Test Report No. LVD2010060143001

TEST REPORT

Of

Lithium Thiony Chloride Battery

Model/ Type/ Machine Type

ER13150 ER13170 ER13460 ER10250 ER10450

ER14200 ER14250 ER14250H ER14335 ER14505H

ER14505C ER17250 ER17335 ER17450 ER17505

ER18505 ER26250(1/2C) ER26500C ER26500H

ER26720 ER261020 ER33060 ER10280 ER20505

ER341245 ER34615H ER34615 ER34320 ER14250M

ER14335M ER14505M ER17335M ER17505M ER48660M

ER34615M ER26500M ER18505M ER14250S ER14335S

ER10450S ER14505S ER17335S ER18505S ER26500S

ER251020S ER34615S ER341245S ER9V100 ER9V120

EF651615 EF651620 EF651625 EF752338 ER12130

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TEST REPORT

EN 60086-4

Primary batteries

Part 4-Safety of lithium batteries

Report	
Report reference No. ..... :	LVD2010060143001
Tested by (+ signature) ..... :	David Zhong .....
Approved by (+ signature) ..... :	Kelvin Chen .....
Date of issue ..... :	2010.06.30
Testing laboratory	
Name ..... :	Guangzhou Lituo Standard-Tech Co.,Ltd.
Address ..... :	No. 305, Guangjun Business Center, No. 6-7, Xinjiao South Road, Haizhu District, Guangzhou, China
Client	
Name ..... :	Guangzhou Markyn Battery Co.,Ltd
Address ..... :	Block2, Haijing Road6, Markyns Industrial Zone, XinZao Town, Panyu District, Guangzhou City, P.R.C.
Test specification	
Standard ..... :	EN 60086-4: 2007 EN 60086-1: 2007
Test procedure ..... :	Guangzhou Lituo Standard-Tech Co.,Ltd.
Non-standard test method ..... :	N.A.
Test item Description	Lithium Thiony Chloride Battery
Trademark ..... :	N.A
Model and/or type reference ..... :	See page 2
Manufacturer ..... :	Guangzhou Markyn Battery Co.,Ltd
Rating(s) ..... :	Norminal voltage: 3,6V ; Capacity: 100-36000mA
Test case verdicts	
Test case does not apply to the test object :	N(.A.)
Test item does meet the requirement ..... :	P(ass)
Test item does not meet the requirement .. :	F(ail)
Testing	
Date of receipt of test item ..... :	2010.06.20

Date(s) of performance of test .....: 2010.06.20 to 2010.06.30	
Particulars : test item vs. test requirements:	
Equipment mobility:	Built in
Operating condition:	Continuous
Tested for IT power systems:	N/A
IT testing, phase-phase voltage(V):	N/A
Operate temperature:	0-55℃
Protection against ingress of water:	IP00

Copy of marking plate

Description and illustration of the sample:

1. Max.capacity 28000mA
2. Min. capacity 8000mA

Remarks:

This report covers the following Lithium Thiony Chloride Battery:

ER13150	3.6V/450mAH	ER34320	3.6V/5000mAH
ER13170	3.6V/500mAH	ER14250M	3.6V/750mAH
ER13460	3.6V/1500mAH	ER14335M	3.6V/1350mAH
ER10250	3.6V/400mAH	ER14505M	3.6V/2200mAH
ER10450	3.6V/750mAH	ER17335M	3.6V/1700mAH
ER14200	3.6V/600mAH	ER17505M	3.6V/3300mAH
ER14250	3.6V/1100mAH	ER48660M	3.6V/28000mAH
ER14250H	3.6V/1200mAH	ER34615M	3.6V/14000mAH
ER14335	3.6V/1650mAH	ER26500M	3.6V/600mAH
ER14505H	3.6V/2400mAH	ER18505M	3.6V/3500mAH
ER14505C	3.6V/2700mAH	ER14250S	3.6V/600MAH

