

Wuhan LiXing(Torch) Power Sources Co.,Ltd

Controlled document's No.

Q/LX.S.E. 08.002-2020

Edition/Status

B/0

Cylindrical Li/MnO₂ Battery

Specification

Model: CR14505

Customer:

Customer's opinion:

signature:

Date:

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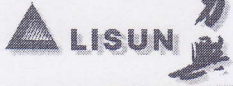
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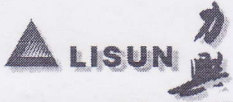
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1. Purpose

1.1 In order to avoid errors and deviations by different testing method or condition, we established this specification to define the battery model and test method of lithium battery manufactured by Lixing.

1.2 Give some guidance for using our products.

2. Description and Model

Table 1

| Description | Model |
|---|---------|
| Lithium manganese dioxide cylindrical battery | CR14505 |

3. Technical parameters

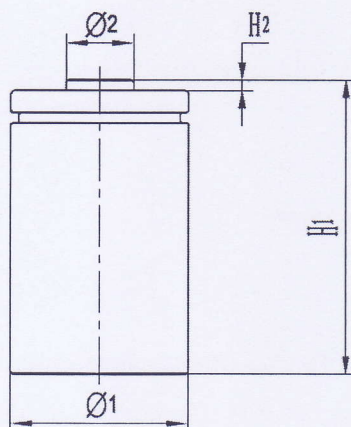
Table 2

| No. | Items | Characteristics |
|-----|---|---|
| 1 | Nominal Capacity* | 1500 mAh |
| 2 | Discharge capacity (continuously discharge under 10mA, till 2.0V end voltage) | 1400 ± 100 mAh |
| 3 | Nominal Voltage | 3V |
| 4 | Operating Temperature range | -20~+60°C |
| 5 | Max. Pulse Current | 3000 mA |
| 6 | Max. Continuous Discharge Current | 1500 mA |
| 7 | Structures | Manganese dioxide cathode, lithium anode, organic electrolyte, polypropylene separator and stainless steel cell can and cap, etc. |
| 8 | Weight for Reference | About 17g |

* Nominal Capacity: The nominal capacity means that when discharged at 10mA、20±2°C、end voltage 2.0V. (the nominal capacity may differ due to change of the discharge current, temperature and end voltage)

4. Outline figure and dimension

4.1. Outline figure is shown as follow



4.2. Outline dimensions

Table 3

| Model | Max. diameter $\Phi 1$ (mm) | Max. diameter $\Phi 2$ (mm) | Max. height $H 1$ (mm) | Min. height $H 2$ (mm) |
|---------|-------------------------------|-------------------------------|--------------------------|--------------------------|
| CR14505 | 14.5 | 6.5 | 50.5 | 0.4 |

5. Appearance

The surfaces of the batteries should be clean. The mark is clear. There should not be deformation、rust、stain or leakage.

6. Characteristics and test method

6.1. Electronic characteristic:

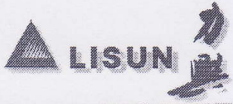


Table 4

| No. | Item | Test condition | Performance within one year under room temperature | Performance after one year under room temperature |
|-----|---|-------------------------|--|---|
| 1 | Open circuit voltage | | | |
| | Room temperature | 20±2 °C | ≥3.0V | ≥3.0V |
| | Low temperature | -20±2 °C | ≥3.0V | ≥3.0V |
| | High temperature | 60±2 °C | ≥3.0V | ≥3.0V |
| 2 | Close circuit voltage | Discharge load: 10Ω | | |
| | Room temperature | 20±2 °C | ≥2.70V | ≥2.65V |
| | Low temperature | -20±2 °C | ≥2.55V | ≥2.50V |
| | High temperature | 60±2 °C | ≥2.75V | ≥2.70V |
| | Working life | Discharge load: 10mA | | |
| | Room temperature | End voltage: 2.0V | | |
| | Low temperature | 20±2 °C | ≥1300mAh | ≥1250mAh |
| | High temperature | -20±2 °C | ≥750mAh | ≥700mAh |
| | | 60±2 °C | ≥1250mAh | ≥1200mAh |
| | Discharge capacity (Celerity test at room temperature) | Discharge load: 50mA | | |
| | | End voltage: 2.0V | ≥1150mAh | ≥1100mAh |

