GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 29.220.20

CCS K 84

GB/T 44649-2024

Nickel-metal Hydride Cells and Modules Used for Electric Road Vehicles - Safety Requirements

电动道路车辆用镍氢电池和模块　安全要求

[IEC 61982-4:2015, Secondary batteries (except lithium) for the propulsion of electric road vehicles - Part 4: Safety requirements of nickel-metal hydride cells and modules, MOD]

Issued on: September 29, 2024 **Implemented on: April 1, 2025**

Issued by: State Administration for Market Regulation;

Standardization Administration of the People's Republic of China.

Table of Contents

Nickel-metal Hydride Cells and Modules Used for Electric Road Vehicles - Safety Requirements

1 Scope

This document specifies the testing and acceptance of the safety performance of nickel-metal hydride (Ni-MH) cells and modules used for electric road vehicles (EV). Electric road vehicles (EV) include battery electric vehicles (BEV) and hybrid electric vehicles (HEV).

This document does not apply to the safety assessment of nickel-metal hydride (Ni-MH) cells during transportation and storage.

NOTE 1: in this document, nickel-metal hydride (Ni-MH) secondary cells refer to sealed metal hydride nickel cells: these sealed cells use nickel hydroxide as the positive electrode and hydrogen alloy as the negative electrode, and alkaline aqueous solution, for example, potassium hydroxide, as the electrolyte. Sealed cells are cells that can maintain their sealed condition and will not release gas or liquid when charged and discharged within the temperature range specified by the cell manufacturer. These cells are equipped with a gas release device to prevent explosion.

NOTE 2: this document is to ensure the basic safety performance of the battery system under expected use and reasonably foreseeable misuse during the normal operation of electric road vehicles.

NOTE 3: in this document, all descriptions of cells are applicable to module testing.

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 2900.41-2008 Electrotechnical Terminology - Primary and Secondary Cells and Batteries [IEC 60050 (482):2004, IDT]

GB/T 19596-2017 Terminology of Electric Vehicles

GB 38031-2020 Electric Vehicles Traction Battery Safety Requirements

IEC 61434 Secondary Cells and Batteries Containing Alkaline or Other Non-acid Electrolytes - Guide to Designation of Current in Alkaline Secondary Cell and Battery Standards

The percentage of the capacity of the current storage battery that can be released in accordance with specified discharge conditions in the available capacity.

[source: GB/T 19596-2017, 3.3.3.2.5]

4 General Test Requirements

4.1 Accuracy of Measurement Equipment

4.1.1 Range of measurement devices

The instruments / devices used shall be able to accurately measure voltage and current values. The measuring range of the instruments / devices and the measurement method selection shall ensure the accuracy specified for each test. For analog instruments, readings shall be taken from the later 1/3 of the dial. Any other measurement instruments of equivalent accuracy can be used.

4.1.1.2 Voltage measurement

The accuracy of the instrument used for voltage measurement shall be equal to 0.5 or higher. The resistance of the voltmeter used shall be at least 1,000 Ω/V.

4.1.1.3 Current measurement

The accuracy of the instrument used for current measurement shall be equal to 0.5 or higher. The entire assembly of ammeter, shunt and leads shall have an accuracy level of 0.5 or higher.

4.1.2 Tolerances

Relative to the specified or actual value, the overall accuracy of the controlled or measured value shall be within the following tolerance ranges:

a) Voltage ± 1%;

b) Current ± 1%;

c) Temperature ± 2 °C;

d) Time ± 0.1%;

e) Dimensions ± 0.1%.

These tolerances include the comprehensive accuracy of the measurement instruments, the measurement technique used and all other errors during the test process.

4.2 General Test Conditions

4.2.1 Test temperature

the following mode:

---Step 1: before charging, the cell shall be placed at ambient temperature and discharged at a constant current of 1/3 I_t to the termination voltage specified by the cell manufacturer;

---Step 2: at ambient temperature, charge the cell in accordance with the charging method specified by the cell manufacturer.

5.2 Capacity

Before adjusting the charging status in accordance with 5.3, the rated capacity of the cell shall be confirmed in accordance with the following steps.

---Step 1: charge the cell in accordance with the provisions of 5.1 After charging, the cell temperature shall be stabilized in accordance with 4.2.1.

---Step 2: the cell shall be discharged at 1 I_t to 0.9 V at ambient temperature. The maximum discharge current is 200 A. When testing a module, the value of the termination voltage is the product of the termination voltage of a cell and the quantity of cells connected in series in the module.

The test method for the current I_t is as defined in IEC 61434.

---Step 3: measure the discharge duration, until the termination voltage is reached; calculate the cell capacity and retain three significant figures.

5.3 Adjustment of State of Charge (SoC)

The test cell shall be charged in accordance with the following steps. The adjustment of state of charge is the procedure for preparing cells with different states of charge for testing.

---Step 1: charge the cell in accordance with 5.1.

---Step 2: in accordance with 4.2.1, let the cell stand at ambient temperature.

