

APPLICATION FOR LOW VOLTAGE DIRECTIVE TEST REPORT

On Behalf of

Shenzhen Tcbest Battery Industry Co., Ltd.

Alkaline Battery

Model:LR6 Alkaline Battery

Prepared For : Shenzhen Tcbest Battery Industry Co., Ltd.
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Date of Test: Sep. 18, 2015 to Oct. 20, 2015
Date of Report: Oct. 20, 2015
Report Number: R011509898S

TEST REPORT

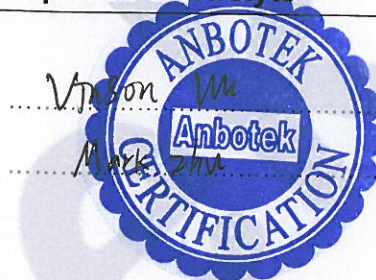
EN 60086-1:2011 & EN 60086-2:2011 & EN 60086-5:2011

Primary batteries –Part 1: General

Primary batteries –Part 2: Physical and electrical specifications

Primary batteries – Part 5: Safety of batteries with aqueous electrolyte

Reference No.....: R011509898S
Compiled by (+ signature).....: Vinson Wu / Project Engineer
Approved by (+ signature).....: Mark Zhu / Project Manager
Date of issue.....: Oct. 20, 2015
Contents.....: 18 pages (including 1 photo pages)



Testing laboratory

Name.....: Anbotek Compliance Laboratory Limited
Address.....: 1/F, 1 /Building, SEC Industrial Park, No.4 Qianhai Road, Nanshan District, Shenzhen, 518054, China
Testing location.....: Same as above

Client

Name.....: Shenzhen Tcbest Battery Industry Co., Ltd.
Address.....: Floor5#, Building A6, Yintian Industrial, Xixiang Street, Bao'an Shenzhen, China

Test specification

Standard.....: EN 60086-1:2011 & EN 60086-2:2011 & EN 60086-5:2011
Test procedure: Compliance with EN 60086-1:2011 & EN 60086-2:2011 & EN 60086-5:2011
Procedure deviation.....: N.A.
Non-standard test method.....: N.A.

Test item

Description : Alkaline Battery
Model and/or type reference.....: LR6 Alkaline Battery
Manufacturer.....: Shenzhen Tcbest Battery Industry Co., Ltd.
Address.....: Floor5#, Building A6, Yintian Industrial, Xixiang Street, Bao'an Shenzhen, China
Rating(s).....: DC1.5V

Testing

Date of receipt of test item.....: Sep. 18, 2015

Date(s) of performance of tests.....: Sep. 18, 2015 to Oct. 20, 2015

General remarks

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

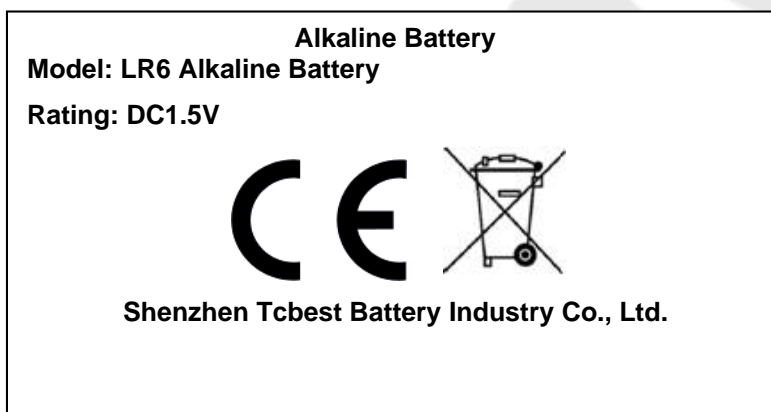
The test results presented in this report relate only to the item tested.

"(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.

Copy of marking plate(s)



