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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 24593-2018

Replacing GB/T 24593-2009

Welded austenitic stainless steel tubes for boilers and heat exchangers

锅炉和热交换器用奥氏体不锈钢焊接钢管

Issued on: June 7, 2018 **Implemented on: March 1, 2019**

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Standardization Administration of China

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Foreword

This Standard was drafted as per the rules specified in GB/T 1.1-2009. This Standard replaced GB/T 24593-2009 Welded Austenitic Stainless Steel Tubes for Boiler and Heat-Exchanger; Compared with GB/T 24593-2009, the major technical changes are as follows:

--- Modify the length specifications (see

4.2 of this Edition;

4.2 of Edition 2009);

--- Modify the specification of out-of-roundness (see

4.4 of this Edition;

4.4 of Edition 2009);

--- Add three steel grades, namely, 015Cr21Ni26Mo5Cu2, 015Cr20Ni18Mo6CuN, and 022Cr21Ni25Mo7N (see

5.4 of this Edition);

--- Modify the requirements for P content in the chemical composition of each grade (see

5.1.1 of this Edition;

5.1.1 of Edition 2009);

--- Add the underwater air tightness test under the pressure test option (see

5.6.2 of this Edition). This Standard was proposed by China Iron and Steel Industry Association. This Standard shall be under the jurisdiction of National Technical Committee for Standardization of Steels (SAC/TC 183). Drafting organizations of this Standard. Zhejiang Jiuli High-Tech Metals Co., Ltd., Jiangsu Wujin Stainless Steel Pipe Group Co., Ltd., Shanxi Taigang Stainless Steel Co., Ltd., Zhejiang Dewei Stainless Steel Pipe Industry Co., Ltd., and China Metallurgical Information and Standardization Institute. Chief drafting staffs of this Standard. Li Jiequan, Shao Yu, Zhou Zhibin, Fu Junsheng, Shen Gengrong, Dong Li, Ding Wenyan, Chen Liang, Wang Bowen, Mo Peiming, Liu Mingyuan, Li Qi. The historical edition replaced by this Standard is as follows:

1 Scope

China's national standard for welded austenitic stainless steel tube for boilers and heat exchangers. It specifies the order content, the dimensions, shape and weight, the technical requirements, the test methods, the inspection rules and the packaging, marking and quality certificate. Welded stainless tube is the economical alternative to seamless for the enormous quantities that a boiler or a heat exchanger consumes, and the trade is well understood: a welded tube is made by forming strip and welding the seam, which gives better dimensional consistency and a lower price, while a seamless tube has no weld and is specified where the service will not tolerate one. What determines whether the welded tube is acceptable is entirely the weld and the treatment after it. An austenitic stainless steel welded without control comes out sensitised: the heat of welding precipitates chromium carbides at the grain boundaries in the heat affected zone, depleting the adjacent metal of chromium and leaving the tube open to intergranular corrosion exactly along a line running the whole length of it. The remedies are solution annealing after welding, or a low-carbon or stabilised grade, and the standard requires the delivery condition and the intergranular corrosion test that demonstrates it. Beyond that the requirements are those of a pressure tube in a heat exchanger: the grades and composition, the mechanical properties, the hydrostatic test and the eddy current or ultrasonic examination over the full length, the flattening and flaring tests that open a bad weld, the dimensional tolerances a tubesheet requires, and the surface finish. Issued on 7 June 2018 and in force since 1 March 2019, it replaces GB/T 24593-2009.

This Standard specifies the ordering content, dimension, shape, weight and permissible deviation, technical requirements, test methods, inspection rules, package, mark and quality certificate of welded austenitic stainless steel tubes for boiler and heat exchanger. This Standard is applicable to the welded austenitic stainless steel tubes (hereinafter referred to as steel tubes) for the heat exchanger and medium-low-pressure boiler.

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) are applicable to this document.

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 223.18 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 Content

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 223.28 Methods for Chemical Analysis of Iron, Steel and Alloy - The Alpha- Benzoin Oxime 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

3 Ordering Contents

The contract and ordering list that orders steel tube as per this Standard include the following contents.

4.1 Outer diameter and wall thickness

4.1.1 The steel tube's outer diameter D shall not exceed 305mm; wall-thickness S shall not exceed 8.0mm; its outer diameter and wall thickness shall conform to the provisions of GB/T 21835.

4.2 Length

4.2.1 The general length of the steel tube is 3000mm~18000mm. Through the negotiation between the supplier and the purchaser, and indicated in the contract, the steel tube with other length can be supplied.

4.3 Bending The bending of the steel tube shall be no greater than 1.5mm/m.

4.4 Out-of-roundness For the thin steel tube with the ratio between wall thickness and outer diameter no greater than 3%, its out-of-roundness shall not exceed 1.5% of nominal outer diameter; the out-of-roundness of other steel tube shall not exceed the tolerance of nominal outer diameter.

4.5 Tip shape Both end surfaces of the steel tube shall be perpendicular to the axis of the steel tube; the burrs of the cutting shall be removed.

4.6 Weight The steel tube shall be delivered as per the theoretical weight. Through the negotiation between the supplier and the purchaser, and indicated in the contract, the steel tube can also be supplied by the actual weight; the theoretical weight per meter of the steel tube shall be calculated as per the Formula (1).

5.2 Manufacturing method

5.2.1 Smelting method of steel The steel shall be smelted by electric arc furnace plus external refining method or converter plus external refining method. Through the negotiation between the supplier and the purchaser, and indicated in the contract, other smelting method can also be taken.

5.2.2 Manufacturing method of the steel tube

5.3 Delivery state The steel tube shall be delivered in a heat-treated and pickled passivated state. Through the heat treatment of protective atmosphere, the steel tube shall be delivered without pickled passivated treatment.

5.4 Mechanical properties

5.4.1 Tensile After heat treatment, the longitudinal tensile properties of the steel tube at room temperature shall conform to the provisions of Table 3.

5.5.4 Welded joint back bend The steel tube shall take the welded joint back bend test. Cut a section of specimen with length of 100mm from the steel tube, cut longitudinally at 90° from both sides of the welded seam; flatten the specimen. The bending core diameter is 4 times of the thickness of the specimen; when bending, the bending core shall be close to and parallel to the outside welded seam; so that the welded seam is at the maximum bending point with bending angle of 180°. After bending test, the specimen shall not occur cracks or welding defects.