GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.140.75

H 48

GB/T 12771-2008

Replacing GB/T 12771-2000

Welded Stainless Steel Pipes for Liquid Delivery

流体输送用不锈钢焊接钢管

Issued on: May 13, 2008 **Implemented on: November 1, 2008**

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.

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Foreword

This Standard replaces GB/T 12771-2000 “Welded Stainless Steel Pipes for Liquid Delivery”. Compared with GB/T 12771-2000, the main changes in this Standard are as follows:

- Application scope is modified;
- The universal standard of welded steel pipe is directly applicable to dimensions;
- Steel grade and chemical composition are modified;
- Permissible deviation of steel pipe dimension is modified;
- Non-circularity provision of steel pipe is added;
- Weld manufacturing method is specified;
- Flattening test of steel pipe whose outer diameter is not less than 200mm is modified;
- Transverse bending test of weld of steel pipe whose outer diameter is not less than 219mm is added;
- Reinforcement provision of weld is modified;
- Expansion test is deleted.

This Standard was proposed by China Iron and Steel Association.

This Standard shall be under jurisdiction of China Steel Standardization Technical Committee.

Main drafting organizations of this Standard: Taiyuan Iron and Steel (Group) Stainless Steel pipe Products Co., Ltd., Zhejiang Jiuli Hi-tech Metals Co., Ltd., and Jiang Su Wujin Stainless Steel Pipe Group Co., Ltd.

Main drafting staffs of this Standard: Li Changyi, Lu Fenghui, Tian Xiaoqing, Shao Yu, Song Jianxin, Yu Yuan and Gong Jianzhong.

The previous versions replaced by this Standard are:

- GB/T 12771-1991, GB/T 12771-2000.

Welded Stainless Steel Pipes for Liquid Delivery

1 Scope

This Standard specifies the classification and code, dimension, appearance, weight, technical requirements, test methods, inspection rules, packaging, marks, and quality certificate of welded stainless steel pipes for liquid delivery.

This Standard is applicable to the anti-corrosion welded stainless steel pipes for liquid delivery (hereinafter referred to as “steel-pipe”).

2 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this Standard. For dated reference, subsequent amendments (excluding corrigendum) or revisions of these publications do not apply. However, parties who enter in agreement based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the documents referred to applies.

GB/T 223.10 Chemical analysis method for steel and alloy - The chrome azurol s photometry for the determination of aluminum content after separation by cupferron

GB/T 223.11 Chemical analysis method for steel and alloy - Ammonium persulfate oxidation volumetric method for the determination of chromium content

GB/T 223.16 Chemical analysis method for steel and alloy: chromotropic acid photometry for the determination of titanium content

GB/T 223.25 Chemical analysis method for steel and alloy - Dimethylglyoxime-gravimetric method for the determination of nickel content

GB/T 223.28 Chemical analysis method for steel and alloy - α-benzoin oxime gravimetric method for the determination of molybdenum content

GB/T 223.30 Chemical analysis method for steel and alloy - Arsenazo III

spectrophotometric method for the determination of zirconium content after separation by p-bromomandelic acid

GB/T 223.37 Chemical analysis method for steel and alloy - Indophenol blue photometry for the determination of nitrogen content after separation by distillation

GB/T 223.40 Steel and alloy: sulphur phenol spectrophotometry for the determination of niobium content

GB/T 223.60 Chemical analysis method for steel and alloy - Perchloric acid dehydration gravimetric method for the determination of silicon content

GB/T 223.62 Chemical analysis method for steel and alloy - Butyl acetate extraction-photometric method for the determination of phosphorus content

GB/T 223.63 Chemical analysis method for steel and alloy - Heavy sodium iodate (kalium iodate) photometry for the determination of manganese content

GB/T 223.68 Chemical analysis method for steel and alloy - Kalium iodate titrimetric method for the determination of sulfur content after combustion in the tubular furnace

GB/T 228 Metallic Materials - Tensile test at ambient temperature (GB/T 228- 2002, eqv ISO 6892:1998)

GB/T 232 Metal materials - Bending test method (GB/T 232-1999, eqv ISO 7438: 1985)

