GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.140.75
H 48

GB/T 14976-2012

Replacing GB/T 14976-2002

Seamless Stainless Steel Pipes for Fluid Transport

流体输送用不锈钢无缝钢管

Issued on: May 11, 2012 **Implemented on: February 1, 2013**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China;

Standardization Administration of the People's Republic of China.

Table of Contents

Foreword

This Standard was drafted in accordance with the rules specified in GB/T 1.1-2009.

This Standard was drafted by making reference to "Seamless and Welded Steel Austenitic Stainless Steel Pipes for General Service" (ASTM A 269/A 269M-04), "Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes" (ASTM A 312/A 312M-05a) and "Seamless and Welded Ferritic and Martensitic Stainless Steel Pipes for General Service" (ASTM A 268/A 268M-05a).

This Standard replaces "Stainless Steel Seamless Tubes for Fluid Transport" (GB/T 14976-2002). The main changes in this Standard, compared with GB/T 14976-2002, are as follows:

— A delivery method in accordance with the minimum wall thickness is added;

— The permissible dimension deviation of the steel pipes is modified;

— The mark examples are deleted;

— The designation and chemical composition of steel are modified according to GB/T 20878;

— Designations of steel, 07Cr17Ni12Mo2, 07Cr19Ni11Ti, 07Cr18Ni11Nb, 06Cr13Al, 10Cr15, 022Cr18Ti, 019Cr19Mo2NbTi and 12Cr13, are added;

— Designation and relevant contents of dual phase steel are deleted.

— Requirements for the hydraulic test of steel pipes are modified;

— Informative A" Designation Comparison Table" is added.

This Standard was proposed by China Iron and Steel Association.

This Standard shall be under the jurisdiction of the National Technical Committee on Iron and Steel of Standardization Administration of China (SAC/TC 183).

Drafting organizations of this Standard: Jiangsu Wujin Stainless Steel Pipe Group Co., Ltd., Pangang Group Chengdu Iron & Steel Co., Ltd., Shangxi Taigang Stainless Steel Co., Ltd., Shanghai Shangshang Stainless Steel Pipe Co., Ltd., Yongxing Special Stainless Steel Co., Ltd. AND Metallurgical Information and Standardization Institute.

Chief drafting staffs of this Standard: Song Jianxin, Zhou Zhibin, Yan Ru, Li Qi, Li Changyi, Ji Xuewen, Yang Hui, Wang Jianyong, Chen Zemin and Dong Li.

The previous editions replaced by this Standard are as follows:

Seamless Stainless Steel Pipes for Fluid Transport

1 Scope

This Standard specifies the classification, code number, order contents, dimension, appearance, weight, technical requirements, test methods, inspection rules, package, marks and quality certificate of seamless stainless steel pipes for fluid transport.

This Standard is applicable to the seamless stainless steel pipes for fluid transport (hereinafter referred to as steel pipes).

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the dated versions apply to this Standard. For undated references, the latest edition of the normative document (include all the amendments) is applicable to this Standard.

GB/T 222 Permissible Tolerances for Chemical Composition of Steel Products

GB/T 223.9 Iron, Steel and Alloy - Determination of Aluminum Content - Chrom Azurol S Photometric Method

GB/T 223.11 Iron Steel and Alloy - Determination of Chromium Content - Visual Titration or Potentiometric Titration Method

GB/T 223.16 Methods for Chemical Analysis of Iron, Steel and Alloy - The Chromotropic Acid 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 223.28 Methods for Chemical Analysis of Iron Steel and Alloy - The D-denzoinoxime Gravimetric Method for the Determination of Molybdenum Content

GB/T 223.36 Methods for Chemical Analysis of Iron, Steel and Alloy - The Neutral Titration Method for the Determination of Ammonia Content after Distillation Separation

GB/T 223.40 Iron Steel and Alloy - Determination of Niobium Content by the Sulphochlorophenol S Spectrophotometric Method

GB/T 223.60 Methods for Chemical Analysis of Iron, Steel and Alloy - The Perchloric Acid Dehydration Gravimetric Method for the Determination of Silicon Content

GB/T 223.62 Methods for Chemical Analysis of Iron, Steel and Alloy - The Butyl Acetate Extraction Photometric Method for the Determination of Phosphorus Content

GB/T 223.63 Methods for Chemical Analysis of Iron, Steel and Alloy - The Sodium (Potassium) Periodate Photometric Method for the Determination of Manganese Content

GB/T 223.68 Methods for Chemical Analysis of Iron, Steel and Alloy - The Potassium Iodate Titration Method after Combustion in the Pipe Furnace for the Determination of Sulfur Content

