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**Seamless corrosion resistant alloy pipes and tubes
for industrial furnace**

工业炉用耐蚀合金无缝管

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Seamless corrosion resistant alloy pipes and tubes for industrial furnace

1 Scope

This Standard specifies the classification and codes, ordering contents, dimensions, shapes, technical requirements, test methods, inspection rules, packaging, marks and quality certificates of seamless corrosion resistant alloy pipes and tubes for industrial furnace.

This Standard is applicable to iron nickel base, nickel base corrosion resistant alloy seamless tubes for industrial furnaces in petroleum refining, chemical industry, polysilicon of which the nominal outer diameter is not greater than 406mm and the nominal wall thickness is not greater than 60mm (hereinafter referred to as alloy pipes and 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 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 diantipyryl methane photometric method for the determination of titanium content*

GB/T 223.18, *Methods for Chemical Analysis of Iron, Steel and Alloy - The*

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

GB/T 2975, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing*

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 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*

3 Classification and codes

3.1 Alloy pipes and tubes are divided into two categories according to the method of product manufacturing. The category and code are:

- a) Hot extruded alloy pipes and tubes, W-H;
- b) Cold rolled (drawn) alloy pipes and tubes, W-C.

3.2 Alloy pipes and tubes are divided according to the dimensional accuracy, as well as the codes, as follows:

- a) Ordinary level, PA;
- b) High level, PC.

4 Ordering contents

The contract or order ordered according to this Standard shall include at least the following information:

- a) Reference to this Standard;
- b) Product name;
- c) Alloy designation;
- d) Dimensions (outer diameter × wall thickness, in millimeters);
- e) Delivery quantity (total weight, total length or count);
- f) Manufacturing method;

6.2.1 Smelting method

The alloy shall be smelted by electric arc furnace plus external refining (or electroslag remelting). After agreed by the supplier and purchaser and indicated in the contract, other smelting methods that meet the requirements of this Standard may also be used.

6.2.2 Pipes and tubes making method

6.2.2.1 Hot rolled or hot forged round bars shall be used for alloy ingots used for pipes and tubes making. The parts of the round bar material equivalent to the alloy ingot head and tail shall be fully removed.

6.2.2.2 Alloy pipes and tubes shall be manufactured by hot extrusion or cold rolling (drawing).

6.3 Delivery status

6.3.1 Alloy pipes and tubes shall be heat treated and pickled for delivery. See Table 4 for recommended heat treatment system. All alloy pipes and tubes that have undergone integral grinding, boring or heat treatment in a protective atmosphere may not be pickled.

6.3.2 As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, NS3306 alloy pipes and tubes can be stabilized after solution treatment. The stabilization treatment system is determined by the supplier and the purchaser through consultation.

6.4 Mechanical properties

6.4.1 The room temperature longitudinal tensile properties of the alloy pipes and tubes in the delivery state shall meet the requirements of Table 4.

6.4.2 As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, alloy pipes and tubes with wall thickness not less than 2.5mm can be tested for Rockwell hardness or Brinell hardness. The hardness value is determined by the supplier and the purchaser through consultation.

6.4.3 As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, alloy pipes and tubes can be subjected to high temperature tensile test. The specific test temperature and mechanical properties are determined by the supplier and the purchaser through consultation.

$$H = \frac{(1 + \alpha)S}{\alpha + S/D} \dots\dots\dots (2)$$

Where,

H - Distance between two parallel pressing plates after flattening, in millimeters (mm);

α - Deformation coefficient per unit length, taking 0.09;

S - Nominal wall thickness of the alloy pipes and tubes (calculated according to the minimum wall thickness when ordering according to the minimum wall thickness), in millimeters (mm);

D - Nominal outer diameter of alloy pipes and tubes, in millimeters (mm).

6.5.1.2 The following conditions shall not be used as the basis for judging whether the flattening test is qualified or not:

- a) Cracks or gaps caused by surface defects in the sample;
- b) When $S/D > 0.1$, the cracks and gaps on the inner surface of the sample at 6 o'clock (bottom) and 12 o'clock (top).

6.5.2 Flaring

The alloy pipes and tubes with a nominal outer diameter not greater than 150mm and a wall thickness not greater than 10mm shall be subjected to flaring test. The taper of the top core of the flaring test is 60°. The outer diameter flaring rate of the sample shall be 22%. There shall be no cracks or gaps in the sample after flaring.

6.5.3 Bending

Alloy pipes and tubes with a nominal outer diameter greater than 168.3mm shall be subjected to bending test. There shall be no cracks or gaps in the sample after bending.

6.6 Grain size

The average grain size of NS1102 and NS1104 alloy pipes and tubes shall be level 5 or coarser. As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, other designations of alloy pipes and tubes can be tested for average grain size and the qualified level is determined by the supplier and the purchaser through consultation.

6.7 Non-metallic inclusions

use other levels for acceptance.

6.10 Ultrasonic testing

6.10.1 The alloy pipes and tubes shall be subjected to ultrasonic testing, and its acceptance level shall meet the requirements of U2 level in GB/T 5777-2019.

6.10.2 As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, ultrasonic testing can use other acceptance levels.

6.11 Penetration testing

6.11.1 Penetrant testing shall be carried out on the repaired surface defects of alloy pipes and tubes.

6.11.2 As required by the purchaser, after agreed by the supplier and purchaser and indicated in the contract, penetrant testing can be performed on the outer surface, end and reachable inner surface of the alloy pipes and tubes.

6.11.3 Penetration testing shall meet the quality level I requirements of other components in NB/T 47013.5-2015.

6.12 Surface quality

6.12.1 There shall be no cracks, folds, chaps, delamination and scars on the inner and outer surfaces of the alloy pipes and tubes. These defects shall be completely removed. The actual wall thickness at the removal site shall not be less than the minimum value allowed by the wall thickness.

6.12.2 The allowable depth of the straight line on the inner and outer surfaces of the alloy pipes and tubes shall meet the following requirements:

- a) Cold rolled (drawn) alloy pipes and tubes: not more than 4% of the wall thickness, and not more than 0.3mm;
- b) Hot extruded alloy pipes and tubes: not more than 5% of the wall thickness, and not more than 0.4mm.

6.12.3 Allow other defects that do not exceed the deviation under the wall thickness.

7 Test methods

7.1 The inspection items and test methods of alloy pipes and tubes shall comply with the requirements in Table 6.

7.2 The chemical composition analysis of alloy pipes and tubes is carried out

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