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QC/T 990-2014

Zinc-air Batteries for Electric Road Vehicle

电动汽车用锌空气电池

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**Ministry of Industry and Information
Technology of the People's Republic of China
Announcement**

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The Ministry of Industry and Information Technology has approved 676 industrial standards including *Blister Packaging Machine* (see Attachment for standard numbers, names, main contents and initial implementation dates), including 394 mechanical industry standards (including 16 standards of pharmaceutical equipment), 1 automotive industry standard, 41 aviation industry standards, 135 light industry standards, 37 textile industry standards, 4 packaging standards, 42 chemical industry standards, 6 petrochemical industry standards, 4 non-ferrous industry standards, 7 metallurgical standards, 2 building material industry standards, 1 electronic industry standard, 2 communication industry standards.

The mechanical industry standards are published by China Machine Press; the standards of automotive, pharmaceutical equipment and packaging industry are published by China Planning Press; the aviation industry standards are published under the organization of AVIC China Aero-polytechnology Establishment; the light industry standards are published by China Light Industry Press; the standards of textile and non-ferrous industry are published by China Standards Press; the chemical industry standards are published by Chemical Industry Press; the petrochemical industry standards are published by China Petrochemical Press; the metallurgical industry standards are published by Metallurgical Industry Press; the building material industry standards are published by China Building Materials Press; the electronic industry standard is published under the organization of China Electronics Standardization Institute of the Ministry of Industry and Information Technology; the communication industry standard is published by Posts and Telecom Press.

Attachment: Number, name and initial implementation date of 1 automotive industry standard.

**Ministry of Industry and Information Technology of the People's Republic of
China**

July 9, 2014

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Zinc-air Batteries for Electric Road Vehicle

1 Application Scope

This standard specifies the terms and definitions, symbols and definitions, requirements, test method and marking, packaging, transportation and storage of zinc-air batteries for electric road vehicle (hereinafter referred to as batteries).

This standard applies to zinc-air batteries for electric road vehicle using mechanical switching as the energy supplement method.

2 Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 2900.41-2008, *Electrotechnical Terminology - Primary and Secondary Cells and Batteries*

GB/T 19596-2004, *Terminology of Electric Vehicles* (ISO 8713:2002, NEQ)

GB/T 2423.17-2008, *Environmental Testing for Electric and Electronic Products – Part 2: Test Method – Test Ka: Salt Mist*

3 Terms and Definitions

For the purposes of this Standard, those defined in GB/T 2900.41-2008 and GB/T 19596-2004 and the following terms and definitions apply.

3.1

zinc-air battery

a device which transforms chemical energy into electric energy using the oxygen in the air as positive active material, zinc metal as negative active material and alkaline solution as electrolyte.

5 Requirements

5.1 Cell

5.1.1 Appearance

Carry out inspection in accordance with 6.2.1. The appearance of battery shall be clean, intact without deformation, rust, crack or alkali liquor. Marking shall be clear, correct.

5.1.2 Polarity marking

Carry out inspection in accordance with 6.2.2. Marking for the polarities of battery terminals shall be correct.

5.1.3 Shape, dimensions and mass

Carry out inspection in accordance with 6.2.3. The shape, dimensions and mass of battery shall meet the specifications of the products supplied by the manufacturer.

5.1.4 Tilting

Carry out inspection in accordance with 6.2.4. Battery shall have no leakage.

5.1.5 Discharge performance

Carry out inspection in accordance with 6.2.5. When using I_5 to discharge, the mean value of discharge capacity shall not be less than 95% of nominal capacity; when using I_3 to discharge, the mean value of discharge capacity shall not be less than 65% of rated capacity.

5.1.6 Low-temperature performance

Carry out inspection in accordance with 6.2.6. When battery is subjected to the test under specified conditions, the discharge capacity of battery shall not be less than 60% of the initial rated capacity; the terminals and appearance shall be intact.

