

ICS 43.120



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

GB/T 46990-2025

**Electrical performance requirements and test methods for
electric double-layer capacitors used in hybrid electric vehicles**

混合动力汽车用双电层电容器电性能要求及试验方法

(English Translation)

Issued on: December 31, 2025

Implemented on: July 1, 2026

Issued by: State Administration for Market Regulation

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1 Scope

This document specifies the performance requirements for electric double-layer capacitor monomers and modules (hereinafter referred to as the "capacitors") used for peak power output of hybrid electric vehicles, and describes the corresponding test methods.

This document applies to electric double-layer capacitors used for peak power output of hybrid electric vehicles, as well as electric double-layer capacitors used in vehicle idle emission reduction systems and start-stop systems.

This document does not apply to electrolytic capacitors.

2 Normative References

This document does not have normative references.

3 Terms and Definitions

3.1

charge accumulated electrical energy

The charge energy accumulated from the start to the end of charging.

3.2

charge current

The current required to charge the capacitor.

3.3

charging efficiency

Under specified charging conditions, the ratio of stored energy to charge accumulated electrical energy.

3.4

constant voltage charging

A charging process in which the voltage remains constant regardless of the charge current or temperature.

3.5

discharge accumulated electrical energy

The discharge energy accumulated from the start to the end of discharging.

capacitor for a period of time to enable the capacitor to exhibit the specified required characteristics.

NOTE 1: this voltage is the design value for the capacitor, denoted by UR.

NOTE 2: Appendix A provides a reference method for endurance test of capacitors at rated voltage.

3.16

room temperature

25 °C ± 2 °C.

3.17

stored energy

The energy stored in the capacitor.

3.18

upper category temperature

The highest ambient temperature at which the capacitor can continuously operate.

3.19

voltage maintenance characteristics

After being charged to its rated voltage, the characteristic of a capacitor to maintain its voltage in an open-circuit state.

3.20

voltage maintenance rate

Over a specified period of time after charging, the ratio of the open-circuit voltage to the charging cut-off voltage of the capacitor.

4.1.1 Appearance

The capacitor shall be inspected in accordance with 5.2.1. The appearance shall be free from deformation and cracks, and the surface shall be flat, dry, and free from electrolyte overflow traces.

4.1.2 Polarity marking

The capacitor shall be inspected in accordance with 5.2.2. The terminal polarity marking shall be clear, complete and accurate.

4.1.3 Mass and dimensions

The capacitor shall be inspected in accordance with 5.2.3. The mass and dimensions of the capacitor shall conform to the product technical specifications provided by the manufacturer.

4.2.1 Capacitance

The capacitor shall be tested in accordance with 5.3.4. The electrostatic capacitance shall be

100% ~ 120% of the nominal capacitance.

4.2.2 Internal resistance

The capacitor shall be tested in accordance with 5.3.5. The internal resistance shall not exceed its nominal internal resistance.

4.2.3 Maximum power density

The capacitor shall be tested in accordance with 5.3.6. The maximum power density shall not be less than its nominal value.

4.3 Voltage Maintenance Characteristics

The capacitor shall be tested in accordance with 5.4, and the voltage between the positive and negative terminals shall not be lower than 80% of its rated voltage.

4.4 Energy Efficiency

The capacitor shall be tested in accordance with 5.5, and the energy efficiency shall not be lower than 90%.

5.1 Environmental Conditions

Unless otherwise specified, the test shall be conducted in an environment with a temperature of

25 °C ± 5 °C, a relative humidity of 10% ~ 90%, and an atmospheric pressure of 86 kPa ~ 106 kPa.

5.2.1 Appearance

Under good lighting conditions, visually inspect the appearance of the capacitor.

5.2.2 Polarity marking

Use a voltmeter to detect the polarity of the capacitor and visually inspect the polarity marking for correctness and clarity.

5.2.3 Mass and dimensions

Before testing, the capacitor shall be fully charged and fully discharged, and then allowed to rest at room temperature or the relevant specified temperature for 2 to 6 hours. If necessary, the charge-discharge process may be repeated multiple times, until the capacitance and internal resistance stabilize. Connect the capacitor sample to be tested to the test equipment.

NOTE: the resting time is determined with reference to the thermal equilibrium time in Appendix B.

5.3.3.2 Test equipment setup

Unless otherwise specified, the test equipment shall be set up as follows.

a) Perform constant current charging. The current value can be calculated using $UR/38R_N$.

At this current, the capacitor can be charged with 95% charging efficiency based on the nominal internal resistance R_N . The constant current value or charging efficiency can be changed through negotiation between the customer and the manufacturer. The concept of 95% charging/discharging efficiency is given in Appendix C. When the rated value of the capacitor's internal resistance is uncertain, the measurement current can be set in accordance with the steps described in Appendix D.

b) Set the maximum voltage for constant current charging to UR .

c) Set the duration of constant voltage charging TCV to 300 s.

d) Set the current value for constant current discharging. This value is calculated based on 95% discharging efficiency of R_N using $UR/40R_N$. The constant current value or