

Lithium primary button cell

1. Identification of the product and of the company undertaking

Product details

Trade name:	Lithium primary button cell
Voltage:	3.0 V (or multiples of this in case of multi-cell configurations)
Electrochemical system:	Lithium metal organic electrolyte manganese dioxide
Anode (negative):	Lithium metal
Cathode (positive):	Manganese dioxide

Type:	Lithium content per cell:
CR 1025	0,009 g
CR 1216	0,008 g
CR 1220	0,01 g
CR 1225	0,015 g
CR 1616	0,02 g
CR 1620	0,02 g
CR 1632	0,04 g
CR 2016	0,03 g
CR 2016-P	0,03 g
CR 2025	0,05 g
CR 2025-P	0,05 g
CR 2032	0,07 g
CR 2032-P	0,07 g
CR 2320	0,043 g
CR 2430	0,09 g
CR 2430-P	0,09 g
CR 2450	0,17 g
CR 2450-P	0,17 g
CR 1/3 N	0,06 g
p 28 pxl	0,05 g

Supplier details

Address:	VARTA Microbattery GmbH Daimlerstr. 1 D-73479 Ellwangen/Jagst Germany
Emergency telephone number:	+49 7961 921 110 (VAC)

Legal Remark (U.S.A.)

Safety Data Sheets are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article". According to OSHA, Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

Because all of our batteries are defined as "articles", they are exempted from the requirements of the Hazard Communication Standard.

Legal remark (EU)

These batteries are no "substances" or "mixtures" according to Regulation (EC) No 1907/2006 EC. Instead they have to be regarded as "articles", no substances are intended to be released during handling. Therefore there is no obligation to supply a "safety data sheet according to Regulation (EC) 1907/2006, Article 31".

General remark

This Safety Data Sheet is provided as a service to our customers. The details presented are in accordance with our present knowledge and experiences. They are no contractual assurances of product attributes.

2. Hazards identification

The battery is sealed hermetically. Thus, the ingredients have no hazard potential, except the battery is violated or dismantled.

If in case of mistreatment the ingredients are released, a spontaneously flammable gas mixture may be released under certain circumstances (measures according to chapter 4 to 6).

Attention: If batteries are treated wrong the danger of burns or bursts occurs. Batteries must not be heated above 100°C or incinerated. The battery contents must not get in contact with water. If the negative electrode gets in contact with water or humidity hydrogen gas is formed, which may inflame spontaneously.

3. Composition/information on ingredients

Ingredients

Contents	CAS No.	Hazard Categories	Hazard Statements	Material
1 - 3 %	7439-93-2	Water-react. 1 Skin Corr. 1B	H260 H314	Lithium
13 - 40 %	1313-13-9	Acute Tox. 4	H302 H332	Manganese dioxide
< 10 %	108-32-7	Eye Irrit. 2	H319	Propylene carbonate
< 10 %	110-71-4	Flam. Liq. 2 Repr. 1B Acute Tox. 4	H225 H360-FD H332	1,2-Dimethoxy ethane
< 5 %	646-06-0	Flam. Liq. 2	H225	1,3-Dioxolane
< 5 %	7791-03-9	Ox. Sol. 2 Skin Irrit. 2 Eye Irrit. 2 STOT SE 3	H272 H315 H319 H335	Lithium perchlorate

Full text of Hazard statements: see section 16.

Heavy Metals and RoHS Relevant Substances

Contents	CAS No.	Material
< 1 mg/kg	7440-43-9	Cadmium
< 10 mg/kg	7439-92-1	Lead
< 0,1 mg/kg	7439-97-6	Mercury (none intentionally introduced, see Chapter 12)
< 5 mg/kg		Hexavalent Chromium (Cr ⁶⁺)
< 5 mg/kg		PBB
< 5 mg/kg		PBDE

Other Ingredients

Contents	CAS No.	Material
33 - 74 %		Steel and nickel
3 - 10 %		Plastic

SVHC substances according to REACH (Article 33)

Contents	EC No.	CAS No.	Material
> 0.1 %	203-794-9	110-71-4	1,2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME)

For information to allow safe use: see section 7.

