

ICS 77.140.75

CCS H 48



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

GB/T 21833.3-2024

**Seamless austenitic-ferritic (duplex) stainless steel tubes and
pipes - Part 3: Pipes for oil and gas transmission**

奥氏体-铁素体型双相不锈钢无缝钢管 第3部分:油气输送用管

Issued on: April 25, 2024

Implemented on: November 1, 2024

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1	Scope
2	Normative references
3	Terms and definitions
4	Classification and codes
5	Information for ordering
6	Dimensions, shape, mass and permissible deviations
6.1	Outside diameter and wall thickness
6.2	Length
6.3	Straightness
6.4	Out-of-roundness and wall thickness variation
6.5	Shape of the ends
6.6	Mass
7	Technical requirements
7.1	Grade and chemical composition of the steel
7.2	Manufacturing method
7.3	Delivery condition
7.4	Mechanical properties
7.5	Hydrostatic test
7.6	Technological properties
7.7	Metallographic structure
7.8	Test for detrimental precipitated phases
7.9	Non-destructive testing
7.10	Surface quality
7.11	Special requirements
8	Test methods
9	Inspection rules
10	Packaging, marking and quality certificate
Annex A	(normative) Test methods for detrimental precipitated phases and evaluation of the results

3 Terms and definitions

The terms and definitions given in GB/T 30062 apply to this document.

4 Classification and codes

Pipes are divided into two classes according to the method of manufacture: hot rolled or hot extruded pipe, code W-H; cold drawn or cold rolled pipe, code W-C.

5 Information for ordering

The contract or order for pipe purchased to this document shall include, but is not limited to, the number of this document; the name of the product; the grade of the steel or its unified numerical code; the dimensions, that is the nominal outside diameter multiplied by the nominal wall thickness, in millimetres; the quantity ordered, as total mass or total length; the delivery condition; the optional requirements; and any special requirements.

6 Dimensions, shape, mass and permissible deviations

6.1 Outside diameter and wall thickness. The nominal outside diameter and the nominal wall thickness of the pipe shall meet the requirements of GB/T 17395. Pipe of other outside diameters and wall thicknesses may be supplied at the request of the purchaser and by agreement between purchaser and supplier. The permissible deviations of the nominal outside diameter and the nominal wall thickness shall meet the requirements of Table 1, which sets an ordinary grade and a high grade of tolerance for each of the two classes of manufacture, expressed for the outside diameter partly as a fixed value in millimetres and partly as a percentage of the diameter, and for the wall thickness as a percentage of the wall thickness; the individual values of Table 1 are not reproduced here because the columns of the table could not be paired with certainty in the source. Where the contract does not state the grade of dimensional tolerance, the permissible deviations of outside diameter and wall thickness are those of the ordinary grade.

6.2 Length. The usual length of the pipe is 6000 mm to 12000 mm. Pipe in another range of length may be supplied at the request of the purchaser, by agreement and with a note in the contract. Exact lengths, multiple lengths or other specified lengths may likewise be supplied; the total length of exact and multiple lengths shall lie within the usual range and the permissible deviation on the whole length is plus 100 mm. For pipe delivered in multiple lengths an allowance of 5 mm to 10 mm shall be left at each cut.

6.3 Straightness. The deviation from straightness of the pipe shall not exceed 1.5 mm per metre, and over the whole length shall not exceed 0.2 % of the length of the pipe.

6.4 Out-of-roundness and wall thickness variation. The out-of-roundness and the wall thickness variation of the pipe shall not exceed 80 % of the tolerance on outside diameter and of the tolerance on wall thickness respectively.

6.5 Shape of the ends. Both ends of the pipe shall be cut square to the axis of the pipe and the burrs shall be removed. At the request of the purchaser, by agreement and with a note in the contract, the two ends may be bevelled; the root face width is (1.6 ± 0.8) mm, while the bevel angle and its tolerance came out damaged in the source and are not reproduced here. Other forms of bevel may be specified in the contract.

6.6 Mass. The pipe is delivered by actual mass, or by theoretical mass. The theoretical mass per metre is calculated by Formula (1) from the nominal wall thickness and the nominal outside diameter in millimetres, with the ratio of the circumference to the diameter taken as 3.1416 and the density of the steel taken as 7.80 kg per cubic decimetre; the theoretical mass is expressed in kilograms per metre.

7 Technical requirements

7.1 Grade and chemical composition of the steel. The grade and the chemical composition on cast analysis shall meet the requirements of Table 2, which covers nine grades with their unified numerical codes: S22253 022Cr22Ni5Mo3N, S22053 022Cr23Ni5Mo3N, S25203 022Cr25Ni7Mo4CuN, S22553 022Cr25Ni6Mo2N, S22583 022Cr25Ni7Mo3WCuN, S22584 022Cr25Ni7Mo3W2CuN, S25073 022Cr25Ni7Mo4N, S27603 022Cr25Ni7Mo4WCuN and S25554 03Cr25Ni6Mo3Cu2N. For each grade the table fixes limits on carbon, silicon, manganese, phosphorus, sulfur, nickel, chromium, molybdenum, nitrogen and copper, and for three grades a tungsten content. The footnotes fix the pitting resistance equivalent number as chromium plus 3.3 times molybdenum plus 16 times nitrogen, which shall be not less than 34 for 022Cr22Ni5Mo3N, not less than 35 for 022Cr23Ni5Mo3N and not less than 41 for 022Cr25Ni7Mo4N; for 022Cr25Ni7Mo4WCuN the equivalent is chromium plus 3.3 times the sum of molybdenum and one half of the tungsten, plus 16 times nitrogen, and shall be not less than 41. Where the purchaser has requirements for other chemical elements, these may be agreed with the supplier and noted in the contract. The permissible deviations of the chemical composition of the finished pipe shall meet the requirements of GB/T 222.

