of equal magnitude. The shocks are to be applied in each of three mutually perpendicular directions unless it has only two axes of symmetry in which case only two directions shall be tested. Each shock is to be applied in a direction normal to the face of the cell. For each shock the cell is to be accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g (where g is the local acceleration due to gravity). The peak acceleration shall be between 125 and 175 g. Cells shall be tested at a temperature of 20 ±5°C (68 ±9°F).	UL 1642 approved battery cell used in the battery.	N/A
16.2	The samples shall not explode or catch fire.		N/A
16.3	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2.		N/A
17	**Vibration Test**		N/A
17.1	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F).	UL 1642 approved battery cell used in the battery.	N/A
17.2	A battery is to be subjected to simple harmonic motion with an amplitude of 0.8 mm (0.03 inch) [1.6 mm (0.06 inch) total maximum excursion].		N/A
17.3	The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz and return in not less than 90 nor more than 100 minutes. The battery is to be tested in three mutually perpendicular directions. For a battery that has only two axes of symmetry, the battery is to be tested perpendicular to each axis.		N/A
17.4	The samples shall not explode or catch fire.		N/A
17.5	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2.		N/A

BATTERY ENCLOSURE TEST			
18	**General**		P
18.1	The batteries are to be tested in an ambient temperature of 20±5°C (68 ±9°F).		P
18.2	Batteries with outer plastic enclosures shall be subjected to the tests described in		P

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	Sections 19, 20, and 21. Batteries with outer enclosures made from materials other than plastic, shall be subjected to the tests described in Sections 19 and 21.		
19	**250N Steady Force Test**		P
19.1	The batteries are to be tested in an ambient temperature of 20±5°C (68 ±9°F).		P
19.2	External enclosures of the battery pack are to be subjected to a steady force of 250 ±10 N (56 ±2 pounds force) for a period of 5 seconds, applied in turn to the top, bottom and sides of the battery pack enclosure by means of a suitable test tool providing contact over a circular plane surface 30 mm (1.2 inches) in diameter.		P
19.3	The samples shall not explode or catch fire. The outer battery enclosure shall not crack to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of application of the 250 N steady force shall meet the criteria of 4.1.5.		P
19.4	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2.		P
20	**Mold Stress Relief Test**		P
20.1	Each of three samples are to be placed in a full-draft circulating-air oven maintained at a uniform temperature of 70°C (158°F). The samples are to remain in the oven for 7 hours.		P
20.2	Deleted effective November 11, 2011 To prevent hazards from overheating energized cells, samples shall either be fully discharged prior to conditioning or provided with “dummy” cells, which are representative of the actual cells.		P
20.3	After careful removal from the oven and after returning to room temperature following the conditioning described in 20.3, the samples shall show no evidence of mechanical damage that would result in damage to cells or protective circuitry. In addition, the battery enclosures shall not crack, warp, or melt to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of the conditioning shall meet the criteria of 4.1.5.		P
21	**Drop Impact Test**		P
21.1	The batteries are to be tested in an ambient temperature of 20±5°C (68 ±9°F).		P
21.2	Each of three samples is to be dropped from a height of 1 m (3.28 ft) so it strikes a concrete surface in the position that is most likely to produce the adverse results in 21.3. Each sample is to be dropped three times.		P

UL 2054			
Clause	Requirement + Test	Result - Remark	Verdict
21.3	The samples shall not explode or catch fire.		P
21.4	The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2, and the integrity of the protective devices shall be maintained.		P
21.5	The outer battery enclosure shall not crack to the extent that cells or any protective devices are exposed. Openings in the enclosure created as a result of the drop impact(s) shall meet the criteria of 4.1.5.		P
FIRE EXPOSURE TESTS			
22	**Projectile Test**		**N/A**
22.1	When subjected to the test described in 22.2 – 22.5 no part of an exploding cell or battery shall create a hole in the wire screen cage or penetrate the wire screen cage such that some or all of the cell or battery protrudes through the screen cage.	UL 1642 approved battery cell used in the battery. And the cells have passed this clause according to cell UL report.	N/A
22.2	Each test sample cell or battery is to be placed on a screen that covers a 102 mm (4 inch) diameter hole in the center of a platform table. The screen is to be constructed of steel wire mesh having 20 openings per inch (25.4 mm) and a wire diameter of 0.43 mm (0.017 inch).		N/A
22.3	The screen is to be mounted 38 mm (1-1/2 inch) above a burner. The fuel and air flow rates are to be set to provide a bright blue flame that causes the supporting screen to glow a bright red.		N/A
22.4	An eight-sided covered wire cage, 610 mm (2 feet) across and 305 mm (1 foot) high, made from metal screening is to be placed over the test sample. See Figure 22.1. The metal screening is to be constructed from 0.25 mm (0.010 inch) diameter aluminum wire with 16 – 18 wires per inch (25.4 mm) in each direction.		N/A
22.5	The sample is to be heated and shall remain on the screen until it explodes or the cell or battery has ignited and burned out. It is not required to secure the sample in place unless it is at risk of falling off the screen before the test is completed. When required, the sample shall be secured to the screen with a single wire tied around the sample.		N/A
ENVIRONMENT TESTS			
23	**Heating Test**		**N/A**
23.1	The sample shall not explode or catch fire when subjected to the test described in 23.2 – 23.4.	UL 1642 approved battery cell used in the battery.	N/A
23.2	A battery is to be heated in a gravity convection or circulating air oven with an		N/A