4. First-aid measures

Measures at accidental release

After inhalation:	Fresh air. Seek for medical assistance.
After skin contact:	Remove solid particles immediately. Flush affected areas with plenty of water (at least 15 min.). Remove contaminated cloth immediately. Seek for medical assistance.
After eye contact:	Flush the eye gently with plenty of water (at least 15 min.). Seek for medical assistance.
After ingestion of battery components:	Drink plenty of water. Avoid vomiting. Seek for medical assistance. No trials for neutralization.

After ingestion of battery:

In the event of battery ingestion, seek immediate medical attention at a hospital emergency room.

Do not let your child eat or drink until an X-ray can determine if a battery is present.

If you still have the battery packaging or the device containing the battery take this with you to help the doctor identify the battery type and chemistry.

Further advice for the medical sector: <http://buttonbatterysafety.com/>

See also Chapter 7.

5. Fire-fighting measures

Suitable extinguishing media:	Metal fire extinction powder, rock salt or dry sand shall be used. In case only water is available, it can be used in large amounts.
Extinguishing media with limited suitability:	Carbon dioxide (CO ₂) is not suitable. Water in small quantities may have adverse effects.
Special protection equipment during fire-fighting:	Protective clothing including breathing apparatus.
Special hazard:	Cells may explode and release metal parts. At contact of anode material with water extremely flammable hydrogen gas and caustic liquid are released.
Attention:	Do not let used extinguishing media penetrate into surface water or ground water. Dispose off properly.

6. Accidental release measures

Person related measures:	Wear personal protective equipment adapted to the situation (protection gloves, cloth, face protection, breathing protection).
Environment protection measures:	Bind released ingredients with powder (rock salt, sand). Dispose off according to the local law and rules. Avoid leached substances to penetrate into the earth, canalization or water.
Treatment for cleaning:	If battery casing is dismantled, small amounts of electrolyte may leak. Package the battery tightly including ingredients together with lime, sand or rock salt. Then clean with water.

7. Handling and storage

Guideline for safe handling:	Always follow the warning information on the batteries and in the manuals of devices. Only use the recommended battery types. Keep batteries away from children. For devices to be used by children, the battery casing should be protected against unauthorized access. Unpacked batteries shall not lie about in bulk. In case of battery change always replace all batteries by new ones of identical type and brand. Do not swallow batteries. Do not throw batteries into water. Do not throw batteries into fire. Do not short-circuit batteries. Do not recharge primary batteries. Do not open or disassemble batteries. Further advice for parents: http://buttonbatterysafety.com/ http://www.productsafety.gov.au/content/index.phtml/itemId/993224
Supply to private end users:	In case the products are supplied to private end users packed with equipment or contained in equipment it is strongly recommended to follow UL product and instruction manual requirements: The product is required to be marked with a graphical symbol that alerts the user to refer to the instruction manual. The instruction manual itself is required to contain - a warning marking with text to alert the user of the potential chemical burn hazard associated with coin/button battery ingestion, - an instruction as to the presence of a coin/button cell battery, - possible effects of battery ingestion, - an instruction to keep batteries away from children, - an advice to seek immediate medical attention if it suspected that batteries have either been swallowed or placed inside any part of the body.

Storage:	Storage preferably at room temperature (approx. 20°C). Avoid large temperature changes. Avoid direct sunlight. At higher temperature the electrical performance may be reduced. Storage of unpacked batteries can cause short circuit and heat generation.
Storage category according to TRGS 510:	It is recommended to consider the "Technical Rule for Hazardous Substances TRGS 510 - Storage of hazardous substances in nonstationary containers" and to handle lithium primary button cells according to storage category 11 ("combustible solids").
Storage of large amounts:	Follow the recommendations of the German Insurance Association (GDV - "Gesamtverband der Deutschen Versicherungswirtschaft e.V.") concerning lithium batteries: http://vds.de/fileadmin/vds_publikationen/vds_3103_web.pdf In case of storage of large amounts (used storage volume > 7 m ³ and/or more than 6 pallets) batteries shall be stored in fire-resistant or separated rooms or areas (e.g. warehouse or container for hazardous materials). Mixed storage with other products is not allowed. The storage area shall be monitored by an automatic fire detection system, connected to a permanently manned place. A fire-extinguishing system shall reflect the extinguishing agents mentioned in chapter 5.

8. Exposure controls/personal protection

Under normal conditions (during discharge) release of ingredients does not occur.

9. Physical and chemical properties

Not applicable if closed.

10. Stability and reactivity

Dangerous reactions: When heated above 100°C the risk of rupture occurs.

