



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

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**Steel cylinders for the on-board storage of compressed natural
gas as a fuel for automotive vehicles**

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1 Scope

This document specifies the types and parameters, technical requirements, test methods, inspection rules, marking, coating, packaging, transportation and storage requirements of steel cylinders for the on-board storage of compressed natural gas as a fuel for automotive vehicles (hereinafter referred to as "steel cylinders").

This document is applicable to the design and manufacturing of steel cylinders with a nominal operating pressure of 20 MPa and 25 MPa, a nominal volume of 30 L ~ 300 L, an operating temperature of -40 °C ~ 65 °C and a design service life of 15 years.

The steel cylinders manufactured in accordance with this document are only used as the storage containers fixed on automotive vehicles and filled with compressed natural gas as automobile fuels that complies with GB 18047; additional loads caused by external forces, etc. are not included in the service conditions.

This document does not apply to gas storage steel cylinders used at compressed natural gas filling stations, nor does it apply to steel cylinders of welded structure.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in this 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 192 General Purpose Metric Screw Threads - Basic Profile

GB/T 196 General Purpose Metric Screw Threads - Basic Dimensions

GB/T 4157 Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H₂S Environment

GB/T 4336 Carbon and Low-alloy Steel - Dimension of Multi-element Contents - Spark Discharge Atomic Emission Spectrometric Method (routine method)

GB/T 5777 Automated Full Peripheral Ultrasonic Testing of Seamless and Welded (except submerged arc-welded) Steel Tubes for the Detection of Longitudinal and / or Transverse S1---the design wall thickness at the center of the bottom of the steel cylinder, expressed in (mm);

S2---the design wall thickness of the grounding point at the concave bottom of the steel cylinder, expressed in (mm).

Figure 2 -- Types of End Structure

5.3.3.4 There shall be a transition section between the annular shell at concave end of the steel cylinder and the cylinder body, and the connection between the transition section and the cylinder body shall be smooth.

5.3.4 Design of cylinder mouth

5.3.4.1 The thread of the cylinder mouth shall adopt tapered thread, which shall comply with the stipulations of GB/T 8335 or relevant standards, and the number of effective threads shall not be less than 8.

5.3.4.2 The thickness of the cylinder mouth shall have sufficient strength; the mouth shall not be plastically deformed when bearing the torque of the upper valve and the additional external force of the riveted neck ring.

5.3.5 Accessories

5.3.5.1 The cylinder valve shall comply with the stipulations of GB/T 17926 and shall be equipped with a safety pressure relief device.

5.3.5.2 The nominal burst pressure of the rupture disc is the hydrostatic test pressure, and the allowable deviation is +10%0 ; the operating temperature of the fusible plug is 110 °C ?

5 ?C.

5.3.5.3 The rated discharge capacity of the safety pressure relief device shall be calculated in accordance with GB/T 33215 and shall not be less than the safe discharge capacity of the gas cylinder. In addition, it shall be ensured that the gas cylinder passes the fire burning test specified in 6.15.

5.3.6 Maximum allowable defect size for non-destructive evaluation (NDE)

The maximum allowable defect size at any point of the steel cylinder shall be specified, so as to prevent failure of the steel cylinder due to leakage or rupture during its service life. The method of determining the maximum allowable defect size is shown in Appendix B.

5.4 Manufacture

5.4.1 General requirements

5.4.1.1 In addition to the stipulations of this document, the manufacture of steel cylinders shall also comply with the stipulations of product drawings and relevant standards.

5.4.1.2 The body of the steel cylinders is generally manufactured through the following methods:

- a) Use steel billets, steel ingots and steel rods as the raw materials, and manufacture through extrusion, stretching or spinning, thinning and mouth-closing;
- b) Use seamless steel pipes as the raw materials, and manufacture through bottom-closing and mouth-closing;
- c) Use steel plates as the raw materials, and manufacture through stamping, stretching or spinning, thinning and mouth-closing.

5.4.1.3 During the bottom-closing and forming process of tubular gas cylinders, metal shall not be added, and welding shall not be performed.

5.4.1.4 The manufacture of the steel cylinders shall be managed in batches. In accordance with the sequence of heat treatment, no more than 200 cylinders, plus the number of cylinders used for destructive tests shall constitute one batch.

5.4.1.5 The depth of the concave end of the steel cylinders shall comply with the specified design value; the thickness of the spherical shell and annular shell at the end shall comply with the design requirements.

5.4.1.6 The preform made of seamless steel pipes by spinning shall be subject to process evaluation; the inner surface of the end of the cylinder body shall not have visible concave holes, wrinkles, bumps and scales; the defects at the end are allowed to be removed, but the design thickness of the end shall be ensured; the cylinder body shall not be subject to welding repair. For the gas cylinders made of seamless steel pipes through bottom-closing, before mouth-closing, the bottom air-tight test shall be carried out one by one.

5.4.1.7 For the surface defects of the cylinder body, it is allowed to use special tools for grinding; after grinding, the requirements of 7.1.3 shall be met.

5.4.2 Heat treatment

5.4.2.1 The body of the steel cylinders shall be subject to heat treatment as a whole. The heat treatment shall be carried out in accordance with the process with assessed conformity.

5.4.2.2 Oil or water-based quenching agent can be used as the quenching medium. When the water-based quenching agent is used as the quenching medium, the cooling rate of the cylinder body in the medium shall not be greater than 80% of the cooling rate in water at 20 °C.

5.4.3 Non-destructive evaluation After heat treatment, the body of the steel cylinders shall be subject to non-destructive evaluation one by one.

5.4.4 Inner surface treatment of cylinder body After the hydrostatic test, the body of the steel cylinders shall be subject to drying treatment on the inner surface.

5.4.5 Accessories

5.4.5.1 Neck ring If assembly is required, the assembly of the neck ring and the cylinder body shall not adopt the mode of welding.

5.4.5.2 Cylinder cap If assembly is required, the cylinder cap shall adopt a detachable structure.

5.4.5.3 Thread of accessories For accessories with threaded connections, the thread profiles, sizes and tolerances shall comply with the stipulations of GB/T 8335, GB/T 192, GB/T 196, GB/T 197 or GB/T 20668.

6 Test Methods

6.1 Wall Thickness and Manufacturing Tolerance

6.1.1 The wall thickness of the cylinder body shall be subject to the ultrasonic full-coverage wall thickness measurement in accordance with Appendix C.

6.1.2 The manufacturing tolerance of the cylinder body is inspected with standard measuring tools or special measuring tools and sample plates. The inspection items include the average outer diameter, roundness, perpendicularity and straightness of the cylinder body.

6.2 Bottom Air-tight Test Adopt an appropriate test device to pressurize the central area of the inner surface of the bottom of the tubular cylinders; the pressurized area shall be at least 1/16 of the bottom area of the cylinder body, and the diameter of the pressurized area shall be at least 20 mm; the test medium can be clean air or nitrogen. After pressurizing to the test pressure of the air-tight test, during the pressure holding period, brush soap