ER17250	3.6V/1000mAH	ER14335S	3.6V/1000MAH
ER17335	3.6V/1900mAH	ER10450S	3.6V/600MAH
ER17450	3.6V/3000mAH	ER14505S	3.6V/1600MAH
ER17505	3.6V/3400mAH	ER17335S	3.6V/1500MAH
ER18505	3.6V/3400mAH	ER18505S	3.6V/3200MAH
ER26250(1/2C)	3.6V/3000mAH	ER26500S	3.6V/4200MAH
ER26500C	3.6V/7500mAH	ER251020S	3.6V/9500MAH
ER26500H	3.6V/8050mAH	ER34615S	3.6V/11000MAH
ER26720	3.6V/12000mAH	ER341245S	3.6V/22000MAH
ER261020	3.6V/15000mAH	ER9V100	9.0V/1000mAH
ER33060	3.6V/1000mAH	ER9V120	9.0V/1200mAH
ER10280	3.6V/450mAH	EF651615	3.6V/400MAH
ER20505	3.6V/4000mAH	EF651620	3.6V/550MAH
ER341245	3.6V/36000mAH	EF651625	3.6V/750MAH
ER34615H	3.6V/19000mAH	EF752338	3.6V/1600MAH
ER34615	3.6V/16500mAH	ER12130	3.6V/100mAH

The above models have the similar circuit and same voltage.They also have the similar constructions and electrical connections. On the basis of these similarities among these models of this manufacturer, this report is also applicable to above-mentioned models.

The differences between above mentioned models are as follows:

1. The rated capacity;
2. The weight.

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

Cl.	Requirement – Test	Result	Verdict
6.2	Evaluation of test criteria		P
6.2.1	Short-circuit		P
	A short-circuit is considered to have occurred during a test if the open-circuit voltage of the cell or battery after the test is less th an 90 % of its voltage immediately prior to the test		P
	This requirement is not applicable to test cells and batteries at fully discharged states		N
6.2.2	Excessive temperature rise	No excessive	P
	An excessive t emperature rise is considered to ha ve oc curred during a test if the external case temperature of the test cell or battery rises above 170 °C.		N
6.2.3	L eakage	No leakage	P
	Leakage is considered to have occurred during a t est if electrolyte, gas or other material escapes from the test cell or battery in a manner not intended by design		N
6.2.4	Mass loss		P
	Mass loss is c onsidered to have occurred if, during a test, the maximum values given in table 3 are exceeded	0,03%	P
6.2.5	Venting		P
	Venting is considered to have occurred if, during a test, an excessive build up of internal gas pressure escapes from a cell or battery through a safety feature designed for this purpose.		P
6.2.6	Fire		N
	A fire is considered to have occurred if, during a test, flames are emitted from the test cell or battery.		N
6.2.7	Rupture		N
	A rupture is considered to have occurred if, during a test, a cell container or battery case has mechanically failed, resulting in expulsion of gas, spillage of liquids, or ejection of solid materials but no explosion		N
6.2.8	Explosion		N
6.3	Tests and requirements – Over view		P

Cl.	Requirement – Test	Result	Verdict
	This standard provides safety tests for intended use (tests A to D) and reasonably foreseeable misuse (tests E to M).		P
6.4	Tests for intended use		P
6.4.1	Test A: Altitude		P
	Test cells and batteries shall be stored at a pressure of 11,6 kPa or less for at least 6 h at ambient temperature.		P
	There shall be no mass loss, no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test.		P
6.4.2	Test B: Thermal cycling		P
	Test cells and batteries shall be stored for at least 6h at a test temperature of 75 °C		P
	followed by storage fo r at least 6h at a test temperature of –40°C.		P
	The maximum time for transfer to each temperature shall b e 30 min. Each test cell and battery shall undergo th is procedure 10 times		P
	This is then followed by storage for at least 24 h at ambient temperature		P
	The te st s hall be conducted using the test cell s an d batteries previously subjected to the altitude test		P
	There shall be no mass loss, no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test		P
6.4.3	Test C: Vibration		P
	Test cells and batteries shall be firmly secured to the platform of the vibration machine without distorting them and in such a manner as to faithfully transmit the vibration		P
	Test cells and batteries shall be subjected to sinusoidal vibration according to Table 5		P
	This cycle shall be repeated 12 times for a total of 3h for each of three mutually perpendicular mounting positions		P
	One of the directions shall be perpendicular to the terminal face		P
	The test s hall be conducted using the test cells and batteries previously subjected to the thermal cycling test		P