11. Toxicological information

Under normal conditions (during charge and discharge) release of ingredients does not occur. In case of accidental release see information in chapter 2.

Swallowing of a battery can be harmful. Call the local Poison Control Centre for advice and follow-up.

12. Ecological information

Lithium primary button cells manufactured by VARTA Microbattery do not contain heavy metals as defined by the European directives 2006/66/EC Article 21; they comply with the chemical composition requirements of this Directive.

Mercury has not been "intentionally introduced (as distinguished from mercury that may be incidentally present in other materials)" in the sense of the U.S.A. "Mercury-Containing and Rechargeable Battery Management Act" (May 13 1996).

The Regulation on Mercury Content Limitation for Batteries promulgated on 1997-12-31 by the China authorities including the State Administration of Light Industry and the State Environmental Protection Administration defines 'low mercury' as 'mercury content by weight in battery as less than 0.025%', and 'mercury free' as 'mercury content by weight in battery as less than 0.0001%'. And therefore: Varta lithium primary button cells/batteries belong to the category of mercury-free battery (mercury content lower than 0.0001%).

13. Disposal considerations

USA: Lithium primary button cells are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream.

In the European Union, manufacturing, handling and disposal of batteries is regulated on the basis of the DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. Customers find detailed information on disposal in their specific countries using the web site of the European Portable Batteries Association (http://www.epbaeurope.net/legislation_national.html).

Importers and users outside EU should consider the local law and rules.

In order to avoid short circuit and heating, used lithium primary button cells should never be stored or transported in bulk. Proper measures against short circuit are:

- Storage of batteries in original packaging
- Coverage of the terminals
- Embedding in dry sand

14. Transport information

General considerations

Lithium primary button cells manufactured by VARTA Microbattery are considered to be UN3090 Lithium Metal Batteries and are tested according to 38.3 of the "UN Manual of Tests and Criteria" for compliance with the requirements of special provisions ADR 188, IMDG 188, as well as the requirements of DOT / 49 CFR § 173.185, and the General Requirements of IATA DGR packing instruction 968. Positive test results as well as other relevant information required for transportation are stated in dedicated "Declarations of Conformity".

Transportations of cells or batteries packed with equipment or contained in equipment have to follow the appropriate regulations for UN3091.

Compilations of transport requirements for Lithium batteries can be found in:

<https://www.lithium-batterie-service.de/en/>

<http://www.iata.org/whatwedo/cargo/dgr/Documents/lithium-battery-guidance-document-2017-en.pdf>

Each cell/battery is manufactured under the quality management program described in IATA DGR clause 3.9.2.6, ADR clause 2.2.9.1.7 e), and IMDG code clause 2.9.4.5.

IEC 60086-1

Code of practice for packaging and shipment of primary batteries given in IEC 60086-1:

The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking. The materials and pack design shall be chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of moisture.

Shock and vibration shall be kept to a minimum. For instance, boxes should not be thrown off trucks, slammed into position or piled so high as to overload battery containers below. Protection from inclement weather should be provided.

15. Regulatory information

Marking consideration:

For the state of California these batteries have to be marked as "containing perchlorate".

According to "DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC" the batteries have to be marked with the crossed bin. Due to the size of the products the battery need not be marked but a symbol measuring at least 1 x 1 cm shall be printed on the packaging.

International safety standards:

The basis cells are recognized components according to UL 1642.

Water hazard class:

The regulations of the German Federal Water Management Act (WHG) are not applicable as Lithium primary batteries are articles and not substances, thus there is no risk of water pollution, except the batteries are violated or dismantled.

16. Other information

Full text of Hazard Statements referred to under section 3

H225	Highly flammable liquid and vapour.
H260	In contact with water releases flammable gases which may ignite spontaneously.
H272	May intensify fire; oxidizer.
H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H360FD	May damage fertility. May damage the unborn child.

Note:	Date of issue of the transport regulations: ADR 2017, RID 2017, IATA 2018 (59th edition), IMDG 2016, DOT / 49 CFR 2018. Latest covered modification of the European Battery Directive 2006/66/EC: Directive 2013/56/EU.
Issued by:	VARTA Microbattery GmbH Quality/Environmental Management
RoHS:	See special Declaration
REACH:	See special Declaration
Issued by:	VARTA Microbattery GmbH Quality / Environmental Management
Contact:	https://www.varta-microbattery.com/contact/?lang=en
Updates:	Current SDS can be downloaded from VARTA's web page .