6.2. Performance Test

6.2.1 Six samples for each testing item

6.2.2 Samples should be placed for 24 hours under the requested temperature, which the test will be done.

6.3. Environment and safety performance

6.3.1 Environment performance

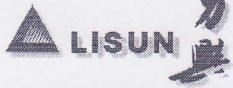


Table 5

| No. | item | requirement | method |
|-----|--------------------------|----------------------|--|
| A | Altitude Simulation Test | NM、NL、NV、NC、NR、NE、NF | At 20°C±5°C, the batteries should be stored at the pressure of 11.6 KPa or less for at least six hours. |
| B | Temperature Cycling | NM、NL、NV、NC、NR、NE、NF | The batteries should be stored at least 6 hours at 75±2°C, then be stored at least six hours at -40±2°C. The interval between the two temperatures should be maximum 30 minutes. Repeat this process for 10 times. Then store batteries 24 hours at 20±5°C, |
| C | Vibration | NM、NL、NV、NC、NR、NE、NF | The batteries should be subjected to a simple harmonic motion with an amplitude of 0.8mm (1.6mm total maximum excursion). The frequency is to be varied at the rate of 1Hz per minute between 10 and 55Hz. The test should be last 90min~100min and the cell should be tested in two mutually perpendicular direction. |
| D | Shock | NM、NL、NV、NC、NR、NE、NF | The batteries should be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each battery should be subjected to a total of three shocks of equal magnitude. The shocks are to be applied in each of the three mutually perpendicular directions. Each shock is to be applied in a direction perpendicular to the face of the battery. For each shock the battery is to be accelerated in such a manner that, during the initial 3ms, the minimum average acceleration is 75×9.8m/s ² . The peak acceleration should be between 125×9.8 m/s ² ~175×9.8 m/s ² . |

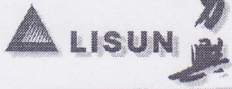
NM: no weight loss NL: no leakage NV: no venting NC: no short circuit (OCV after testing is not less than 90% of its voltage prior to this procedure) NR: no rupture NE: no explosion

NF: no fire NT: no overheating (the temperature at the surface of battery not exceed 170°C)

6.3.2 Safety performance

Table 6

| No. | item | requirement | method |
|-----|------------------------|-------------|---|
| E | External Short Circuit | NT、NR、NE、NF | The batteries to be tested should be temperature stabilized so that its external case temperature reaches 55 ± 2 °C and then the batteries should be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 55 ± 2 °C. This short circuit condition is continued for at least one hour after the battery external case temperature has returned to 55 ± 2°C. The battery must be observed for a further six hours for the test to be |



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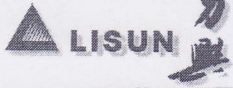
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| | | | |
|---|------------------------|----------|--|
| | | | concluded. The battery to be tested should have endured vibration and shock test. |
| F | Impact | NT、NE、NF | The test sample battery is to be placed on a flat surface. A 15.8 mm diameter bar is to be placed across the centre of the sample. A 9.1 kg mass is to be dropped from a height of 610 ± 25 mm onto the sample. The battery is to be impacted with the flat surface of the sample parallel to the flat surface and the 15.8 mm diameter curved surface lying across its centre. The battery should be impacted for one time. |
| G | Crush | NE、NF | The cell or battery is crushed between two plates through the vise or 32mm diameter hydraulic piston arm with the pressure of about 13KN. |
| H | Forced-dis charge 1 | NE、NF | Each battery should be forced discharged at ambient temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current* specified by the manufacturer. Each battery should be forced discharged for a time equal to the time in which a new cell is discharged to 2.0 V. |
| I | Abnormal Charge | NE、NF | Sample batteries are to be connected reversely with a D.C. power supply, and subjected to a constant charging current at 3 times the I_c Charge time $t_d = 2.5 \times C_n / (3 \times I_c)$ ** |
| J | Free Drop | NV、NE、NF | The not-discharged battery is to be dropped from a height of 1m onto a concrete surface. Each sample is to be dropped six times, two times in each direction. The sample should be examined 1 hours after testing |
| K | Heating Test | NE、NF | The battery should be placed in an oven. The oven temperature should be increased at a rate of $5^{\circ}\text{C} \pm 2^{\circ}\text{C}$ per minute until the oven reached $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The oven should be maintained at $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 10min. |
| L | Forced-dis charge 2 | NE、NF | The cell or battery to be tested is discharged of 50% DOD, 75% DOD, and then connect it with fresh cells at qty of n-1 pieces and resistance R, of which n and R is specified by manufacturer. |
| M | Incorrect installation | NE、NF | Connect a test battery with three fresh cells of same model in series, but with cells reversal. The hydraulic resistance of the circuit is less than or equal to 0.1Ω . Test should be under $(20 \pm 5)^{\circ}\text{C}$ for continuous 24 hours. |