EN 60086-1:2011 & EN 60086-2:2011			
Test Item	Specifications of Standard(Digest)	Test Result	Conclusion
4.1.2 Battery Dimensions (mm)	49.5≤Height≤50.5	44.44~50.47	P
	13.7≤Diameter≤14.5	14.03~14.36	P
4.1.3 Terminals	Accordance with clause 7 of IEC 60086-2. Ensure that the batteries make and maintain good electrical contact at all times. Made of materials that provide adequate electrical conductivity and corrosion protection.	Conformity	P
4.1.6 Cell Designation & Marking	Marked with the following information: designation; year and month or week of manufacture, or the expiration of guarantee period; polarity of terminals; nominal voltage; name or trade mark of the manufacturer or supplier	Conformity	P
4.2.1 Discharge performance	Minimum average duration of 5.1 Ω discharge (discharge conditions: 4min beginning at hourly intervals for 8h per day, discharge to 0.9V)>50min.	MAD=76.41min	P
	Minimum average duration of 24 Ω discharge (discharge conditions: 15s per minute, 8h per day, discharge to 1.0V)>4h.	MAD=7.5h	P
	Minimum average duration of 10 Ω discharge (discharge conditions: 1h per day, discharge to 0.9V)≥1.4h.	MAD=2.8h	P
	Minimum average duration of 75 Ω discharge (discharge conditions: 4h per day, discharge to 0.9V)≥20h.	MAD=26.46h	P
4.2.2 Dimensional stability	The dimensions shall conform with the relevant specified dimensions as given in IEC 60086-2 at all times during testing.	Conformity	P
4.2.3 Leakage	No leakage shall occur.	Conformity	P
4.2.4 Open-circuit voltage limits	1.5V~1.68V	1.613~1.625	P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
4	Requirements for safety		P
4.1	Design		P
4.1.1	General		P
	Batteries shall be so designed that they do not present a safety hazard under conditions of normal (intended) use and reasonable foreseeable misuse.		P
4.1.2	Venting		N
	All batteries shall incorporate a pressure relief feature or shall be so constructed that they will relieve excessive internal pressure at a value and rate which will preclude explosion. If encapsulation is necessary to support cells within an outer case, the type of encapsulant and the method of encapsulation shall not cause the battery to overheat during normal operation nor inhibit the operation of the pressure relief feature.		N
4.1.3	Insulation resistance		P
	The insulation resistance between externally exposed metal surfaces of the battery excluding electrical contact surfaces and either terminal shall be not less than 5 M Ω at (500 \pm 20) V.		P
4.2	Quality plan		P
	The manufacturer shall prepare a quality plan defining the procedures for the inspection of materials, components, cells and batteries during the course of manufacture, to be applied to the total process of producing a specific type of battery.		P
5	Sampling		N
5.1	General		N
	Samples should be drawn from production lots in accordance with accepted statistical methods.		N
5.2	Sampling for type approval		N
6	Testing and requirements		P
6.1	General		P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
	Test methods and requirements are shown in Table 1		P
	Tests described in Tables 2 and 6 are intended to simulate conditions which the battery is likely to encounter during intended use and reasonably foreseeable misuse		P
6.1.1	Safety notice		P
	WARNING These tests call for the use of procedures which may result in injury if adequate precautions are not taken. It has been assumed in the drafting of these tests that their execution is undertaken by appropriately qualified and experienced technicians using adequate protection.		P
6.1.2	Ambient temperature		P
	Unless otherwise specified, these tests shall be carried out at $(20 \pm 5) ^\circ\text{C}$.		P
6.2	Intended use		P
6.2.1	Intended use tests and requirements		P
6.2.2	Intended use test procedures		P
6.2.2.1	Test A – storage after partial use		P
	<p>a) Purpose This test simulates the situation when an appliance is switched off and the installed batteries are partly discharged. These batteries may be left in the appliance for a long time or they are removed from the appliance and stored for a long time.</p> <p>b) Test procedure An undischarged battery is discharged under an application/service output test condition, with the lowest resistive load test as defined in IEC 60086-2 until the service life falls by 50 % of the minimum average duration (MAD) value, followed by storage at $45 ^\circ\text{C} \pm 5 ^\circ\text{C}$ for 30 days.</p> <p>c) Requirements There shall be no leakage and no explosion during this test.</p>		P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
6.2.2.2	Test B-1 – Transportation shock		P
	a) Purpose This test simulates the situation when an appliance is carelessly dropped with batteries installed in it. This test condition is generally specified in IEC 60068-2-27.		P
	b) Test procedure An undischarged battery shall be tested as follows. The shock test shall be carried out under the conditions defined in Table 3 and the sequence given in Table 4. c) Requirements There shall be no leakage and no explosion during this test.		P
6.2.2.3	Test B-2 – Transportation vibration		P
	a) Purpose This test simulates vibration during transportation. This test condition is generally specified in IEC 60068-2-6. b) Test procedure An undischarged battery shall be tested as follows. The vibration test shall be carried out under the following test conditions and the sequence given in Table 5. Vibration – A simple harmonic motion shall be applied to the battery having an amplitude of 0,8 mm, with a total maximum excursion of 1,6 mm. The frequency shall be varied at the rate of 1 Hz/min between the limits of 10 Hz and 55 Hz. The entire range of frequencies (10 Hz to 55 Hz) and return (55 Hz to 10 Hz) shall be traversed in (90 ± 5) min for each mounting position (direction of vibration). c) Exigences Il ne doit pas y avoir de fuite ou d'explosion pendant cet essai.		P
6.2.2.4	Test C – Climatic-temperature cycling		P
	a) Purpose This test assesses the integrity of the battery seal which may be impaired after temperature cycling. b) Test procedure		P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
	<p>An undischarged battery shall be tested under the following procedure.</p> <p>Temperature cycling procedure (see below and/or Figure 2)</p> <p>1) Place the batteries in a test chamber and raise the temperature of the chamber to $70^{\circ}\text{C} \pm 5^{\circ}\text{C}$ within 30 min (t_1).</p> <p>2) Maintain the chamber at this temperature for 4 h (t_2).</p> <p>3) Reduce the temperature of the chamber to $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ within 30 min (t_1) and maintain at this temperature for 2 h (t_3).</p> <p>4) Reduce the temperature of the chamber to $-20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ within 30 min (t_1) and maintain at this temperature for 4 h (t_2).</p> <p>5) Raise the temperature of the chamber to $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ within 30 min (t_1).</p> <p>6) Repeat the sequence for a further nine cycles.</p> <p>7) After the 10th cycle, store the batteries for seven days prior to examination.</p> <p>c) Requirements</p> <p>There shall be no explosion during this test.</p>		

