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

GB/T 21832.3-2024

**Welded 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焊接钢管 第3部分：油气输送用管

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Annex A (normative) Test methods and evaluation of results for detrimental precipitated phases

4 Classification and codes

Pipes are classified by delivery condition with the following codes: as-welded condition, H; heat-treated condition, T.

5 Ordering information

The contract or order for pipes to this document shall include, but is not limited to: the number of this document; the product name; the steel designation or unified numerical code; the size (nominal outside diameter times nominal wall thickness, in millimetres); the quantity ordered, as total mass or total length; the delivery condition; and any special requirements.

6 Dimensions, shape, mass and permissible deviations

6.1 The nominal outside diameter and nominal wall thickness shall comply with GB/T 21835; other diameters and wall thicknesses may be supplied by agreement between supplier and purchaser. Permissible deviations of outside diameter and wall thickness shall comply with Table 1, and by agreement, stated in the contract, pipes with deviations other than those of Table 1 may be supplied. For pipes with an outside diameter greater than 508 mm, the difference between the outside diameter converted from a circumference measurement and the nominal outside diameter shall comply with Table 1. Table 1 gives the outside diameter deviation as plus 0.4 mm and minus 0.8 mm for a nominal outside diameter not greater than 48.3 mm, $\pm 0.75\%$ of the nominal outside diameter for diameters above 48.3 mm and up to 457 mm, and $\pm 1\%$ of the nominal outside diameter for diameters above 457 mm; a footnote states that the weld area is not subject to the upper limit of the wall thickness deviation. The extractor did not preserve the row boundaries of the wall thickness column, so the wall thickness deviations are not reproduced here.

6.1.4 By agreement between supplier and purchaser, stated in the contract, the pipe ends may be checked with a ring gauge, in accordance with Table 2. Within 100 mm of the pipe end, a ring gauge with an inside diameter of the nominal outside diameter plus 1.6 mm shall pass over the end for pipes with a nominal outside diameter not greater than 273.1 mm, and a ring gauge with an inside diameter of the nominal outside diameter plus 2.4 mm shall pass over the end for the intermediate diameter range up to 508 mm; for diameters greater than 508 mm, the requirement of 6.1.3 applies. Where the pipe has weld reinforcement, a notch or groove may be cut in the ring gauge so that it can pass over the weld.

6.2 The usual length of the pipes is 6 000 mm to 12 000 mm; other length ranges may be supplied by agreement, stated in the contract. Exact lengths, multiple lengths or other length requirements may also be supplied by agreement. Exact and multiple total lengths shall lie within the usual length range and the permissible deviation on the total length is plus 100 mm. For pipes delivered in multiple lengths, an allowance of 5 mm to 10 mm shall be left for each cut.

6.3 The straightness deviation shall be not more than 1.5 mm per metre and not more than 0.2 % of the pipe length over the full length.

6.4 For thin-walled pipes whose ratio of wall thickness to outside diameter is not greater than 3 %, the out-of-roundness shall not exceed 1.5 % of the nominal outside diameter; for other pipes the out-of-roundness shall not exceed the outside diameter tolerance.

6.5 Both ends of the pipe shall be cut square to the pipe axis and burrs shall be removed. By agreement, stated in the contract, the ends may be bevelled, with a root face width of 1.6 mm plus or minus 0.8 mm; the bevel angle is given in the original as a nominal 30 degrees with a one-sided tolerance, but the extracted text does not allow the tolerance to be read with certainty. Other types of bevel may be specified in the contract.

6.6 Pipes are delivered on the basis of theoretical mass; by agreement, stated in the contract, they may be delivered on the basis of actual mass. The theoretical mass per metre is calculated by Formula (1), in which the mass per metre is expressed in kilograms per metre, the constant π is taken as 3.1416, the density of the steel is taken as 7.80 kilograms per cubic decimetre, and the nominal wall thickness and nominal outside diameter are expressed in millimetres. When delivered on the basis of theoretical mass, the permissible deviation of the actual mass from the theoretical mass is plus 10 % and minus 3.5 %.

7 Technical requirements

7.1 The steel designation and chemical composition on cast analysis shall comply with Table 3. Table 3 fixes, for each unified numerical code and steel designation covered by the document, the limits on the individual alloying and residual elements of the cast analysis, together with the corresponding equivalent designations. The extracted text of Table 3 is corrupted and none of its values can be read, so no composition limits are reproduced here. The permissible deviations of the chemical composition of the finished pipe shall comply with GB/T 222.