7.2 Manufacturing method. The steel shall be melted in an electric arc furnace with secondary refining, or in a converter with secondary refining; other melting methods may be used by agreement between purchaser and supplier with a note in the contract. The pipe shall be made by the seamless process, hot rolled or hot extruded, or cold drawn or cold rolled.

7.3 Delivery condition. The pipe shall be delivered heat treated and pickled. Pipe heat treated under a protective atmosphere, or ground or polished all over, may be delivered without pickling. The recommended heat treatment for the pipe is given in Table 3, and heat treatments other than those of Table 3 may be used by agreement with a note in the contract. Table 3 gives, for each grade, the recommended heat treatment and, as minimum values, the tensile strength, the proof strength at 0.2 % non-proportional extension and the

elongation after fracture, and, as maximum values, the Brinell and Rockwell C hardness: S22253 022Cr22Ni5Mo3N, 1020 °C to 1100 °C and rapid cooling, 620 MPa, 450 MPa, 25 %, 290 HBW, 30 HRC; S22053 022Cr23Ni5Mo3N, 1020 °C to 1100 °C and rapid cooling, 655 MPa, 485 MPa, 25 %, 290 HBW, 30 HRC; S25203 022Cr25Ni7Mo4CuN, 1080 °C to 1120 °C and rapid cooling, 770 MPa, 550 MPa, 25 %, 310 HBW, 32 HRC; S22553 022Cr25Ni6Mo2N, 1050 °C to 1100 °C and rapid cooling, 690 MPa, 450 MPa, 25 %, 280 HBW, 29 HRC; S22583 022Cr25Ni7Mo3WCuN, 1020 °C to 1100 °C and rapid cooling, 690 MPa, 450 MPa, 25 %, 290 HBW, 30 HRC; S22584 022Cr25Ni7Mo3W2CuN, 1025 °C to 1125 °C and rapid cooling, 758 MPa, 552 MPa, 20 %, 310 HBW, 32 HRC; S25073 022Cr25Ni7Mo4N, 1025 °C to 1125 °C and rapid cooling, 800 MPa, 550 MPa, 15 %, 300 HBW, 32 HRC; S27603 022Cr25Ni7Mo4WCuN, 1070 °C to 1140 °C and rapid cooling, 750 MPa, 550 MPa, 25 %, 300 HBW, 32 HRC; S25554 03Cr25Ni6Mo3Cu2N, not below 1040 °C and rapid cooling, 760 MPa, 550 MPa, 15 %, 297 HBW, 31 HRC.

7.4 Mechanical properties. The longitudinal tensile properties at room temperature of pipe delivered in the heat treated condition shall meet the requirements of Table 3. Where the size of the pipe allows a transverse tensile specimen to be taken, the transverse tensile test may replace the longitudinal test and the results shall meet the requirements of Table 3. Pipe with a wall thickness of not less than 1.7 mm shall be subjected to a Brinell or Rockwell hardness test and the value shall meet the requirements of Table 3. At the request of the purchaser, by agreement and with a note in the contract, the pipe may be impact tested, the test temperature and the absorbed energy being agreed between purchaser and supplier. Where sub-size impact specimens are used, the required minimum Charpy V-notch absorbed energy is the value required for the full-size specimen multiplied by the reduction factor of Table 4, which is 1 for the standard specimen of 10 mm x 10 mm, 0.75 for the small specimen of 10 mm x 7.5 mm and 0.5 for the small specimen of 10 mm x 5 mm.

7.5 Hydrostatic test. Every pipe shall be hydrostatically tested. The test pressure is calculated by Formula (2) and the maximum test pressure is 20 MPa. Under the test pressure the pressure shall be held for not less than 10 s and the pipe shall show no leakage. The content of chloride ions in the water used for the hydrostatic test shall not exceed 0.005 % by mass. In the formula the test pressure is expressed in megapascals and is rounded to the nearest 0.5 MPa when it is below 7 MPa and to the nearest 1 MPa when it is 7 MPa or above; the nominal wall thickness and the nominal outside diameter are expressed in millimetres, and the allowable stress is 75 % of the minimum proof strength at 0.2 % non-proportional extension specified in Table 3, expressed in megapascals.

7.6 Technological properties. Flattening: pipe with a wall thickness not greater than 10 mm shall be subjected to the flattening test. The specimen shall be flattened until the distance between the two platens reaches the value calculated by Formula (3) from the nominal wall thickness and the nominal outside diameter in millimetres, with a deformation coefficient per unit length of 0.07; after the test the specimen shall show no crack or split. Flaring: at