5.1.7 High-temperature performance

Carry out inspection in accordance with 6.2.7. When battery is subjected to the test under specified conditions, the discharge capacity of battery shall not be less than 80% of the initial rated capacity; the terminals and appearance shall be intact.

5.1.8 Charge retention

Carry out inspection in accordance with 6.3.5, battery shall not have leakage.

5.2.5 Discharge performance

Carry out inspection in accordance with 6.3.6. When using I_5 to discharge, the discharge capacity shall not be less than 90% of nominal capacity; when using I_3 to discharge, the discharge capacity shall not be less than 60% of rated capacity.

5.2.6 Safety and reliability

5.2.6.1 When short-circuit test is carried out in accordance with 6.3.7.1, there shall be no explosion or fire.

5.2.6.2 When squeeze test is carried out in accordance with 6.3.7.2, there shall be no explosion or fire.

5.2.6.3 When drop test is carried out in accordance with 6.3.7.3, there shall be no explosion or fire.

5.2.6.4 When heating test is carried out in accordance with 6.3.7.4, there shall be no explosion or fire.

5.2.6.5 When overdischarge test is carried out in accordance with 6.3.7.5, there shall be no explosion, fire or leakage.

5.2.6.6 When inspection is carried out in accordance with 6.3.7.6, product shall have necessary vibration resistance capacity. When subjected to the test under specified conditions, its discharge voltage shall be free from abnormalities and without mechanical damage, leakage, fire and explosion.

6 Test Method

6.1 Test conditions

6.1.1 Environmental conditions

Unless specified otherwise, the test shall be carried out under the following environmental conditions:

- a) test temperature $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- b) relative humidity: 25% ~ 85%.
- c) atmospheric pressure: 86 kPa ~ 106 kPa.

6.2.2 Polarity

Use a voltmeter to measure the terminal voltage of battery to be tested to determine whether it conforms to the marking of terminal polarity.

6.2.3 Shape, dimensions and mass

6.2.3.1 Use a general-purpose or special-purpose measuring tool to measure the external dimensions of cells.

6.2.3.2 Use a general-purpose or special-purpose to weigh the mass of cells.

6.2.4 Tilting

Tilt cells to be tested 90° along the horizontal direction (X direction) from the height direction (Y direction); maintain it for 30 s; carry out visual inspection.

6.2.5 Discharge performance test

At $25^\circ\text{C} \pm 2^\circ\text{C}$:

- a) cells discharge at I_5 until final voltage is 0.8 V: measure their discharge time, calculate discharge capacity C_5 , replace negative electrode and electrolyte, repeat testing for 3 times and calculate the mean value of discharge capacity;
- b) cells discharge at I_3 until final voltage is 0.8 V: measure their discharge time, calculate discharge capacity C_3 , replace negative electrode and electrolyte, repeat testing for 3 times and calculate the mean value of discharge capacity.

6.2.6 Low-temperature test

Place the cell samples to be tested in a test chamber for 12 h at $-20^\circ\text{C} \pm 2^\circ\text{C}$; discharge at I_5 until final voltage is 0.6 V. Measure their discharge time, calculate their discharge capacity and carry out visual inspection for the appearance of battery and the terminals of two poles.

6.2.7 High-temperature test

Place cell samples to be tested in a test chamber for 4 h at $55^\circ\text{C} \pm 2^\circ\text{C}$; discharge at I_5 until final voltage is 0.8 V. Measure their discharge time, calculate their discharge capacity and carry out visual inspection for the appearance of battery and the terminals of two poles.

6.2.8 Charge retention test

Under the normal environmental conditions specified for the test, measure the actual capacity C_5' of battery after a cell sample is allowed to stand for 7 d at room

After cells are fully charged by mechanical switching in accordance with 6.1.3, lay aside for 30 min at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, drop freely to cement floor with the terminal of cells downwards from a height of 1.5 m and observe for 1 h.