UL 2054			
Clause	Requirement + Test	Result - Remark	Verdict
	initial temperature of 20 ±5°C (68 ±9°F).		
23.3	The temperature of the oven is to be raised at a rate of 5 ±2°C (9 ±4°F) per minute to a temperature of 130 ±2°C (266 ±4°F) and remain at that temperature for 10 minutes.		N/A
23.4	The sample shall return to room temperature (20±5°C) and then be examined.		N/A
24	**Temperature Cycling Test**		N/A
24.1	The batteries are to be placed in a test chamber and subjected to the following cycles: a) Raising the chamber-temperature to 70 ±3°C (158 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. b) Reducing the chamber temperature to 20 ±3°C (68 ±5°F) within 30 minutes and maintaining this temperature for 2 hours. c) Reducing the chamber temperature to minus 40 ±3°C (minus 40 ±5°F) within 30 minutes and maintaining this temperature for 4 hours. d) Raising the chamber temperature to 20 ±3°C (68±5°F) within 30 minutes. e) Repeating the sequence for a further 9 cycles. f) After the 10th cycle, storing the batteries for a minimum of 24 hours at 20±5°C (68±9°F) prior to examination.	UL 1642 approved battery cell used in the battery.	N/A
24.2	The samples shall not explode or catch fire. In addition, the samples shall not vent or leak as described in 5.2.		N/A

MARKING AND INSTRUCTIONS			
25	General		P
25.1	A battery shall be legibly and permanently marked with: a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the product may be identified; b) A distinctive ("catalog" or "model") number or the equivalent; c) The electrical rating in Vdc and Ah. (Secondary lithium batteries may be marked in Wh rather than Ah); and d) The date or other dating period of manufacture not exceeding any three consecutive months.	Printed on battery pack.	P
25.2	When a manufacturer produces the battery at more than one factory, each battery shall have a distinctive marking to identify it as the product of a particular factory.		P
25.3	A battery or the smallest unit package or instructions provided with each battery shall include the following statements or equivalent:		P

UL 2054			
Clause	Requirement + Test	Result - Remark	Verdict
	a) An attention word, such as “Caution”, “Warning”, or “Danger”. b) A brief description of possible hazards associated with mishandling of the battery, such as burn hazard, fire hazard, explosion hazard. c) A list of actions to take to avoid possible hazards, such as do not crush, disassemble, dispose of in fire, or similar actions, and for primary batteries, do not charge. d) Instructions regarding replacement batteries if the batteries are replaceable by the user. A lithium ion battery pack shall be marked with the following or equivalent: “CAUTION: Risk of Fire and Burns. Do Not Open, Crush, Heat Above (manufacturer’s specified maximum temperature) or Incinerate. Follow Manufacturer’s Instructions.” This wording or equivalent shall also be included in the instructions packaged with the battery pack.		
25.4	The manufacturer’s specified charging instructions shall be included for secondary batteries. Primary batteries shall include instructions indicating that the batteries shall not be charged.	Specified in battery specification.	P
25.5	A cell or battery that is less than 32 mm (1.25 inches) in diameter by 3.8 mm (0.15 in) thick shall include the following marking or equivalent on the smallest unit package or instructions provided with each cell or battery: **“Caution – Never put batteries in mouth. If swallowed, contact your physician or local poison control center.”**		N/A
25.6	Batteries which meet the requirements of the Limited Power Source Test, Paragraph 13.4, may include the Marking “Limited Power Source” or “LPS”.		N/A