GB/T 241 Metal pipe - Hydraulic test method

GB/T 245 Metal pipe - Flange test method (GB/T 245-1997, eqv ISO 8494: 1986)

GB/T 246 Metal pipe - Flattening test method (GB/T 246-2007, ISO 8492:1998, IDT)

GB/T 2102 Acceptance inspection, packaging, mark and quality certificate of steel pipe

GB/T 2650 Soldered joint impact test method

GB/T 2975 Mechanical test of steel and steel products - Sampling location and specimen preparation (GB/T 2975-1998, eqv ISO 377:1997)

GB 3323 Methods for radiographic inspection and classification of radiographs for fusion welded butt joints in steel

GB/T 4334.5 Stainless steel - Sulfuric acid - Copper sulfate corrosion test method

GB/T 6394 Average particle dimension determination method for metal

GB/T 7735 Eddy current inspection method for steel pipes (GB/T 7735-2004, ISO 9304: 1989, MOD)

GB/T 11170 Photoemission spectral analysis method for stainless steel

GB/T 20066 Specimen sampling and sampling method for the determination of chemical composition in steel and iron (GB/T 20066-2006, ISO 14284:1996, IDT)

GB/T 20123 Infrared absorption method (conventional method) for the determination

of total carbon and sulfur content of steel after combustion in the Efco-Northrup furnace (GB/T 20123-2006, ISO 15350:2000, IDT)

GB/T 20124 Inert gases heat of melting conductance method (conventional method) for the determination of nitrogen content of steel (GB/T 20124-2006, ISO 15351:1999, IDT)

GB/T 21835 Dimension and unit weight of welded steel pipe (GB/T 21835-2008, ISO 1127:1992, ISO 4200:1991, NEQ)

3 Classification and Code

3.1 Steel-pipe is divided into the following six categories according to manufacture categories:

Type I - Steel-pipe is made according to bi-facial automatic welding procedure; and radiographic inspection is adopted for the 100% overall length of weld.

Type II - Steel-pipe is made according to single-facial automatic welding procedure; and radiographic inspection is adopted for the overall length of weld.

Type III - Steel-pipe is made according to bi-facial automatic welding procedure; and radiographic inspection is adopted for partial length of weld.

Type IV - Steel-pipe is made according to single-facial automatic welding procedure; and radiographic inspection is adopted for partial length of weld.

Type V - Steel-pipe is made according to bi-facial automatic welding procedure; and radiographic inspection is not adopted for the weld.

Type VI - Steel-pipe is made according to single-facial automatic welding procedure; and radiographic inspection is not adopted for the weld.

3.2 Steel-pipe is divided into the following four categories according to its supply situation:

a) Welding condition H;

b) Heat treatment condition T;

c) Cold drawing (rolling) condition WC;

d) Grinding (polishing) condition SP.

4 Order Content

At least the following contents shall be included in the steel-pipe purchasing contract or order sheet based on this Standard:

5.5.3 Through the negotiation of both buyer and seller, and indicated in contract, steel-pipe whose outer diameter is not less than 508mm is allowed to have double longitudinal seam or circular seam joint of which the quality is same as longitudinal weld.

5.6 Terminal appearance

Both ends of steel-pipe shall be perpendicular with the tubular steel axle; all the burrs of kerf shall be removed.

According to the requirements of the buyer, through the mutual negotiation of both buyer and seller, and indicated in contract, both ends of the steel-pipes may be processed with groove; the groove angle is determined according to the agreement.

5.7 Weight

Steel-pipe may be delivered by theoretical weight or by actual weight. If theoretical weight is used, the theoretical weight shall be calculated according to formula (1).

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

Where,

W - the theoretical weight of steel-pipe, kg/m;

π - PI, the value is 3.1416;

S - the nominal wall thickness of steel-pipe, mm;

D - the nominal outer diameter of steel-pipe, mm;

ρ - the density of steel, in kg/dm^3; the density of each grade is given in Table 4.