Cl.	Requirement – Test	Result	Verdict
	There shall be no mass loss, no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test		P
6.4.4	Test D: Shock		P
	Test cell s and batteries shall be secured to the testing m achine by means of a rigid mount which will support all mounting surfaces of each test cell or battery		P
	Each test cell or battery shall be subjected to 3 shocks in each direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks	Each direction 3 shocks	P
	For each shock, the parameters given in T able 6 shall be applied		P
	The te st s hall be conducted using the test cell s and batteries previously subjected to the vibration test		P
	There shall be no mass loss, no leakage, no venting, no short-circuit, no rupture, no explosion and no fire during this test		P
6.5	Tests for reasonably foreseeable misuse		P
6.5.1	Test E: External short-circuit		P
	The test cell or battery shall be stabilized at an external case temperature of 55 °C and then subjected to as hort- circuit condition with a total external resistance of less than 0,1 Ω at 55 °C.		P
	This short-circuit condition is continued for at least 1 h after the cell or battery external case temperature has returned to 55 °C.		P
	The test sample shall be observed for a furt her 6 h.		P
	The test shall be conducted using the test samples previously subjected to the shock test.		P
	The test shall be conducted using the test s amples previously subjected to the shock t est.		P
	There shall be no excessive temperature rise, no rupture, no explosion and no fire during this test and within the 6 h of observation.		P
6.5.2	Test F: Impact		N
	The t est cell or component cell is placed on a flat plate		N

Cl.	Requirement – Test	Result	Verdict
	Test procedure A s teel bar with a diameter of 15,8mm is placed across the centre of the test sample.		N
	A mass of 9,1kg is dropped from a height of 61 cm ± 2,5 cm onto the bar on the test sample		N
	A cylindrical or prismatic cell is impacted with its longitudinal axis parallel to the flat plate and perpendicular to the longi tudinal axis of the bar lying across the cent re of the test sample		N
	A prismatic cell is also rotated 90° around it s longitudinal axis so that both the wide and narrow sides will be subjected to the impact		N
	A button cell is impacted with its flat surface parallel to the flat plate and the bar lying across its centre		N
	Each test cell or component cell shall be subjected to one impact only		N
	The test sample shall be observed for a further 6 h.		N
	The test shall be conducted using test cells or component cells that have not been previously subjected to other tests		N
	There shall be no excessive tem perature rise, no ex plosion and no fire during this test and within the 6 h of observation		N
6.5.3	Test G: Crush		P
	The cell or component cell shall be crushed between two flat surfaces.		P
	The force shall be applied by a vice or by a hydraulic ram with a round piston.		P
	The crushing shall be gradual with a speed of a pproximately 1,5cm / s at the first point of contact. The crushing shall be continued until the applied force reaches approximately 13 kN.		P
	A cylindrical cell shall be crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus.		P
	A prismatic cell shall be crushed by applying the force in the direction of one of the two axes perpendicular to its longitudinal axis, a nd, separately, by applying the force in the direction of the other one of these two axes		N

Cl.	Requirement – Test	Result	Verdict
	A button/coin cell shall be crushed by applying the force on its flat surfaces.		N
	Each test cell or component cell shall be subjected to one crush only		P
	The test sample shall be observed for a further 6 h.		P
	The test shall be conducted using test cells or component cells that have not been previously subjected to other tests		P
	There shall be no ex cessive tem perature rise, no explosion and no fire dur ing this te s t and within the 6 h of observation.		P
6.5.4	Test H: Forced discharge		P
	Each cell shall be force discharged at ambient temperature by connecting it in series with a 12 V direct current power supply at an initial current equal to the maximum continuous discharge current specified by the manufacturer		P
	The specified discharge current is obtained by connecting a resistive load of appropriate size and rating in series with the test cell and the direct current power supply		P
	Each cell shall be force discharged for a time interval td equal to:$t_d = C_r / I_i$		P
	The test shall be cond ucted with fully discharged test batteries.		P
	The test cells shall be observed for 7 days after the forced discharge condition has been discontinued		P
	There shall be no explosion and no fire during this test and the 7 days of observation		P
6.5.5	Test I: Abnormal charging		P
	Each te st battery shall be sub jected to a charging current of three times the abnormal charging current Ic specified by the battery manufacturer by connecting it in opposition to a d.c. pow er s upply.		P
	Unless the power supply allows for setting the current, the specified charging current shall be obtained by connecting a resistor of the appropriate size and rating in series with the battery		P
	The test duration shall be calculated using the formula: $t_d = 2{,}5 \times C_n / (3 \times I_c)$		P