GB/T 223.69 Iron Steel and Alloy - Determination of Carbon Contents - Gas-volumetric Method after Combustion in the Pipe Furnace

GB/T 228.1 Metallic Material - Tensile Test - Part 1: Ambient-temperature Test

GB/T 241 Metal Materials – Tubes - Hydrostatic Pressure Testing

GB/T 242 Metallic Materials – Tube - Drift Expanding Test

GB/T 246 Metallic Materials – Tube - Flattening Test

GB/T 2102 Acceptance, Packing, Marking and Certification of Pipe

GB/T 2975 Steel and Steel Products - Location and Preparation of Test Pieces for Mechanical Testing

GB/T 4334-2008 Corrosion of Metals and Alloys - Test Methods for Intergranular Corrosion of Stainless Steels

GB/T 5777-2008 Seamless Steel Pipe and Tubing Methods for Ultrasonic Testing

GB/T 7735-2004 Steel Tubes - The Inspection Method on Eddy Current Test

GB/T 11170 Stainless Steel - Determination of Multi-element Contents - Spark Discharge Atomic Emission Spectrometric Method (Routine Method)

GB/T 17395 Dimensions, Shapes, Masses and Tolerances of Seamless Steel Tubes

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 20124 Steel and Iron - Determination of Nitrogen Content - Thermal Conductimetric Method after Fusion in a Current of Inert Gas

GB/T 20878 Stainless and Heat-resisting Steels - Designation and Chemical Composition

3 Classification and Code

3.1 The steel pipes may be classified into two types according to the product processing method, and the category and code are:

— Hot rolled (squeezed and extended) steel pipes W-H;

— Cold-drawn (rolled) steel pipes W-C.

3.2 The steel pipes may be divided into two grades according to the dimensional accuracy, and the grade and code are:

— Ordinary grade PA;

— High grade PC.

3.3 The following codes are applicable to this Standard:

— D The outer diameter or nominal outer diameter;

— S The wall thickness or nominal wall thickness;

— S_{min} The minimum wall thickness.

4 Ordering Information

The contract or order for purchasing steel pipes according to this Standard shall include, but not limited to the following contents:

a) Standard number;

b) Product name;

c) Steel designation;

d) Dimensions;

e) Ordered quantity (total weight or total length);

f) Condition of delivery;

g) Optional requirements;

h) Other special requirements.

5 Dimension, Appearance and Weight

5.1 Outer diameter and wall thickness

5.1.1 The steel pipes shall be delivered according to nominal outer diameter and nominal wall thickness. As required by the purchaser and based on the agreement of both the supplier and the purchaser, the steel pipes may be delivered according to the nominal outer diameter and the minimum wall thickness or other dimensions.

5.1.2 The outer diameter and wall thickness of steel pipes shall meet the relevant requirements of GB/T 17395. As required by the purchaser and based on the agreement of both the supplier and the purchaser, steel pipes beyond the dimensions specified in GB/T 17395 may be supplied.

5.1.3 Where the steel pipes are delivered according to the nominal outer diameter and nominal wall thickness, the permissible deviation of its nominal outer diameter and nominal wall thickness shall meet those specified in Table 1. Where the steel pipes are delivered according to the nominal outer diameter and minimum wall thickness, the permissible deviation of its nominal outer diameter shall meet those specified in Table 1 and the permissible deviation of wall thickness shall meet those specified in Table 2.

5.1.4 Where the purchaser does not note the permissible dimension deviation grade of steel pipes in the contract, the permissible deviation of the steel pipe outer diameter and wall thickness shall meet the requirements of ordinary grade dimensional accuracy. Where the purchaser requires high grade dimensional accuracy, the purchaser shall note it in the contract.

5.1.5 As required by the purchaser and noted in the contract based on the agreement of both the supplier and the purchaser, the steel tubes beyond the permissible dimension deviation specified in Table 1 and Table 2 may also be delivered.

following requirements;

— Outer diameter ≤159mm, 5mm~10mm;

— Outer diameter >159mm, 10mm~15mm.

5.2.3 For steel pipes of special dimensions, e.g. extreme thin steel pipe with wall thickness less than or equal to 3% of the outside diameter and minor diameter steel pipe with outer diameter less than or equal to 30mm, the length deviation may be specified by the supplier and the purchaser separately through negotiation.

5.3 Bending

5.3.1 Full length bending

The full length bending of steel pipe shall not be greater than 0.15% of the full length of steel pipe.