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
6.3	Reasonably foreseeable misuse		P
6.3.1	Reasonably foreseeable misuse tests and requirements		P
6.3.2	Reasonably foreseeable misuse test procedures		P
6.3.2.1	Test D – Incorrect installation (four batteries in series)		P
	<p>a) Purpose This test simulates the condition when one battery in a set is reversed.</p> <p>b) Test procedure Four undischarged batteries of the same brand, type and origin shall be connected in series with one reversed (B1) as shown in Figure 3. The circuit shall be completed for 24 h or until the battery case temperature has returned to ambient. The resistance of the inter-connecting circuitry shall not exceed 0,1 Ω</p> <p>c) Requirements There shall be no explosion during this test (see NOTE 2 of 6.3.2.1b)).</p>		P
6.3.2.2	Test E – External short circuit		P
	<p>a) Purpose This misuse may occur during daily handling of batteries.</p> <p>b) Test procedure An undischarged battery shall be connected as shown in Figure 4. The circuit shall be completed for 24 h or until the battery case temperature has returned to ambient. The resistance of the inter-connecting circuitry shall not exceed 0,1 Ω</p> <p>c) Requirements There shall be no explosion during this test.</p>		P
6.3.2.3	Test F – Overdischarge		P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
	<p>a) Purpose This test simulates the condition when one (1) discharged battery is series-connected with three (3) other undischarged batteries.</p> <p>b) Test procedure One undischarged battery (C1) is discharged under the application or service output test condition, with the highest MAD value (expressed in time units), as defined in IEC 60086-2 until the on-load voltage falls to $(n \times 0,6 \text{ V})$ where n is the number of cells in the battery. Then, three undischarged batteries and one discharged battery (C1) of the same brand, type and origin shall be connected in series as shown in Figure 5. The discharge shall be continued until the total on-load voltage falls to four times $(n \times 0,6 \text{ V})$.</p> <p>c) Requirements There shall be no explosion during this test.</p>		P
6.3.2.4	Test G – Free fall test		P
	<p>a) Purpose This test simulates the situation when a battery is accidentally dropped. The test condition is based upon IEC 60068-2-32.</p> <p>b) Test procedure Undischarged test batteries shall be dropped from a height of 1 m onto a concrete surface. Each test battery shall be dropped six times, a prismatic battery once on each of its six faces, a round battery twice in each of the three axes shown in Figure 6. The test batteries shall be stored for 1 h afterwards.</p> <p>c) Requirements There shall be no explosion during this test.</p>		P
7	Information for safety		P
7.1	Safety precautions during handling of batteries		P
	When used correctly, primary batteries with aqueous electrolyte provide a safe and dependable source of power. However, if they are misused or abused, leakage or in extreme cases explosion and/or possibly fire may result.		P
7.2	Packaging		N

