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NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.140.75

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GB/T 8162-2008

Replacing GB/T 8162-1999

Seamless Steel Tubes for Structural Purposes

结构用无缝钢管

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Issued on: August 19, 2008

Implemented on: April 1, 2009

**Jointly 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.....	3
1. Scope.....	4
2. Normative References	4
3. Order content	8
4. Dimension, shape, and weight	8
4.1 Outer diameter and wall thickness	8
4.2 Allowable deviation of outer diameter and wall thickness.....	9
4.3 Length	10
4.4 Bending degree	10
4.5 Non-circularity and wall unevenness	11
4.6 Terminal shape	11
4.7 Weight	11
5. Technical requirements	12
5.1 Grade and chemical composition of steel	12
5.2 Manufacturing method.....	13
5.3 Delivery state	13
5.4 Mechanical properties	13
5.5 Process properties	17
5.6 Surface quality	18
5.7 Non-destructive test	18
6. Test method	18
7. Inspection rules.....	19
8. Packaging, marking, and quality certification	20

Foreword

This Standard is not equivalent to EN 10297-1:2003 "Seamless Circular Steel Tubes for Mechanical and General Engineering Purposes - Technical Delivery Conditions".

This Standard replaces GB/T 8162-1999 "Seamless Steel Tubes for Structural Purposes". Compared with GB/T 8162-1999, the main changes of this Standard are as follows:

- ADD order content;
- MODIFY allowable deviation of the dimension;
- ADD requirements of the full-length bending degree;
- ADD requirements of the terminal oblique cutting;
- CANCEL marking examples;
- ADD steel grades;
- CANCEL requirements of the expanding test;
- ADD negotiation provisions of the non-destructive test.

This Standard was proposed by China Iron & Steel Association.

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

Main drafting organizations of this Standard: An'gang Steel Co., Ltd., Pangang Group Chengdu Iron & Steel Co., Ltd., and Hunan Hengyang Steel Tube Group Co., Ltd.

Main drafters of this Standard: Zhang Huixuan, Zhang Peng, Piao Zhimin, Li Qi, Zhao Bin, and Li Zhi.

The previous editions replaced by this Standard are as follows:

- GB/T 8162-1987, GB/T 8162-1999.

Seamless Steel Tubes for Structural Purposes

GB/T 8162-2008

1. Scope

This Standard specifies order content, dimension, shape, weight, technical requirements, test methods, inspection rules, packaging, marking, and quality certificate of seamless steel tubes for structural purposes.

This Standard is applicable to seamless steel tubes for mechanical and general engineering structural purposes.

2. Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

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

GB/T 223.3 Methods for Chemical Analysis of Iron, Steel and Alloy - The Diantipyrylmethane Phosphomolybdate Gravimetric Method for the Determination of Phosphorus Content

GB/T 223.5 Methods for Chemical Analysis of Iron, Steel and Alloy - The Reduced Molybdosilicate Spectrophotometric Method for the Determination of Acid-soluble Silicon Content

GB/T 223.8 Methods for Chemical Analysis of Iron, Steel and Alloy - The Sodium Fluoride Separation - EDTA Titration Method for the Determination of Aluminium Content

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

GB/T 223.11 Methods for Chemical Analysis of Iron, Steel and Alloy - The Ammonium Persulfate Oxidation Volumetric Method for the Determination of Chromium Content

GB/T 223.12 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 223.13 Methods for Chemical Analysis of Iron, Steel and Alloy - The Ammonium Ferrous Sulfate Titration Method for the Determination of Vanadium Content

GB/T 223.14 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 223.16 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 223.19 Methods for Chemical Analysis of Iron Steel and Alloy - The Neocuproine-chloroform Extraction Photometric Method for the Determination of Copper Content

GB/T 223.23 Iron Steel and Alloy - Determination of Nickel Content - The Dimethylglyoxime Spectrophotometric Method

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 223.26 Iron Steel and Alloy - Determination of Molybdenum Content - The Thiocyanate Spectrophotometric Method

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

GB/T 223.37 Methods for Chemical Analysis of Iron Steel and Alloy - The Indophenol Blue Photometric Methods for the Determination of Nitrogen Content after Distillation Separation

