



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

GB/T 44131-2024

Post-crash safety requirements for fuel cell electric vehicles

燃料电池电动汽车碰撞后安全要求

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1 Scope

GB/T 44131-2024 sets the safety requirements that apply to a fuel cell electric vehicle after a crash. The question it answers is the one that decides whether hydrogen vehicles are acceptable on the road: after the impact, is the vehicle carrying several kilogrammes of hydrogen at 700 bar and a live high voltage system, and what must be true of both. The standard specifies the requirements after the prescribed impact tests: the hydrogen leakage limit and the period over which it is measured, the integrity of the hydrogen storage system and its mounting and of the shut-off valves, which must close and stay closed, the concentration limits in the passenger compartment and in the enclosed spaces of the vehicle, the electrical safety requirements covering isolation resistance, the absence of accessible live parts and the depletion of stored energy, and the requirements on the fuel cell system state. It then gives the measurement methods, the sensor placement and the timing of the measurements. For a carmaker or a regulator dealing with hydrogen vehicles in China, this is the governing text.

This document specifies the special post-crash safety requirements for fuel cell electric vehicles and describes the corresponding test methods. This document applies to M and N fuel cell electric vehicles that use compressed gaseous hydrogen and the nominal working pressure of the on-board hydrogen system does not exceed 70 MPa.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 11551 The protection of the occupants in the event of a frontal collision for motor vehicle

GB/T 15089 Classification of power-driven vehicles and trailers

GB 17578 Requirements and test methods of strength for the superstructure of bus

GB/T 18385 Battery electric vehicles - Power performance - Test method

GB/T 19596 Terminology of electric vehicles

GB 20071 The protection of the occupants in the event of a lateral collision

GB 20072 The requirements of fuel system safety in the event of rear-end collision for passenger car

GB/T 24548 Fuel cell electric vehicles - Terminology

GB/T 24549-2020 Fuel cell electric vehicles - Safety requirements

GB 26512-2021 The protection of the occupants of the cab of commercial vehicles

GB/T 26990 Fuel cell electric vehicles - Onboard hydrogen system technical specifications

GB/T 31498-2021 Post crash safety requirement for electric vehicle

GB 38032-2020 Electric buses safety requirements

3 Terms and definitions

For the purpose of this document, the terms and definitions defined in GB/T 19596, GB/T 24548, GB/T 24549-2020, GB/T 26990, GB/T 15089 and the following apply to this document.

3.1 main shut-off valve A valve used to shut off the supply of hydrogen from the hydrogen storage cylinder to the downstream. [Source: GB/T 24549-2020, 3.1, modified]

3.2 enclosed or semi-enclosed spaces Spaces in the vehicle that may be exposed to hydrogen storage cylinders and environmental spaces and areas where hydrogen may accumulate. NOTE. The passenger compartment, luggage compartment, cargo compartment, or space under the front hatch are all enclosed or semi-enclosed spaces. [Source: GB/T 24549-2020, 3.4, modified]

3.3 nominal working pressure; NWP At the reference temperature (15 °C), the limit filling pressure when the gas pressure in the hydrogen storage cylinder reaches full stability. [Source: GB/T 24549-2020, 3.5, modified]

3.4 compressed hydrogen storage system; CHSS A device for storing hydrogen in a fuel cell vehicle, consisting of a hydrogen storage cylinder (set), a safety pressure relief device, and a closing device for isolating the stored hydrogen from the rest of the fuel system and its environment. NOTE. See the thick solid line in Figure 1.

5.1.2.1 The installation requirements for CHSS of M2, M3, N2 and N3 vehicles are as follows:

- a) The main shut-off valve of CHSS is located behind the vertical plane 420 mm backward from the frontmost end of the vehicle, and the hydrogen storage cylinder shall not be located at the outermost part of the vehicle.
- b) The main shut-off valve of CHSS is located between the vertical planes 200 mm inward from the outermost end of the vehicle body on both sides, and the hydrogen storage cylinder shall not be located at the outermost part of the vehicle. If the position of the CHSS does not meet this requirement, a side impact test shall be conducted in accordance with 6.2.5, and the vehicle shall meet the requirements of

5.2.3 after the test.

- c) The main shut-off valve of CHSS is located in front of the vertical plane 300 mm forward from the rearmost end of the vehicle, and the hydrogen storage cylinder shall not be located at the outermost part of the vehicle. If the position of the CHSS does not meet this requirement, a rear-end collision test shall be conducted in accordance with 6.2.5, and the vehicle shall meet the requirements of

5.2.3 after the test. NOTE. The frontmost and outermost parts do not contain external vision devices.

5.1.2.2 The CHSS of M2, M3, N2 and N3 vehicles shall meet the requirements of

5.2.3 after completing the sled test in accordance with 6.2.4.

5.1.2.3 M2 and M3 vehicles of which the lowest point of the rechargeable energy storage system (REESS) is no more than 1 m above the ground when unloaded shall meet the requirements of 5.3,

5.2 Post-crash safety requirements for CHSS

5.2.1 Fuel leakage limit of CHSS According to the test method specified in 7.1, within the leakage test time Δt , the sum of the average hydrogen leakage rates of all hydrogen storage cylinders shall not exceed 118 L/min (standard state). NOTE. Δt is a calculated value, which is calculated either according to formula (2) or formula (10), depending on the medium filled in the hydrogen storage cylinder during the test.

5.2.2 Concentration limit in closed or semi-closed spaces REESS shall meet the requirements of

4.4 of GB/T 31498-2021.

5.4.3 Special safety requirements for hydrogen system Within the leakage test time, Deltat, after the collision, the CHSS and fuel cell engine shall not catch fire or explode.

6.1 Vehicle preparation before test

6.1.1 For externally rechargeable fuel cell electric vehicles, the REESS shall be fully charged according to the method specified in GB/T 18385 and tested within 24 hours.

6.1.2 For non-externally rechargeable fuel cell electric vehicles, the REESS shall be prepared for test in normal operating conditions.

6.1.3 The manufacturer shall install pressure and temperature measuring equipment that meets the requirements of Table 1 on the CHSS and provide a metrological certificate. Before the test, the testing agency may refer to Annex A for verification and prepare for the post-crash fuel leakage test in accordance with 7.1.1.

6.1.4 The gas concentration test in closed or semi-closed spaces shall be prepared in accordance with 7.2.

6.1.5 For frontal collision, lateral collision and rear-end collision tests, preparations shall be made in accordance with the test methods specified in GB 11551, GB 20071 and GB 20072, respectively.

6.1.6 The sled test shall be prepared in accordance with

7.3.1 and 7.3.2.

6.2 Collision test

6.2.1 The form and test method for the frontal collision test of the vehicle shall be carried out in accordance with the relevant provisions of GB 11551.

6.2.2 The form and test method for the lateral collision test of the vehicle shall be carried out in accordance with the relevant provisions of GB 20071.

6.2.3 The form and method for the rear-end collision test of the vehicle shall be carried out in accordance with the relevant provisions of GB 20072.

6.2.4 The sled test shall be carried out in accordance with the relevant provisions of 7.3.

6.2.5 The lateral collision and rear-end collision tests of the vehicle shall be carried out in accordance with the relevant provisions of 7.4. where. V_{He} - the value of the average volume flow rate of helium in the time interval, in liters per minute (L/min). Use formula (18) to convert the average helium flow rate into the average hydrogen flow rate.

7.1.4 Fuel leakage test when the pressure sensor is located outside the hydrogen storage cylinder