Test Summary

Sequence	Test item	Clause	Verdict
1. ☒	**Short-Circuit Test**	9	☒ Pass ☐ Fail ☐ N/A
2. ☒	**Abnormal Charging Test**	10	☒ Pass ☐ Fail ☐ N/A
3. ☒	**Abusive Overcharge Test**	11	☒ Pass ☐ Fail ☐ N/A
4. ☒	**Forced-Discharged Test**	12	☒ Pass ☐ Fail ☐ N/A
5. ☐	**Limited Power Source Test**	13	☐ Pass ☐ Fail ☒ N/A
6. ☒	**Battery Pack Component Temperature Test**	13A	☒ Pass ☐ Fail ☐ N/A
7. ☒	**Battery Pack Surface Temperature Test**	13B	☒ Pass ☐ Fail ☐ N/A
8. ☐	**Crush Test**	14	☐ Pass ☐ Fail ☒ N/A
9. ☐	**Impact Test**	15	☐ Pass ☐ Fail ☒ N/A
10. ☐	**Shock Test**	16	☐ Pass ☐ Fail ☒ N/A
11. ☐	**Vibration Test**	17	☐ Pass ☐ Fail ☒ N/A
12. ☒	**250N Steady Force Test**	19	☒ Pass ☐ Fail ☐ N/A
13. ☒	**Mold Stress Relief Test**	20	☒ Pass ☐ Fail ☐ N/A
14. ☒	**Drop Impact Test**	21	☒ Pass ☐ Fail ☐ N/A
15. ☐	**Projectile Test**	22	☐ Pass ☐ Fail ☒ N/A
16. ☐	**Heating Test**	23	☐ Pass ☐ Fail ☒ N/A
17. ☐	**Temperature Cycling Test**	24	☐ Pass ☐ Fail ☒ N/A

Table 6.1
Testing required for cells

Revised Table 6.1 effective November 11, 2011

Test	Section	Number of fully charged cells
Electrical Tests		
Short-Circuit	9	
at room temp.		5
at 55°C (131 °F)		5
Abnormal Charging	10	5
Forced-Discharge	12	5
Mechanical Tests		
Crush	14	5
Impact	15	5
Shock	16	5
Vibration	17	5
Fire Exposure Tests		
Projectile	22	5
Environmental Tests		
Heating	23	5
Temperature Cycling	24	5

Table 6.2
Testing required for battery packs

Revised Table 6.2 effective November 11, 2011

Test	Section	Number of fully charged packs
Electrical Tests		
Short-Circuit	9	
at room temp.		5 (unsealed)
at 55°C (131°F)		5 (unsealed)
Abnormal Charging	10	5 (unsealed)
Abusive Overcharge	11	5 (unsealed)
Forced-Discharge[a]	12	5 (unsealed)
Limited Power Source	13	6 (unsealed)
Battery Pack Component Temperature	13A	2 (unsealed)
Battery Pack Surface Temperature	13B	2 (complete)
Battery Enclosure Tests		
250 N Steady Force	19	3 (complete)
Mold Stress Relief	20	3 (complete)
Drop Impact	21	3 (complete)
Enclosure Flammability[b]	4	3 (+3, if necessary) unsealed enclosures

NOTE – Unsealed refers to batteries which do not use securement such as adhesive and/or ultrasonic welding to seal the top and bottom enclosures in order to facilitate access to the inside of the battery pack. Complete refers to a whole sample of the battery pack representative of production.

[a] Forced Discharge test is conducted only for multi-cell series configurations.

[b] Enclosure materials classified as V-1 or less flammable in the minimum part thickness do not require enclosure flammability tests.

9 Short-Circuit Test		**Pass**
Requirement	Each fully charged test sample cell, in turn, is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of 80 20 m ohm. The temperature of the battery case is to be recorded during the test. The battery is to discharge until a fire or explosion is obtained, or until it has reached a discharged state of less than 0.2 volts and/or the case temperature has returned to ±10°C (±18°F) of ambient temperature. Tests are to be conducted at 20 ±5°C (68±9°F), and at 55±2°C (131±4°F). The cells are to reach equilibrium at 20±5°C (68±9°F) or 55±2°C (131±4°F) as applicable, before the terminals are connected. One of the above five test sample battery packs, tested at 20±5°C (68±9°F) shall be evaluated with the following additional conditions in place. The terminals are to be subjected to a short circuit condition with a minimum length of 16 AWG (1.3 mm2) bare copper wire. The test is to be conducted on a tissue paper covered soft wood surface and the sample battery pack and bare conductor is to be covered with a single layer of cheesecloth. For all samples tested, the samples shall not explode or catch fire and the tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the cell casing. The temperature of the internal cell casings shall not exceed 150°C (302°F) for lithium chemistries. For battery pack samples tested in accordance with 9.11, the cheesecloth and tissue paper shall not catch fire.	
Sample No.: 160240 Recharge Li-ion Battery #001~010		
Acceptance criteria	No explosion or catch fire, or chemical leak The temperature of the internal cell casings does not exceed 150°C (302°F)	

Measurement Record

Model	**OCV(Vdc)**	**Single fault component**	**Maximum Short Circuit Current (mA)**	**Maximum Cell Temperature (°C)**	**Results**
Ambient temperature (°C): 24.6					
160240 Recharge Li-ion Battery #001	4.21	U1 (pin 1-4) SC	/	50.7	P
160240 Recharge Li-ion Battery #002	4.22	R1 SC	/	54.5	P
160240 Recharge Li-ion Battery #003	4.21	C1 SC	/	52.6	P
160240 Recharge Li-ion Battery #004	4.22	R2 SC	/	54.3	P
160240 Recharge Li-ion Battery	4.21	U1 (pin 1-7) SC	/	50.2	P

