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

GB/T 21833.1-2020

Replacing GB/T 21833-2008

**Seamless austenitic-ferritic duplex stainless steel tubes and
pipes - Part 1: Tubes for heat exchangers**

奥氏体-铁素体型双相不锈钢无缝钢管 第1部分：热交换器用管

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Foreword

GB/T 21833 "Seamless austenitic-ferritic (duplex) stainless steel tubes and pipes" is intended to be divided into three parts. - Part

1 Scope

China's national standard for seamless duplex stainless steel tube for heat exchangers. It is Part 1 of GB/T 21833 and specifies the order content, the dimensions, shape and weight, the technical requirements, the test methods, the inspection rules, and the packaging, marking and quality certification. This is the seamless counterpart of GB/T 21832.1, and the difference between welded and seamless is the reason both standards exist. A welded tube is made by forming strip and welding the seam, which is cheaper and gives a better dimensional consistency; a seamless tube is pierced and drawn from a solid billet and has no weld at all. In a duplex steel that matters more than in an ordinary stainless, because the weld is exactly where the phase balance is disturbed and where sigma phase can form, and because a heat exchanger tube spends its life in the crevice conditions that attack a weld first. For the most severe services - high chloride, high temperature, sour service, or where the consequences of a tube failure are unacceptable - the seamless tube is specified

despite costing more, and some codes and end users require it outright. The standard accordingly sets the grades and their composition, the solution annealing and the delivery condition, the mechanical properties, the intergranular and pitting corrosion tests, the flattening and flaring tests that reveal a defective wall, the hydrostatic and eddy current or ultrasonic examination over the full length, and the dimensional tolerances - which for a heat exchanger tube are tighter than for any other pipe product, because the tube has to be expanded into a tubesheet hole. Issued on 28 April 2020 and in force since 1 November 2020, it replaces GB/T 21833-2008.

This Part of GB/T 21833 specifies the order content, dimensions, shapes, masses, technical requirements, test methods, inspection rules, packing, marking, and quality certification of seamless austenitic-ferritic (duplex) stainless steel tubes and pipes for heat exchanger. This Part applies to seamless austenitic-ferritic (duplex) stainless steel tubes and pipes for heat exchanger (hereinafter referred to as steel tubes).

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (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 iodometric 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 223.26 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 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 Order content

The contract or order for ordering in accordance with this Part shall include the following.

4.1 Outer diameter and wall thickness

4.1.1 Steel tubes are delivered according to nominal outer diameter (D) and nominal wall thickness (S).

4.1.2 The nominal outer diameter and wall thickness of the steel tubes shall comply with the provisions of GB/T 17395.

4.2 Length

4.2.1 Normal length The normal length of the steel tubes is 3000 mm~12000 mm. According to the requirements of the purchaser, through negotiation between the supplier and the purchaser, and indicated in the contract, steel tubes of other lengths can be supplied.

4.3 Bending The bending of each meter of the steel tube shall not be greater than 1.5 mm/m. The bending of the total length shall not be greater than 0.1% of the length of the steel tube.

4.4 Out-of-roundness and uneven wall thickness The out-of-roundness and uneven wall thickness of the steel tubes shall not exceed 80% of the tolerances of the outer diameter and wall thickness, respectively.

4.5 End shape The end faces of both ends of the steel tube shall be perpendicular to the axis of the steel tube. It shall remove the cut burrs.

4.6 Masses Steel tubes are delivered according to actual mass; can also be delivered according to theoretical mass.

5.1 Designation and chemical composition of steel

5.1.1 The designation and chemical composition (melting analysis) of steel shall meet the requirements of Table 2.

5.2 Manufacturing method

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

5.3 Delivery state

5.3.1 Steel tubes shall be delivered after heat treatment and pickling. Steel tubes, which have been heat-treated in a protective atmosphere or ground (polished) as a whole, can be delivered without pickling.

5.4 Mechanical properties

5.4.1 The longitudinal mechanical properties of steel tubes delivered in heat-treated state shall comply with the requirements of Table 3.

5.5 Hydrostatic pressure

5.5.1 Steel tubes shall be subjected to hydrostatic pressure test one by one. The test pressure is calculated according to formula (2). The maximum test No.

5.6 Flattening According to the requirements of the purchaser, through negotiation between the supplier and the purchaser, and indicated in the contract, the steel tube can be subjected to flattening test. After flattening, the spacing H between two parallel pressing plates is calculated according to formula (3). After the sample is flattened, there shall be no cracks or gaps.

5.7 Drift-expending The steel tube shall be tested for drift-expending. The center taper of the drift-expending test is 60° . The minimum drift-expending rate of the outer diameter of the sample after drift-expending is 10%. After drift-expending, there shall be no cracks or gaps on the sample.

5.11 Ultrasonic testing The steel tubes shall be tested ultrasonically one by one. The artificial defects of the comparative sample tube for ultrasonic testing shall comply with the provisions of GB/T 5777-2019. The acceptance level is U2.5.

5.13 Special requirements When the purchaser has the following special requirements, the supplier and the purchaser shall negotiate and indicate in the contract.

6 Test methods

6.1 Sampling for chemical composition analysis of steel tubes shall be carried out according to the rules of GB/T 20066. The chemical composition analysis is usually carried out according to GB/T 11170, GB/T 20123, GB/T 20124, or other general methods.

6.2 The dimensions and shapes of the steel tubes shall be measured one by one using a measuring tool, which meets the accuracy requirements.

7 Inspection rules

7.1 Inspection and acceptance The inspection and acceptance of steel tubes shall be