6.2.10.4 Heating test

Heating test shall be carried out in accordance with the following procedure:

- a) cells are fully charged by mechanical switching in accordance with 6.1.3;
- b) place cells into a thermal chamber, raise the temperature of thermal chamber to $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$ at the rate of $5^{\circ}\text{C}/\text{min}$ and stop heating after maintaining the temperature for 30 min;
- c) observe for 1 h.

6.2.10.5 Overdischarge test

Overdischarge test shall be carried out in accordance with the following procedure:

- a) cells are fully charged by mechanical switching in accordance with 6.1.3;
- b) cells discharge at current $2I_3$ (A) until the voltage of cells is 0 V and are forced to continue to discharge for 30 min at $2I_3$ (A).
- c) observe for 1 h.

6.2.10.6 Salt spray test

Salt spray test shall be carried out in accordance with the following procedure:

- a) cells are fully charged by mechanical switching in accordance with 6.1.3;
- b) carry out the test in accordance with GB/T 2423.17-2008, *Test Ka: Salt Mist*, with the continuous atomization time 24 h.

6.3 Module test

6.3.1 Test conditions

Module samples for testing shall meet the following criteria:

- a) the total voltage is not less than 5 times of the voltage of cells;
- b) the rated capacity of modules is not less than the rated capacity of cells.

6.3.2 Appearance

a) use an appropriate conductor (of resistance less than or equal to 5 mΩ) to directly force a short-circuit between positive terminal and negative terminal of battery for 50 s.

b) observe for 1 h.

6.3.7.2 Squeeze test

After modules are fully charged by mechanical switching in accordance with 6.1.3, lay aside for 30 min at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and carry out squeeze test in accordance with the following conditions:

a) the form of squeeze board: a half cylinder of diameter 75 mm with the height of the half cylinder greater than the maximum dimensions of batteries squeezed;

b) the direction of squeeze: perpendicular to the plane direction of air electrodes of cells;

c) the degree of squeeze:

-- stop squeezing until the deformation of modules achieves 30%.

-- stop squeezing until the squeezing force achieves 1 000 times of the mass of modules or 500 kN, whichever is larger;

d) observe for 1 h.

6.3.7.3 Drop test

After modules are fully charged by mechanical switching in accordance with 6.1.3, lay aside for 30 min at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and then:

a) drop freely to cement floor with the terminal of cells downwards from a height of 1.5 m;

b) observe for 1 h.

6.3.7.4 Heating test

Heating test shall be carried out in accordance with the following procedure:

a) modules are fully charged by mechanical switching in accordance with 6.1.3;

b) place modules into a thermal chamber, raise the temperature of thermal chamber to $130^{\circ}\text{C} \pm 2^{\circ}\text{C}$ at the rate of $5^{\circ}\text{C}/\text{min}$ and stop heating after maintaining the temperature for 30 min;

f) once every two years.

7.3.2 Criterion: if one item fails to pass type inspection, then the products are rejected.

8 Marking, Packaging, Transportation and Storage

8.1 Marking

8.1.1 Products shall be marked with the following information:

- a) manufacturer name or trademark;
- b) product type or specification;
- c) manufacturing date;
- d) polarity symbol;
- e) warning sign.

8.1.2 The outside of packing case shall be marked with the following information:

- a) name, type, specification, quantity of product and name, address and zip code of manufacturer;
- b) number of product standard;
- c) net weight and gross weight of each case;
- d) mark the words including keep dry, keep upright, handle with care.

8.2 Packaging

8.2.1 The packaging of batteries shall meet the requirements for moisture proofing and vibration resistance.

8.2.2 Documents accompanied with products shall be enclosed in packing case:

- a) packing list (referring to multiple packages);
- b) product quality certificate;
- c) product instruction manual;
- d) the package of zinc electrode shall be sealed, air-tight, vibration-proof and breakage-proof.

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