---Step 3: the cell shall be discharged at a constant current of 1/3 I_t at ambient temperature for $\frac{3\times(100-n)}{100}$ h. The current SoC of the cell is n%, which needs to be adjusted for each test.

6 Safety Test

WARNING: when selecting a test, if Scheme A is selected, only Scheme A can be selected for other test methods; if Scheme B is selected, only Scheme B can be selected for other test methods.

6.1 General Requirements

Safety tests shall be conducted under conditions specified by the cell manufacturer, using cells or modules that are no more than 6 months old.

In accordance with the agreement between the cell manufacturer and customer, determine the quantity of cells required for each test.

For all specified tests, the test installation conditions, including cell or module safety and wiring conditions, shall be recorded.

NOTE: if necessary, in order to prevent deformation, without violating the purpose of the test, the cells shall be maintained during the test.

6.2 Mechanical Test

6.2.1 Mechanical shock

6.2.1.1 Test purpose

This test is to verify the safety performance of the cell under inertial loads that may occur in a vehicle collision.

6.2.1.2 Test steps

The test shall be carried out in accordance with the following steps:

---Step 1: in accordance with 5.3, adjust the SoC of the cell for BEV to 100%, and adjust the SoC of the cell for HEV to 80%.

---Step 2: the cell shall be fixed onto the testing machine through rigid structural support. This support will support all surfaces of the cell.

---Step 3: apply a half-sine impact with a peak acceleration of 50 g_n (g_n represents the standard gravity acceleration, which is 9.80665 m/s^2) and a pulse duration of 11 ms to the cell. In three mutually perpendicular installation positions, the cell shall respectively withstand 3 impacts in the positive direction, then, respectively 3 impacts in the negative direction, for a total of 18 impacts.

6.2.1.3 Acceptance indicator

During the test, the cell shall not manifest signs of fire or explosion.

6.2.2 Extrusion

6.2.2.1 Test purpose

This test is used to measure the cell's response to external load forces that may cause deformation.

This test is to simulate the high-temperature environment that the cell will experience during normal vehicle operation and to verify the safety performance of the cell under such conditions.

6.3.1.2 Test steps

Scheme A: the test shall be carried out in accordance with the following steps.

---Step 1: in accordance with 5.3, adjust the SoC of the cell for BEV to 100%, and adjust the SoC of the cell for HEV to 80%.

---Step 2: the cell shall be placed in a box with circulating air. The temperature inside the box is 60 °C ± 2 °C, and the cell shall be maintained at this temperature for 2 hours. Then, lower the temperature to 25 °C ± 2 °C and observe the cell in the box for 1 hour.

NOTE: if necessary, in order to prevent deformation, without violating the purpose of the test, the cells shall be maintained during the test.

Scheme B: the test steps shall comply with GB 38031-2020.

6.3.1.3 Acceptance indicator

During the test, the cell shall not manifest signs of fire or explosion.

6.3.2 Temperature cycle

6.3.2.1 Test purpose

This test is to simulate alternative high and low temperature environments that may cause expansion and contraction of battery packs and verify the safety performance of the cell under such conditions.

6.3.2.2 Test steps

Scheme A:

The test steps are as follows.

---Step 1: in accordance with 5.3, adjust the SoC of the cell for BEV to 100%, and adjust the SoC of the cell for HEV to 80%.

---Step 2: all protective devices that may affect cell performance and test results shall be normally used.

---Step 3: unless the cell manufacturer requires a higher temperature, the cell shall be stored at 60 °C ± 2 °C for at least 6 hours. Then, unless the cell manufacturer requires a higher temperature, the cell shall be stored at –40 °C ± 2 °C or lower for at least 6 hours. The maximum time interval between these two extreme temperature tests is 30 minutes. This step shall be repeated, until at least 5 cycles are completed, after which, the cell shall be stored at room temperature for 24 hours.

---Step 4: after completing the above-mentioned test steps, observe the cell at ambient temperature for 1 hour.

Scheme B:

The test steps shall comply with GB 38031-2020.

6.3.2.3 Acceptance indicator

During the test, the cell shall not manifest signs of fire or explosion.

6.4 Electrical Test

6.4.1 External short-circuit current

6.4.1.1 Test purpose

This test is to verify the safety performance of the cell when exposed to external short circuit.

6.4.1.2 Test steps

Scheme A:

The test steps are as follows.

---Step 1: the cell shall be fully charged in accordance with 5.1.

---Step 2: the positive and negative terminals of the cell shall be connected through an external resistor for 10 minutes for short-circuit test. The total external resistance of each cell shall be not greater than 5 mΩ and may also be specified by the customer and cell manufacturer.

---Step 3: after completing the above-mentioned test steps, observe the cell at ambient temperature for 1 hour.

Scheme B:

The test steps shall comply with GB 38031-2020.

6.4.1.3 Acceptance indicator

During the test, the cell shall not manifest signs of fire or explosion.

6.4.2 Overcharge

6.4.2.1 Test purpose

This test is to verify the safety performance of the cell under overcharge conditions.

6.4.2.2 Test steps

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------