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Replacing GB 13296-2007

Seamless stainless steel tubes for boiler and heat exchanger

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Foreword

Sub-clauses of 5.3, 5.4, 5.5, 6.1, 6.2, 6.3, 6.4.1, 6.5, 6.6, 6.8, 6.9, 6.10, clauses of 7, 8, 9 are mandatory; the rest are recommendatory.

This Part was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces GB 13296-2007 *Seamless stainless steel Tubes for Boiler and Heat Exchanger*. Compared with GB 13296-2007, in addition to editorial modifications, the main technical changes in this Standard are as follows:

- modified normative references;
- modified the allowable tolerance of outer-diameter and wall-thickness;
- modified steel's designation and chemical composition;
- deleted the designation of 1Cr18Ni9Ti; merged designations of 0Cr18Ni12Mo2Ti, 1Cr18Ni12Mo2Ti, 0Cr18Ni12Mo3Ti, 1Cr18Ni12Mo3Ti into 06Cr17Ni12Mo2Ti;
- added designations of 015Cr21Ni26Mo5Cu2 and 06Cr13.

This Standard was formulated by the reference of ASME SA-213 / SA-213 M (Edition 2010) *Seamless ferritic and austenitic alloy steel tubes for boilers, superheaters and heat exchangers*.

This Standard was proposed by China Iron and Steel Association.

This Standard shall be under the jurisdiction of National Technical Committee on Steel of Standardization Administration of China (SAC/TC 183).

The drafting organizations of this Part: Zhejiang Jiuli Special Material Technology Co., Ltd., Jiangsu Wujin Stainless Steel Tube Factory Group Co., Ltd., Jiangsu Yinhuan Precision Steel Tube Co., Ltd., Wuxi Tangyue Special Steel Pipe Co., Ltd., Yongxing Special Stainless Steel Co., Ltd., Shanxi Taigang Stainless Steel Tube Co., Ltd., Metallurgical Industry Information Standards Institute.

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The previous versions replaced by this Standard are as follows:

- GB 13296-1991, GB 13296-2007.

Seamless stainless steel tubes for boiler and heat exchanger

1 Scope

This Standard specifies the classification, code, size, shape, weight, technical requirements, test method, inspection rules, packaging, marks and quality certificate of seamless stainless steel tubes for boiler and heat exchanger.

This Standard is applicable to seamless stainless steel tubes for boiler and heat exchanger (hereinafter referred to as “steel tubes”).

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 223.11 *Iron, Steel and Alloy - Determination of Chromium Content - Visual Titration or Potentiometric Titration Method*

GB/T 223.16 *Methods for Chemical Analysis of Iron, Steel and Alloy - The Chromotropic Acid Photometric Method for the Determination of Titaninm Content*

GB/T 223.18 *Methods for Chemical Analysis of Iron, Steel and Alloy - The Sodium Thiosulfate Separation Iodimetric Method for the Determination of Copper Content*

GB/T 223.19 *Methods for chemical analysis of iron, steel and alloy - The neocuproine-chloroform extraction photometric method for the determination of copper conten*t

GB/T 223.25 *Methods for chemical analysis of iron, steel and alloy. The dimethylglyoxime gravimetric method for the determination of nickel content*

GB/T 223.26 *Iron, Steel and Alloy - Determination of Molybdenum*

Content - The Thiocyanate Spectrophotometric Method

GB/T 223.28 *Methods for chemical analysis of iron, steel and alloy - The α-benzoinoxime gravimetric method for the determination of molybdenum content*

GB/T 223.36 *Methods for chemical analysis of iron, steel and alloy The neutral titration method for the determination of nitrogen content after distillation separation*

GB/T 223.37 *Methods for Chemical Analysis of Iron, Steel and Alloy - the Indophenol Blue Photometric Method for the Determination of Nitrogen Content after Distillation Separation*

GB/T 223.40 *Iron, Steel and Alloy - Determination of Niobium Content by the Sulphochlorophenol S Spectrophotometric Method*

GB/T 223.58 *Methods for chemical analysis of iron, steel and alloy - The extraction-absorption catalytic polarographic method for the determination of manganese content*

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 223.60 *Methods for chemical analysis of iron, steel and alloy The perchloric acid dehydration gravimetric method for the determination of silicon content*

GB/T 223.62 *Methods for chemical analysis of iron, steel and alloy; The butyl acetate extraction photometric method for the determination of phosphorus content*

GB/T 223.63 *Methods for chemical analysis of iron, steel and alloy - The sodium(potassium) periodate photometric method for the determination of manganese content*

GB/T 223.64 *Iron, Steel and Alloy - Determination of Manganese Content - Flame Atomic Absorption Spectrometric Method*

GB/T 223.68 *Iron, Steel and Alloy - Determination of Manganese Content - Flame Atomic Absorption Spectrometric Method*

GB/T 223.69 *Iron, Steel and Alloy-Determination of Carbon Contents-Gas-volumetric Method after Combustion in the Pipe Furnace*

GB/T 223.72 *Iron, Steel and Alloy - Determination of Sulfur Content - Gravimetric Method*

GB/T 223.84 *Steel and iron - Determination of titanium content - Diantipyrylmethane 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 *Metallic materials - Tensile testing - Part 1 : Method of test at room temperature*

GB/T 230.1 *Metallic materials - Rockwell hardness test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

GB/T 231.1 *Metallic materials - Brinell hardness test - Part 1: Test method*

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

GB/T 242 *Metal materials - Tube - Drift-expending test*

GB/T 246 *Metal materials - Tube - Flattening test*

GB/T 2102 *Acceptance packing marking and quality certification of steel pipe*

GB/T 2975 *Steel and Steel Products - Location and Preparation of Test Pieces for Mechanical Testing*

