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National Standard of People's Republic of China

GB/T 8163--1999

neq ISO 559: 1991

Seamless steel tubes for liquid service

输送流体用无缝钢管

1999-11-01 Issuance

2001-08-01 Enforcement

Issued by: State Bureau of Quality and Technical Supervision

Gb/T8163-1999

Forward

The Standard unequivocally adopted ISO 559: 1991 “Tubes for clear water and sewage”

and made revision to GB/T 8163-1987 “Seamless steel tubes for liquid service” in accordance with the specific conditions in our country.

The permissible tolerances of dimension of the Standard are more strict than those of ISO 559 while others are equivalent to those of ISO 559.

The following clauses were revised for this revision of the Standard:

1. Permissible tolerances of dimensions. The dimensions in the original Table 1 and 2 were removed and instead those in Table 1 of GB/T 17395-1998 were quoted.
2. Steel grades and mechanical properties.
3. Testing items for hydrostatic pressure test and flattening test.
4. The original Appendix A was removed and put into the text of the Standard.

The Standard takes the place of GB/T 8163-1987 “Seamless steel tubes for liquid service” as from its effective date.

The Standard is proposed by the State Bureau of Metallurgical Industry.

The Standard is under the charge of the National Technical Committee on Steel Standardization.

The units involved in the preparation and drafting of the Standard are Anshan Iron and Steel Company and Chengdu Seamless Steel Tubes Co., Ltd.

Major draftmen of the Standard are Chen Yong, Piao Zhimin, You Kemin and Fen Wenhua.

The Standard was initially issued in July 1987.

1. Scope

The Standard specified the dimensions, shapes, masses, technical specifications, testing methods, provisions for checking, packing, marking and quality certification of seamless steel tubes for liquid service.

The Standard is applicable to the normal seamless steel tubes for liquid service.

2. Reference of Standards

The clauses contained in the following standards constitute those of the Standard by being quoted. All the revisions shown are valid at the time that the Standard is published. All the reference standards will be revised and all the parties using the Standard shall have discussions on the possibility of making use of the latest revision of the following standards.

GB/T 222-1984	Method of sampling steel for determination of chemical composition and permissible variations for product analysis
GB/T 223.5-1997	Methods for chemical analysis of iron, steel and alloy—The reduced molybdosilicate spectro-photometric method for the determination of acid-soluble silicon content
GB/T 223.12-1991	Methods for chemical analysis of iron, steel and alloy—The sodium carbonate separation-diphenyl carbazide photometric method for the determination of chromium content
GB/T 223.14-1989	Methods for chemical analysis of iron, steel and alloy—The N-benzoyl-N-phenylhydroxylamine extraction photometric method for the determination of vanadium content
GB/T 223.53-1987	Methods for chemical analysis of iron, steel and alloy—The flame atomic absorption spectrophotometric method for the determination of copper content
GB/T 223.54-1987	Methods for chemical analysis of iron, steel and alloy—The flame atomic absorption spectrophotometric method for the determination of nickel content
GB/T 223.62-1988	Methods for chemical analysis of iron, steel and alloy—The butyl acetate extraction photometric method for the determination of phosphorous content
GB/T 223.64-1988	Methods for chemical analysis of iron, steel and alloy—The flame atomic absorption spectrometric method for the determination of manganese content

GB/T 223.69-1997	Methods for chemical analysis of iron, steel and alloy—The gas-volumetric method after combustion in the pipe furnace for the determination of carbon content
GB/T 223.72-1991	Methods for chemical analysis of iron, steel and alloy—The alumina chromatographic separation-barium sulfate gravimetric method for the determination of sulphur content
GB/T 228-1987	Metallic materials—Tensile testing
GB/T 241-1990	Metal tubes—Hydrostatic pressure testing
GB/T 242-1997	Metallic materials—Tube-Drift expanding test
GB/T 244-1997	Metallic materials—Tube-Bend test
GB/T 246-1997	Metallic materials—Tube-Flattening test
GB/T 699-1999	Quality carbon structure steel
GB/T 1591-1994	High strength low alloy structural steels
GB/T 2102-1988	Acceptance, packing, marking and certification of pipe
GB/T 5777-1996	Seamless steel pipe and tubing—Methods for ultrasonic testing
GB/T 7735-1995	Steel tubes—The inspection method on eddy current test
GB/T 12606-1999	Magnetic leakage flux testing method of steel tubes
GB/T 17395-1998	Dimensions, shapes, masses and tolerances of seamless steel tubes
YB/T 5222-1998	Quality carbon steel tube billet

3. Dimensions, Shapes and Masses

3.1 Outer diameter and wall thickness

Steel tubes fall into two groups: hot-rolled (extruded and expanded) tubes and cold-drawn (cold-rolled) tubes. Their outer diameter and wall thickness shall comply with the specifications of GB/T 17395.

