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NATIONAL STANDARD OF THE
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ICS 27.180

F 19

GB/T 34583-2017

**Safety technical requirements for hydrogen storage devices
used in hydrogen fuelling station**

加氢站用储氢装置安全技术要求

Issued on: October 14, 2017

Implemented on: May 01, 2018

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine;
Standardization Administration of the People's Republic of China.**

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Safety technical requirements for hydrogen storage devices used in hydrogen fuelling station

1 Scope

This Standard specifies the safety technical requirements for hydrogen storage devices used in hydrogen fuelling station (hereinafter referred to as hydrogen storage devices).

This Standard applies to stationary type storage devices for high-pressure hydrogen and seamless tubes for storage of high-pressure hydrogen used in the hydrogen fuelling station that is filled with high-pressure hydrogen, where the design pressure is not greater than 100 MPa, the operating temperature is not lower than -40 °C and not higher than 60 °C.

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 4962, Technical safety regulation for gaseous hydrogen use

GB/T 24499, Technology glossary for gaseous hydrogen, hydrogen energy and hydrogen energy system

GB/T 26466, Stationary flat steel ribbon wound vessels for storage of high pressure hydrogen

GB/T 29729, Essential requirements for the safety of hydrogen systems

GB 50166, Code for installation and acceptance of fire alarm system

GB 50516, Technical code for hydrogen fuelling station

JB 4732, Steel Pressure Vessels - Design by Analysis

TSG 21, Supervision Regulation on Safety Technology for Stationary Pressure Vessel

The set maximum pressure of the hydrogen storage device, which, together with the corresponding design temperature, is used as the basic design load conditions of the hydrogen storage device; its value is not lower than the working pressure.

4 Safety technical requirements

4.1 General requirements

4.1.1 The quality of hydrogen charged into the hydrogen storage device shall comply with the provisions of relevant standards and design documents.

4.1.2 The pipeline connected to the hydrogen storage device shall comply with the provisions of the corresponding codes, standards and design documents.

4.1.3 The hydrogen storage device shall minimize the number of joints or other potentially dangerous points that may cause leakage.

4.1.4 The hydrogen storage capacity of the hydrogen storage device shall meet the requirements of design pressure, hydrogen supply method, hydrogen supply pressure, hydrogen charging pressure, hydrogen charging amount and balanced continuous gas supply; the design pressure of the hydrogen storage device should be set according to level 2 or 3.

4.1.5 When hydrogen storage devices of different design pressures are connected to each other, a decompression device shall be installed to ensure that the hydrogen storage device of lower design pressure is not over-pressured.

4.1.6 The materials of parts and components in the hydrogen storage device that are in direct contact with hydrogen shall be verified to have good compatibility with hydrogen.

4.1.7 The influence of hydrogen embrittlement shall be considered in the design and selection of pipes, valves, pressure gauges, bursting discs, etc. of the hydrogen storage device.

4.1.8 The installation area of the hydrogen storage device shall be well ventilated and equipped with fire-fighting facilities and hydrogen leakage alarm facilities.

4.1.9 The installation area of the hydrogen storage device shall be equipped with obvious fire prohibition signs, such as flammable gas, no smoking, no open flame, etc.

4.1.10 The anti-thunder, anti-static and grounding of the hydrogen storage device shall comply with the provisions of GB 50516.

4.1.11 The required relief capacity of the hydrogen storage device shall be determined according to the pressurization method of hydrogen. When a compressor is used for supercharging, the required relief capacity shall be the maximum displacement of the compressor per unit time.

4.1.12 The replacement of the hydrogen storage device shall not only meet the relevant provisions of GB 4962, but also meet the following provisions:

- a) The volume fraction of oxygen in nitrogen for replacement shall not be greater than 0.5%;
- b) The replaced gas shall be discharged through the vent pipe.

4.2 Design and manufacture

4.2.1 The design and manufacture of gas storage tanks and steel seamless tubular gas storage cylinders in hydrogen storage devices shall comply with the relevant regulations of TSG 21 and JB 4732. The design and manufacture of the flat steel ribbon wound vessels for storage of hydrogen shall also comply with the relevant provisions of GB/T 26466.

4.2.2 The design unit of the hydrogen storage device shall obtain the corresponding pressure vessel design qualification, and shall provide the design entrusting party with complete design documents, including stress analysis report, design drawings, manufacturing technical conditions, risk assessment report, installation, use and maintenance instructions, required relief capacity of hydrogen storage device, safety valve discharge or calculation of rupture disc discharge area.

