

Material Safety Data Sheet

For

Shenzhen Keep Better Tech Electronics Co., Ltd

16 Building, Fuyuan Industrial Park, 28 Qiaotang Road, Fuyong Town, Baoan District, Shenzhen
China

And for their product

Li-ion Battery

Model/type reference: 18650

Nominal Voltage: 3.7V

Rated Capacity: 2600mAh (9.62Wh)

Version number: V1.0

Revision date: N/A

Laboratory: Shenzhen NTEK Testing Technology Co., Ltd.**Address: 1/F, Building C, Fenda Science Park, Sanwei Community, Xixiang
Street, Bao'an District, Shenzhen 518126 P. R. China**

Compiled by (name+ signature) ..: Leo Huang*Leo Huang***Approved by (+ signature): KK Yu***KK Yu***Shenzhen NTEK Testing Technology Co., Ltd.**Address: 1/F, Building C, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China
Tel: +86-755-6115 6588 Fax: +86-755-6115 6599 [Http://www.ntek.org.cn](http://www.ntek.org.cn)

Section 1- Chemical Product and Company Identification

Product Identification: Li-ion Battery

Model No.: 18650

Manufacturer's / Supplier Name: Shenzhen Keep Better Tech Electronics Co., Ltd

Address: 16 Building, Fuyuan Industrial Park, 28 Qiaotang Road, Fuyong Town, Baoan District, Shenzhen China

Telephone number of the supplier: +86-13424223712

Emergency Telephone No. (24h): +86-13424223712

Fax: None

E-mail address: sales02@kbtbattery.com

Preparation Date: 2019-12-19

Effective date: 2020-01-01 ~ 2020-12-31

This MSDS was prepared by Shenzhen NTEK Testing Technology Co., Ltd.

Item Number: S19121103421001

Referenced documents: ISO 11014:2009 Safety data sheet for chemical products

Section 2 – Hazards Identification

Preparation hazards and classification	Not dangerous with normal use. Do not dismantle, open or shred the Li-ion Battery ingredients contained within or their ingredients products could be harmful.
Appearance, Color, and Odor	Solid object with no odor, no color.
Primary Route(s) of Exposure	These chemicals are contained in a sealed enclosure. Risk of exposure occurs only if the cell is mechanically, thermally or electrically abused to the point of compromising the enclosure. If this occurs, exposure to the electrolyte solution contained within can occur by Inhalation, Ingestion, Eye contact and Skin contact
Potential Health Effects:	<p>ACUTE (short term): see Section 8 for exposure controls In the event that this battery has been ruptured, the electrolyte solution contained within the battery would be corrosive and can cause burns.</p> <p>Inhalation: Inhalation of materials from a sealed battery is not an expected route of exposure. Vapors or mists from a ruptured battery may cause respiratory irritation.</p> <p>Ingestion: Swallowing of materials from a sealed battery is not an expected route of exposure. Swallowing the contents of an open battery can cause serious chemical burns of mouth, esophagus, and gastrointestinal tract.</p> <p>Skin: Contact between the battery and skin will not cause any harm. Skin contact with contents of an open battery can cause severe irritation or burns to the skin.</p> <p>Eye: Contact between the battery and the eye will not cause any harm. Eye contact with contents of an open battery can cause severe irritation or burns to the eye.</p> <p>CHRONIC (long term): see Section 11 for additional toxicological data</p>

Medical Conditions Aggravated by Exposure	Not applicable
Reported as carcinogen	Not applicable

Section 3 – Composition/Information on Ingredients

Li-ion Battery is a mixture.

Hazardous Ingredients (Chemical Name)	Concentration or concentration ranges (%)	CAS Number
Aluminum foil (Al)	4	7429-90-5
Copper foil (Cu)	8	7440-50-8
SBR	0.5	9003-55-8
PVDF	1.4	24937-79-9
Lithium cobalt oxide	45	12190-79-3
Graphite (C)	23	7782-42-5
Phosphate(1-), hexafluoro-, lithium	16	21324-40-3
Ethylene carbonate		96-49-1
Dimethyl carbonate		616-38-6
Ethyl methyl carbonate		623-53-0
Other	0.2	N/A
Sodium carboxymethyl cellulose	0.3	9004-32-4
Diaphragm	0.1	N/A
Crystalline flake graphite	0.5	N/A
Super Li	1	N/A

Labeling according to EC directives.

No symbol and risk phrase are required.

Note: CAS number is Chemical Abstract Service Registry Number.

N/A=Not applicable.

Section 4 – First-aid Measures

Inhalation	If contents of an opened battery are inhaled, remove source of contamination or move victim to fresh air. Obtain medical advice.
Skin contact	If skin contact with contents of an open battery occurs, as quickly as possible remove contaminated clothing, shoes and leather goods. Immediately flush with lukewarm, gently flowing water for at least 30 minutes. If irritation or pain persists, seek medical attention. Completely decontaminate clothing, shoes and leather goods before reuse or discard.
Eye contact	If eye contact with contents of an open battery occurs, immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes while holding the eyelids open. Neutral saline solution may be used as soon as it is available. If necessary, continue flushing during transport to emergency care facility. Take care not to rinse contaminated water into the unaffected eye or onto face. Quickly transport victim to an emergency care facility.
Ingestion	If ingestion of contents of an open battery occurs, never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 60 to 240 mL (2-8 oz.) of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.