6.2 Manufacturing Method

6.2.1 Smelting process of steel

For steel, the smelting method of electric arc furnace plus out-of-furnace refining shall be adopted. Based on the mutual negotiation of seller and buyer, and indicated in contract, other smelting methods which comply with the requirements of this Standard may also be adopted.

6.2.2 Manufacturing method of steel-pipe

Steel-pipe shall be manufactured with filler metal-added or non-filler metal-added single-facial automatic arc welding method or bi-facial automatic arc welding method. For specific manufacturing method, it shall be mutually agreed by the buyer and the seller, and be indicated in the contract.

If filler metal material is filled in the process of manufacturing, the alloying ingredient of the filler metal material shall not be less than that of parent metal.

6.3 Condition of Delivery

Steel-pipe shall be delivered in the heat treatment and pickling conditions. Continuous or periodic furnace full length heat treatment shall be adopted in the entire heat treatment process. Recommended heat treatment systems of steel-pipe are presented in Table 6.

According to the requirements of the buyer and the negotiation between the buyer and the seller, the steel-pipe may also be delivered under other conditions.

Table 6 Heat Treatment System of Steel-pipe

No.	Type	New grade	Old grade	Commendatory heat treatment system [a]	
1	Austenitic	12Cr18Ni9	1Cr18Ni9	Solution heat treatment	1010°C~1150°C rapid cooling
2		06Cr19Ni10	0Cr18Ni9		1010°C~1150°C rapid cooling
3		022Cr19Ni10	00Cr19Ni10		1010°C~1150°C rapid cooling
4		06Cr25Ni20	0Cr25Ni20		1030°C~1180°C rapid cooling
5		06Cr17Ni12Mo2	0Cr17Ni12Mo2		1010°C~1150°C rapid cooling
6		022Cr17Ni12Mo2	00Cr17Ni14Mo2		1010°C~1150°C rapid cooling
7		06Cr18Ni11Ti	0Cr18Ni10Ti		920°C~1150°C rapid cooling
8		06Cr18Ni11Nb	0Cr18Ni11Nb		980°C~1150°C rapid cooling
9	Ferritic	022Cr18Ti	00Cr17	Annealing treatment	780°C~950°C rapid cooling or slow cooling
10		019Cr19Mo2NbTi	00Cr18Mo2		800°C~1050°C rapid cooling
11		06Cr13Al	0Cr13Al		780°C~830°C rapid cooling or slow cooling
12		022Cr11Ti	-		830°C~950°C rapid cooling
13		022Cr12Ni	-		830°C~950°C rapid cooling
14	Martensitic	06Cr13	0Cr13		750°C rapid cooling or 800°C~900°C slow cooling

S - the nominal wall thickness of steel-pipe, mm;

D - the nominal outer diameter of steel-pipe, mm.

Hydraulic test may be replaced with eddy current inspection by the seller. For eddy current inspection, artificial defects of comparative test cylinders shall meet the provisions of acceptance grade A in “GB/T 7735”.

According to the mutual negotiation of both the seller and the buyer, and indicated in the contract, other non-destructive inspection may also be adopted to substitute hydraulic test.

6.5.2 Flattening test

Flattening test shall be carried out for steel-pipe whose outer diameter is not more than 219.1mm. Circularity flattening specimen shall be adopted for steel-pipe whose outer diameter is not more than 50mm; C-shaped flattening specimen shall be adopted by steel-pipe whose outer diameter is more than 50mm but not more than 219.1mm. In the test, welding-seam shall be at the 90° position from the force direction. For the heat-treated steel-pipe, the specimen shall be pressed to 1/3 of outer diameter of the steel-pipe; for the non-heat-treated steel-pipe, the specimen shall be pressed to 2/3 of outer diameter of the steel-pipe. After flattened, there shall not be cracks and ruptures.

6.5.3 Transverse bending test of welding-seam

6.5.3.1 Welding-seam transverse bending test shall be carried out for steel-pipe whose outer diameter is more than 219.1mm. Bent specimen shall be cut from steel-pipe or welded test plate. The material, furnace number, heat treatment system as well as welding process of the welded test plate shall be same as those of the steel-pipe. A set of bending test shall be composed of a normal bending test, a root bending test (namely, outer welding-seam and inner welding-seam of steel-pipe are at the maximum bending surface respectively).