Cl.	Requirement – Test	Result	Verdict
	There shall be no explosion and no fire during this test		P
6.5.6	Test J: Free fall		P
	The test batteries shall be dropped from a height of 1 m onto a concrete surface.		P
	Each test attery shall be dropped six times		P
	A prismatic battery once from each of its six faces		N
	a round battery twice in e ach of the t hree ax es shown in Figure 3		P
	The tes t batteries shall be stored for 1 h afterwards		P
	There shall be no venting, no explosion and no fire during this test and within the 1h of observation		P
6.5.7	Test K: Thermal abuse		P
	A test battery shall be placed in an oven and the tem perature raised at a rate of 5 ° C/min to a temperature of 130 °C at which the battery shall remain for 10 min		P
	There shall be no explosion and no fire during this test		P
6.5.8	Test L: Incorrect installation		P
	A test battery is connected in series with three undischarged add itional single cell batteries of the same type in such a way that the terminals of the test battery are connected in r everse		P
	The resistance of the interconnecting circu it shall be less than or equal to 0,1 Ω		P
	The circuit shall be completed for 24 h or until the battery case temperature has returned to ambient		P
	There shall be no explosion and no fire during this test		P
6.5.9	Test M: Overdischarge		P
	Each test b attery shall be predischarged to 50% depth of discharge. It shall then be connected in series with three undischarged additional single cell batteries of the same type		P
	A resistive load R1 is connected in series with the assembly of batteries in Figure 5 where R1 is taken from Table 7		P

Cl.	Requirement – Test	Result	Verdict
	The test shall be continued for 24 h or until the battery case temperature has returned to ambient		P
	There shall be no explosion and no fire during this test		P
6.6	Information to be given in the relevant specification		P
	When this standard is referred to in a relev ant specification, the following parameters shall be given in so far as they are applicable		P
	a) Predischarge current specified by the manufacturer 6.1.5;		P
	b) Declaration whether the impact test or the crush test is more appropriate to simula te an internal short-circuit condi tion 6.5.2 and 6.5.3;	Crush test	P
	c) Maximum continuous discharge current specified by the manufacturer for test H 6.5.4;		P
	d) Abnormal charging current declared by the manufacturer for test I 6.5.5		P
6.7	Evaluation and report		P
	If a report is issued, the following list of items should be considered:		P
	a) name and address of the test facility;	See page 1	P
	b) name and address of applicant (where a ppropriate);	See page 1	P
	c) a unique test report identification;	LVD2010060143001	P
	d) the date of the test report;	See page 1	P
	e) characteristics of the test cells or batteries according to 4.1;		P
	f) test descriptions and results, including th e parameters according to 6.6;		P
	g) a signature with name and status of the signatory.	See page 1	P

7	Information for safety		**P**
7.1	Safety precautions during design of equipment		N
	See also Annex B for guidelines for designers of equipment using lithium batteries		N

Cl.	Requirement – Test	Result	Verdict
7.1.1	Charge protection		N
	When incorporating a primary lithium battery into a memory back-up circuit, a blocking diode and current lim iting resistor or other protective devices shall be used to prevent the main power source from charging the battery (see Figure 6).		N
7.1.2	Parallel connection		N
	Parallel connection should be avoided when designing battery compartments.		N
	However, if required, the battery manufacturer shall be contacted for advice		N
7.2	Safety precautions during handling of batteries		P
	a) Always insert batteries correctly with regard to polarity (+ and –) marked on the battery and the equipment		P
	b) Do not short-circuit batteries		P
	c) Do not charge batteries		P
	d) Do not force discharge batteries		P
	e) Do not mix old and new batteries or batteries of different types or brands		P
	f) Exhausted batteries sho uld be immediately removed from equipment and properly disposed		P
	g) Do not heat batteries		P
	h) Do not weld or solder directly to batteries		P
	i) Do not dismantle batteries		P
	j) Do not deform batteries		P
	k) Do not dispose of batteries in fire		P
	l) A lithium battery with a damaged container should not be exposed to water		P
	m) Keep batteries out of the reach of children		P
	n) Do not allow children to replace batteries without adult supervision		P
	o) Do not encapsulate and/or modify batteries		P