Section 5 – Fire-fighting Measures

Flammable Properties	In the event that this battery has been ruptured, the electrolyte solution contain within the battery would be flammable. Like any sealed container, battery cells may rupture when exposed to excessive heat; this could result in the release of flammable or corrosive materials.
Suitable extinguishing Media	Use extinguishing media suitable for the materials that are burning.
Unsuitable extinguishing Media	Not available
Explosion Data	Sensitivity to Mechanical Impact: This may result in rupture in extreme cases Sensitivity to Static Discharge: Not Applicable
Specific Hazards	Fires involving Li-ion Battery are controlled with water. When water is used, however, hydrogen gas may evolve. In a confined space, hydrogen gas can form

arising from the chemical	an explosive mixture. In this situation, smothering agents are recommended to extinguish the fire
Protective Equipment and precautions for firefighters	As for any fire, evacuate the area and fight the fire from a safe distance. Wear a pressure-demand, self-contained breathing apparatus and full protective gear. Fight fire from a protected location or a safe distance. Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.
NFPA	Health: 0 Flammability: 0 Instability: 0

Section 6 – Accidental Release Measures

Personal Precautions, protective equipment, and emergency procedures	Restrict access to area until completion of clean-up. Do not touch the spilled material. Wear adequate personal protective equipment as indicated in Section 8.
Environmental Precautions	Prevent material from contaminating soil and from entering sewers or waterways.
Methods and materials for Containment	Stop the leak if safe to do so. Contain the spilled liquid with dry sand or earth. Clean up spills immediately.
Methods and materials for cleaning up	Absorb spilled material with an inert absorbent (dry sand or earth). Scoop contaminated absorbent into an acceptable waste container. Collect all contaminated absorbent and dispose of according to directions in Section 13. Scrub the area with detergent and water; collect all contaminated wash water for proper disposal.

Section 7 – Handling and Storage

Handling	Don't handle Li-ion Battery with metalwork. Do not open, disassemble, crush or burn battery. Ensure good ventilation/ exhaustion at the workplace. Prevent formation of dust. Information about protection against explosions and fires: Keep ignition sources away- Do not smoke.
Storage	If the Li-ion Battery is subject to storage for such a long term as more than 3 months, it is

	<p>recommended to recharge the Li-ion Battery periodically.</p> <p>3 months: -10°C~+40°C, 45 to 85%RH</p> <p>And recommended at 0°C~+35°C for long period storage.</p> <p>The capacity recovery rate in the delivery state (50% capacity of fully charged) after storage is assumed to be 80% or more.</p> <p>The voltage for a long time storage shall be 3.7V~4.2V range.</p> <p>Do not store Li-ion Battery haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.</p> <p>Keep out of reach of children.</p> <p>Do not expose Li-ion Battery to heat or fire. Avoid storage in direct sunlight.</p> <p>Do not store together with oxidizing and acidic materials.</p>
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Section 8 – Exposure Controls and Personal Protection

Engineering Controls	<p>Use local exhaust ventilation or other engineering controls to control sources of dust, mist, fumes and vapor.</p> <p>Keep away from heat and open flame. Store in a cool, dry place.</p>
Personal Protective Equipment	<p>Respiratory Protection: Not necessary under normal conditions.</p> <p>Skin and body Protection: Not necessary under normal conditions, Wear neoprene or nitrile rubber gloves if handling an open or leaking battery.</p> <p>Hand protection: Wear neoprene or natural rubber material gloves if handling an open or leaking battery.</p> <p>Eye Protection: Not necessary under normal conditions, Wear safety glasses if handling an open or leaking battery.</p>
Other Protective Equipment	<p>Have a safety shower and eye wash fountain readily available in the immediate work area.</p>
Hygiene Measures	<p>Do not eat, drink, or smoke in work area.</p> <p>Maintain good housekeeping.</p>

Section 9 - Physical and Chemical Properties

Physical State	Form: Solid
	Color: Blue
	Odor: Odorless
Change in condition:	
pH, with indication of the concentration	Not applicable
Melting point/freezing point	Not available.
Boiling Point, initial boiling point and Boiling range:	Not available.
Flash Point	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapor Pressure:	Not applicable
Vapor Density: (Air = 1)	Not applicable
Density/relative density	Not available.
Solubility in Water:	Insoluble
n-octanol/water partition coefficient	Not available.
Auto-ignition temperature	130°C
Decomposition temperature	Not available.
Odour threshold	Not available.
Evaporation rate	Not available.
Flammability (soil, gas)	Not available.
Viscosity	Not applicable

Section 10 - Stability and Reactivity

Stability	The product is stable under normal conditions.
Conditions to Avoid (e.g. static discharge, shock or vibration)	Do not subject Li-ion Battery to mechanical shock. Vibration encountered during transportation does not cause leakage, fire or explosion. Do not disassemble, crush, short or install with incorrect polarity. Avoid mechanical or electrical abuse.

Incompatible Materials	Not Available
Hazardous Decomposition Products	This material may release toxic fumes if burned or exposed to fire
Possibility of Hazardous Reaction	Not Available

Section 11 - Toxicological Information

Irritation	Risk of irritation occurs only if the cell is mechanically, thermally or electrically abused to the point of compromising the enclosure. If this occurs, irritation to the skin, eyes and respiratory tract may occur.
Sensitization	Not Available
Neurological Effects	Not Available
Teratogenicity	Not Available
Reproductive Toxicity	Not Available
Mutagenicity (Genetic Effects)	Not Available
Toxicologically Synergistic Materials	Not Available

Section 12 - Ecological Information

General note:	Water hazard class 1(Self-assessment): slightly hazardous for water. Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Anticipated behavior of a chemical product in environment/possible environmental impace/ecotoxicity	Not Available
Mobility in soil	Not Available

Persistence and Degradability	Not Available
Bioaccumulation potential	Not Available
Other Adverse Effects	Not Available

Section 13 – Disposal Considerations

Product disposal recommendation: Observe local, state and federal laws and regulations.