3.2 Permissible tolerance of outer diameter and wall thickness

3.2.1 The permissible tolerance of outer diameter and wall thickness of steel tubes

shall comply with the specifications in Table 1. Steel tubes of average grade of permissible tolerance of outer diameter and wall thickness shall be supplied if the client didn't indicate the permissible tolerance of dimension in the contract in advance.

Steel tubes with tolerance of dimension beyond those specified in Table 1 can be produced as required by the client, through mutual discussion between the client and the supplier and with indication in the contract.

3.3.3 Range length

The range length of steel tubes shall be within the range of ordinary length.

3.4 Flexibility

The flexibility of steel tubes shall not be greater than the following specifications:

Wall thickness \leq 15mm	1.5mm/m
Wall thickness $>$ 15mm	2.0mm/m
Wall thickness \geq 351mm	3.0mm/m

3.5 End Profile

Both the end faces of steel tubes shall be perpendicular to the axis of the tube. All burrs shall be removed from the faces.

3.6 Delivery weight

3.6.1 The delivery weight of steel tubes shall comply with the specifications of GB/T 17395

(the density of steel is calculated as 7.85 kg/dm³).

3.6.2 Permissible tolerance of weight

The permissible tolerance of actual delivery weight of steel tubes from theoretical weight shall be as follows as required by the client, through mutual discussion between the client and the supplier and with indication in the contract:

Single piece of tube: $\pm 10\%$;

Steel tubes with minimum batch weight of 10 tons: $\pm 7.5\%$

3.7 Example of marking

Steel tubes made of Grade 10 steel with an outer diameter of 73mm and a wall thickness of 3.5mm:

a) hot-rolled tube with a length of 8000mm multiple length.

10-73 x 3.5 x 8000 multiple length ---GB/T 8163-1999

b) cold-drawn (cold-rolled) tube with a diameter of high class accuracy and a wall thickness of average class accuracy and a length of 5000mm.

cold 10-73 high class x 3.6 x 5000 -GB/T 8163 -1999

4. Technical Specifications

4.1 Steel grade and chemical composition

4.1.1 Steel tubes are made of Grade 10, 20, Q205, Q345 steel.

Steel tubes of other grades can be produced as required by the client and through mutual discussion between the client and the supplier.

4.1.2 The steel grade and chemical composition (melting analysis) shall comply with

the specifications of GB/T 699 or GB/T 3591. The steel tubes are accepted according to the melting composition.

4.1.3 The permissible tolerance of chemical composition of steel tubes shall comply

with the specifications of Table 1 and 2 of GB/T 222-1984 when the client requests to make the product analysis..

4.2 Method of manufacturing

4.2.1 Method of steel manufacturing

Steel shall be made by electric furnace, Martin furnace or oxygen converter.

When the client specified a certain method of manufacturing, it shall be indicated in the contract.

4.2.2 Method of manufacturing of tube billet

Tube billets can be manufactured by hot-rolled (forged) process. The hot-rolled (forged) tube billet shall comply with the specifications of YB/T 5222. Also, continuous casting billet or steel ingot may be used.

4.2.3 Method of manufacturing of steel tube

Steel tubes shall be manufactured by hot-rolled (extruded and expanded) and cold-drawn (cold-rolled) seamless process. When the client specified a certain method of manufacturing, it shall be indicated in the contract.

4.3 Delivery status

Hot-rolled (extruded and expanded) steel tubes are delivered in hot-rolled or heat-treated status while cold-drawn (rolled) steel tubes are delivered in heat-treated status.

4.4 Mechanical properties

The longitudinal mechanical properties of steel tubes as delivered shall comply with the specifications indicated in Table 2.

Table 2 Longitudinal Mechanical Properties of Steel Tubes

No.	Steel grade	Tensile strength σ_b MPa	Yield point σ_s MPa		Elongation after breaking δ_5 %
			$s \leq 16$	$s > 16$	
			Not less than		
1	10	335~475	205	195	24
2	20	410~550	245	235	20
3	Q295	430~610	295	285	22
4	Q345	490~665	325	315	21

4.5 Process test

4.5.1 Flattening test

For steel tubes with an outer diameter >22—400mm and the ratio of wall thickness to outer diameter $\leq 10\%$, flattening test shall be carried out. The distance H between flat plates is calculated according to the following equation:

$$H = \frac{(1+a)S}{a+S/D} \quad (1)$$

where: s— Nominal wall thickness of steel tube, mm;

D-- Nominal outer diameter of steel tube, mm;

α —Deformation coefficient of unit length, 0.09 for Grade 10 steel, 0.07 for Grade 20 steel and 0.06 for Q295 and Q345 steel.

After the flattening test, no flaws and cracks shall exist on the specimen.

4.5.2 Expanding test

For steel tubes with a wall thickness ≤ 8 mm, expanding test may be carried out as required by the client, through mutual discussion between both parties and with indication in the contract. The conical degree shall one of the following three— 30° , 45° and 60° . No flaws or cracks are allowed to exist after the expanding test on the specimen.