GB/T 223.40 Methods for Chemical Analysis of Iron, Steel and Alloy - The Sulphochlorophenol S Photometric Method for the Determination of Niobium Content

GB/T 223.43 Iron Steel and Alloy - Determination of Tungsten Content - Gravimetric Method and Spectrophotometric Method

GB/T 223.53 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 Methods for Chemical Analysis of Iron, Steel and Alloy - The Flame

Atomic Absorption Spectrophotometric Method for the Determination of Nickel Content

GB/T 223.58 Methods for Chemical Analysis of Iron, Steel and Alloy - The Sodium Arsenite-sodium Nitrite Titrimetric Method for the Determination of Manganese Content

GB/T 223.59 Methods for Chemical Analysis of Iron, Steel and Alloy - The Reduced Molybdoantimonyl Phosphoric Acid Photometric Method for the Determination of Phosphorus Content

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 223.61 Methods for Chemical Analysis of Iron, Steel and Alloy - The Ammonium Phosphomolybdate Volumetric Method for the Determination of Phosphorus 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 223.64 Iron Steel and Alloyed - Determination of Manganese Content - Flame Atomic Absorption Spectrometric Method

GB/T 223.66 Methods for Chemical Analysis of Iron, Steel and Alloy - The Thiocyanate-chlorpromazine Hydrochloride-Chloroform Extraction Photometric Method for the Determination of Tungsten Content

GB/T 223.67 Iron Steel and Alloy - Determination of Sulfur Content-Methylene Blue Spectrophotometric Method

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 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 223.71 Methods for Chemical Analysis of Iron, Steel and Alloy - The Gravimetric Method after Combustion in the Pipe Furnace for the Determination of Carbon Content

GB/T 223.72 Iron Steel and Alloy - Determination of Sulfur Content - Gravimetric Method

GB/T 223.74 Methods for Chemical Analysis of Iron, Steel and Alloy - The Combustion Gravimetric/gas - Volumetric Method for the Determination of Combined Carbon Content

GB/T 223.75 Iron Steel and Alloy - Determination of Boron Content - Methanol Distillation-Curcumin Photometric Method

GB/T 223.76 Methods for Chemical Analysis of Iron, Steel and Alloy - The Flame Atomic Absorption Spectrometric Method for the Determination of Vanadium Content

GB/T 223.78 Methods for Chemical Analysis of Iron, Steel and Alloy - Curcumin Spectrophotometric Method for the Determination of Boron Content (GB/T 223.78-2000, ISO 10153:1997, IDT)

GB/T 228 Metallic Materials - Tensile Testing at Ambient Temperature (GB/T 228-2002, eqv ISO 6892:1998)

GB/T 229 Metallic Materials - Charpy Pendulum Impact Test Method (GB/T 229-2007, ISO 148-1:2006, MOD)

GB/T 231.1 Metallic Materials - Brinell Hardness Test-Part 1: Test Method (GB/T 231.1-2002, ISO 6506-1:1999, EQV)

GB/T 244 Metallic Materials - Tube-Bend Test (GB/T 244-2008, ISO 8491:1996, IDT)

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

GB/T 699 Quality Carbon Structural Steels

GB/T 1591 Low-alloy High-tensile Structural Steel

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

GB/T 2975 Steel and Steel Products - Location and Preparation of Test Pieces for Mechanical Testing (GB/T 2975- 1998, eqv ISO 377:1997)

GB/T 3077 Alloy Structure Steels

GB/T 4336 Standard Test Method For Spark Discharge Atomic Emission Spectrometric Analysis of Carbon and Low-alloy Steel (Routine Method)

GB/T 5777 Seamless Steel Pipe and Tubing-methods for Ultrasonic Testing (GB/T 5777-2008, ISO 9303:1989, MOD)

GB/T 7735 Steel Tubes - the Inspection Method on Eddy Current Test (GB/T 7735-2004, ISO 9304:1989, MOD)

GB/T 12606 Steel Tubes - The Testing Method of Magnetic Flux Leakage (GB/T 12606- 1999, eqv ISO 9402:1989, ISO 9598:1989)