Packaging disposal recommendation: Be aware discarded batteries may cause fire, tape the battery terminals to insulate them. Don't disassembly the battery. Completely discharge containers (no tear drops, no powder rest, scraped carefully). Containers may be recycled or re-used. Observe local, state and federal laws and regulations.

Section 14 – Transport Information

The Li-ion Battery (18650) had passed the UN 38.3 test and is classified as non-dangerous goods and also complies with the UN Recommendations on the Transport of Dangerous Goods; IATA Dangerous Goods regulations, and applicable U.S. DOT regulations for the safe transport of Li-ion Battery.

The Li-ion Battery is transported according to the PACKING INSTRUCTION 965 Section I B of IATA DGR 61st edition (Proper shipping name and UN ID number: LITHIUM ION BATTERIES, UN No.: UN3480)

However, the Li-ion Battery may also be transported according to the PACKING INSTRUCTION 966 Section II of IATA DGR 61st edition (Proper shipping name and UN ID number: LITHIUM ION BATTERIES PACKED WITH EQUIPMENT, UN No.: UN3481) or PACKING INSTRUCTION 967 Section II of IATA DGR 61st edition (Proper shipping name and UN ID number: LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT, UN No.: UN3481).

More information concerning shipping, testing, marking and packaging can be obtained from label master at <http://www.labelmaster.com/>.

Each package must be labeled with a Lithium Battery handling label.

Li-ion batteries can be treated as "Non-dangerous goods" under the United Nations Recommendations on the Transport of Dangerous Goods, Special Provision 188, provided that packaging is strong and prevent the products from short-circuit.

With regard to transport, the following regulations are cited and considered:

- The International Civil Aviation Organization (ICAO) Technical Instructions (2019-2020 edition).
- The International Air transport Association (IATA) Dangerous Goods Regulations (61st edition).
- The International Maritime Dangerous Goods (IMDG) Code (Amdt. 39-18).
- The US Hazardous Materials Regulation (HMR) pursuant to a final rule issued by RSPA
- The Office of Hazardous Materials Safety within the US Department of Transportations' (DOT) Research and Special Programs Administration (RSPA)

Section 15 - Regulatory Information

OSHA hazard communication standard (29 CFR 1910.1200)

Hazardous

Non-hazardous

Section 16 - Other Information

The information above is believed to be accurate and represents the best information currently available to us. However, NTEK makes no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. This material safety data sheet provides guidelines for the safe handling and use of this product; it does not and cannot advise on all possible situations, therefore, your specific use of this product should be evaluated to determine if additional precautions are required.

The data/information contained herein has been reviewed and approved for general release on the basis that this document contains no export controlled information.

***** End of MSDS *****

Lithium cell and battery test summary 锂电池和锂电池组试验情况概要	
Applicant 委托单位	
Name 名称	Shenzhen Keep Better Tech Electronics Co., Ltd 深圳市康贝特电子有限公司
(a) Product manufacturer 产品生产厂商	
Name 名称	Shenzhen Keep Better Tech Electronics Co., Ltd 深圳市康贝特电子有限公司
(b) Contact information of manufacturer 生产厂商联系信息	
Address 地址	16 Building, Fuyuan Industrial Park, 28 Qiaotang Road, Fuyong Town, Baoan District, Shenzhen China 深圳市宝安区福永桥塘路28号福源工业区16栋
Tel 电话	+86-13424223712
E-mail 邮箱	sales02@kbtbattery.com
Website 网址	www.kbtbattery.com
(c) Information of test laboratory 测试实验室信息	
Name 名称	Shenzhen NTEK Testing Technology Co., Ltd. 深圳市北测检测技术有限公司
Address 地址	1/F, Building C, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China 深圳市宝安区西乡三围奋达科技园 C 栋 1 楼
Tel 电话	+86-755-6115 6588
E-mail 邮箱	Kevin@ntek.org.cn
Website 网址	http://www.ntek.org.cn
(d) (e) Information of UN38.3 Test Report UN38.3测试报告信息	
UN38.3 Test Report No. UN38.3测试报告编号	SNB180327013001B-R1
Date of UN38.3 Test Report UN38.3测试报告日期	2019-12-19
(f) Description of product 产品描述	
Name 名称	Li-ion Battery 锂离子电池
Model 型号	18650
Rating 额定	3.7V 2600mAh 9.62Wh
Mass 质量	48g
Appearance 外观	Blue and Cylindrical 蓝色、圆柱形

Lithium cell and battery test summary
锂电池和锂电池组试验情况概要



(g) Test items and results 测试项目及结果

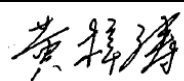
T.1-Altitude simulation 高度模拟	Pass 合格	T.5-External short circuit 外部短路	Pass 合格
T.2-Thermal Test 温度试验	Pass 合格	T.6-Impact 撞击	Pass 合格
T.3-Vibration 振动	Pass 合格	T.7-Overcharge 过度充电	Pass 合格
T.4-Shock 冲击	Pass 合格	T.8-Forced discharge 强制放电	Pass 合格

(h) Reference to assembled battery testing requirements 关于集成电池组试验要求

38.3.3 (f)	Not applicable 不适用	38.3.3 (g)	Not applicable 不适用
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(i) Revised edition of the Manual of Tests and Criteria 试验和标准手册修订版本

Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Tests and Criteria, PART III, section 38.3 Lithium metal and lithium ion batteries, the sixth revised edition (ST/SG/AC.10/11/Rev.6).
 联合国《关于危险货物运输的建议书，试验和标准手册》，第三部分，38.3节锂金属和锂离子电池要求，第六修订版

