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Cold-drawn precision single welded steel tubes

冷拔精密单层焊接钢管

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Cold-drawn precision single welded steel tubes

1 Scope

This document specifies the classification and code, size, shape, weight and allowable deviation, technical requirements, test methods, inspection rules, packaging, marking and quality certificate of cold-drawn precision single welded steel tubes.

This document is applicable to cold-drawn precision single welded steel tubes (hereinafter referred to as "steel tubes") used for the manufacture of condensers, evaporators, fuel pipes, lubricating oil pipes, electric heating pipes, cooler pipes and general piping in industries such as refrigeration, automobiles, and electric heating appliances.

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/T 222, *Permissible tolerances for chemical composition of steel products*

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

GB/T 223.59, *Iron, steel and alloy - Determination of phosphorus content - Bismuth phosphomolybdate blue spectrophotometric method and antimony phosphomolybdate blue spectrophotometric method*

GB/T 223.63, *Iron, steel and alloy - Determination of manganese content - Sodium (potassium) periodate spectrophotometric method*

GB/T 223.85, *Steel and iron -- Determination of sulfur content -- Infrared absorption method after combustion in an induction furnace*

GB/T 223.86, *Steel and iron -- Determination of total carbon content -- Infrared absorption method after combustion in an induction furnace*

GB/T 228.1-2021, *Metallic materials -- Tensile testing -- Part 1: Method of test at room temperature*

GB/T 241, *Metal materials -- Tube -- Hydrostatic pressure test*

time shall be no less than 5 s. The steel tube shall not be cracked or leaking.

$$P = 2SR/D \qquad \cdots\cdots(2)$$

Where,

P - test pressure, in megapascals (MPa);

S - nominal wall thickness of the steel tube, in millimeters (mm);

R - allowable stress, the value of which is 140 MPa;

D - nominal outer diameter of the steel tube, in millimeters (mm).

7.6 Airtightness

The disc-shaped steel tube shall be subjected to underwater air tightness test or active gas air tightness test. For underwater air tightness test, the test pressure shall be not less than 1.8 MPa. The pressure stabilization time shall be not less than 3 min. The steel tube shall not have gas leakage. For active gas air tightness test, the active gas test pressure shall be not less than 0.5 MPa. The pressure stabilization time shall be not less than 10 min. The steel tube shall not have gas leakage.

7.7 Nitrogen sealing

According to the requirements of the purchaser, after negotiation between the supplier and the purchaser and specified in the contract, the disc-shaped steel tube shall be filled with nitrogen with a pressure of not less than 1.0 MPa and then the two ends of the steel tube shall be sealed by flattening, welding or other methods. The filled gas shall not leak at the sealing point.

7.8 Surface quality

7.8.1 The inner and outer surfaces of the steel tube shall be clean, free of rust and stains. There shall be no cracks, scars, delamination or lap welding.

7.8.2 The surface of steel tubes without coating or cladding shall be bright and free of rust. For steel tubes with coating or cladding, the coating or cladding shall be uniform, complete and firmly bonded.

7.8.3 The surface of the steel tube is allowed to have abrasions and scratches with a length not exceeding 50 mm and a depth not exceeding the lower deviation of the wall thickness.

7.8.4 The weld burrs on the outer surface of the steel tube shall be removed. The weld height on the inner surface shall not be greater than 0.20 mm.

7.8.5 For hot-dip galvanized steel tubes, local roughness, zinc nodules, zinc flowers and dark spots on the surface are allowed but they do not affect the use.

7.8.6 The coating layer on the surface of HPPP and HPPA steel tubes is generally black. The coating layer shall be uniform, clean and smooth. There shall be no cracks, scars, scratches, crushing, deformation, unevenness and defects that affect the use. The outer surface of the coating layer is allowed to have local tiny particle defects that do not affect the use.

7.9 Internal surface cleanliness

7.9.1 Steel tubes shall be inspected for internal surface cleanliness residues. The residues shall not exceed 160 mg/m^2.

7.9.2 Based on the purchaser's requirements, after consultation between the supplier and the purchaser and specified in the contract, the high cleanliness of the inner surface of high-cleanliness steel tubes for refrigeration shall comply with the provisions of Annex B.

7.10 Surface coating and cladding

7.10.1 The surface conditions of different types of steel tubes shall comply with the provisions of Table 1. According to the requirements of the purchaser, steel tubes with surface conditions other than those in Table 1 may be supplied after consultation between the purchaser and the supplier.