GB/T 17395 Dimensions, Shapes, Masses and Tolerances of Seamless Steel Tubes (GB/T 17395-2008, ISO 1127:1992, ISO 4200:1991, ISO 5252:1991, NEQ)

GB/T 20066 Steel and Iron - Sampling and Preparation of Samples for the Determination of Chemical Composition (GB/T 20066-2006, ISO 14284:1996, IDT)

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 20123-2006, ISO 15350:2000, IDT)

GB/T 20124 Steel and Iron - Determination of Nitrogen Content - Thermal Conductimetric Method after Fusion in a Current of Inert Gas (Routine Method) (GB/T 20124-2006, ISO 15351:1999, IDT)

GB/T 20125 Low-Alloy Steel-Determination of Multi-element Contents-Inductively Coupled Plasma Atomic Emission Spectrometric Method

3. Order content

Contract or order ordering steel pipes, according to this Standard, shall include the following contents:

- a) Standard number;
- b) Product name;
- c) Grade of steel - If there is quality classification, it needs to be indicated;
- d) Dimensions;
- e) Order quantity (total weight or total length);
- f) Delivery state;
- g) Special requirements.

4. Dimension, shape, and weight

4.1 Outer diameter and wall thickness

The outer diameter (D) and wall thickness (S) of steel tubes shall comply with the

5.2 Manufacturing method

5.2.1 Smelting method of steel

The steel shall be smelted with electric arc furnace plus out-of-furnace refining or oxygen converter plus out-of-furnace refining method.

Through the mutual negotiation of the purchaser and the supplier, the steel may also be smelted by other methods with higher requirements. If the purchaser specifies some smelting method, the smelting method shall be clearly indicated in the contract.

5.2.2 Manufacturing method of the tubular billet

The tubular billet is manufactured by the method of continuous casting or hot rolling (forging). And the steel ingot may also be used as tubular billet directly.

5.2.3 Manufacturing method of the steel tube

The steel tube shall be manufactured by the method of hot rolling (extruding and expanding) or cold drawing (rolling) seamless. If the purchaser specifies some steel tube manufacturing method, the manufacturing method shall be clearly indicated in the contract.

5.3 Delivery state

5.3.1 The hot rolling (extruding and expanding) steel tube shall be delivered in hot rolling state or heat treatment condition. If the purchaser requires delivery in heat treatment condition, it shall be clearly indicated in the contract.

5.3.2 The cold drawing (rolling) steel tube shall be delivered in heat treatment condition. According to the requirement of the purchaser, through the mutual negotiation of the purchaser and the supplier, and indicated in the contract, the cold drawing (rolling) steel tube may be delivered in cold drawing (rolling) state as well.

5.4 Mechanical properties

5.4.1 Tensile property

5.4.1.1 As for quality carbon structural steel, low-alloy high-tensile structural steel, or Q235 and Q275 steel tubes, their tensile property in their delivery state shall comply with specifications in Table 6.

5.4.1.2 Sample blank of alloy structure steel tube is heat-treated according to heat treatment system recommended in Table 7, and the longitudinal tensile property measured for the sample shall comply with specifications in Table 7.

5.4.1.3 The mechanical properties of steel tube delivered in cold drawing (rolling) state shall be agreed by both the purchaser and the supplier.

Table 7 (Continued)

S/N	Grade	Recommended heat treatment system ^a					Tensile property			Brinell
		Quenching (normalizing)			Tempering		Tensile strength R _m /MPa	Lower yield strength R _{eL} /MPa	After-fracture elongation rate A/%	Hardness of steel tube annealing or high tempering in delivery state
		Temperature /°C		Coolant	Temperature /°C	Coolant				
		First time	Second time							
27	20CrMnTi ^{d,e}	880	870	oil	200	Water and air	1080	835	10	217
28	30CrMnTi ^{d,e}	880	850	oil	200	Water and air	1470	—	9	229
29	12CrNi2	860	780	Water and oil	200	Water and air	785	590	12	207
30	12CrNi3	860	780	oil	200	Water and air	930	685	11	217
31	12Cr2Ni4	860	780	oil	200	Water and air	1080	835	10	269
32	40CrNiMoA	850	—	oil	600	Water and oil	980	835	12	269
33	45CrNiMoVA	860	—	oil	460	oil	1470	1325	7	269

^a The permissible adjustment range of heat treatment temperature listed in the table: $\pm 20^{\circ}\text{C}$ for quenching; $\pm 30^{\circ}\text{C}$ for low-temperature tempering; $\pm 50^{\circ}\text{C}$ for high-temperature tempering.