Signature 签名		Date of issue 签发日期	2019-12-19
Title 职务	Engineer 工程师		



中国认可
国际互认
检测
TESTING
CNAS L5516

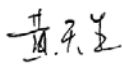
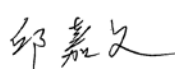

Report No./报告编号:
SNB180327013001B-R1

UN38.3 检测报告

UN38.3 Test Report

产品名称:	锂离子电池 18650
Name of Products:	Li-ion Battery 18650
委托单位:	深圳市康贝特电子有限公司
Client:	Shenzhen Keep Better Tech Electronics Co., Ltd
制造商:	深圳市康贝特电子有限公司
Manufacturer:	Shenzhen Keep Better Tech Electronics Co., Ltd
签发日期:	2019-12-19
Date of issue:	

深圳市北测检测技术有限公司
Shenzhen NTEK Testing Technology Co., Ltd.

Manufacturer 制造商	Shenzhen Keep Better Tech Electronics Co., Ltd 深圳市康贝特电子有限公司	
Address of manufacturer 制造商地址	16 Building, Fuyuan Industrial Park, 28 Qiaotang Road, Fuyong Town, Baoan District, Shenzhen China 深圳市宝安区福永桥塘路 28 号福源工业区 16 栋	
Factory 工厂	Shenzhen Keep Better Tech Electronics Co., Ltd 深圳市康贝特电子有限公司	
Address of factory 工厂地址	16 Building, Fuyuan Industrial Park, 28 Qiaotang Road, Fuyong Town, Baoan District, Shenzhen China 深圳市宝安区福永桥塘路 28 号福源工业区 16 栋	
Name of Products 产品名称	Li-ion Battery 锂离子电池	
Model/type reference 型号	18650	
Trade Mark 商标	-	
Tested according to 测试依据: Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Test and Criteria, PART III, section 38.3 Lithium metal and lithium ion batteries, the sixth revised edition (ST/SG/AC.10/11/Rev.6). 联合国《关于危险货物运输的建议书, 试验和标准手册》, 第三部分, 38.3 节锂金属和锂离子电池要求, 第六修订版 (ST/SG/AC.10/11/Rev.6)		
Tests performed 测试项目: Test T.1: Altitude simulation 试验 T.1: 高度模拟 Test T.5: External short circuit 试验 T.5: 外部短路 Test T.2: Thermal Test 试验 T.2: 温度试验 Test T.6: Impact 试验 T.6: 撞击 Test T.3: Vibration 试验 T.3: 振动 Test T.8: Forced discharge 试验 T.8: 强制放电 Test T.4: Shock 试验 T.4: 冲击		
Test Conclusion 试验结论: The Li-ion Battery submitted by Shenzhen Keep Better Tech Electronics Co., Ltd is tested according to the <i>Recommendations on the TRANSPORT OF DANGEROUS GOODS, Manual of Test and Criteria, PART III, section 38.3 Lithium metal and lithium ion batteries, the sixth revised edition (ST/SG/AC.10/11/Rev.6)</i> . Test results: PASS 由深圳市康贝特电子有限公司提交的锂离子电池按照联合国《关于危险货物运输的建议书, 试验和标准手册》, 第三部分, 38.3 节锂金属和锂离子电池要求, 第六修订版 (ST/SG/AC.10/11/Rev.6)进行测试。 测试结果: 合格		
Tested by: 主检人: 	Reviewed by: 审核人: 	Approved by: 批准人: 
Seal of NTEK 报告单位 (盖章)		

General product information 通用产品信息:			
Nominal Voltage 标称电压	3.7V	Rated Capacity 额定容量	2600mAh (9.62Wh)
Standard Charging Current 标准充电电流	520mA	Max. Continuous Charging Current 最大充电电流	2600mA
Limited Charging Voltage 充电限制电压	4.2V	Cut-Off Voltage 放电截止电压	2.5V
Standard Continuous Discharge Current 标准放电电流	520mA	Max. Continuous Discharge Current 最大放电电流	2600mA
Number of cells 电芯数量	Single cell 单电芯	Rated Capacity of Cell 电芯额定容量	2600mAh
Cell's Max. Continuous Discharge Current 电芯最大放电电流	2600mA	Appearance 外观	Blue and Cylindrical 圆柱形、蓝色
Classification 类别	Small Lithium ion Cells 小型锂离子电芯	Size (T×W×L) 尺寸	18.7×66.0mm

Date of receipt of test item 接收日期	2018-03-27	Completion Date 完成日期	2018-04-14
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<p>Remarks 备注说明:</p> <p>Batteries of A1#-A10# are fully charged at first cycle; Component cells of A11#-A15# at 50% charged of the design rated capacity at first cycle; Component cells of A16#-A25# are fully discharged at first cycle; Component cells of A26#-A35# are fully discharged after 50 cycles; Test environment condition: Room temperature: 15-25°C; Room humidity: 40-70% Note: This testing report displaces the original report of No. SNB180327013001B, and the original one No. SNB180327013001B was invalid since the date of this testing report released. 电池 A1#-A10#为首次循环满电状态; 元件电池芯 A11#-A15#为首次循环 50%充电状态; 元件电池芯 A16#-A25#为首次循环完全放电状态; 元件电池芯 A26#-A35#为 50 个循环后完全放电状态; 试验环境条件: 环境温度: 15-25°C; 环境湿度: 40-70% 注: 本报告替换原报告 SNB180327013001B, 自本报告签发之日起, 原报告 SNB180327013001B 作废。</p>
<p>Summaries of testing 测试摘要:</p> <p>Each battery type is subjected to tests T.1 to T.8. Tests T.1 to T.5 are conducted in sequence on the same battery. Tests 6 and 8 are conducted using not otherwise tested batteries. Test T.7 may be conducted using undamaged batteries previously used in Tests T.1 to T.5 for purposes of testing on cycled batteries.</p>