GB/T 4334-2008 *Corrosion of metals and alloys - Test methods for intergranular corrosion of stainless steels*

GB/T 4340.1 *Metallic materials - Vickers hardness test - Part 1: Test method*

GB/T 4338 *Metallic materials - Tensile testing at elevated temperature*

GB/T 5777-2008 *Seamless Steel Pipe and Tubing Methods for Ultrasonic Testing*

GB/T 6394 *Metal-methods for estimating the average grain size*

GB/T 7735 *Steel tubes - The Inspection Method on Eddy Current Test*

GB/T 11170 *Stainless steel - Determination of multi-element contents - Spark discharge atomic emission spectrometric method (Routine method)*

GB/T 17395-2008 *Dimensions, shapes, masses and tolerances of*

value calculated by equation (1); the the theoretical weight of cold-drawn (rolled) steel tubes shall be 1.1 times the numerical value calculated by equation (1).

6 Technical requirements

6.1 Steel designation and chemical composition

6.1.1 Steel designation and chemical composition (melting analysis) shall comply with the provisions of Table 3.

6.1.2 Tolerance of chemical composition of finished steel tube shall comply with the provisions of GB/T 222.

6.2 Manufacturing method

6.2.1 Steel smelting method

Steel should use electric arc furnace plus secondary refining or converter plus secondary refining. It shall also use electro-slag re-melting smelting. After negotiating by both parties and indicating in the contract, it shall also use other more demanding smelting methods.

6.2.2 Manufacturing method of steel tubes

Steel tubes shall be manufactured by hot rolling (extrusion) or cold drawing (rolling) seamless method.

6.3 Delivery status

The steel tubes shall be heat treated and pickled for delivery. The heat treatment of steel tubes shall comply with the provisions of Table 4. The steel tubes which are treated by whole grinding, boring or heat treatment under protective atmosphere can be delivered without pickling.

6.4 Mechanical properties

6.4.1 Longitudinal tensile properties at room temperature of steel tubes at heat treatment shall comply with the provisions of Table 4.

6.4.2 According to buyer's requirements, after negotiating both parties and indicating in the contract, the steel tubes of which the wall thickness is not less than 1.7 mm can be used for Brinell hardness test or Rockwell hardness test or Vickers hardness test. Its values shall comply with the provisions of Table 5.

6.4.3 According to buyer's requirements, after negotiating both parties and

is not allowed to have cracks or gaps.

$$H=\frac{(1+\alpha)S}{\alpha+S/D} \qquad \cdots\cdots(3)$$

where,

H - distance between plates after the sample is flattened, in millimeters (mm);

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

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

α - coefficient of deformation per unit length; α of Austenitic steel tube is 0.09, α of other steel tubes is 0.07.

6.6.2 Flaring test

Flaring test should be carried out for steel tubes of which wall thickness is not greater than 10 mm. Taper of the top core of flaring test is 60°. The flaring rate of outer diameter after flaring test shall be respectively 18% for Austenitic steel tube, 15% for other steel tubes. After flaring test, the sample is not allowed to have cracks or gaps.

6.7 Steel tubes of which the designations are 07Cr19Ni10, 16Cr23Ni13, 20Cr25Ni20, 07Cr17Ni12Mo2, 07Cr19Ni11Ti, 07Cr18Ni11Nb can be free from intergranular corrosion test. The intergranular corrosion test should be carried out for other Austenitic steel tubes. Intergranular corrosion test method shall comply with the provisions of Method E in GB/T 4334-2008. The sample must not be allowed to have intergranular corrosion tendency after the test.

After negotiating by the supplier and the buyer and indicating in the contract, the buyer can designate other corrosion test methods.

6.8 Grain fineness

The grain fineness for 07Cr19Ni10, 07Cr17Ni12Mo2, 07Cr19Ni11Ti, 07Cr18Ni11Nb steel tubes should be grade 4 ~ 7.

6.9 Ultrasonic examination

The ultrasonic examination should be carried out for steel tubes one by one according to provisions of acceptance grade L2 in GB/T 5777-2008.

According to buyer's requirements, after negotiating by the supplier and the buyer and indicating in the contract, the ultrasonic flaw detection shall use other acceptance grades.

		from two tubes in each batch		of this Standard
8	Flaring test	Respectively take 1 sample from two tubes in each batch	GB/T 242	GB/T 242
9	Grain fineness	Respectively take 1 sample from two tubes in each batch	GB/T 6394	GB/T 6394
10	Corrosion test	Respectively take 1 sample from two tubes in each batch	Method E of GB/T 4334-2008	Method E of GB/T 4334-2008
11	Ultrasonic examination	One by one	-	GB/T 5777-2008

8 Inspection rules

8.1 Examination and acceptance

The examination and acceptance of steel tubes shall be carried out by quality and technical supervision department of the supplier.

8.2 Batching rules

Steel tubes shall be examined and accepted by batch. Each batch should be composed of steel tubes of same designation, same furnace number, same specification and same heat treatment system (furnace number). The number of steel tubes per batch shall not exceed the following provisions:

a) nominal outer diameter D ≤ 76 mm and wall thickness S ≤ 3 mm: 400 tubes;

b) other specifications: 200 tubes.

8.3 Sampling quantity

The sampling quantity of each inspection item for each batch of steel tubes shall comply with the provisions of Table 6.

8.4 Re-inspection and determination rules

The re-inspection and determination rules of steel tubes shall comply with the provisions of GB/T 2102.

9 Packaging, marks and quality certificate

Packaging, marks and quality certificate of steel tubes shall comply with the provisions of GB/T 2102.

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