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
	The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking. The materials and packaging design shall be chosen so as to prevent the development of unintentional electrical contact and corrosion of the terminals. Protection from inclement weather should be provided.		N
7.3	Handling of battery cartons		N
	Rough handling of battery cartons may result in battery damage and impaired electrical performance and may result in leakage, explosion, or possibly fire and may cause personal injury.		N
7.4	Display and storage		P
7.5	Transportation		P
	When loaded for transportation, battery packages should be so arranged to minimise the risk of falling e.g. one from the top of another. They should not be stacked so high that damage to the lower packages occurs. Protection from inclement weather should be provided.		P
8	Instructions for use		P
	a) <i>Always select the correct size and grade of battery most suitable for the intended use. Information provided with the equipment to assist correct battery selection should be retained for reference.</i> b) <i>Replace all batteries of a set at the same time.</i> c) <i>Clean the battery contacts and also those of the equipment prior to battery installation.</i> d) <i>Ensure that the batteries are installed correctly with regard to polarity (+ and –).</i> e) <i>Remove batteries from equipment which is not to be used for an extended period of time.</i> f) <i>Remove exhausted batteries promptly.</i>		P
9	Marking		--
9.1	General		P
	With the exception of batteries designated as small, each battery shall be marked with the following information: a) electrochemical system;		P

IEC 60086-5			
Clause	Requirement – Test	Result - Remark	Verdict
	b) designation; c) year and month or week of manufacture, which may be in code, or the expiration of a guarantee period in clear; d) polarity of terminals (when applicable); e) nominal voltage; f) name or trade mark of the manufacturer or supplier; g) cautionary advice; h) caution for ingestion of swallowable batteries (refer to 7.1 I).		
9.2	Small batteries		N
	Batteries, whose external surface area is too small to accommodate the markings shown in 9.1 shall show, on the battery, the designation (see 9.1 b) and polarity (see 9.1 d). All other markings shown in 9.1 should be on the immediate packing.		N

Tables

Test A	TABLE: storage after partial use			P
Model		OCV at start of test, (Vdc)	Storage time (days)	Results
C1		1.418	30	no leakage and no explosion
C2		1.465	30	
C3		1.432	30	
C4		1.446	30	
C5		1.415	30	
Note (s): 45 °C ± 5 °C, 30 days.				

Test B-1	TABLE: Transportation shock		P
Sample No.	OCV at start of test, Vdc	Result	
Cells			
C16	1.628	No explosion, no leakage.	
C17	1.618		
C18	1.615		
C19	1.616		
C20	1.617		
Note (s):			

Tables

Test B-2	TABLE: Transportation vibration			P
Sample No.	Vibration time (minute)	OCV at Start of Test, Vdc	Visual examination result	
Cells				
C11	90*3	1.615	No explosion, no leakage	
C12	90*3	1.619		
C13	90*3	1.621		
C14	90*3	1.616		
C15	90*3	1.618		
Note(s): 1. The vibration is applied in each of three mutually perpendicular directions. 2. Rest cell or batteries for 1 h, then make a visual inspection.				

Test C	TABLE: Climatic-temperature cycling			P
Sample No.	OCV at Start of Test, Vdc	Temperature(℃)	Result	
Cells				
C06	1.614	(-20 ℃, +70 ℃)	No explosion	
C07	1.617	(-20 ℃, +70 ℃)		
C08	1.621	(-20 ℃, +70 ℃)		
C09	1.615	(-20 ℃, +70 ℃)		
C10	1.616	(-20 ℃, +70 ℃)		
Note(s):				

Tables

Test D	TABLE: Incorrect installation			P
Sample No.	OCV at start of test, Vdc	Resistance (m Ω)	Result	
Test ambient temperature: 10°C				
C41	1.815	< 100	No explosion.	
C42	1.813	< 100		
C43	1.811	< 100		
C44	1.816	< 100		
C45	1.812	< 100		
Note (s): The test was complete when cut-off current was reached.				

Test E	TABLE: – External Short Circuit Test of cells				P
Sample No.	OCV at start of test, (Vdc)	Resistance of circuit, (mΩ)	Maximum case temperature rise ΔT, (°C)	Results	
C21	1.820	<100	54.4	No explosion.	
C22	1.818	<100	55.3		
C23	1.816	<100	54.8		
C24	1.821	<100	57.3		
C25	1.817	<100	54.4		
Note (s):					

Test F	TABLE: Overdischarge		P
Sample No.	OCV at start of test, Vdc	Result	
Test ambient temperature: 10°C			
C46	1.120	No explosion.	
C47	1.116		
C48	1.114		
C49	1.118		
C50	1.115		
Note (s): The test was complete when cut-off current was reached.			

Tables

Test G	TABLE: Free fall test			P
Sample No.	OCV at start of test, Vdc	Drop height (m)	Result	
Cells				
C21	1.616	1.0	No explosion.	
C22	1.614	1.0	No explosion.	
C23	1.618	1.0	No explosion.	
Note (s): Each sample dropped for 3 times.				

Tables



Tables

Photo 3

- ☐ front
☒ rear
☐ right side
☐ left side
☐ top
☐ bottom
☐ internal



Photo 4

- ☐ front
☒ rear
☐ right side
☐ left side
☐ top
☐ bottom
☐ internal