每一种类型的电池均应进行T.1至T.8项试验。电池必须按顺序在相同的一组电池上进行T.1至T.5的试验。T.6和T.8的试验应使用未另外试验过的电池。T.7的试验可以使用先前在T.1至T.5的试验中使用过的未损坏电池进行，以便测试进行在循环过的电池上。

In order to quantify the mass loss, the following procedure is provided:

$$\text{Mass loss}(\%)=(M_1-M_2)/M_1 \times 100$$

为了量化质量损失，可用以下公式计算：

$$\text{质量损失}(\%)=(M_1-M_2)/M_1 \times 100$$

Where M_1 is the mass before the test and M_2 is the mass after the test. When mass loss does not exceed the values in Table below, it is considered as "no mass loss".

式中： M_1 是试验前的质量， M_2 是试验后的质量。如果质量损失不超过下表所列的数值，应视为“无质量损失”。

Mass M of cell or battery 电芯或电池的质量	Mass loss limit 质量损失限值
$M < 1g$	0.5%
$1g \leq M \leq 75g$	0.2%
$M > 75g$	0.1%

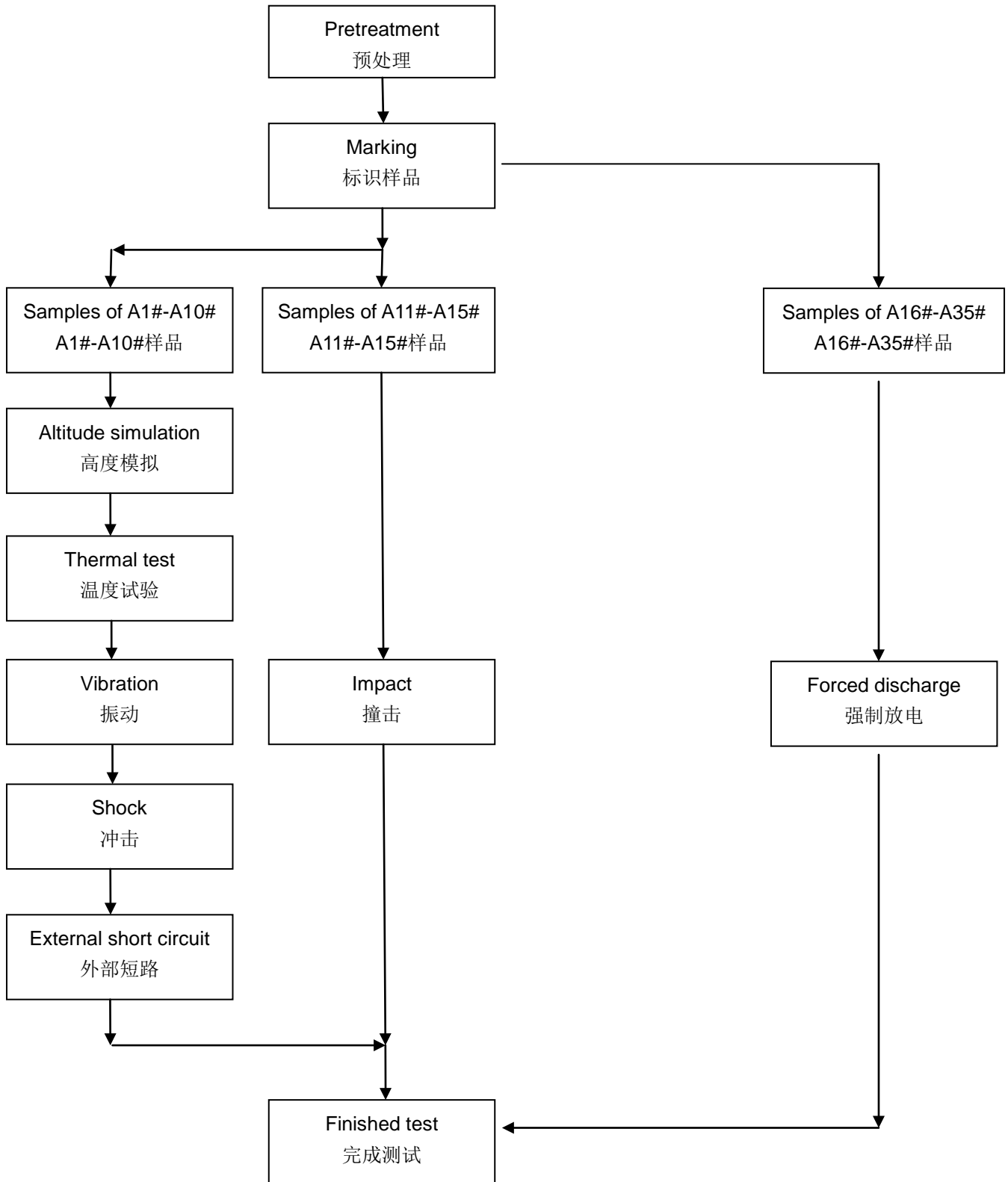
In tests T.1 to T.4, batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test battery after testing is not less than 90% of its voltage immediately prior to this procedure.

