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

GB/T 21833.2-2020

Replacing GB/T 21833-2008

**Seamless austenitic-ferritic duplex stainless steel tubes and
pipes - Part 2: Pipes for fluid service**

奥氏体-铁素体型双相不锈钢无缝钢管 第2部分：流体输送用管

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1 Scope

China's national standard for seamless duplex stainless steel pipe for fluid service. It is Part 2 of GB/T 21833 and specifies the order content, the dimensions, shapes and masses, the technical requirements, the test methods, the inspection rules, and the packing, marking and quality certification. It completes a set of four: welded and seamless, heat exchanger tube and transport pipe. This is the most demanding member of that set and the most expensive. A seamless duplex pipe is specified where the service is severe enough that chloride stress corrosion cracking would destroy an austenitic stainless steel, and where a weld seam is not acceptable either - offshore firewater and produced water lines, seawater lift and injection systems, sour service gathering lines, desalination high-pressure piping, and chemical duties involving hot chlorides. In those services the pipe is a safety-critical pressure component that cannot be inspected easily once installed and whose failure is expensive or dangerous. The requirements follow. The grades and their composition are fixed, since the resistance to pitting depends directly on the chromium, molybdenum and nitrogen content through the pitting resistance equivalent. The solution annealing and delivery condition are specified, because the whole benefit of a duplex steel depends on the phase balance and on the absence of the intermetallic phases that form if it is held in the wrong temperature range. Then the mechanical properties and the impact toughness, the intergranular and pitting corrosion tests, the hydrostatic test, the non-destructive examination over the full length, and the dimensional, wall thickness and straightness

tolerances. 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 fluid service. This Part applies to seamless austenitic-ferritic (duplex) stainless steel tubes and pipes for fluid service (hereinafter referred to as steel pipes).

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 4334-2020 Corrosion of metals and alloys - Test methods for intergranular corrosion of austenitic and ferritic-austenitic (duplex) stainless steels

GB/T 5777-2019 Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections

GB/T 7735-2016 Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for detection of imperfections

GB/T 11170 Stainless steel - Determination of multi-element contents - Spark discharge

atomic emission spectrometric method (Routine method)

GB/T 13305 Micrographic method for determining area content of the alpha- phases in stainless steels

GB/T 17395 Dimensions, shapes, masses and tolerances of seamless steel tubes

3 Order content

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

- a) Number of this Part;
- b) Product name;
- c) Steel designation;
- d) Dimensions and specifications (outer diameter and wall thickness);
- e) Quantity ordered (total mass or total length);

4.2 Length

4.2.1 Normal length The normal length of the steel pipes 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 pipes of other lengths can be supplied.

4.2.2 Fixed length and multiple length According to the requirements of the purchaser, through negotiation between the supplier and the purchaser, and indicated in the contract, steel pipes with fixed length, multiple length, or other specific length requirements can be supplied. The total fixed length and multiple length shall be within the normal length range. The tolerance of the total length is mm. For steel pipes delivered in multiple lengths, the cut margin shall be 5 mm~10 mm for each cut.

4.3 Bending The bending of each meter of the steel pipe shall meet the following requirements:

- a) When $S \leq 15$ mm, it is not more than
- b) When $S > 15$ mm, it is not more than

4.4 Out-of-roundness and uneven wall thickness The out-of-roundness and uneven wall thickness of the steel pipes 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 pipe shall be perpendicular to the axis of the steel pipe. It shall remove the cut burrs.

4.6 Masses Steel pipes are delivered according to actual mass; can also be delivered

according to theoretical mass. The theoretical mass of the steel pipe per meter is calculated according to formula (1). Where:

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.

5.2.2 Manufacturing method of steel pipe The steel pipes shall be manufactured by hot-rolling (hot-extrusion) or cold- drawing (rolling) seamless production process.

5.3 Delivery state

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

5.3.2 See Table 3 for the recommended heat treatment system for steel pipes. Through negotiation between the supplier and the purchaser, and indicated in the contract, heat treatment systems other than Table 3 can be used for steel pipes.

5.4 Mechanical properties

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

5.4.2 Steel pipes with a wall thickness of not less than

1.7 mm shall be tested for Brinell or Rockwell hardness. Their values shall comply with the requirements of Table 3.

5.4.3 According to the requirements of the purchaser, through negotiation between the supplier and the purchaser, and indicated in the contract, the steel pipes can be subjected to an impact test. The test temperature and impact absorbed energy are negotiated between the supplier and the purchaser.

5.5 Hydrostatic pressure

5.5.1 Steel pipes shall be subjected to hydrostatic pressure test one by one. The test pressure is calculated according to formula (2). The maximum test pressure is 20 MPa. Under the test pressure, the pressure stabilization time shall be no less than 10 s. The steel pipe shall not leak. Where: P - Test pressure, in megapascals (MPa); S - The nominal wall thickness of the steel pipe, in millimeters (mm); R - Allowable stress. It is 50% of the minimum R_p