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**Electrical Performance Requirements and Test Methods for
Traction Battery of Electric Vehicle**

电动汽车用动力蓄电池电性能要求及试验方法

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Electrical Performance Requirements and Test Methods for Traction Battery of Electric Vehicle

1 Scope

This document specifies the electrical performance requirements for traction battery cells of electric vehicles (hereinafter referred to as the “battery cells”) and describes the corresponding test methods.

This document is applicable to lithium-ion batteries and metal hydride nickel battery cells installed on electric vehicles. Other types of batteries may take this as a reference.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 10592-2023 Specifications for High / low Temperature Testing Chambers

GB/T 19596 Terminology of Electric Vehicles

GB 38031 Electric Vehicles Traction Battery Safety Requirements

3 Terms and Definitions

The terms and definitions defined in GB/T 19596 and GB 38031, and the following are applicable to this document.

3.1 high energy battery

At room temperature, batteries with the ratio of the maximum allowable output electric power (W) to 3 I_3 rate discharge energy (Wh) less than 10.

NOTE: high energy batteries are generally applied to pure electric vehicles and plug-in hybrid electric vehicles.

[source: GB/T 19596-2017, 3.3.1.1.1.3, modified]

3.2 high power battery

At room temperature, batteries with the ratio of the maximum allowable output electric power

5.2 Polarity Markings

The battery cells shall be inspected in accordance with 6.2.2. The terminal polarity markings shall be correct and clear.

5.3 Mass and Overall Dimensions

The battery cells shall be inspected in accordance with 6.2.3. The mass and overall dimensions shall comply with the product technical conditions provided by the manufacturer.

5.4 Room Temperature Discharge Capacity

The battery cells shall be tested in accordance with 6.2.5, and their initial capacity shall not be less than the rated capacity and not exceed 110% of the rated capacity. At the same time, the initial capacity range of all test objects shall not be greater than 5% of the average initial capacity.

NOTE: the range is the difference between the maximum and minimum values of all samples.

5.5 Room Temperature Rate Discharge Capacity

The high energy battery cells shall be tested in accordance with 6.2.6.1, and their discharge capacity shall not be less than 95% of the initial capacity.

The high power battery cells shall be tested in accordance with 6.2.6.2, and their discharge capacity shall not be less than 80% of the initial capacity.

5.6 Room Temperature Rate Charging Performance

The battery cells shall be tested in accordance with 6.2.7, and their discharge capacity shall not be less than 80% of the initial capacity.

5.7 Low Temperature Discharge Capacity

Lithium-ion battery cells shall be tested in accordance with 6.2.8, and their discharge capacity shall not be less than 70% of the initial capacity.

Metal hydride nickel battery cells shall be tested in accordance with 6.2.8, and their discharge capacity shall not be less than 80% of the initial capacity.

5.8 High Temperature Discharge Capacity

The battery cells shall be tested in accordance with 6.2.9, and their discharge capacity shall not be less than 95% of the initial capacity.

5.9 Charge Holding and Capacity Recovery Capabilities

Lithium-ion battery cells shall be tested in accordance with 6.2.10. Their room temperature and high temperature charge holding capacity shall not be less than 90% of the initial capacity, and

the recovery capacity shall not be lower than 95% of the initial capacity. At the same time, the high temperature charge holding capacity and high temperature recovery capacity range of all test objects shall not be greater than 5% of the average initial capacity, and the energy efficiency range shall not be greater than 5% of the average energy efficiency of all test objects.

Metal hydride nickel battery cells shall be tested in accordance with 6.2.10. Their room temperature charge holding capacity shall not be less than 83% of the initial capacity, high temperature charge holding capacity shall not be less than 70% of the initial capacity, and recovery capacity shall not be less than 95% of the initial capacity. At the same time, the high temperature charge holding capacity and high temperature recovery capacity range of all test objects shall not be greater than 5% of the average initial capacity, and the energy efficiency range shall not be greater than 5% of the average energy efficiency of all test objects.

5.10 Storage

The battery cells shall be tested in accordance with 6.2.11, and their recovery capacity shall not be less than 95% of the initial capacity. At the same time, the recovery capacity range of all test objects shall not be greater than 5% of the average initial capacity, and the energy efficiency range shall not be greater than 5% of the average energy efficiency of all test objects.

6 Test Methods

6.1 Test Conditions

6.1.1 General conditions

6.1.1.1 Unless otherwise specified, the test shall be conducted in an environment with a room temperature of $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, a relative humidity of 10% ~ 90%, and an atmospheric pressure of 86 kPa ~ 106 kPa.