Pony Testing International Group

报告编号(Report ID): MLIIIV2VB47412721

UN38.3 测试报告

UN38.3 Test Report

Sample Description
& Model

Disposable button lithium cell CR2032

Applicant

AML Dongguan Jie Xun Electronic Co.,Ltd.

Manufacturer

renata sa

P O N Y 谱尼测试
Pony Testing International Group
www.ponytest.com

No.: MLIIIV2VB47412721

Code: kdc03gzlx





Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 1 of 14

I、SAMPLE DESCRIPTION

Sample Description	Disposable button lithium cell		Sample Model	CR2032	
Applicant	AML Dongguan Jie Xun Electronic Co.,Ltd.				
Manufacturer	renata sa				
Nominal Voltage	3V	Rated Capacity	225mAh	Limited Charge Voltage	---
Charge Current	---	Maximum Continuous Charge Current	---	End Charge Current	---
Cut-off Voltage	2V	Maximum Discharge Current	3mA	Use	---
Cell Number In Each Battery	1PCS	Cell Model	CR2032	Cell Capacity	---
Electrochemistry System	Li/MnO ₂				
Manufacturer of cell	renata sa				
Entrust date	2017-07-21		Finished date	2017-08-11	

II、TEST METHOD

UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.6), Part III sub-section.

III、TEST ITEM

- | | |
|------------------------|---------------------------|
| 1. Altitude simulation | 5. External short circuit |
| 2. Thermal test | 6. Crush |
| 3. Vibration | 7. Overcharge |
| 4. Shock | 8. Forced discharge |

IV、CONCLUSION

ITEM	SAMPLE NUMBER	STANDARD	CONCLUSION
Altitude simulation	N1~N10 N11~N20	UN38.3 ST/SG/AC.10/11/Rev.6	PASS
Thermal test			PASS
Vibration			PASS
Shock			PASS
External short circuit			PASS
Crush	N21~N30		PASS
Overcharge	---		N/A (Not applicable)
Forced discharge	N31~N40		PASS

The Samples has passed the test items of UNITED NATIONS "Recommendations on the TRANSPORT OF DANGEROUS GOODS" Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.6), Part III sub-section.

Appraiser:

liuwei

Checker:

yjdmm

Approver:

Yishaobin

Issue Date: August 11, 2017

www.ponytest.com

☎Hotline 400-819-5688

北京实验室: (010) 82618116

长春实验室: (0431) 85150908

上海实验室: (021) 64851999

深圳实验室: (0755) 26050909

青岛实验室: (0532) 88706866

哈尔滨实验室: (0451) 88104651

宁波实验室: (0574) 87736499

广州实验室: (020) 89224310

天津实验室: (022) 27360730

大连实验室: (0411) 84650820

杭州实验室: (0571) 87219096

武汉实验室: (027) 83997127

新疆实验室: (0991) 6684186

郑州实验室: (0371) 69350670

苏州实验室: (0512) 62997900

厦门实验室: (0592) 5568048

PONY 谱尼测试

Pony Testing International Group

Pony Testing International Group Shenzhen Co., Ltd.
Address: 1F., Building 6, Zhongxing Industry City, Chuangye
Road, Nanshan District, Shenzhen, Guangdong, China



Pony Testing International Group

Report ID: MLIIIV2VB47412721

Page 2 of 14

Notes:

N1~N10, N21~N25: Cells in undischarged states;

N11~N20, N26~N40: Cells in fully discharged states.

V、PHOTO OF THE SAMPLE



Authenticate the photo on original report only



Pony Testing International Group

VI、 TEST METHOD

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or 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.

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

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

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 blow, it shall be considered as “no mass loss”.

Mass M of cell or battery	Mass loss limit
$M < 1\text{g}$	0.5%
$1\text{g} \leq M \leq 75\text{g}$	0.2%
$M > 75\text{g}$	0.1%

T.1 Altitude simulation

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature ($20 \pm 5^\circ\text{C}$).

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.2 Thermal test

Test cells and 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 until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature ($20 \pm 5^\circ\text{C}$). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.



Pony Testing International Group

T.3 Vibration

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

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 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.

For large batteries: from 7 Hz to 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 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery after testing in its perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.4 Shock

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds.

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.