在T.1至T.4的试验中，电池须满足无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的90%。

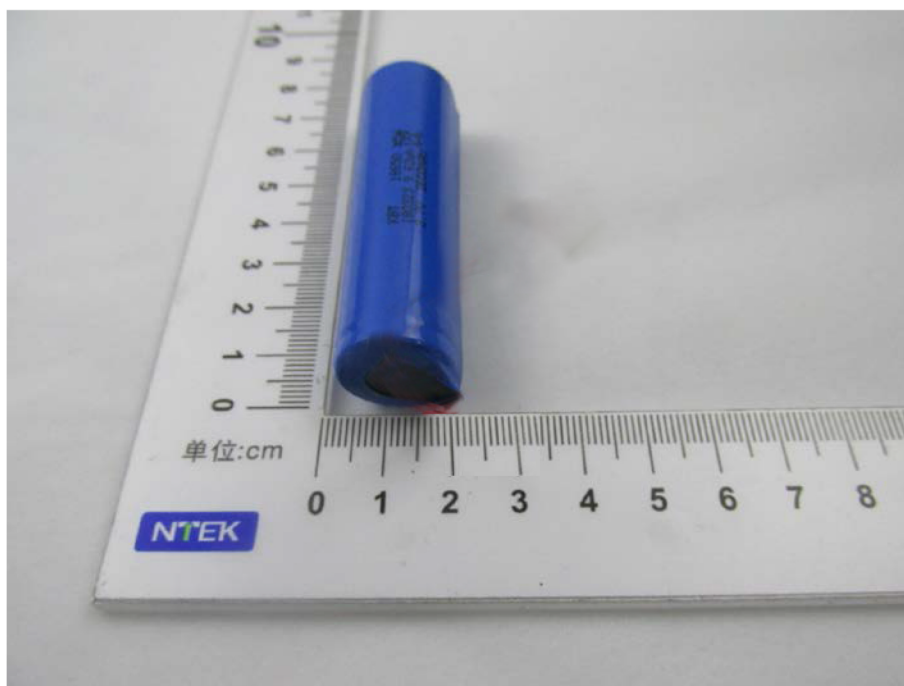
Test equipments 检测设备:

- LNS-005 Battery test system 电池检测系统
- LNS-006 Electronic balance 电子天平
- LNS-007 Low pressure chamber 低气压试验箱
- LNS-068 Programmable Temperature Chamber 可程式恒温箱
- LNS-008 Vibration test system 振动测试系统
- LNS-009 Hydraulic Hoist Vertical Shock System 液压垂直冲击系统
- LNS-010 Short circuit tester 短路测试机
- LNS-012 Explosion-proof chamber 防爆箱
- LNS-013 DC Source 直流电源
- LNS-044 Digital multimeter 数字式万用表
- LNS-035 midi Logger 记录仪
- LNS-011 Battery Impact tester 电池撞击试验机

Test Procedure 测试程序



Photos of sample 样品照片



Photos of sample 样品照片



Photos of sample 样品照片



Test results 测试结果:

Test T.1: Altitude simulation 试验T.1: 高度模拟

Test method 测试方法

Batteries are stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ($20 \pm 5^\circ\text{C}$).
 试验电池被放置在压力等于或低于11.6 kPa和环境温度($20\pm 5^\circ\text{C}$)下存放至少6小时。

Requirement 要求

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.

电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的90%。

Test Data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Prior to test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/ voltage prior to test (%) 试验后电压/ 试验前电压	Results 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Fully charged at first cycle 首次循环满电状态	A1#	47.799	4.174	47.799	4.172	0.00	99.95	PASS 合格
	A2#	48.420	4.181	48.420	4.175	0.00	99.86	PASS 合格
	A3#	47.794	4.179	47.794	4.173	0.00	99.86	PASS 合格
	A4#	47.956	4.175	47.956	4.170	0.00	99.88	PASS 合格
	A5#	47.047	4.170	47.047	4.168	0.00	99.95	PASS 合格
	A6#	47.190	4.183	47.190	4.177	0.00	99.86	PASS 合格
	A7#	47.345	4.177	47.345	4.172	0.00	99.88	PASS 合格
	A8#	47.852	4.175	47.852	4.173	0.00	99.95	PASS 合格
	A9#	47.114	4.174	47.114	4.170	0.00	99.90	PASS 合格
	A10#	47.622	4.178	47.622	4.173	0.00	99.88	PASS 合格

Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后，电池未渗漏、未泄气、未解体、未破裂和未起火。

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Room temperature 环境温度: 22.4°C

Test T.2: Thermal test 试验T.2: 温度试验
Test method 测试方法

Batteries are to be stored for at least six hours at a test temperature equal to $72 \pm 2^\circ\text{C}$, followed by storage for at least six hours at a test temperature equal to $-40 \pm 2^\circ\text{C}$. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated 10 times, after which all test batteries are to be stored for 24 hours at ambient temperature ($20 \pm 5^\circ\text{C}$).

电池放置在试验温度等于 $72 \pm 2^\circ\text{C}$ 的条件下存放至少6小时,接着再在试验温度等于 $-40 \pm 2^\circ\text{C}$ 的条件下存放至少6小时。两个极端试验温度之间的最大时间间隔为30分钟。此程序重复进行,共完成10次,接着将所有试验电池在环境温度($20 \pm 5^\circ\text{C}$)下存放24小时。

Requirement 要求

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.