6.5.3.2 In the bending test, diameter of bending core is 3-times of the thickness of the sample; the bending angle is 180°. After bent, the welding-seam area shall be free from cracks and ruptures.

6.5.4 Intergranular corrosion test

For austenitic steel-pipe, intergranular corrosion test shall be carried out according to the provisions of “GB/T 4334.5”.

According to the requirements of the buyer, mutually agreed by the supplier and the buyer, and indicated in the contract, other corrosion test methods may be adopted.

6.6 Non-destructive Test

6.6.1 For the steel-pipe made according to the Type-I and Type-II methods, 100% radiographic inspection shall be carried out for the overall length of welding-seam. The eligible grade of radiographic inspection shall meet the provisions of III-grade in “GB/T 3323”.

6.6.2 For the steel-pipe made according to the Type-III and Type-IV methods, radiographic inspection shall be carried out for not less than 20% of its welding-seam length. The eligible grade of radiographic inspection shall meet the provisions of III-grade in “GB/T 3323”.

6.7 Surface Quality

6.7.1 Inner and outer surface of steel-pipe shall be smooth and be free from lamination, fold, double skin, distortion, over pickling, residual oxide scale and other hindering-use defects. The aforesaid defects shall be cleaned completely. Surplus wall thickness of the cleaned part shall not be less than the permissible minus-tolerance of the wall thickness. If their depth is not more than the minus-tolerance of wall thickness, slight scuffing, knock out and pock are allowed; for defects such as misalignment, undercut, heave and crevasse, their depth shall not be more than permissible deviation of wall thickness.

6.7.2 Welding-seam defect is allowed to be repaired; the hydraulic test shall be carried out again after the repair. For the steel-pipe delivered under heat treatment condition, heat treatment shall be carried out again.

6.7.3 For the steel-pipe made according to the bi-facial automatic welding procedure, residual-height of any side of their inner welding-seam and outer welding-seam shall be level with the parent metal or uniform residual-height not exceeding 2 mm.

For the steel-pipe made according to the single-facial automatic welding procedure, the residual-height its outer welding-seam shall be level with the parent metal and shall be rounding off. The residual-height of its inner welding-seam shall meet the following provisions:

a) For the steel-pipe whose outer diameter is less than 133 mm, inner side residual-height of the welding-seam is not more than 10%S.

b) For the steel-pipe whose outer diameter is not less than 133mm and not more than 325mm, inner side residual-height of the welding-seam is not more than 15%S.

c) As for the steel-pipe whose outer diameter is more than 325mm, the inner side residual-height of the welding-seam is not more than 20%S, and the maximum is 3mm.

6.8 Special Requirement

According to the requirements of the buyer, through negotiation of the buyer and the seller, and indicated in the contract, the following inspection items may be added:

a) Flange test of steel-pipe;

b) Austenitic grain dimension test;

c) Welding-joint impact test.

8.2 Lot-batch Rules

The steel-pipe shall be carried out inspection and acceptance in batches. Each batch shall be consisted of the steel-pipes with the same-grade, the same-furnace number, the same-dimension, the same-welding procedure, and the same-heat treatment system. The quantity of the steel-pipes per batch shall not exceed the following provisions:

a) For outer diameter is not more than 57mm, 400 sticks;

b) For outer diameter is more than 57mm and not more than 219.1mm, 200 sticks;

c) For outer diameter is more than 219.1 mm, 100 sticks.

8.3 Sampling Quantity

Sampling quantity of each inspection item of the steel-pipe shall meet the provisions of Table 8.

8.4 Re-inspection and Decision Rules

The re-inspection and decision rules of steel-pipe shall meet the provisions of GB/T 2102.

9 Packaging, Mark and Quality Certificate

The mark of steel-pipe shall contain categories of technical requirements. The rest shall meet the provisions of GB/T 2102.

The packaging and quality certificate of steel-pipe shall meet the provisions of GB/T 2102.

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