Pony Testing International Group

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g _n or result of formula	6 ms
	$\text{Acceleration}(g_n) = \sqrt{\left(\frac{100850}{\text{mass}^*}\right)}$	
	Whichever is smaller	
Large batteries	50 g _n or result of formula	11 ms
	$\text{Acceleration}(g_n) = \sqrt{\left(\frac{30000}{\text{mass}^*}\right)}$	
	Whichever is smaller	

* Mass is expressed in kilograms.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

Cells and 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 cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

T.5 External short circuit

The cell or battery to be tested shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of $57 \pm 4^\circ\text{C}$, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at $57 \pm 4^\circ\text{C}$ shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to $57 \pm 4^\circ\text{C}$, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value. The short circuit and cooling down phases shall be conducted at least at ambient temperature.

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



Pony Testing International Group

T.6 Impact / Crush

Impact (applicable to cylindrical cells not less than 18 mm in diameter)

The test sample cell or component cell is to be placed on a flat smooth surface. A $15.8 \text{ mm} \pm 0.1 \text{ mm}$ 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 $9.1 \text{ kg} \pm 0.1 \text{ kg}$ mass is to be dropped from a height of $61 \pm 2.5 \text{ cm}$ 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 $15.8 \text{ mm} \pm 0.1 \text{ mm}$ diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18 mm in diameter)

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

- (a) The applied force reaches $13 \text{ kN} \pm 0.78 \text{ kN}$;
- (b) The voltage of the cell drops by at least 100 mV; or
- (c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

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

T.7 Overcharge

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:



Pony Testing International Group

- (a) When the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.
- (b) When the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature; the duration of the test shall be 24 hours.

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

T.8 Forced discharge

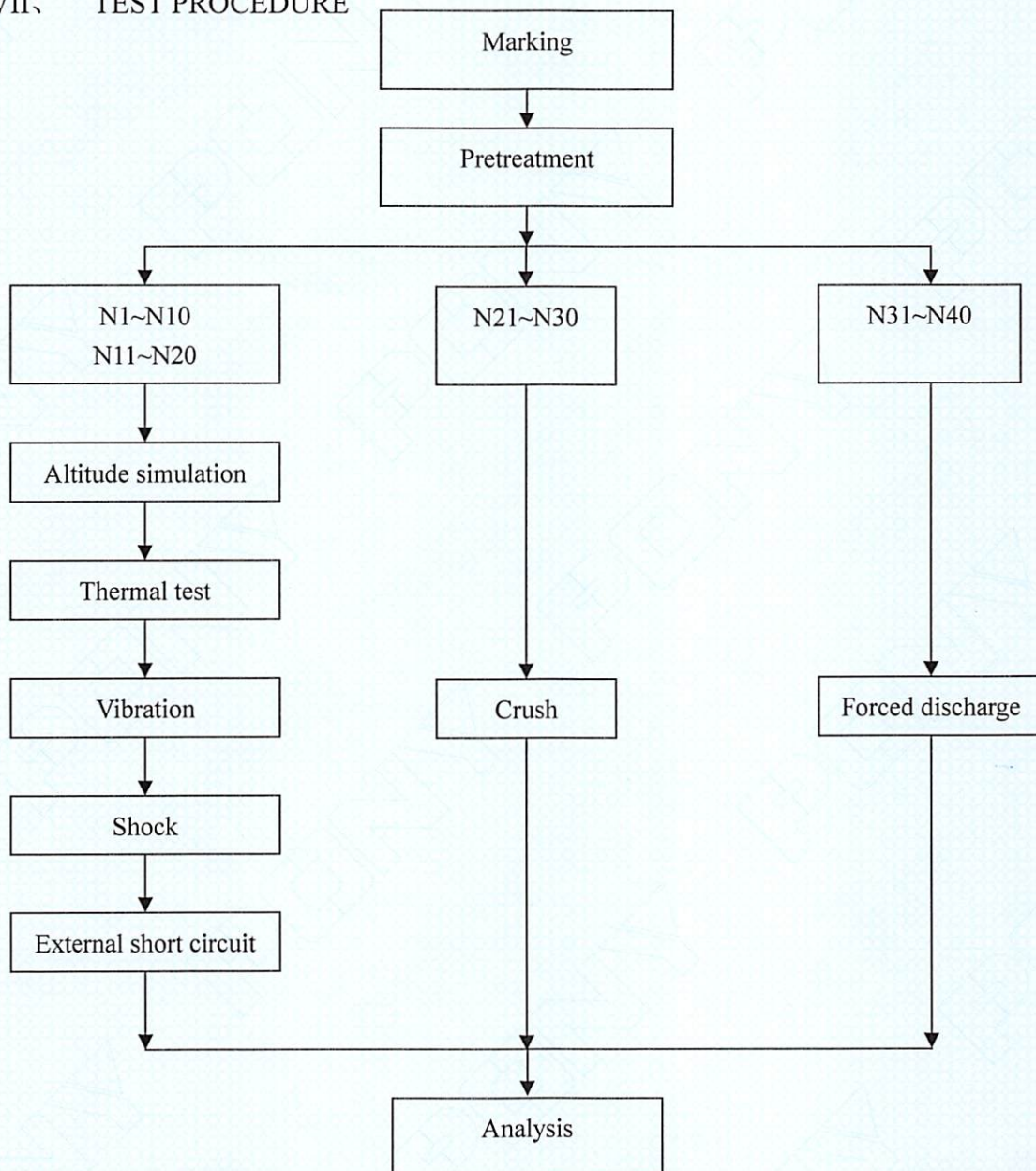
Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