电池须无渗漏、无泄气、无解体、无破裂和无起火,并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的90%。

Test Data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Prior to test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/ voltage prior to test (%) 试验后电压/ 试验前电压	Results 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Fully charged at first cycle 首次循环满电状态	A1#	47.799	4.172	47.785	4.148	0.029	99.42	PASS 合格
	A2#	48.420	4.175	48.410	4.142	0.021	99.21	PASS 合格
	A3#	47.794	4.173	47.779	4.146	0.031	99.35	PASS 合格
	A4#	47.956	4.170	47.938	4.141	0.038	99.30	PASS 合格
	A5#	47.047	4.168	47.032	4.146	0.032	99.47	PASS 合格
	A6#	47.190	4.177	47.179	4.143	0.023	99.19	PASS 合格
	A7#	47.345	4.172	47.331	4.146	0.030	99.38	PASS 合格
	A8#	47.852	4.173	47.839	4.140	0.027	99.21	PASS 合格
	A9#	47.114	4.170	47.102	4.146	0.025	99.42	PASS 合格

	A10#	47.622	4.173	47.608	4.145	0.029	99.33	PASS 合格
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Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电池未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 22.6°C

Test T.3: Vibration 试验T.3: 振动
Test method 测试方法

Batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep is as follows: from 7 Hz a peak acceleration of 1 g_n 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 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

电池紧固于振动台台面, 但不得造成电池变形, 并能准确可靠地传播振动。振动应是正弦波形, 对数扫描频率在 7 Hz 和 200 Hz 之间, 再回到 7 Hz, 1 次循环时间为 15 分钟。这一振动过程须对三个互相垂直的电池安装方位的每一方向重复进行 12 次, 总共为时 3 小时。其中一个振动方向必须与端面垂直。

对数扫频方式: 从 7 Hz 开始, 保持 1 g_n 的最大加速度, 直到频率达到 18 Hz。然后将振幅保持在 0.8 mm (总位移 1.6 mm), 并增加频率直到峰值加速度达到 8 g_n (频率约为 50 Hz)。将峰值加速度保持在 8 g_n 直到频率增加到 200 Hz。

Requirement 要求

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.

电池须无渗漏、无泄气、无解体、无破裂和无起火, 并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。

Test Data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Prior to test 试验前		After test 试验后		Mass loss 质量损失 (%)	Voltage after test/ voltage prior to test (%) 试验后电压/ 试验前电压	Results 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Fully charged at first cycle 首次循环满电状态	A1#	47.785	4.148	47.785	4.147	0.00	99.98	PASS 合格
	A2#	48.410	4.142	48.410	4.142	0.00	100.0	PASS 合格

	A3#	47.779	4.146	47.779	4.144	0.00	99.95	PASS 合格
	A4#	47.938	4.141	47.938	4.141	0.00	100.0	PASS 合格
	A5#	47.032	4.146	47.032	4.146	0.00	100.0	PASS 合格
	A6#	47.179	4.143	47.179	4.143	0.00	100.0	PASS 合格
	A7#	47.331	4.146	47.331	4.145	0.00	99.98	PASS 合格
	A8#	47.839	4.140	47.839	4.140	0.00	100.0	PASS 合格
	A9#	47.102	4.146	47.102	4.146	0.00	100.0	PASS 合格
	A10#	47.608	4.145	47.608	4.145	0.00	100.0	PASS 合格

Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电池未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 22.9°C

Test T.4: Shock 试验 T.4: 冲击
Test method 测试方法

Batteries are secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each battery is subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Each battery is subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the battery for a total of 18 shocks.

试验电池用刚性支架紧固在试验装置上, 支架支撑着每个试验电池组的所有安装面。每个电池须经受峰值加速度 150 g_n和脉冲持续时间6 ms的半正弦波冲击。每个电池须在三个互相垂直的电池安装方位的正方向经受三次冲击, 接着在反方向经受三次冲击, 总共经受18次冲击。

Requirement 要求

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.

电池须无渗漏、无泄气、无解体、无破裂和无起火, 并且每个试验电池在试验后的开路电压不小于其在进行这一试验前电压的90%。

Test Data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Prior to test 试验前		After test 试验后		Mass loss 质量损	Voltage after test/ voltage prior to test	Results 结果
		Mass 质量	Voltage 电压	Mass 质量	Voltage 电压			

		(g)	(V)	(g)	(V)	失 (%)	(%) 试验后电压/ 试验前电压	
Fully charged at first cycle 首次循环满电状 态	A1#	47.785	4.147	47.785	4.147	0.00	100.0	PASS 合格
	A2#	48.410	4.142	48.410	4.142	0.00	100.0	PASS 合格
	A3#	47.779	4.144	47.779	4.144	0.00	100.0	PASS 合格
	A4#	47.938	4.141	47.938	4.141	0.00	100.0	PASS 合格
	A5#	47.032	4.146	47.032	4.145	0.00	99.98	PASS 合格
	A6#	47.179	4.143	47.179	4.143	0.00	100.0	PASS 合格
	A7#	47.331	4.145	47.331	4.145	0.00	100.0	PASS 合格
	A8#	47.839	4.140	47.839	4.140	0.00	100.0	PASS 合格
	A9#	47.102	4.146	47.102	4.146	0.00	100.0	PASS 合格
	A10#	47.608	4.145	47.608	4.145	0.00	100.0	PASS 合格

Notes 注释:

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire.

测试后, 电池未渗漏、未泄气、未解体、未破裂和未起火。

Room temperature 环境温度: 22.3°C

Test T.5: External short circuit 试验T.5: 外部短路

Test method 测试方法

Batteries to be tested are 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 battery and is assessed and documented. Then the battery at 57 ± 4 °C is 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 are conducted at least at ambient temperature.

试验电池首先被加热或恒定一段时间, 使其达到 57 ± 4 °C并使其外表面温度均匀恒定在 57 ± 4 °C。该加热时间或热恒定时间的长短取决于该电池的尺寸和设计, 并同时加以评估及提供文件证明。然后该电池在 57 ± 4 °C的条件下承受一个外部总阻抗小于0.1Ω的短路条件。

该短路测试持续到电池外表面温度返回至 57 ± 4 °C后再保持至少1小时。

该短路和冷却阶段均被执行在 57 ± 4 °C的环境温度下。

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Requirement 要求

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 test.