^b The boracic steel may be normalizing before quenching, and the normalizing temperature shall not be higher than its quenching temperature.

^c Deliver according to a group of data specified by the purchaser; when the purchaser does not specify, it may be delivered according to any group of data therein.

^d The first quenching of Cr-Mn-Ti steel may be replaced by normalizing.

^e Isothermal quenching at temperature of $280^{\circ}\text{C} \sim 320^{\circ}\text{C}$.

^f During the tensile test period, if yield strength cannot be measured, the specified non-proportion extension intensity $R_{P0.2}$ may be measured to replace R_{eL} .

5.4.2 Hardness test

For the alloy structure steel tube that is delivered in annealing or high-temperature tempering state and of which the wall thickness is not greater than 5mm, the Brinell hardness shall comply with specifications in Table 7.

5.4.3 Impact test

5.4.3.1 For low-alloy high-tensile structural steel and Q235 or Q275 steel tubes, when their outer diameter is not less than 70mm and their wall thickness is not less than 6.5 mm, it shall carry out impact test. And the impact absorption energy and test temperature of its Charpy V-notch impact test shall comply with specifications in Table 6. Impact absorption energy is calculated according to arithmetic mean value of three samples of one group. And single value of one of the samples therein is allowed to be less than the specified value, but it shall not be less than 70% of the specified value.

5.4.3.2 Impact absorption energy listed in Table 6 is the required value of impact absorption energy for Charpy V-notch samples in standard dimension. When the steel

5.6 Surface quality

Inner and outer surfaces of the steel tube are not allowed to occur visible crack, folding, scar, rolling, and delamination. These flaws shall be removed completely, and the removing depth shall not be more than the negative deviation of the nominal wall thickness; the actual wall thickness at the removing place shall not be less than the minimum value that is allowed by the wall thickness deviation.

Other local flaws that do not exceed the negative deviation of wall thickness are allowed to exist.

5.7 Non-destructive test

According to the requirements of the purchaser, through mutual negotiation of both the purchaser and the supplier, and indicated in the contract, the steel tube may be non-destructive tested with one or more of the following methods, or with other methods.

- a) CONDUCT ultrasonic inspection according to GB/T 5777, the manual flaw dimensions are: L3 (C10) for cold drawing (rolling) pipe; L4 (C12) for hot rolling (extruding and expanding steel tube);
- b) CONDUCT eddy current inspection according to specifications of GB/T 7735, the acceptance grade is A;
- c) CONDUCT magnetic leakage test according to specifications of GB/T 12606, the acceptance grade is L4.

6. Test method

6.1 The dimensions and shape of steel tube shall be measured with the measuring tools that meet accuracy requirement.

6.2 The internal and external surfaces of steel tube shall be subject to visual inspection under sufficient lighting conditions.

6.3 The sampling method and test method for other inspection items of steel tube shall comply with specifications in Table 10.

Table 10 Inspection item, sampling quantity, sampling method, and test method of steel tube

No.	Inspection item	sampling quantity	sampling method	test method
1	Chemical composition	One sample from each furnace	GB/T 20066	GB/T 223 GB/T 4336 GB/T 20123 GB/T 20124 GB/T 20125
2	Tensile test	Take 1 sample from 2 tubes respectively, for each batch	GB/T 2975	GB/T 228

7.3 Sampling quantity

The sampling quantity for each inspection item of each batch steel tube shall comply with specifications in Table 10.

7.4 Re-inspection and determination rules

The re-inspection and determination of steel tubes shall comply with specifications in GB/T 2102.

8. Packaging, marking, and quality certification

The packaging, marking, and quality certification of steel tubes shall comply with specifications in GB/T 2102.

_____ **END** _____

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