#005					
Ambient temperature (°C): 55.0					
160240 Recharge Li-ion Battery #006	4.21	U1 (pin 1-4) SC	/	74.7	P
160240 Recharge Li-ion Battery #007	4.22	R1 SC	/	73.5	P
160240 Recharge Li-ion Battery #008	4.22	C1 SC	/	77.3	P
160240 Recharge Li-ion Battery #009	4.22	R2 SC	/	74.0	P
160240 Recharge Li-ion Battery #010	4.21	U1 (pin 1-7) SC	/	70.8	P
Remark: The resistance of the circuit were within 80±20m ohm. No explosion or catch fire, or chemical leak; The temperature of the internal cell casings does not exceed 150°C (302°F).					

10 Abnormal Charging Test (Secondary cells or batteries)	**Pass**
Requirement	**Secondary cells:** The cells are to be tested in an ambient temperature of 20±5°C (68±9°F). Each battery shall be discharged at a constant current of 0.2 C/1 hour, to a manufacturer specified discharge endpoint voltage. The cells are to be charged with a constant maximum specified charger output voltage and a current limit of three times the maximum current I_c, specified by the manufacturer. Charging duration is the time required to reach the manufacturer's specified end-of-charge condition plus seven additional hours. A cell is to be tested without the assistance of protective devices, unless such protective devices are either integral to the cell constructions or have been investigated for the purpose. A re-settable protective device that actuates during the test shall be allowed to reset and the test shall be resumed, cycling as often as necessary to complete the test. When a protective device operates during the test (whether re-settable or not) the test is repeated with the same charging time, but with the cell connected to the maximum load that does not cause the protective devices to operate. A protective device that is not integral to the cell and that has not been investigated for the purpose is to be short-circuited. The samples shall not explode or catch fire. **Secondary battery packs:** The batteries are to be tested in an ambient temperature of 20±5°C (68±9°F). A thermocouple is to be attached to the cells of each test sample battery. Each battery shall be discharged at a constant current of 0.2C/1 hour, to a manufacturer specified discharge endpoint voltage.

	Each of the test sample batteries are to be subjected to the following overcharge conditions, in sequential order. a) The battery is to be initially charged using a constant current charging mode with a current limit of three times the maximum current I_c, specified by the manufacturer until the maximum specified charger output voltage is reached. At that point, the battery is to be charged with a constant maximum specified charger output voltage and a current limit of three times the maximum current I_c. Charging duration is the time required to reach the manufacturer's specified end-of-charge condition plus seven additional hours. The temperature on the cell casing shall be monitored. A re-settable protective device such as a PTC that actuates during the test shall be allowed to reset and the test shall be resumed, cycling as often as necessary, but no less than 10 times, to complete the test. Automatic reset devices are allowed to cycle during the test. When an overcurrent protective device operates during the test, the test is repeated with the same charging time, but with the battery connected to the maximum load that does not cause the protective devices to operate. b) The charge condition in accordance with (a) shall be conducted with each single component fault that is likely to occur in the charging circuit and which would result in overcharging of the battery. *Exception No. 1: A protective device determined to be reliable may remain in the circuit without being faulted. See 2.4 and Appendix A.* *Exception No. 2: For batteries without protective devices, the overcharge condition(s) in (b) do not apply.* The samples shall not explode or catch fire. For battery pack samples, tests shall not result in chemical leaks caused by cracking, rupturing or bursting of the cell casing.

Sample No.: 160240 Recharge Li-ion Battery #010~015

Acceptance criteria	No explosion or catch fire, or chemical leak

Measurement Record

Model	Charge voltage (V)	Charge current (mA)	Charge time (h)	Single fault component	Maximum Cell Temperature (°C)	Results
160240 Recharge Li-ion Battery #011	3.71	1500	10	U1 (pin 1-4) SC	49.6	P
160240 Recharge Li-ion Battery #012	3.71	1500	10	R1 SC	49.1	P
160240 Recharge Li-ion Battery #013	3.71	1500	10	C1 SC	49.8	P
160240 Recharge Li-ion Battery #014	3.71	1500	10	R2 SC	49.3	P
160240 Recharge Li-ion Battery #015	3.71	1500	10	U1 (pin 1-7) SC	50.3	P

Remark:

11 Abusive Overcharge Test		**Pass**
Requirement	The batteries are to be tested in an ambient temperature of 20 ±5°C (68 ±9°F). Sample batteries are to be subjected to a constant charging current at 10 times the C5 amp rate, using a supply voltage sufficient to maintain the 10 times C5 amp rate throughout the duration of the test. During the test, the temperature is to be measured on the internal cell casing of each sample. The test is to continue until the cell or battery explodes, vents, or a single operation protective device operates, and the temperature of the internal cell casing reaches steady state conditions or returns to ambient. If a PTC or other re-settable protection device operates during the test, it is to be reset a minimum of 10 times during the test. An automatic reset device is allowed to cycle during the test. During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault condition which is likely to occur in the charging circuit and which would result in overcharging of the battery. *Exception: Protective devices determined to be reliable, may remain in the circuit without being faulted. See Appendix A.* The samples shall not explode or catch fire. At least one of the five samples shall be subjected to the test outlined in 11.2 and 11.3 with a constant current charge 5 times the C_5 rate (for example: at the C rate) with a supply voltage sufficient to maintain that rate throughout the duration of the test.	
Ambient temperature (°C):	**25.0**	
Sample No.: 160240Recharge Li-ion Battery #016~020		
Acceptance criteria	No explosion or catch fire	

Measurement Record

Model	**OCV (V)**	**Single fault component**	**Maximum measured charge current (mA)**	**Maximum Cell Temperature (°C)**	**Results**
160240Recharge Li-ion Battery #016	5.55	U1 (pin 1-4) SC	1500	61.5	P
160240Recharge Li-ion Battery #017	5.55	R1 SC	1500	60.1	P
160240Recharge Li-ion Battery #018	5.55	C1 SC	1500	60.6	P
160240Recharge Li-ion Battery #019	5.55	R2 SC	1500	61.4	P
160240Recharge Li-ion	5.55	U1 (pin 1-7) SC	1500	62.7	P

Battery #020					
Remark:					

12 Forced-Discharge Test	**Pass**
Requirement	This test is intended for cells that are to be used in multicell applications, such as battery packs. The batteries are to be tested in an ambient temperature of 20±5°C (68±9°F). For multi-cell series configurations without parallel strings a fully discharged cell is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged cell is to equal the total number of cells in the pack less one. For multi-cell series configurations with parallel strings, a fully discharged parallel string is to be force-discharged by connecting it in series with fully charged cells of the same kind. The number of fully charged cells to be connected in series with the discharged parallel string is to equal the total number of cells in the pack less the number of cells in the discharged parallel string. Each of the five battery packs shall be prepared as described in 12.2 or 12.3, as applicable. Once the completely discharged cells (or string of cells) are connected in series with the specified number of fully charged cells, the resultant battery pack is to be short circuited. The positive and negative terminals of the sample are to be connected with a copper wire with a resistance load of 80±20 m ohms. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state and the cell case temperature has returned to ±10°C (±18°F) of ambient temperature. During the tests, batteries supplied with protective devices shall be subjected to a single component fault using any single fault condition which is likely to occur in the discharge circuit and which would result in excessive discharge of the battery. *Exception: A positive temperature coefficient device which complies with the applicable tests specified in the Standard for Thermistor-Type Devices, UL 1434 and the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1A, or other protective devices determined to be reliable, may remain in the circuit without being faulted. See Appendix A for additional component standards.* The samples shall not explode or catch fire.
Ambient temperature (°C):	**24.5**
Sample No.: 160240Recharge Li-ion Battery #021~025	
Acceptance criteria	No explosion or catch fire

Measurement Record

Model	OCV of cell /cellblock (V)	Single fault component	Maximum measured discharge current (mA)	Maximum Cell Temperature (°C)	Results
160240Recharge Li-ion Battery #021	4.22	U1 (pin 1-4) SC	2200	57.6	P
160240Recharge Li-ion	4.12	R1 SC	2200	54.3	P

Battery #022					
160240Recharge Li-ion Battery #023	4.22	C1 SC	2200	58.2	P
160240Recharge Li-ion Battery #024	4.22	R2 SC	2200	56.1	P
160240Recharge Li-ion Battery #025	4.22	U1 (pin 1-7) SC	2200	55.9	P
Remark:					

13 Limited Power Source Test	**N/A**
Requirement	The batteries are to be tested in an ambient temperature of 20±5°C (68±9°F). A battery intended to be a limited power source shall comply with one of the following: a) The output is inherently limited in compliance with Table 13.1; or b) A linear or nonlinear impedance limits the output in compliance with Table 13.1. If a positive temperature coefficient device is used, it shall: 1) Comply with the Standard for Thermistor-Type Devices, UL 1434, or 2) Pass the tests specified in the Manufacturing Deviation and Drift Section, the Endurance Section, and the Manufacturing Deviation and Drift Section and the Endurance Section in the Annex for Requirements for Controls Using Thermistors of the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1; or 3) Meet the requirements in the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 for a device for Type 2.AL Action; c) A regulating network or an integrated circuit (IC) current limiter, limits the output in compliance with Table 13.1, both under normal operating conditions and after any simulated single fault in the regulating network or IC current limiter (open circuit or short circuit); or d) An overcurrent protective device is used and the output is limited in compliance with Table 13.2. Where an overcurrent protective device is used, it shall be a fuse or a non-adjustable, nonautoreset, electromechanical device. Batteries shall be fully charged when conducting the measurements for U_{oc}, I_{sc}, and S according to Tables 13.1 and 13.2. The non-capacitive load referenced in Tables 13.1 and 13.2 shall be adjusted to develop maximum measured values of current (I_{sc}) and power (S) that can be obtained over the time limits noted in Tables 13.1 and 13.2. Simulated faults in a regulating network required according to 13.2 item (c) above are applied under these load conditions. Batteries that meet the limited power source requirements may be marked “Limited Power Source” “LPS” to indicate that they are considered to be a limited power source. Batteries that do not meet these requirements, regardless of terminal design, shall not be marked to indicate that they are a limited power source and are restricted to applications where a limited power source is not required.
Ambient temperature (°C):	**24.5**