NM: no weight loss NL: no leakage NV: no venting NC: no short circuit (OCV after testing is not less than 90% of its voltage prior to this procedure) NF: no fire NR: no rupture
NE: no explosion
NT: no overheating (the temperature at the surface of battery not exceed 170°C)

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* Max discharge current: in table 2 means maximum continuous discharge current 1500mA .

** $t_d=2.5 \times C_n / (3 \times I_c)$

t_d —test time, Ours t_d is 50h

C_n —nominal capacity, Ours C_n is 1500mAh

I_c —the abnormal charge current for the tests provided by battery supplier. Ours I_c is 25mA

7. Test condition

7.1 State of batteries:

The batteries should be marked with manufacture date (year, month, date)

7.2 Normal testing environment:

If no special requirement, test should be made under the temperature of $(20 \pm 5)^\circ\text{C}$ and relative humidity of 45%-75%.

7.3 Test precision:

The measuring tolerances relative to the specified or actual values should be within these range:

| Voltage | Current | Capacity | Temperature | Time | Weight | Dimension |
|-----------|-----------|-----------|-----------------------|-------------|-------------|-------------|
| $\pm 1\%$ | $\pm 1\%$ | $\pm 1\%$ | $\pm 3^\circ\text{C}$ | $\pm 0.1\%$ | $\pm 0.1\%$ | $\pm 0.1\%$ |

These tolerances include all errors caused by precision of testing instrument, testing method and testing process.

8. Packaging

| Dimension of box | Net weight | Gross weight |
|-------------------|------------|--------------|
| 406mm×287mm×165mm | 12KG | 15KG |

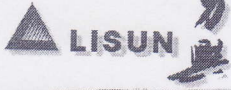
Normal package: 600 pcs per box.

9. Environment requirement

The product meets ROHS standard.

10. Producing standard and certification

Our batteries are produced according to the IEC-60086 standard and UN38.3



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shipment authentication.

11. Transportation

- The Batteries should be stored away from solarization, fire, rain, water, and never put together with corrosive during transportation.
- Vibration and shock during transportation and load-and-unload should be restrict to a minimum level.
- The height should not exceed 1.5m for cardboard packages.
- The batteries if transported by sea should be stored away from ship engines during prolonged transit, and not left for long periods in unventilated environment during summer.

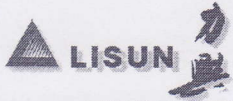
12. Information for safety

! Dangerous

- Do not overheat batteries or dispose of batteries in fire.
- Do not put batteries together with metalwork such as necklace, coins, etc in one bag, or store them together
- Do not short-circuit batteries.
- Do not inset batteries in reverse. Observe the + and - markings on battery and equipment.
- Do not disassemble batteries.
- Do not weld or solder directly to batteries.
- Do not use deformed batteries or batteries with serious scar.
- Read the guide carefully before using batteries. Unsuitable operation will make batteries overheat, fire, explode, destroy or reduce battery's capacity.