The rate of expanding of the outer diameter for the specimens shall comply with the specifications indicated in Table 3.

Table 3 Rate of Expanding of Outer Diameter of Steel Tubes

Type of steel tube	Rate of expanding of outer diameter of steel tubes, %		
	Inner/outer diameter		
	≤ 0.6	$>0.6\sim 0.8$	>0.8
High quality carbon steel	10	12	17
Low alloy steel	8	10	15

4.5.3 Bend test

For steel tubes with an outer diameter ≤ 22 mm, bend test can be carried out based on the requirements of the client and through mutual discussions between the client and supplier and with indication in the contract. The bending angle is 90° and bending radius is 6 times of the outer diameter of the steel tube and no cracks or gaps are allowed at the bends.

4.5.4 Hydrostatic pressure test

Steel tubes shall be hydrostatic pressure tested piece by piece. The testing pressure shall be calculated according to the following equation with the maximum pressure not greater than 19MPa.

$$P = \frac{2sR}{D} \quad (2)$$

where: P—Testing pressure, MPa;

s—Nominal wall thickness of steel tube, mm;

D—Nominal outer diameter of steel tube, mm;

R—Permissible stress, 60% of the specified yield point, MPa.

Under the testing pressure, the pressure holding time shall be guaranteed no less than 5s, and no leakage is allowed on the tube.

The supplier may carry out ultrasonic test, eddy current test or magnetic leakage flux test instead of hydrostatic pressure test. When ultrasonic test is carried out, the depth of the longitudinal notch on the outer surface of the contrast specimen shall be 12.5% of the nominal wall thickness of the steel tube; when eddy current test is carried out, acceptance level A of GB/T 7735-1995 shall be adopted; when magnetic leakage flux test is carried out; the longitudinal notch on the outer surface of the contrast specimen shall comply with the specifications indicated in N12.5 of GB/T 12606-1990, i.e. the minimum depth is 0.5mm and the maximum depth is 1.5mm.

4.6 Surface quality

No crack, folding, rolled scrimp, separation layer and scab are allowed to exist. These defects shall be completely removed and the removal depth shall not exceed the negative tolerance of the nominal wall thickness.

The other defects that do not exceed the negative tolerance of the wall thickness shall be allowed to exist.

5. Testing Methods

5.1 The dimensions and shapes of steel tubes shall be measured piece by piece using

measuring tools conforming to the requirements of accuracy.

5.2 The inner and outer surfaces of steel tubes shall be visual checked piece by piece with

adequate lighting.

5.3 Other testing items of steel tubes shall comply with the specifications of Table 4.

Table 4 Testing Items for Steel Tubes

No.	Testing item	Testing method	Number of specimen
1	Chemical composition	GB/T 222 GB/T 223	A specimen per hearth.
2	Tensile test	GB/T 228	A specimen taken from each of two pieces of steel pipes per hearth.
3	Flattening test	GB/T 246	A specimen taken from each of two pieces of steel pipes per hearth.

No.	Testing item	Testing method	Number of specimen
4	Expanding test	GB/T 242	A specimen taken from each of two pieces of steel pipes per hearth.
5	Bending test	GB/T 244	A specimen taken from each of two pieces of steel pipes per hearth.
6	Hydrostatic pressure test	GB/T 241	Piece by piece.
7	Eddy-current test	GB/T 7735	Piece by piece.
8	Ultrasonic test	GB/T 5777	Piece by piece.
9	Magnetic leakage flux test	GB/T 12606	Piece by piece.

6. Provisions for checking

6.1 Inspection and acceptance

Inspection and acceptance of steel pipes shall be made by the technical supervision department of supplier.

6.2 Rules for grouping batches

Steel pipes shall be inspected and accepted in batches. Each batch shall be composed of the steel pipes manufactured with same grade no., same heat, same size and same heat treatment system (furnace no.). The quantity of each batch of steel pipes shall not be beyond the following provisions:

OD \leq 76mm and wall thickness \leq 3mm..... 400 pieces

OD > 351mm50 pieces

Other sizes200 pieces

If the quantity of the remaining tubes is not less than 50% of the above-mentioned quantity, one separate batch shall be set; if it is less than 50% of the above-mentioned quantity, the remaining tubes can be included into the neighbouring batch of the same grade no., same furnace (port) no..

High quality carbon steel may be grouped into one batch of same size and grade no., but different furnace (port) no. if no special requirements were raised by the client in advance.

6.3 Number of specimens

Number of specimens for each testing item of steel pipes every batch shall be based on the specifications made in Table 4.

6.4 Verification and qualification rules

Verification and qualification of steel pipes shall be made according to the relevant provisions in GB/T 2102.

7. Packing, Marking and Quality Certification

The packing, marking and quality certification shall conform to the relevant provisions of GB/T 2102.

The inner and outer surfaces of steel tubes can be applied with protective coatings based on the requirements of the client and indicated in the contract. The material for protective coatings shall be determined by the supplier if no special requirements are raised by the client.