6.1.1.2 When the target ambient temperature of the test changes, before carrying out the test, the battery cells shall be placed at the target ambient temperature for 12 hours to complete environmental adaptation. Meanwhile, when the following conditions are satisfied, it may be terminated early:

- a) The difference between the battery cell temperature and the target ambient temperature does not exceed $2\text{ }^{\circ}\text{C}$;
- b) The change rate of the battery cell temperature is not greater than $1\text{ }^{\circ}\text{C/h}$ within at least 30 minutes.

6.1.1.3 The wind speed of the high and low temperature test chambers shall not be greater than 1.7 m/s, or the test tooling that complies with the requirements of Appendix A shall be used.

6.1.1.4 Before the test, the manufacturer shall provide parameters, such as: rated capacity, rated energy, charge termination voltage and discharge termination voltage, etc.

NOTE: for square and pouch batteries, measure the length, width and height; for cylindrical batteries, measure the diameter and height.

6.2.4 Standard charge

At room temperature, discharge the high energy batteries at a current of $1 I_3$ and the high power batteries at a current of $1 I_1$ to the discharge termination voltage specified in the manufacturer's technical conditions. Let them sit for 1 hour (or a time of no more than 1 hour provided by the manufacturer), then, charge in accordance with the charging method provided by the manufacturer, or the following charging methods:

- a) For lithium-ion batteries, charge with a constant current specified by the manufacturer and not less than $1 I_3$, until reaching the charge termination voltage specified in the manufacturer's technical conditions, then, switch to constant voltage charging. When the charge current drops to $0.15 I_3$, stop charging. After charging, let them sit for 1 hour (or a time of no more than 1 hour provided by the manufacturer);
- b) For metal hydride nickel batteries, charge with a constant current specified by the manufacturer and not less than $1 I_1$ for 1 hour, then, charge with $0.2 I_1$ for 0.5 hour. After charging, let them sit for 1 hour (or a time of no more than 1 hour provided by the manufacturer).

6.2.5 Room temperature discharge capacity

The room temperature discharge capacity test shall be carried out in accordance with the following steps:

- a) Charge the battery cells in accordance with the method of 6.2.4;
- b) At room temperature, discharge the high energy batteries at a current of $1 I_3$ and the high power batteries at a current of $1 I_1$, until reaching the discharge termination voltage specified in the manufacturer's technical conditions;
- c) Measure the discharge capacity (in Ah), and calculate the discharge energy (in Wh) and discharge specific energy (in Wh/kg);
- d) Repeat steps a) ~ c) for 5 times. When the range of three consecutive test results is less than 3% of the rated capacity, the test may be terminated early; take the average value of the last three test results as the initial capacity.

6.2.6 Room temperature rate discharge capacity

6.2.6.1 High energy batteries

6.2.6.1.1 The data recording interval for the room temperature rate discharge capacity test shall not be greater than 100 ms.

6.2.6.1.2 The room temperature rate discharge capacity test shall be carried out in accordance

with the following steps:

- a) Charge the battery cells in accordance with the method of 6.2.4;
- b) At room temperature, discharge the battery cells at a current of $3 I_3$, until reaching the discharge termination voltage specified in the manufacturer's technical conditions;
- c) Measure the discharge capacity (in Ah).

6.2.6.2 High power batteries

6.2.6.2.1 The data recording interval for the room temperature rate discharge capacity test shall not be greater than 100 ms.

6.2.6.2.2 The room temperature rate discharge capacity test shall be carried out in accordance with the following steps:

- a) Charge the battery cells in accordance with the method of 6.2.4;
- b) At room temperature, discharge the battery cells at a current of $10 I_1$ (the maximum current does not exceed 800 A), until reaching the discharge termination voltage specified in the manufacturer's technical conditions;
- c) Measure the discharge capacity (in Ah).

6.2.7 Room temperature rate charging performance

The room temperature rate charging performance test shall be carried out in accordance with the following steps:

- a) At room temperature, discharge the high energy batteries at a current of $1 I_3$ and the high power batteries at a current of $1 I_1$, until reaching the discharge termination voltage specified in the manufacturer's technical conditions, then, let them sit for 1 hour;
- b) At room temperature, charge the battery cells in accordance with the charging strategy specified by the manufacturer to the charge termination conditions specified by the manufacturer, and the total charging time shall not exceed 30 minutes; let them sit for 1 hour;
- c) At room temperature, discharge the high energy batteries at a current of $1 I_3$ and the high power batteries at a current of $1 I_1$, until reaching the discharge termination voltage specified in the manufacturer's technical conditions;
- d) Measure the discharge capacity (in Ah).

6.2.8 Low temperature discharge capacity

The low temperature discharge capacity test shall be carried out in accordance with the

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