

ICS 43.120  
CCS T47



**NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA**

**GB/T 31467-2023**

Replacing GB/T 31467.1-2015, GB/T 31467.2-2015

**Electrical performance test methods for lithium-ion traction  
battery packs and systems of electric vehicles**

电动汽车用锂离子动力电池包和系统电性能试验方法

**Issued on: November 27, 2023**

**Implemented on: November 27, 2023**

**Issued by: State Administration for Market Regulation;  
Standardization Administration of the PRC**

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# 1 Scope

GB/T 31467-2023 specifies the electrical performance test methods for the lithium-ion traction battery packs and systems of electric vehicles. It is the document behind every capacity and range figure quoted for a Chinese electric vehicle, and it is what makes two such figures comparable: the capacity and energy at stated rates and temperatures, the power and internal resistance by the pulse method at stated states of charge, the energy efficiency, the storage and self-discharge behaviour, the capacity retention and the cycle life, the low and high temperature performance, and the state of charge and state of health determination. The document sets the test conditions, the preparation and conditioning of the unit under test, the sequence of the tests and the calculation and expression of each result. It replaces the two parts of GB/T 31467-2015, bringing the electrical performance tests into a single document. For a cell or pack maker, a vehicle manufacturer or a testing house working in China, this is the protocol a specification is verified against.

This document describes the electrical performance test methods for lithium-ion traction battery pack and systems for electric vehicles. This document applies to the development and testing of lithium-ion traction battery pack and systems for electric vehicles.

# 2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to the date applies to this document; for undated reference documents, the latest version (including all amendments) applies to this document.

GB/T 19596 Terminology of electric vehicles

GB 38031 Electric vehicles traction battery safety requirements

# 3 Terms and definitions

The terms and definitions as defined in GB/T 19596 and GB 38031, as well as the following terms and definitions, apply to this document.

3.1 High energy application At room temperature, the device characteristics or application characteristics, where the ratio -- BETWEEN the maximum allowable continuous output power (W) of the battery pack or system AND its discharge energy (W·h) at 1 C rate is less than 10.

Note. High-energy batteries are generally used in pure electric vehicles and plug-in hybrid electric vehicles.

3.2 High power application At room temperature, the device characteristics or application characteristics, where the ratio -- BETWEEN the maximum allowable continuous output power (W) of the battery pack or system AND its discharge energy (W·h) at 1 C rate is more than or equal to 10.

Note. High-power batteries are generally used in hybrid electric vehicles.

3.3 Energy density The electrical energy released per unit mass of a battery pack or system.

Note. The unit of energy density is Watt-hour per kilogram (W·h/kg).

3.4 Energy round trip efficiency The ratio -- of the total discharged energy TO the total charged energy of a battery pack or system during testing.

Note. The unit of total charging energy and total discharging energy is watt hour (W·h).

## 4 Symbols and abbreviations

The following symbols and abbreviations apply to this document. BCU. Battery Control Unit FS. Full Scale RT. Room Temperature SOC. State-of-Charge  $I_{\max}(T)$ . The maximum allowable continuous discharge current under a certain test environment temperature  $T$   $I_{\max}(SOC, T, t)$ . The maximum allowable discharge current under a certain SOC, test environment temperature  $T$ , pulse duration  $t$   $n$  C. Current rate, whose value is equal to  $n$  times of 1h discharge capacity  $\eta$ . Efficiency

### 5.1 General conditions

5.1.1 Unless otherwise specified, the test is conducted at room temperature (RT) of  $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , relative humidity of 10% ~ 90%, atmospheric pressure of 86 kPa ~ 106 kPa.

5.1.2 The test sample handover needs to include the necessary operating documents, as well as the interface components required to connect to the test equipment, such as connectors, plugs, including cooling interfaces. See Appendix A for the typical structure of the battery pack and battery system. The manufacturer needs to provide safe operating limits for the battery pack or system, to ensure the safety of the entire test.

5.1.3 When the test target environment temperature changes, the test object shall complete the environmental adaptation process before conducting the test. if there is no active cooling within 1 hour and the difference between the battery cell temperature and the target temperature does not exceed  $2\text{ }^{\circ}\text{C}$ , the environment adaptation process is completed.

5.1.4 If the battery pack or system is not suitable for certain tests due to some reasons (such as size or mass), the subsystem of the battery pack or system can be used as the test object to conduct all or part of the test, after agreement between the supplier and the buyer. The subsystem used as the test object shall include all parts related to the vehicle

requirements (such as connecting parts or protective parts, etc.).

5.1.5 During the test process, in order to balance the internal reaction and temperature of the battery pack or system, a certain period of standing time is required between certain test steps. During the standing time, the low-voltage electronic control unit of the battery pack or system works normally, such as battery electronic components and BCU, etc.

5.1.6 During the test process, the thermal management system works according to the manufacturer's provisions or BCU's instructions. The ON/OFF status of the thermal management system shall be clearly stated in the test report. For the test of energy round trip efficiency (see 7.9), charging performance (see 7.11), operating discharge (see 7.12), it should turn on the thermal management system. However, for the capacity and energy (see 7.4), power and internal resistance (see 7.5), no load capacity loss (see 7.6), capacity loss during storage (see 7.7), high and low temperature starting power (see 7.8), energy density (see 7.10), it should not turn on the thermal management system OR turn it on after negotiation between the supplier and buyer.

5.1.7 The charge and discharge rate during the test process shall be carried out, in accordance with the provisions of this document. The charge and discharge mechanism and charge and discharge cut-off conditions shall be provided by the manufacturer. The charge and discharge cut-off conditions shall be consistent in different test items.

5.1.8 If the absolute value of the difference -- between the actual capacity of the battery (see 7.4.2.1) and the rated capacity -- exceeds 3% of the rated capacity, it shall be clearly stated in the test report; meanwhile the actual capacity shall be used instead of the rated capacity, for calculation of charge and discharge current and SOC.

5.1.9 Please see Appendix B for the test items, test method clause number, test conditions and other information that need to be performed on the battery pack and system.

5.1.10 The sign of battery discharge current is positive; the sign of charging current is negative.

## 5.2 Requirements for test instrument accuracy

5.2.1 The accuracy of measuring instruments and meters shall not be lower than the following requirements. - Voltage measuring device.  $\pm 0.5\%$  FS; - Current measuring device.  $\pm 0.5\%$  FS; - Temperature measuring device.  $\pm 1^\circ\text{C}$ ; - Time measuring device.  $\pm$

0.1 s; - Dimensional measuring device.  $\pm 0.1\%$  FS; - Mass measuring device.  $\pm 0.1\%$  FS.

5.2.2 During the measurement process, the control accuracy of control instruments, such as charging and discharging devices and temperature control boxes, shall meet the following requirements. - Voltage.  $\pm 1\%$ ; - Current.  $\pm 1\%$ ; - Temperature.  $\pm 2^\circ\text{C}$ .

5.3 Data recording and recording interval Unless otherwise stated in some specific test items, the recording interval of test data (such as time, temperature, current, voltage, etc.)