5.3.2 Bending per meter

The bending per meter of steel pipe shall not be greater than the following requirements:

— Wall thickness ≤15mm, 1.5mm/m;

— Wall thickness >15mm, 2.0mm/m;

— Hot-extended steel pipe, 3.0mm/m.

5.4 End-face appearance

Both end-faces of steel pipe shall be perpendicular to the steel pipe axis and the cut burrs on the end-face shall be cleaned up.

5.5 Out-of-roundness and wall unevenness

As required by the purchaser and noted in the contract upon the agreement of both the supplier and the purchaser, the out-of-roundness and wall unevenness of steel pipes shall respectively not exceed 80% of the outer diameter and wall thickness tolerance.

5.6 Weight

5.6.1 Steel pipes shall be delivered according to the actual weight.

5.6.2 As required by the purchaser and noted in the contract, the steel pipes may also be delivered according to the theoretical weight. The theoretical weight per meter of steel pipes shall be calculated according to Formula (1):

external refining. Other smelting process may be adopted based on the agreement of both the supplier and the purchaser.

6.2.2 Manufacturing method of steel pipes

The steel pipes shall be manufactured by hot-rolling (squeezing, extending) or cold-drawing (rolling) seamless method. The hot-extended steel pipe refers to the steel pipes with larger diameter formed by overall heating of blank steel pipe and then extending. Where the purchaser specifies a manufacturing method, the purchaser shall note it in the contract.

6.3 Delivery state

6.3.1 The steel pipes shall be delivered after heat treatment and pickling. The steel pipe grinded, bored or heat treated at protective atmosphere may not be picked before delivery. Recommended heat treatment systems for finished steel pipes are detailed in Table 4.

6.3.2 For hot extended austenitic steel pipes, if direct water cooling or other rapid cooling method is conducted for it within the heat treatment temperature range specified in Table 4 after thermal deformation, it shall be deemed that it has meet the steel pipe heat treatment requirements.

6.3.3 As required by the purchaser and noted in the contract upon the agreement of both the supplier and the purchaser, the cold-drawn (rolled) austenitic steel pipes may also be delivered at cold processing state. Its bending, mechanical property and flattening test shall be negotiated between the supplier and the purchaser.

6.3.4 Based on the agreement between the supplier and the purchaser and noted in the contract, heat treatment systems beyond those specified in Table 4 may be adopted for steel pipes.

6.4 Mechanical properties

6.4.1 The longitudinal mechanical properties (tensile strength R_m and percentage elongation after fracture A) of steel pipes in heat treatment state shall be in accordance with those specified in Table 4.

6.4.2 As required by the purchaser and noted in the contract upon the agreement of both the supplier and the purchaser, the specified non-proportional elongation strength, $R_{P0.2}$, of steel pipes maybe inspected and the inspection result shall meet those specified in Table 4.

maximum permissible depth is 0.5mm; for steel pipes with a diameter greater than 140 mm, the maximum permissible depth is 0.8mm;

— Cold-drawn (rolled) steel pipe: less than or equal to 4% of the wall thickness and the maximum permissible depth is 0.30 mm; for steel pipes with a wall thickness less than 1.4mm, the permissible depth of the straight is 0.05mm.

6.8.3 Other local defects not exceed the negative deviation of wall thickness are permissible.

6.9 Nondestructive inspection

Steel pipes may be subjected to ultrasonic inspection or eddy current inspection as required by the demander and agreed by the supplier and the purchaser. Where ultrasonic inspection is adopted, the artificial defects on contrast pipe shall meet the requirements of acceptance level L3 in GB/T 5777; where eddy current inspection is adopted, the artificial defects on contrast pipe shall meet the requirements of acceptance level Class A in GB/T 7735.

7 Test Methods

7.1 The dimension and appearance of steel pipes shall be measured one by one by measuring instruments meeting the precision requirements.

7.2 The internal and external surfaces of steel pipes shall be inspected visually one by one at sufficient lighting condition.

7.3 Test methods and sampling methods of other inspection items of steel pipes shall meet those specified in Table 5.

Table 5 Inspection Items, Test Methods and Sampling Quantity of Steel Pipes

No.	Inspection item	Sampling quantity	Sampling method	Test method
1	Chemical composition	One sample taken from each furnace	GB/T 20066	GB/T 223, GB/T 11170 GB/T 20123, GB/T 20124
2	Tensile test	One sample respectively taken from two steel pipes of each batch.	GB/T 2975	GB/T 228.1
3	Flattening test	One sample respectively taken from two steel pipes of each batch.	GB/T 246	GB/T 246
4	Drift expanding test	One sample respectively taken from two steel pipes of each batch.	GB/T 242	GB/T 242
5	Hydraulic test	One by one	-	GB/T 241

6	Ultrasonic inspection	One by one	-	GB/T 5777-2008
7	Eddy current inspection	One by one	-	GB/T 7735-2004
8	Intergranular corrosion test	One sample respectively taken from two steel pipes of each batch.	GB/T 4334-2008	GB/T 4334-2008

8 Inspection Rules

8.1 Inspection and acceptance

The inspection and acceptance of steel pipes shall be carried out by the quality and technical supervision department of the supplier.