Sample No.:						
Acceptance criteria	Does the output power sources meet the LPS limit？no					
Measurement Record						
Model	**OCV (V)**	**Single fault component**	**Isc (A)**		**VA**	
			Meas.	**Limit**	**Meas.**	**Limit**
--	--	--	--	8	--	100
--	--	--	--	8	--	100
Remark:						

13 Battery Pack Component /Surface Temperature Test	**Pass**
Requirement	A battery pack with enclosure shall be subjected to a normal temperature test under both input (charging) and output (discharging) conditions. As a result of this testing, temperatures on temperature sensitive components shall not exceed the limits outlined in Table 13A.1/13B.1. For the output loading temperature test, a fully charged battery pack shall be subjected to a constant resistive loading across the output terminals of the pack with the output load current set to just below the operating limit of the discharging protection circuit. Temperatures are monitored until thermal stabilization or until the pack is at its specified endpoint voltage, whichever comes first. The input loading temperature test shall be conducted on a fully discharged battery pack, discharged at a constant current of 0.2C/1 hour to a manufacturer specified discharge endpoint voltage. For the input loading temperature test, a fully discharged sample shall be subjected to a CCCV charging method with the maximum charging voltage not to exceed the manufacturer's recommended maximum charging voltage limits. During the test, the charging current shall not exceed three times the maximum charge current or the operating limit of the charging protection circuit, whichever is less, during the test. Temperatures are monitored until thermal stabilization or until the pack is at its fully charged state, whichever comes first. Temperatures are considered to be stabilized when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 15 minutes, indicate no further increase. Protective devices within the pack shall not operated during the test. Temperatures are monitored on surfaces of components using thermocouples. Thermocouples are to consist of 30 AWG wires. Larger size wires may be used, but they shall not exceed 24 AWG and shall not be large enough to result in a heat sink condition on the part under test. During the normal temperature test, temperature measurement T shall not exceed ($T_{max} + T_{amb} - T_{ma}$) where: T is the temperature of the given part measured under the prescribed test, T_{max} is the maximum temperature specified for compliance with the test, T_{amb} is the ambient temperature during the test, T_{ma} is the maximum ambient temperature permitted by the manufacturer's specification, or 25°C (77°F), whichever is greater. During the test T_{amb} should not exceed T_{ma} unless agreed by all parties involved.

Table 13A.1
Normal temperature limits – Component

Part	Maximum Temperature (T_{max}) °C
Synthetic rubber or PVC insulation of internal and external wiring	
– without temperature marking	75
– with temperature marking	The temperature marking
Components, insulation, and thermoplastic materials	[a]
Cell casing	[b]

[a]Temperatures measured on components and materials shall not exceed the maximum temperature rating for that component or material including internal cells.
[b] The cell casing temperature shall not exceed the manufacturer's recommended maximum temperature.

Table 13B.1
Normal temperature limits – Surface

Accessible Surfaces	Maximum Temperature (T_{max}) °C	
	Metal	Plastic[a]
Accessible parts held continuously during normal use	55	75
Accessible surfaces held or touched for short periods only	60	85
Accessible surfaces which may be touched	70	95

[a]Temperatures measured on accessible plastic enclosure surfaces shall not exceed the temperature ratings of the materials.

Sample No.: 160240 Recharge Li-ion Battery #026~027	
Acceptance criteria	Does the temperature not exceed the limits

19 250 N Steady Force Test	**Pass**
Requirement	The batteries are to be tested in an ambient temperature of 20±5°C (68±9°F). External enclosures of the battery pack are to be subjected to a steady force of 250 10 N (56±2 pounds force) for a period of 5 seconds, applied in turn to the top, bottom and sides of the battery pack enclosure by means of a suitable test tool providing contact over a circular plane surface 30 mm (1.2 inches) in diameter. The samples shall not explode or catch fire. The outer battery enclosure shall not crack to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of application of the 250 N steady force shall meet the criteria of 4.1.5. The sample shall be examined 6 hours after testing and shall not vent or leak as described in 5.2.
Ambient temperature (°C):	**24.6**
Sample No.: 160240Recharge Li-ion Battery #028~030	
Acceptance criteria	No explode or catch fire No vent or leak after 6 h