电池外壳温度不超过170°C，并且在试验过程中及试验后6小时内无解体、无破裂，无起火。

Test data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Maximum outer casing temperature 电池表面最高温度 (°C)	Results 结果
Fully charged at first cycle 首次循环满电状态	A1#	68.3	PASS 合格
	A2#	57.9	PASS 合格
	A3#	67.3	PASS 合格
	A4#	90.4	PASS 合格
	A5#	78.2	PASS 合格
	A6#	61.2	PASS 合格
	A7#	75.0	PASS 合格
	A8#	61.6	PASS 合格
	A9#	58.6	PASS 合格
	A10#	57.8	PASS 合格

Notes 注释:

There is no disassembly, no rupture and no fire during the test and within six hours after test.

电池在测试中和测试后 6 小时内未解体、未破裂，未起火。

Room temperature 环境温度: 23.2°C

Test T.6: Impact 试验T.6: 撞击
Test method 测试方法

Each component cell is to be placed on a flat smooth surface. A 15.8 mm \pm 0.1 mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg \pm 0.1 kg mass is to be dropped from a height of 61 \pm 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm \pm 0.1mm diameter curved surface lying across the centre of the test sample.

Each sample is to be subjected to only a single impact.

每个元件电芯放在平坦光滑的表面上。一根 316 型不锈钢棒横放在试样中心，钢棒直径 15.8 \pm 0.1 毫米，长度至少 6 厘米，或电芯的最长尺度，取二者中较大者。将一块 9.1 \pm 0.1 kg 的重锤从 61 \pm 2.5 厘米高处跌落到钢棒和试样交叉点，使用一个几乎没有摩擦的、对落体重锤阻力很小的垂直导轨或管道加以控制。垂直导轨或管道用于引导落锤沿与水平支撑表面呈 90 度落下。

接受撞击的试样，纵轴应与测试平面平行并与横放在试样中心的直径 15.8 \pm 0.1 毫米弯曲表面的纵轴垂直。每一试样只经受一次撞击。

Requirement 要求

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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 the test.

元件电池芯外壳温度不超过170°C，并且在试验过程中及试验后6小时内无解体，无起火。

Test data showed in table below 测试数据见下表

State of samples 样品状态	No. 编号	Maximum outer casing temperature 电池表面最高温度 (°C)	Results 结果
50% charged of the design rated capacity at first cycle 首次循环 50%充电状态	A11#	123.6	PASS 合格
	A12#	128.2	PASS 合格
	A13#	120.1	PASS 合格
	A14#	125.4	PASS 合格
	A15#	119.8	PASS 合格

Notes 注释:

There is no disassembly, no rupture and no fire during the test and within six hours after test.

电池在测试中和测试后 6 小时内未解体、未起火。

Room temperature 环境温度: 22.6°C

Test T.8: Forced discharge 试验 T.8: 强制放电

Test method 测试方法

Each component cell is 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 is forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

每个元件电池芯在环境温度下与 12V 直流电电源串联在起始电流等于制造商给定的最大放电电流的条件下强制放电。

元件电池芯与一个适当大小的电阻负载串联以调节到规定大小的放电电流。每块电芯的放电时间（单位为 h）等于电芯的额定容量除以试验初始放电电流（单位 A）。

Requirement 要求

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

元件电池芯在试验过程中和试验后 7 天内无解体，无起火。

Test data showed in table below 测试数据见下表

Initial current 初始电流(mA)	2600mA		
Supply voltage 试验电压(Vdc)	12Vdc		
Time interval 试验时间(Minutes)	60 Minutes		
State of samples 样品状态	No. 编号	Results 结果	
Fully discharged at first cycle 首次循环完全放电状态	A16#	PASS 合格	
	A17#	PASS 合格	

	A18#	PASS 合格
	A19#	PASS 合格
	A20#	PASS 合格
	A21#	PASS 合格
	A22#	PASS 合格
	A23#	PASS 合格
	A24#	PASS 合格
	A25#	PASS 合格
Fully discharged after fifty cycles 50 个循环后完全放电状态	A26#	PASS 合格
	A27#	PASS 合格
	A28#	PASS 合格
	A29#	PASS 合格
	A30#	PASS 合格
	A31#	PASS 合格
	A32#	PASS 合格
	A33#	PASS 合格
	A34#	PASS 合格
	A35#	PASS 合格

Notes 注释:

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

元件电池芯在测试中和测试后 7 天内未解体, 未着火。

Room temperature 环境温度: 22.4°C

*******End of Test Report 检测报告结束*******

Important 注意事项

1. The test report is invalid without the Report Seal of NTEK and Paging seal of NTEK.
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2. Nobody is allowed to photocopy or partly photocopy this test report without written permission of NTEK.
未经本公司书面同意，不得部分地复制本报告书。
3. The test report is invalid without the signatures of Ratifier, Reviewer and Testing engineer.
本报告书无批准人、审核人、及主检人签名无效。
4. The report is invalid when anything of following happens – illegal transfer, reproduce, embezzlement, imposture, modification or tampering in any media form.
私自转让、复制、盗用、冒用、涂改、或以任何媒体形式篡改的报告书无效。
5. Objections to the test report must be submitted to NTEK within 15 days.
对报告书若有异议，应于收到报告之日起15天内向本公司提出。
6. The test report is valid for the tested samples only.
本报告仅对测试样品有效。
7. The Chinese contents in this report are only for reference.
本报告中的中文内容仅供参考。

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