7.2 The steel shall be melted in an electric arc furnace or converter with secondary refining; other melting methods may be used by agreement, stated in the contract. Pipes may be made by any one of the following methods: submerged arc welding with filler metal; gas metal arc welding with filler metal; plasma arc welding with or without filler metal; gas tungsten arc welding with or without filler metal; or combined welding with or without filler metal. Where the purchaser specifies one welding method, this shall be stated in the

contract. Where a filler metal is used, it shall match the specified chemical composition of the parent metal; where the purchaser requires higher corrosion resistance or other properties, a more highly alloyed filler metal may be specified. By agreement, stated in the contract, pipes with an outside diameter not less than 508 mm may have two longitudinal welds, the circumferential distance between them being not less than 300 mm.

7.3 Pipes shall be delivered heat treated, pickled and passivated. By agreement, stated in the contract, they may be delivered in the as-welded condition, in which case the mark H shall be applied to the pipe. The recommended heat treatment practice is given in Table 4. Pipes that have been ground or bored all over need not be pickled before delivery.

7.3 Table 4 gives, for eight steels, the recommended heat treatment and the mechanical properties. For S22253 (022Cr22Ni5Mo3N): rapid cooling from 1 020 °C to 1 100 °C; tensile strength not less than 620 MPa; proof strength at 0.2 % plastic extension not less than 450 MPa; elongation after fracture not less than 25 %; hardness not more than 290 HBW or 30 HRC. For S22053 (022Cr23Ni5Mo3N): rapid cooling from 1 020 °C to 1 100 °C; 655 MPa; 485 MPa; 25 %; 290 HBW or 30 HRC. For S22553 (022Cr25Ni6Mo2N): rapid cooling from 1 050 °C to 1 100 °C; 690 MPa; 450 MPa; 25 %; 280 HBW or 29 HRC. For S22583 (022Cr25Ni7Mo3WCuN): rapid cooling from 1 020 °C to 1 100 °C; 690 MPa; 450 MPa; 25 %; 290 HBW or 30 HRC. For S22584 (022Cr25Ni7Mo3W2CuN): rapid cooling from 1 025 °C to 1 125 °C; 758 MPa; 552 MPa; 20 %; 310 HBW or 32 HRC. For S25073 (022Cr25Ni7Mo4N): rapid cooling from 1 025 °C to 1 125 °C; 800 MPa; 550 MPa; 15 %; 300 HBW or 32 HRC. For S27603 (022Cr25Ni7Mo4WCuN): rapid cooling from 1 100 °C to 1 140 °C; 750 MPa; 550 MPa; 25 %; 300 HBW or 32 HRC. For S25554 (03Cr25Ni6Mo3Cu2N): rapid cooling from not less than 1 040 °C; 760 MPa; 550 MPa; 15 %; 297 HBW or 31 HRC.

7.4 Pipes shall be subjected to a tensile test on the parent metal, the longitudinal tensile properties at room temperature complying with Table 4. A transverse parent metal tensile test may replace the longitudinal test, the transverse properties complying with Table 4, but in case of dispute the longitudinal properties govern. Pipes with an outside diameter not less than 219.1 mm shall be subjected to a transverse weld tensile test; the specimen is taken transversely from the pipe or from a welded test plate of the same designation, cast, welding procedure and heat treatment, with the weld at the centre of the specimen and perpendicular to its axis, and the transverse weld tensile strength shall comply with Table 4. Pipes shall be subjected to a Rockwell or Brinell hardness test on the parent metal, the values complying with Table 4; by agreement, stated in the contract, a weld hardness test or a Vickers hardness test may also be carried out, the values being agreed between the parties. By agreement, stated in the contract, a weld impact test may be carried out, the test temperature and absorbed energy being agreed; where subsize specimens are used, the minimum required Charpy V-notch absorbed energy is the full-size requirement multiplied by the reduction factor of Table 5, which is 1 for the standard 10 mm by 10 mm specimen, 0.75 for the 10 mm by 7.5 mm subsize specimen and 0.5 for the 10 mm by 5 mm subsize