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



VII、 TEST PROCEDURE



VIII、 TEST APPARATUS

IE-0121 High precision battery test system

IE-0434 Vacuum drying oven

IE-0090 Multimeter

IE-0259 Electronic balance

IE-0219 Rapid temperature change test chamber

IE-0281 Temperature controlled short circuit testing machine

IE-0544 High speed programmable power supply

IE-0503 Electric vibration test system

IE-0287 Vertical impact crash test platform

IE-0185 The digital thermometer (TC)

IE-0198 Battery crush testing machine



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 9 of 14

IX、 DATA

1. Altitude simulation

No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassembly, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
N1	3.047	3.239	3.047	3.239	0.000	0.000	N
N2	3.071	3.235	3.070	3.235	0.033	0.000	N
N3	3.055	3.240	3.055	3.240	0.000	0.000	N
N4	3.049	3.228	3.049	3.228	0.000	0.000	N
N5	3.055	3.223	3.054	3.223	0.033	0.000	N
N6	3.048	3.222	3.048	3.222	0.000	0.000	N
N7	3.031	3.115	3.031	3.116	0.000	-0.032	N
N8	3.061	3.215	3.060	3.216	0.033	-0.031	N
N9	3.054	3.227	3.052	3.227	0.065	0.000	N
N10	3.055	3.225	3.055	3.224	0.000	0.031	N
N11	3.037	---	3.035	---	0.066	---	N
N12	3.038	---	3.038	---	0.000	---	N
N13	3.043	---	3.043	---	0.000	---	N
N14	3.034	---	3.034	---	0.000	---	N
N15	3.039	---	3.039	---	0.000	---	N
N16	3.024	---	3.024	---	0.000	---	N
N17	3.054	---	3.053	---	0.033	---	N
N18	3.049	---	3.049	---	0.000	---	N
N19	3.054	---	3.054	---	0.000	---	N
N20	3.040	---	3.040	---	0.000	---	N



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 10 of 14

2. Thermal test

No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassembly, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
N1	3.047	3.239	3.047	3.239	0.000	0.000	N
N2	3.070	3.235	3.070	3.232	0.000	0.093	N
N3	3.055	3.240	3.054	3.241	0.033	-0.031	N
N4	3.049	3.228	3.049	3.233	0.000	-0.155	N
N5	3.054	3.223	3.054	3.232	0.000	-0.279	N
N6	3.048	3.222	3.048	3.229	0.000	-0.217	N
N7	3.031	3.116	3.031	3.231	0.000	-3.691	N
N8	3.060	3.216	3.060	3.220	0.000	-0.124	N
N9	3.052	3.227	3.051	3.226	0.033	0.031	N
N10	3.055	3.224	3.055	3.232	0.000	-0.248	N
N11	3.035	---	3.035	---	0.000	---	N
N12	3.038	---	3.038	---	0.000	---	N
N13	3.043	---	3.043	---	0.000	---	N
N14	3.034	---	3.032	---	0.066	---	N
N15	3.039	---	3.039	---	0.000	---	N
N16	3.024	---	3.024	---	0.000	---	N
N17	3.053	---	3.053	---	0.000	---	N
N18	3.049	---	3.049	---	0.000	---	N
N19	3.054	---	3.054	---	0.000	---	N
N20	3.040	---	3.040	---	0.000	---	N