Cl.	Requirement – Test	Result	Verdict
	p) Store unused batteries in their original packaging away from metal objects. If already unpacked, do not mix or jumble batteries		P
	q) Remove batteries from equipment if it is not to be used for an extended period of time unless it is for emergency purposes		P
7.3	Packaging		P
	The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking.		P
	T hem aterials and packaging design shall be chosen so as to prevent the development of unintentional electrical contact, short-circuit, shifting and corrosion of the terminals, and afford some protection from the environment.		P
7.4	Handling of battery cartons		P
	Battery cartons should be handled with care. Rough handling may result in batteries being short-circuited or damaged. This may cause leakage, explosion, or fire.		P
7.5	Transport		P
7.5.1	General		P
	Tests and requirements for the transport of lithium cells or batteries are given in IEC 62281 [11].		P
	Regulations concerning international transport of lithium batteries are based on the UN Recommendations on the Transport of Dangerous Goods [16].		P
	Regulations f or transport are subject to change. For the transport of lithium batteries, the latest editions of the following regulations should be consulted.		P
7.5.2	Air transport		P
	Regulations concerning air transport of lithium batteries are specified in the Technical Instructions for the Safe Transport of Dangerous Goods by Air published by the International Civil Aviation Organization (ICAO) [2] and in the Danger ous Goods Regulations publi shed by the International Air Transport Association (IAT A) [1]		P

Cl.	Requirement – Test	Result	Verdict
7.5.3	Sea transport		P
	Regulations concerning s ea transport of lithium batteries are specified in the International Maritime Dangerous Goods (I MDG) Code published by the International MaritimeOrganization (IMO) [12]		P
7.5.4	Land transport		P
	Regulations concerning road and railroad transport are specified on a national or multilateral basis. While an increasing number of regulators adopt the UN Model Regulations [16], i t is recommended that country-specific transport regula tions be consulted before shipping		P
7.6	Display and storage		P
	a) Store batteries in well ventilated, dry and cool conditions		P
	b) Do not stack battery cartons on top of each other exceedi ng a specified height		P
	c) Avoid storing or displaying batteries in direct sun or in places where they get exposed to rain		P
	d) Store and display batteries in their original packing		P
7.7	Disposal		P
	a) Do not dismantle batteries		P
	b) Do not dispose of bat teries in fi re exce pt und er condi tions of approved and controlled incineration		P
	c) Store colle cted batteries in a clean and dry environment out of direct sunlight and away from extreme heat		P
	d) Store collected batteries in a well-ventilated area		P
	e) Do not mix collected batteries with other materials		P
	f) Protect battery terminals		P
8	Instructions for use		**P**
	a) Always select the correct size a nd type of battery most suitable for the intended use. Information provided with the equipment to assist correct battery selection should be retained for reference		P

Cl.	Requirement – Test	Result	Verdict
	b) Replace all batteries of a set at the same time		P
	c) Clean the battery contacts and also those of the equipment prior to battery installation		P
	d) Ensure that the batteries are installed correctly with regard to polarity (+ and –)		P
	e) Remove exhausted batteries promptly		P
9	Marking		**P**
9.1	General		P
	a) designation;		P
	b) expiration of a recommended us age period or year and month or week of manufacture. The year and month or week of manufacture may be in code;		P
	c) polarity of terminals (when applicable);		N
	d) nominal voltage;		P
	e) name or trade mark of the manufacturer or supplier;		P
	f) cautionary advice;		P
	g) caution for ingestion of swallow able batteries (see also 7.2 m)).		P
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 of 9.1 a) and polarity of 9. 1 c).		N
	All other markings shown in 9.1 may be given on the immediate package instead of on the battery.		N

Photo:

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