8.2 Batching rules

The steel pipes are inspected and accepted according to batches. Each batch shall be composed by steel pipes with same designation, same furnace number, same size, and same heat treatment system (furnace number). The quantity of steel pipes in each batch shall not exceed the following requirements:

— Outer diameter ≤76mm and wall thickness ≤3mm: 500 pieces;

— Outer diameter >351mm: 50 pieces;

— Other dimension: 200 pieces.

8.3 Sampling quantity

The sampling quantity of each batch of steel pipes for each inspection item shall be in accordance with those specified in Table 5.

8.4 Re-inspection and judgment rules

The re-inspection and judgment rules of steel pipes shall meet the relevant requirements of GB/T 2102.

9 Packaging, Marking and Quality Certificate

The packaging, marking and quality certificate of steel pipes shall comply with those specified in GB/T 2102.

Appendix A

(Informative)

Designation Comparison Table of Stainless Steel

Designation comparison of stainless steel in each standard is detailed in Table A.1.

Table A.1 Designation Comparison of Stainless Steel in Each Standard

No. in this Standard	GB/T 20878-2007				U.S. ASTM A 959-09	Japan JIS G 4303-2005 JIS G 4311-1991	International ISO/TS 15510:2003 ISO 4955: 005	Europe EN 10088: -2005	Former Soviet Union ГОСТ 5632-1972
	No.	Unified code number	New designation	Former designation					
1	13	S30210	12Cr18Ni9	1Cr18Ni9	S30200,302	SUS302	X10CrNi18-8	X10CrNi18-8,1.4310	12X18H9
2	17	S30408	06Cr19Ni10	0Cr18Ni9	S30400,304	SUS304	X5CrNi18-9	X5CrNi18-10,1.4301	-
3	18	S30403	022Cr19Ni10	00Cr19Ni10	S30403,304L	SUS304L	X2CrNi19-11	X2CrNi19-11,1.4306	03X18H11
4	23	S30458	06Cr19Ni10N	0Cr19Ni9N	S30451,304N	SUS304N1	X5CrNiN18-8	X5CrNiN19-9,1.4315	-
5	24	S30478	06Cr19Ni9NbN	0Cr19Ni10NbN	S30452, XM-21	SUS304NS	-	-	-
6	25	S30453	022Cr19Ni10N	00Cr18Ni10N	S30453, 304LN	SUS304LN	X2CrNiN18-9	X2CrNiN18-10,1.4311	-
7	32	S30908	06Cr23Ni13	0Cr23Ni13	S30908,309S	SUS309S	X12CrNi23-13	X12CrNi23-13, 1.4833	-
8	35	S31008	06Cr25Ni20	0Cr25Ni20	S31008, 310S	SUS310S	X8CrNi25-21	X8CrNi25-21,1.4845	10X23H18
9	38	S31608	06Cr17Ni12Mo2	0Cr17Ni12Mo2	S31600,316	SUS316	X5CrNiMo17-12-2	X5CrNiMo17-12-2,1.4401	-
10	39	S31603	022Cr17Ni12Mo2	00Cr17Ni14Mo2	S31603,316L	SUS316L	X2CrNiMo17-12-2	X2CrNiMo17-12-2,1.4404	03X17H14M3
11	40	S31609	07Cr17Ni12Mo2	1Cr17Ni12Mo2	S31609, 316H	-	-	X3CrNiMo17-13-3,1.4436	-
12	41	S31668	06Cr17Ni12Mo2Ti	0Cr18Ni12Mo3Ti	S31635,316Ti	SUS316Ti	X6CrNiMoTi17-12-2	X6CrNiMoTi17-12-2,1.4571	08X17H13M2T
13	43	S31658	06Cr17Ni12Mo2N	0Cr17Ni12Mo2N	S31651,316N	SUS316N	-	-	-
14	44	S31653	022Cr17Ni12Mo2N	00Cr17Ni13Mo2N	S31653, 316LN	SUS316LN	X2CrNiMoN17-12-3	X2CrNiMoN17-13-3,1.4429	-

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