



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

GB/T 5099.3-2017

Seamless steel gas cylinders -- Part 3: Normalized cylinders

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1 Scope

This Part of GB/T 5099 specifies the types and parameters, technical requirements, test methods, inspection rules, marks, coating, packaging, transportation, storage, product qualification certificate, batch inspection quality certificate of seamless steel gas cylinders, after normalizing or post-normalizing tempering treatment (hereinafter referred to as steel cylinder).

This Part is applicable to the design and manufacture of refillable steel cylinders, which have a nominal working pressure not greater than 15 MPa, a nominal water volume of 0.5 L ~ 150 L, an ambient temperature of use at -20 °C ~ 60 °C, for holding compressed gas or high-pressure liquefied gas.

This Part does not apply to vehicle gas cylinders and cylinder-type pressure vessels attached to machinery and equipment.

Note: For steel seamless gas cylinders, which have a nominal water volume of less than 0.5

L, it can also be manufactured and inspected with reference to this Part.

2 Normative references

The following documents are essential to the application of this document. 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 196 General purpose metric screw threads - Basic dimensions (ISO 724)

GB/T 197 General purpose metric screw threads - Tolerances (ISO 965-1)

GB/T 222 Permissible tolerances for chemical composition of steel products

GB/T 223 (all parts) Methods for chemical analysis of iron, steel and alloy

GB/T 224 Determination of depth of decarburization of steels (ISO 3887)

GB/T 228.1 Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892)

GB/T 229 Metallic materials - Charpy pendulum impact test method (ISO 148-1)

When the steel cylinder is designed with a bottom ring structure, it shall be ensured that the bottom ring has sufficient strength, meanwhile the material of the bottom ring shall be compatible with the material of the cylinder body. The shape of the bottom ring shall be cylindrical, which can ensure the stability of the cylinder. The connection between the bottom ring and the cylinder body must not be welded; its structure must not cause water accumulation.

5.2.6 Neck ring design When the steel cylinder is designed with a neck ring, it shall be ensured that the neck ring has sufficient strength, meanwhile the material of the neck ring shall be compatible with the material of the cylinder body. The connection between the neck ring and the cylinder body must not use welding methods. The axial pull-off force of the neck ring shall not be less than 10 times the weight of the empty cylinder AND not less than 1000 N; the anti-rotation torque shall not be less than 100 N.m.

5.3 Manufacturing

5.3.1 General requirements

5.3.1.1 The manufacture of steel cylinders shall comply with the provisions of this Part, product drawings, relevant technical documents.

5.3.1.2 The cylinder body generally adopts the following manufacturing methods:

a) Using steel billet as raw material, it is made by drawing, stretching, sealing, referred to as drawn cylinder;

b) It is made of seamless steel pipes after closing the bottom and mouth, referred to as pipe cylinders.

5.3.1.3 The chemical composition of the steel cylinder shall be analyzed and verified, according to the furnace number of the material, before manufacture. The analysis method shall be carried out, according to GB/T 223 or GB/T 4336; the result shall meet the requirements of 5.1.

5.3.1.4 Steel cylinders are not allowed to be welded. Defects such as cracks, inclusions, lack of fusion on the inner surface of the bottom of the pipe cylinder shall be removed, by mechanical milling or other methods.

5.3.1.5 It is allowed to use special tools for grinding the surface defects of the cylinder body; the grinding slope is not greater than 1:3.

5.3.2 Group batching Manufacture shall be managed in batches; the quantity of each batch shall not exceed 500 plus the number of cylinders used for destructive tests.

5.3.3 Heat treatment The body of the steel cylinder shall be heat treated as a whole; the heat treatment shall be carried out, according to the qualified normalizing or post-normalizing tempering.

5.3.4 Non-destructive testing Non-destructive testing shall be carried out one by one, after the cylinder body is heat treated.

5.3.5 Hydrostatic test The cylinder body shall be hydrostatically tested one by one; the inner surface shall be dried after the hydrostatic test; there shall be no residual water stains.

5.3.6 Cylinder mouth thread The profile, size, tolerance of the cylinder mouth thread shall comply with the provisions of GB/T 8335 or relevant standards.

5.3.7 Accessories

5.3.7.1 Select and match the corresponding cylinder valves, according to the nature of the gas to be filled. For the control of assembly torque of tapered screw cylinder valves and common thread cylinder valves, refer to the requirements in Table A.1 and Table A.2 in Appendix A.

5.3.7.2 Steel cylinders shall generally be delivered with caps or shields. The caps or shields can be fixed or detachable. They can be made of metal or resin, which can resist the impact of external forces.

5.3.7.3 For accessories that use threaded connections, the profile, size, tolerance shall comply with the provisions of GB/T 8335 or relevant standards.

6 Test method

6.1 Wall thickness and manufacturing tolerances

6.1.1 The thickness of the cylinder body shall be measured by an ultrasonic thickness gauge.

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

6.2 Bottom tightness test Use an appropriate test device, to pressurize the central area of the inner surface of the bottom of the cylinder. The pressurized area shall be at least 1/16 of the bottom area of the cylinder; 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 tightness test pressure, keep the pressure for at least 1 min. Observe whether there is any leakage, in the central area of the bottom of the cylinder, during the pressure keeping.

6.3 Inner and outer surfaces For visual inspection, there shall be enough light for inner surface inspection; the inspection can be carried out, with the help of endoscope or appropriate tools.

6.4 Internal thread of cylinder mouth Check visually and with a gauge. The tapered thread shall be inspected, according to

GB/T 8335 and GB/T 8336 or relevant standards; the ordinary thread shall be inspected, according to GB/T 196 and GB/T 197 or relevant standards.

6.5 Non-destructive testing Non-destructive testing can use online automatic ultrasonic testing or online automatic magnetic particle testing. Ultrasonic testing shall be carried out according to Appendix B; magnetic particle testing shall be carried out according to Appendix C.

6.6 Hydrostatic test The hydrostatic test adopts the external measurement method for the volume deformation rate test, which is carried out according to GB/T 9251.

6.7 Air tightness test The air tightness test shall be carried out, according to GB/T 12137.

6.8 Determination of various performance indicators of the cylinder body after heat treatment

6.8.1 Sampling

6.8.1.1 The cutting position of the specimen is as shown in Figure 4, wherein the tensile test specimen shall be cut at a 180° symmetrical position along the cylinder.

6.11.4 The assessment of banding texture and Widmanstatten texture shall be carried out, according to GB/T 13299.

6.12 Fatigue test

6.12.1 The fatigue test shall be carried out according to GB/T 9252.