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Corrosion-resistant alloy seamless tube and pipe

耐蚀合金无缝管

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Table of Contents

Corrosion-resistant alloy seamless tube and pipe

1 Scope

This Standard specifies the ordering content, dimensions, shape, weight, technical requirements, test methods, inspection rules, packing, marking, and quality certification of corrosion-resistant alloy seamless tube and pipe.

This Standard applies to nickel-based, iron-nickel-based, pure-nickel, and nickel-copper corrosion-resistant alloy cold-rolled (drawn) seamless tube and pipe or hot-extruded (rolled, expanded) seamless tube and pipe (hereinafter referred to as alloy tube and pipe).

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 223.5 Steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdosilicate spectrophotometric method

GB/T 223.8 Methods for chemical analysis of iron, steel and alloy - The sodium fluoride separation-EDTA titration method for the determination of aluminium content

GB/T 223.9 Iron, steel and alloy - Determination of aluminium content - Chrome azurol S photometric method

GB/T 223.11 Iron, steel and alloy - Determination of chromium content - Visual titration or potentiometric titration method

GB/T 223.17 Methods for chemical analysis of iron steel and alloy - The diantipyrylmethane photometric method for the determination of titanium 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 223.25 Methods for chemical analysis of iron, steel and alloy - The dimethylglyoxime gravimetric method for the determination of nickel content

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 7735-2016 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 15007 Designations of corrosion-resistant alloy

GB/T 15260 Standard Test Method for Intergranular Corrosion of Nickel Alloys by Corrosion of Metals and Alloys

GB/T 20066 Steel and Iron - Sampling and Preparation of Samples for the Determination of Chemical Composition

GB/T 20123 Steel and iron - Determination of total carbon and sulfur content - Infrared absorption method after combustion in an induction furnace (routine method)

GB/T 20125 Low-alloy steel - Determination of multi-element contents - Inductively coupled plasma atomic emission spectrometric method

YB/T 4395 Steel Determination of molybdenum, niobium and tungsten contents - Inductively coupled plasma atomic emission spectrometric method

YS/T 325.2 Methods for chemical analysis of nickel-copper alloy - Part 2: Determination of copper content - Electrolysis weight method

3 Ordering content

The contract or order for ordering according to this Standard shall include the following:

a) Standard number;

b) Product name;

c) Alloy designation;

d) Dimensions (outer diameter×wall thickness, in millimeters);

e) Weight or quantity (total length or pieces);

4.3.1 Alloy tubes and pipes shall be delivered according to actual weight or may be delivered according to theoretical weight. The theoretical weight per meter of alloy tube and pipe is calculated according to formula (1):

$$W = \frac{\pi}{1\ 000}\rho S(D - S) \qquad \cdots\cdots(1)$$

Where:

W - The theoretical weight per meter of alloy tube and pipe, in kilograms per meter (kg/m);

π - Pi, 3.1416;

ρ - The alloy density, in kilograms per cubic decimeter (kg/dm^3). For the alloy density, see GB/T 15007;

S - The nominal wall thickness of alloy tube and pipe, in millimeters (mm);

D - The nominal outer diameter of alloy tube and pipe, in millimeters (mm).

4.3.2 When the alloy tube and pipe are delivered according to the theoretical weight, for hot-extruded (rolled, expanded) seamless tube and pipe, the value calculated according to formula (1) is increased by 15%; for cold-rolled (drawn) seamless tube and pipe, the value calculated according to formula (1) is increased by 10% as the delivery weight.

5 Technical requirements

5.1 Manufacturing method

5.1.1 Smelting method

Unless otherwise specified in the contract, the smelting method of alloy is chosen by the manufacturer itself. When using electric arc furnace smelting, it shall be refined outside the furnace.

5.1.2 Tube-making method

The alloy tube and pipe are manufactured by cold-rolling (drawing), hot-extrusion (rolling, expanding) production process.

5.2 Chemical composition

5.2.1 The designation and chemical composition (heat analysis) of alloy shall comply with the requirements of Table 3.

minimum value of $R_{p0.2}$ in Table 4 and 1/4 of the minimum value of R_m;

D - The nominal outer diameter of alloy tube and pipe, in millimeters (mm).

5.5.2 Through consultation between the supplier and the purchaser, and indicated in the contract, the test pressure may be greater than 6.9 MPa; but the test pressure calculated according to formula (2) shall not exceed the allowable stress of the material.

5.5.3 The supplier may use eddy current testing instead of hydrostatic test. When using eddy current testing, the artificial imperfections of the comparative samples shall comply with the acceptance level E4H of GB/T 7735-2016. According to the requirements of the purchaser, through consultation between the supplier and the purchaser, and indicated in the contract, other levels of acceptance may also be used.

5.6 Grain size

Heat-treated or protective-atmosphere heat-treated NS1102, NS1104 alloy tubes and pipes shall be inspected for grain size. The average grain size shall be Level 5 or coarser.

5.7 Ultrasonic testing

5.7.1 The alloy tube and pipe shall be subjected to ultrasonic testing. The acceptance level shall comply with the provisions of L3 level in GB/T 5777-2008.

5.7.2 According to the requirements of the purchaser, through consultation between the supplier and the purchaser, and indicated in the contract, other acceptance levels may be adopted for ultrasonic testing.

5.8 Surface quality

5.8.1 The inner and outer surfaces of the alloy tube and pipe shall be free of defects such as cracks, folds, checking, delamination, and scabbing. It shall completely remove these defects. The actual wall thickness at the clearing point shall not be less than the allowable minimum wall thickness.

5.8.2 Other local imperfections which do not exceed the tolerances are allowed to exist. The allowable depth of the straightway is not more than 4% of the nominal wall thickness; but the maximum depth shall be no more than 0.3 mm. For alloy tubes and pipes with a nominal wall thickness of less than 1.4 mm, the allowable depth of the straightway shall be no more than 0.05 mm.

5.9 Special requirements

According to the requirements of the purchaser, through consultation between

Table 6 (continued)

No.	Inspection items	Sampling quantities	Sampling locations	Test methods
7	Ultrasonic testing	Piece by piece	-	GB/T 5777-2008
8	Flattening test	2/lot	On different pieces of alloy tube and pipe	GB/T 246
9	Drift-expanding test	2/lot	On different pieces of alloy tube and pipe	GB/T 242
10	Intergranular corrosion	1/lot	On any alloy tube and pipe	GB/T 15260
11	Dimensions and shape	Piece by piece	-	Appropriate gages such as caliper, micrometer
12	Surface quality	Piece by piece	-	Visual

7 Inspection rules

7.1 Inspection and acceptance

The inspection and acceptance of the alloy tube and pipe shall be carried out by the technical supervision department of the supplier. The purchaser has the right to, in accordance with the provisions of this Standard, inspect the alloy tube and pipe.

7.2 Lot grouping rules

Alloy tubes and pipes shall, in lots, be submitted for acceptance. Each lot shall consist of alloy tubes and pipes of the same designation, the same furnace number, the same specification, the same processing method, and the same heat treatment system (heat). The alloys smelted by remelting, under the condition that the process is stable and the requirements of this Standard can be guaranteed, are allowed to be delivered in lots according to the smelting mother furnace number.

7.3 Sampling quantities and sampling locations

The sampling quantities and sampling locations of the alloy tubes and pipes shall comply with the requirements of Table 6.

7.4 Re-inspection and judgment rules

7.4.1 When the analysis result of chemical composition is unqualified, it is allowed to re-sample at the previous sampling location to analyze the unqualified elements. If the analysis result is still unqualified, the alloy of this furnace is judged as unqualified.

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