4.2.3 The hydrogen storage device shall be subjected to fatigue analysis.

4.2.4 The working pressure of the hydrogen storage device shall be determined according to the hydrogen charging method of the vehicle-mounted hydrogen storage cylinder and the nominal working pressure, which is, usually, not less than 1.38 times the nominal working pressure.

4.2.5 The design pressure of the piping components in the hydrogen storage device shall not be less than 1.1 times its working pressure.

4.2.6 The design life (number of cycles) of the hydrogen storage device shall not be less than the number of pressure cycles within the expected service life.

4.2.7 The minimum design metal temperature of the hydrogen storage device shall be less than or equal to the lowest value of the monthly average minimum temperature in the area where it is used over the years.

4.2.8 The cylinder body of the seamless tube for storage of hydrogen shall not be welded.

4.3 Safety accessories

4.3.1 General requirements

4.3.1.1 The hydrogen storage device shall at least be provided with the following safety accessories:

4.3.2.3 The bursting disc shall also meet the following requirements:

- a) No sparks and metal fragments shall be produced during bursting;
- b) It shall be replaced regularly according to the service life;
- c) It shall be provided with a safety cover.

4.3.3 Valve

4.3.3.1 A block valve and a check valve shall be set before the nitrogen purging port of the hydrogen storage device.

4.3.3.2 The block valve of the hydrogen storage device should be a stop valve or a ball valve.

4.3.4 Vent pipe

4.3.4.1 The vent pipe shall be arranged vertically and shall be more than 2 m above the roof or operating platform.

4.3.4.2 The vent pipe shall be provided with 2 block valves and sampling ports.

4.3.4.3 The reaction force of the exhaust gas shall be considered in the design of the vent pipe.

4.3.4.4 The inner diameter of the vent pipe shall be larger than the outlet diameter of the overpressure relief device; if a vent header is used for multiple relief devices, the cross-sectional area of the header shall be greater than the sum of the cross-sectional areas of the relief ports of each relief device.

4.3.4.5 The vent pipe orifice shall be provided with a flame arrester.

4.3.4.6 The vent pipe shall be provided with an electrostatic grounding device and shall be within the scope of lightning protection.

4.3.4.7 The vent pipe shall be provided with measures to prevent air backflow, intrusion of rain and snow, condensation of water vapor and blockage by foreign objects.

4.3.5 Control and monitoring device

4.3.5.1 The precision level and range of the control and monitoring device of the hydrogen storage device shall meet the requirements for use, and shall be provided with corresponding product qualification certificate and verification date. It can be installed only after being qualifiedly checked and sealed with lead, and the installation location shall be easy for operators to observe and overhaul.

4.3.5.2 The hydrogen storage device shall at least be provided with the following alarm measures:

4.6.2 The user unit shall establish technical files of hydrogen storage devices one by one and keep them uniformly by their management department. The technical file shall at least include the following:

- a) special equipment use registration certificate;
- b) hydrogen storage device registration card;
- c) technical documents and information on the design and manufacture of the hydrogen storage device;
- d) annual inspection and periodic inspection report of the hydrogen storage device, and other technical documents related to inspection;
- e) plans, drawings, material quality certificates and other technical data for the maintenance and technical transformation of the hydrogen storage device;
- f) verification, maintenance and replacement records of safety accessories;
- g) record materials and handling reports of relevant incidents.

4.6.3 The user unit shall clearly put forward the safety operation requirements of the hydrogen storage device and the emergency handling plan in the process operation procedures and post operation procedures. The handling of emergencies shall comply with the relevant provisions of GB/T 29729.

4.6.4 The user unit shall conduct safety education for the operators to ensure that the operators master the operating procedures and emergency measures for accidents; the dedicated safety person and operators of the hydrogen storage device shall hold the corresponding special equipment operator certificates.

4.6.5 The user unit shall carry out routine maintenance of the hydrogen storage device and its safety accessories, and shall deal with and record the abnormal situation in time.

4.6.6 The user unit shall conduct an annual inspection of the hydrogen storage device; the annual inspection shall include the inspection of the safety management of the hydrogen storage device, the inspection of the main body and operation of the device, and the inspection of safety accessories.

4.6.7 The user unit shall submit periodic inspection requirements to the inspection agency one month before the expiration of the periodical inspection of the hydrogen storage device.

4.6.8 The hydrogen storage device shall be purged and replaced with nitrogen before it is put into operation, before maintenance and hot work, or before and after long-term deactivation.

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