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 11 of 14

3. Vibration

No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassembly, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
N1	3.047	3.239	3.047	3.238	0.000	0.031	N
N2	3.070	3.232	3.069	3.232	0.033	0.000	N
N3	3.054	3.241	3.054	3.242	0.000	-0.031	N
N4	3.049	3.233	3.049	3.233	0.000	0.000	N
N5	3.054	3.232	3.054	3.232	0.000	0.000	N
N6	3.048	3.229	3.048	3.229	0.000	0.000	N
N7	3.031	3.231	3.031	3.232	0.000	-0.031	N
N8	3.060	3.220	3.060	3.220	0.000	0.000	N
N9	3.051	3.226	3.051	3.226	0.000	0.000	N
N10	3.055	3.232	3.055	3.232	0.000	0.000	N
N11	3.035	---	3.034	---	0.033	---	N
N12	3.038	---	3.038	---	0.000	---	N
N13	3.043	---	3.043	---	0.000	---	N
N14	3.032	---	3.032	---	0.000	---	N
N15	3.039	---	3.039	---	0.000	---	N
N16	3.024	---	3.024	---	0.000	---	N
N17	3.053	---	3.053	---	0.000	---	N
N18	3.049	---	3.049	---	0.000	---	N
N19	3.054	---	3.054	---	0.000	---	N
N20	3.040	---	3.040	---	0.000	---	N



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 12 of 14

4. Shock

No.	Pre-test		After test		Mass loss (%)	Voltage loss (%)	Whether leakage, venting, disassembly, rupture, fire (Y/N)
	Mass (g)	Voltage (V)	Mass (g)	Voltage (V)			
N1	3.047	3.238	3.047	3.238	0.000	0.000	N
N2	3.069	3.232	3.069	3.232	0.000	0.000	N
N3	3.054	3.242	3.054	3.241	0.000	0.031	N
N4	3.049	3.233	3.049	3.233	0.000	0.000	N
N5	3.054	3.232	3.053	3.232	0.033	0.000	N
N6	3.048	3.229	3.048	3.229	0.000	0.000	N
N7	3.031	3.232	3.031	3.233	0.000	-0.031	N
N8	3.060	3.220	3.059	3.220	0.033	0.000	N
N9	3.051	3.226	3.051	3.226	0.000	0.000	N
N10	3.055	3.232	3.055	3.232	0.000	0.000	N
N11	3.034	---	3.034	---	0.000	---	N
N12	3.038	---	3.038	---	0.000	---	N
N13	3.043	---	3.043	---	0.000	---	N
N14	3.032	---	3.032	---	0.000	---	N
N15	3.039	---	3.039	---	0.000	---	N
N16	3.024	---	3.024	---	0.000	---	N
N17	3.053	---	3.053	---	0.000	---	N
N18	3.049	---	3.049	---	0.000	---	N
N19	3.054	---	3.054	---	0.000	---	N
N20	3.040	---	3.040	---	0.000	---	N



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 13 of 14

5. External short circuit

No.	Peak temperature (°C)	Whether disassembly, rupture, fire (Y/N)
N1	61.6	N
N2	61.3	N
N3	60.7	N
N4	62.0	N
N5	61.9	N
N6	61.3	N
N7	62.0	N
N8	61.7	N
N9	61.5	N
N10	61.8	N
N11	59.6	N
N12	59.3	N
N13	58.9	N
N14	59.4	N
N15	58.7	N
N16	58.8	N
N17	59.2	N
N18	59.3	N
N19	59.5	N
N20	59.2	N



Pony Testing International Group

Report ID: MLIIV2VB47412721

Page 14 of 14

6. Crush

No.	Peak temperature (°C)	Whether disassembly, fire (Y/N)
N21	26.2	N
N22	26.3	N
N23	26.5	N
N24	26.4	N
N25	26.1	N
N26	26.0	N
N27	26.1	N
N28	25.9	N
N29	26.2	N
N30	25.9	N

7. Overcharge

N/A

8. Forced discharge

No.	Whether disassembly, fire (Y/N)
N31	N
N32	N
N33	N
N34	N
N35	N
N36	N
N37	N
N38	N
N39	N
N40	N

*** End of report ***