



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

GB/T 42612-2023

**Fully-wrapped carbon fiber reinforced cylinder with a plastic
liner for the on-board storage of compressed hydrogen as a
fuel for land vehicles**

车用压缩氢气塑料内胆碳纤维全缠绕气瓶

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1 Scope

GB/T 42612-2023 specifies type IV hydrogen cylinders for vehicles - a plastic liner fully wrapped in carbon fibre, holding hydrogen at 70 MPa. It is the enabling component of a fuel cell vehicle and the most safety-critical one: the cylinder is under the floor of a passenger vehicle, it holds a gas that embrittles metals and permeates polymers, and it must survive a service life of filling cycles, impacts, fire and the ordinary abuse of a road vehicle. The standard sets the types, parameters, classification and models, the technical requirements and test methods, the inspection rules, the installation and protection, the marking, packaging, transport and storage, and the product certificate, with normative annexes on the test parameter tolerances, routine maintenance and inspection, the evaluation of compatibility between the plastic liner and hydrogen, the performance of the O-ring seals, the qualification of the liner welding procedure, and the interlayer shear test. It took effect on 1 June 2024.

This document specifies the type, parameters, classification and model, technical requirements, test methods, inspection rules, installation, protection, marking, packaging, transportation and storage requirements of fully-wrapped carbon fiber reinforced cylinders with a plastic liner for the on-board storage of compressed hydrogen as a fuel for land vehicles (hereinafter referred to as cylinders). This document is applicable to the design and manufacture of refillable cylinders, which have a nominal working pressure of 35 MPa and 70 MPa, a nominal volume greater than or equal to 20 L and not greater than 450 L, an operating temperature not lower than -40 °C and not higher than 85 °C, are fixed on motor vehicles for containing hydrogen fuel. Hydrogen gas cylinders, which are used for hydrogen fuel cell urban rail transit, hydrogen ships, hydrogen aircraft, hydrogen power generation devices, etc., can refer to this document.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 223.3 Methods for chemical analysis of iron, steel and alloy - The diantipyryl methane phosphomolybdate gravimetric method for the determination of phosphorus content

GB/T 223.4 Methods for chemical analysis of iron, steel and alloy - The volumetric method for determination of manganese content by ammonium nitrate oxidation

GB/T 223.5 Steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdosilicate spectrophotometric method

GB/T 223.11 Iron, steel and alloy - Determination of chromium content - Visual

5.1 General requirements

5.1.1 Design service life The design service life of the gas cylinder is 15 years.

5.1.2 Number of design cycles The cylinders are designed for 11000 cycles.

5.1.3 Allowable pressure During filling and use, the allowable pressure of the gas cylinder is 1.25 times the nominal working pressure.

5.1.4 Tolerance of test parameters Unless otherwise specified, the test parameter tolerances shall comply with the provisions of Appendix A.

5.1.5 Temperature range During filling and use, the temperature of the gas cylinder shall not be lower than - 40 °C and not higher than 85 °C.

5.1.6 Hydrogen quality The compressed hydrogen gas for filling cylinders shall meet the requirements of GB/T 37244.

5.1.7 Working environment The design of gas cylinders shall consider its ability to continuously withstand mechanical damage or chemical erosion; its outer surface shall at least adapt to the following working environments:

- a) Intermittent immersion in water or road splashing;
- b) The vehicle is driven near the ocean or on roads where ice has been melted with salt;
- c) UV radiation from sunlight;
- d) Vehicle vibration or gravel impact;
- e) Contact with acid solution, alkali solution, fertilizer;
- f) Contact with automotive fluids, such as gasoline, hydraulic oil, battery acid, glycol and other greases;

5.2.1 General requirements

5.2.1.1 The material properties shall comply with the relevant national standards or industry standards.

5.2.1.2 The material shall have the original quality certificate, which is provided by the material manufacturer, OR a copy of the quality certificate with the official seal of the material management organization and the signature (seal) of the person in charge.

5.2.1.3 The materials shall be re-inspected by the gas cylinder manufacturer, before they can be used.

5.2.2 Plastic liner

5.2.2.1 The plastic liner should be made of polyethylene (including modified polyethylene) or polyamide (including modified polyamide). Its compatibility with hydrogen shall meet the requirements of Appendix C.

5.2.2.2 The melting peak temperature of the plastic liner material shall be greater than or equal to the specified value in the design documents.

5.2.2.3 When the raw material of the plastic liner is granular, the melt mass flow rate of polyethylene (including modified polyethylene) and the melt volume flow rate of polyamide (including modified polyamide) shall meet the requirements of the design documents.

5.2.2.4 When the raw material of the plastic liner is powder, the apparent density, powder fluidity, particle size distribution shall meet the requirements of the design documents.

5.2.2.5 The gas cylinder manufacturer shall conduct re-inspection of the plastic liner material by batch. The melting peak temperature shall be measured, according to the test method specified in GB/T 19466.3, wherein the heating and cooling rate of polyethylene (including modified polyethylene) is 10 °C/min; the heating and cooling rate of polyamide (including modified polyamide) is 20 °C/min. When the raw material of austenitic stainless steel S31603 and the tensile properties of aluminum alloy 6061, according to the material batch number. The tensile and impact tests of austenitic stainless steel S31603 are carried out, according to the provisions of GB/T 228.1 and GB/T 229, respectively; the tensile test of aluminum alloy 6061 is carried out, according to the provisions of GB/T 228.1.

5.2.4 O-ring seals

5.2.4.1 The material of O-ring seals shall be polymers, which have good compatibility with high-pressure hydrogen, such as silicone rubber, fluororubber, fluorosilicone rubber, fluorocarbon rubber, EPDM rubber or hydrogenated nitrile rubber.

5.2.4.2 The applicable temperature range of the O-ring material shall meet the requirements of -50 °C ~ 85 °C.

5.2.4.3 The material properties of O-ring seals shall meet the requirements of D.2 in Appendix D.

5.2.5 Resin

5.2.5.1 Epoxy resin or modified epoxy resin shall be used as impregnation resin matrix. The epoxy value or epoxy equivalent of the resin shall meet the requirements of the design documents; the glass transition temperature shall be greater than or equal to 105 °C.

5.2.5.2 The gas cylinder manufacturer shall re-inspect the resin by batch. The epoxy value is determined, according to GB/T 1677; the epoxy equivalent is determined, according to