! Warning

- Do not place the battery in heater, washer or high-pressure container.
- Do not use the battery together with different kind of or different type of battery.
- Stop using when the battery become heat, emit smell or appear other abnormality during use, or storing.
- Do not recharge the battery.
- Do not force-discharge the battery.



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- Keep away from the battery when the battery is leakage or emit abnormal smell.
- Wash yourself quickly when the electrolyte infiltrate to your skin or clothes.
- Wash your eyes with clean water quickly and go to hospital for further check if the electrolyte infiltrate to your eyes.
- Please contact with us in advance If two or more batteries are to be connected in a series and / or placed in a parallel arrangement.

! Caution

- Keep the battery away from the children, avoid being swallowed.
- Read the guide carefully and pay attention to the guide when using the battery.
- Read the instrument guide carefully before installing the battery or uninstalling the battery from the instrument.
- Take out of the battery when the life of the battery is over.
- Take out of the battery and keep it under the condition of low temperature and low humidity when the battery is not used for a long time.
- Clean the battery with dry cloth before use if the connection of the battery is dirty.
- Battery should be used and stored far from the electrostatic place.

13. Storage

- The batteries should be stored at 10°C ~ 25°C (never exceed 30°C) , 45%~75%RH.
- The batteries should not be stored next to heat sources nor in direct sunlight. The storage area should be clean, cool, dry, ventilated and weatherproof.
- The height to which batteries may be stacked is clearly dependent on the strength of the packaging. As a general rule, this height should not exceed 1.5m for cardboard packages nor 3m for wooden cases.
- Store and display batteries in their original package. The batteries may be short-circuited or damaged if been unpacked and stacked mussily.

14. Declaration

- Please contact with Wuhan Lixing (Torch) Power Source Co., Ltd. If you have any question with this specification.

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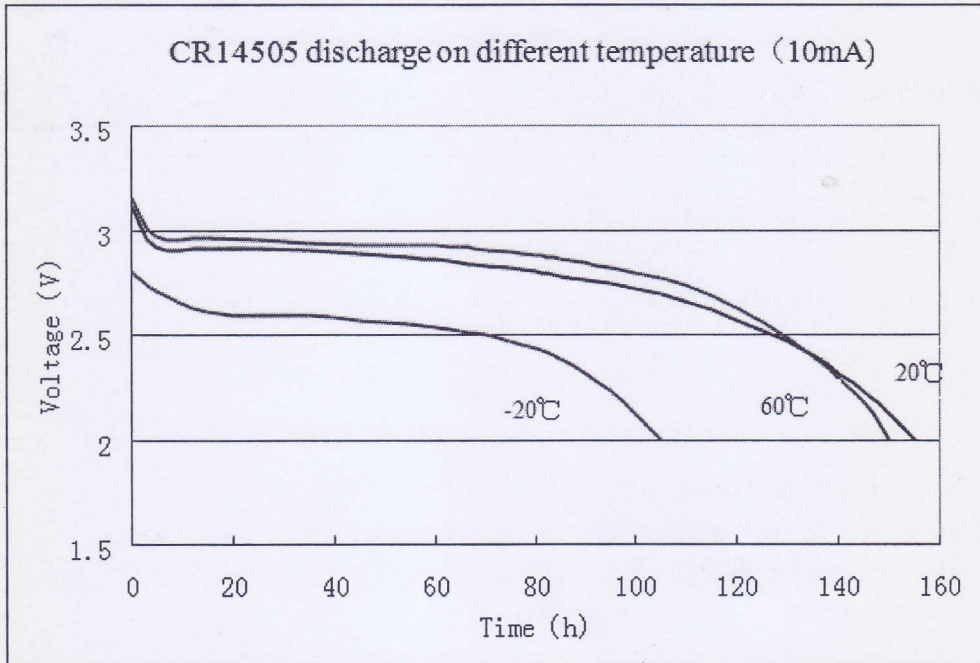
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Appendix 1:



Appendix 2:

Battery structural drawing
(CR cylindrical)