7.10.2 Based on the purchaser's requirements, after consultation between the supplier and the purchaser and with specified in the contract, the outer coating and cladding of the steel tube may be specified in Annex C.

8 Test methods

8.1 The chemical composition of the steel tube shall be subject to the quality certificate of the steel strip manufacturer. The sampling for chemical composition analysis shall comply with the provisions of GB/T 20066. Chemical composition analysis usually complies with the provisions of GB/T 4336, GB/T 20123, GB/T 20126 or other general methods. During arbitration, the provisions of GB/T 223.5, GB/T 223.59, GB/T 223.63, GB/T 223.85 and GB/T 223.86 shall be followed.

8.2 The size and shape of the steel tube shall be measured piece by piece (roll) using measuring tools that meet the accuracy requirements. The wall thickness shall be measured away from the weld.

8.3 The surface of the steel tube is to be visually inspected piece by piece (coil) under adequate lighting conditions.

9 Inspection rules

9.1 Inspection classification

The inspection of steel tubes is divided into exit-factory inspection and type inspection.

9.2 Exit-factory inspection

The exit-factory inspection and acceptance of steel tubes shall be carried out by the supplier's quality and technical supervision department. The exit-factory inspection items shall comply with the provisions of Table 9.

9.3 Type inspection

When any of the following situations occurs, type inspection shall be carried out. Type inspection items shall comply with the provisions of Table 9:

a) When the factory manufactures for the first time or the product is finalized;

b) After formal production, when there are major changes in structure, materials or processes that may affect product performance;

c) When production is resumed after a suspension of six months or more;

d) When there is a significant difference between the factory inspection results and the last type test.

9.4 Batching rules

Steel tubes shall be inspected and accepted in batches. Each batch shall consist of steel tubes of the same steel strip category, the same mechanical property category, the same specification, and the same surface condition. The weight of each batch of steel tubes shall not exceed 10,000 kg.

9.5 Sampling quantity

The sampling quantity for each inspection of steel tubes shall comply with the provisions of Table 9.

9.6 Reinspection and judgment rules

9.6.1 Judgement rules for exit-factory inspection

The reinspection and judgment rules for steel tubes shall comply with the provisions of GB/T 2102.

9.6.2 Type inspection judgment

state. The HPPP or HPPA steel tubes that have been subjected to the thermal oxidation test shall be subjected to a neutral salt spray test for 360 h. No rust marks shall appear on the surface of the base steel tube. The pipelines that have been subjected to the neutral salt spray test shall be subjected to an air tightness test for no less than 3 min. The pressure shall not be less than 1.8 MPa. No leakage shall occur. The test method of the neutral salt spray test shall be carried out in accordance with the provisions of GB/T 10125.

C.4.3 Chemical resistance test

HPPP and HPPA steel tubes shall be tested for chemical resistance. Take three 200 mm long HPPP or HPPA steel tube specimens. Bend them 180° with a groove wheel with a radius of 13 mm. Seal the pipe ends. Perform immersion tests in 5% acetic acid, 10% citric acid, 10% lactic acid or 1% sodium hydroxide solution according to actual needs. The test temperature is (23±2)℃, and the specimens are taken out after immersion for 168 h. After the test, the coating layer shall not have cracks, peeling, blistering, delamination, or surface stickiness or dissolution. There shall be no rust marks on the surface of the base steel tube. The test method for chemical resistance test shall be implemented in accordance with the provisions of GB/T 11547.

C.4.4 High and low temperature impact test

HPPP and HPPA steel tubes shall be subjected to high and low temperature impact tests. Take three 200 mm long HPPP or HPPA steel tube specimens. Bend them 180° using a groove wheel with a radius of 13 mm. Put them into a high and low temperature impact box. Exposure to low temperature -40℃ for 2 h and high temperature 85℃ for 2 h is one cycle. Run 10 cycles of hot and cold impact tests. After the test, the coating shall not have cracks or peeling. The test method of high and low temperature impact test shall be carried out in accordance with the provisions of GB/T 2423.22.

C.4.5 UV aging test

HPPP and HPPA steel tubes shall be subjected to UV aging test. Place the HPPP or HPPA steel tube specimens that have been subjected to high and low temperature impact tests in a UV weathering test chamber. The light source shall be a 1A (UVA-340) fluorescent UV lamp. The irradiance is 0.76 W/m^2. After continuous irradiation for 168 h, bend the straight pipe part of the specimen 180° once. After the test, the coating shall not have cracks or peeling. The test method of the UV aging test shall be carried out in accordance with the provisions of GB/T 16422.3.

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