Measurement Record

Model	Before test		After test		Mess lost (%)	Results
	OCV (V)	Weight (g)	OCV (V)	Weight (g)		
160240 Recharge Li-	4.2	20	4.2	20	0	P

ion Battery #028						
160240 Recharge Li-ion Battery #029	4.2	20	4.2	20	0	P
160240 Recharge Li-ion Battery #030	4.2	20	4.2	20	0	P
Remark:						

20 Mold Stress Relief Test		**Pass**
Requirement	Each of three samples are to be placed in a full-draft circulating-air oven maintained at a uniform temperature of 70°C (158°F). The samples are to remain in the oven for 7 hours. *Exception: If the maximum temperature, T, recorded on the battery pack thermoplastic enclosure parts, obtained during the normal temperature test of Section 13A exceeds 60°C (140°F), then the oven temperature is to be maintained at a temperature equal to T + 10°C (50°F).* To prevent hazards from overheating energized cells, samples shall either be fully discharged prior to conditioning or provided with "dummy" cells, which are representative of the actual cells. After careful removal from the oven and after returning to room temperature following the conditioning described in 20.3, the samples shall show no evidence of mechanical damage that would result in damage to cells or protective circuitry. In addition, the battery enclosures shall not crack, warp, or melt to the extent that the cells or any protective devices are exposed. Openings in the enclosure created as a result of the conditioning shall meet the criteria of 4.1.5.	
Ambient temperature (°C):	**70**	
Sample No.: 160240 Recharge Li-ion Battery #031~033		
Acceptance criteria	No mechanical damage that would result in damage to cells or protective circuitry. Battery enclosures shall not crack, warp, or melt to the extent that the cells or any protective devices are exposed.	
Remark:		

21 Drop Impact Test		**Pass**
Requirement	The batteries are to be tested in an ambient temperature of 20±5°C (68±9°F). *Exception: Battery packs employing plastic enclosures that are intended for use in 0°C (32°F) temperatures shall be conditioned for 3 hours at 0°C (or temperature specified if lower than 0°C) prior to conducting the drop test, which shall be conducted immediately after removing the samples from the cold conditioning.* Each of three samples is to be dropped from a height of 1 m (3.28 ft) so it strikes a concrete surface in the position that is most likely to produce the adverse results in 21.3. Each sample is to be dropped three times. The samples shall not explode or catch fire. The sample shall be examined 6 hours after testing and shall not vent or leak as	

	described in 5.2, and the integrity of the protective devices shall be maintained. The outer battery enclosure shall not crack to the extent that cells or any protective devices are exposed. Openings in the enclosure created as a result of the drop impact(s) shall meet the criteria of 4.1.5.
Ambient temperature (°C):	**24.5**
Sample No.: 160240 Recharge Li-ion Battery #034~036	
Acceptance criteria	No explode or catch fire No vent or leak after 6 h Enclosure not crack

Measurement Record

Model	Before test		After test		Mess lost (%)	Results
	OCV (V)	Weight (g)	OCV (V)	Weight (g)		
160240 Recharge Li-ion Battery #034	4.2	20	4.2	20	0	P
160240 Recharge Li-ion Battery #035	4.2	20	4.2	20	0	P
160240 Recharge Li-ion Battery #036	4.2	20	4.2	20	0	P

Remark:

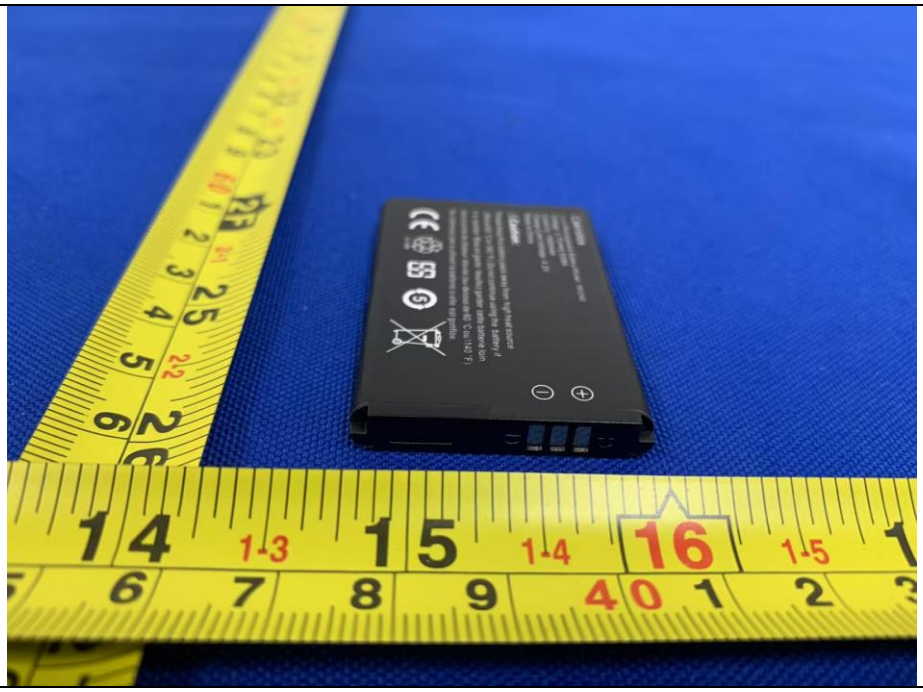
Pictures

Details of: Overview for model 160240

Details of: Overview for model 160240

Pictures

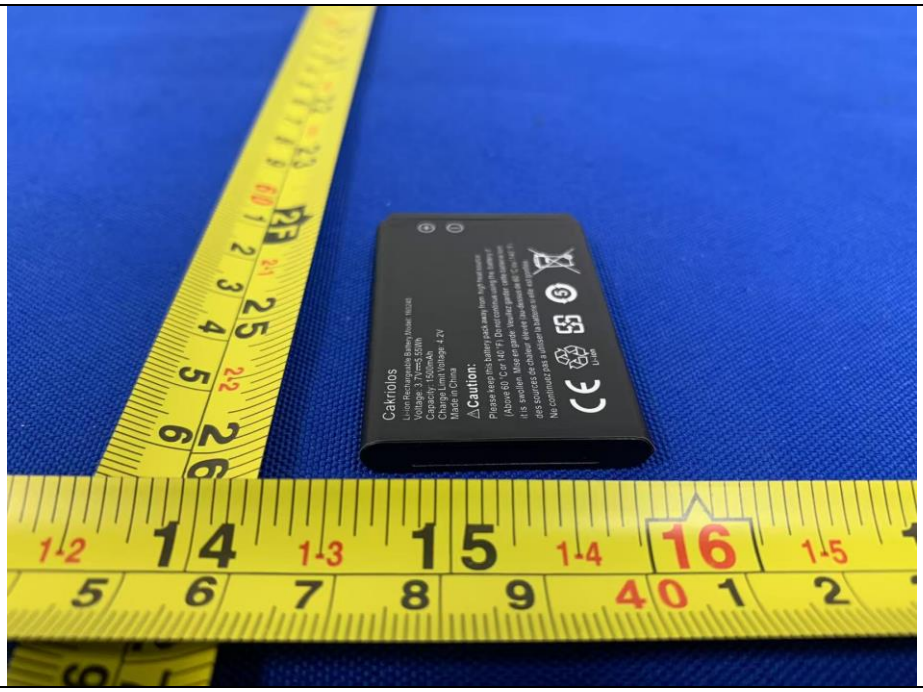
Details of: Overview for model 160240



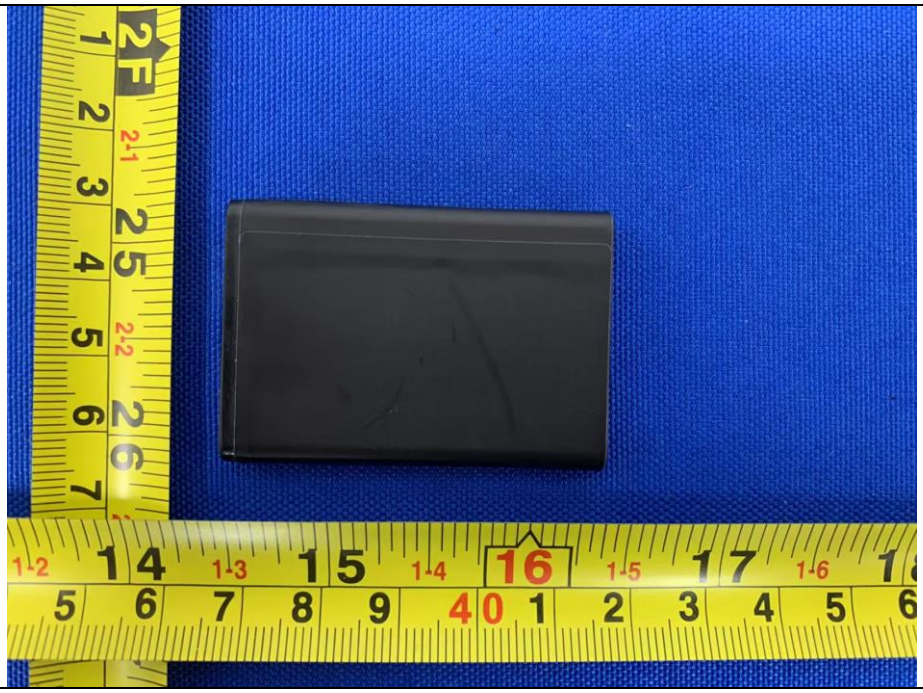
Details of: Overview for model 160240

Pictures

Details of: Overview for model 160240



Details of: Overview for model 160240



********** The End of Report **********