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OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 714-2015

Replacing GB/T 714-2008

Structural steel for bridge

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard replaces GB/T 714-2008 “Structural steel for bridge”. As compared with GB/T 714-2008, the main technical changes are as follows:

- INCREASE the thickness range to 150 mm;
- ADD the terms and definitions (SEE Chapter 3);
- CANCEL the Q235q steel designation (SEE 2008 version);
- Based on the different delivery status, respectively SPECIFY the chemical compositions of the steel of different designations;
- CONTROL stricter the P, S and N element in the chemical composition, and ADD the requirements of H element (SEE Table 1 ~ Table 5);
- ADD the technical requirements for the quality class F of Q420q and above designation steel (SEE Table 1, Table 3, Table 4, Table 5, Table 8);
- CHANGE the defective part of the strip which shall not exceed 8% of the total length of each coil of strip into not exceeding 6%;
- ADD the yield strength ratio of the recommended steels in Appendix B (informative);
- ADD Appendix C (informative) for the guidance of the weathering resistance assessment for bridge steels.

This standard was proposed by China Iron and Steel Association.

This standard shall be under the jurisdiction of National Steel Standardization Technical Committee (SAC/TC 183).

The main drafting organizations of this standard: Anshan Iron and Steel Group Corporation, Metallurgical Industry Information Standards Research Institute, Tianjin Iron and Steel Group Co., Ltd., Xinyu Iron and Steel Co., Ltd., Jiangsu Shagang Group Co., Ltd., Nanyang Hanye Special Steel Co., Ltd., Hunan Valin Xiangtan Iron & (Group) Co., Ltd., Fujian Sanming Iron and Steel Group Co., Ltd., Hebei Iron and Steel Co., Ltd. Handan Branch, Wuhan Iron and Steel Co., Ltd., Shougang Corporation.

Structural steel for bridges

1 Scope

This standard specifies the terms and definitions, the designation presentation methods, the order content, dimensions, shape, mass and allowable tolerances, technical requirements, test methods, inspection rules, packaging, marking and quality certificates of the structural steel for bridge.

This standard is applicable to the structural steel sheets of the thickness not more than 150 mm, the structural steel strips and shear steel sheets of the thickness not more than 25.4 mm for bridges, AND the structural steel of the thickness not more than 40 mm for bridges.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 222 Permissible tolerances for chemical composition of steel products;

GB/T 223.5 Steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdo-silicate spectrophotometric method;

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 223.14 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 223.19 Methods for chemical analysis of iron, steel and alloy - The neocuproin-hydrochlorid monnohydrat trichloromethane extraction photometric method for the determination of copper content;

GB/T 223.23 Iron and steel alloys - Determination of nickel content – The dimethylglyoxime spectrophotometric method;

GB/T 223.26 Iron, steel and alloy - Determination of molybdenum content – The thiocyanate spectrophotometric method;

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 periodate (potassium) photometric method for the determination of manganese content;

GB/T 223.64 Iron, steel and alloy - Determination of manganese content - Flame atomic absorption spectrometric method;

GB/T 223.72 Steel and alloy - Determination of sulfur content - Gravimetric method;

GB/T 223.78 Methods for chemical analysis of iron, steel and alloy - Curcumin spectrophotometric method for the determination of boron content;

GB/T 223.79 Iron and steel - Determination of multi-element content - X-ray fluorescence spectrometry (Routine method);

GB/T 223.81 Iron, steel and alloy - Determination of total aluminium and total boron contents - Microwave digestion-inductively coupled plasma mass spectrometric method;

GB/T 223.82 Steel and iron - Determination of hydrogen content - Inert gas pulse fusion heat conductivity method;

GB/T 223.84 Steel and iron - Determination of titanium content - Diantipyrylmethane spectrophotometric method;

GB/T 223.85 Steel and iron - Determination of sulfur content - Infrared absorption method after combustion in induction furnace;

GB/T 223.86 Steel and iron - Determination of total carbon content - Infrared absorption method after combustion in induction furnaces;

GB/T 228.1 Metallic materials - Tensile testing - Part 1: Method of test at room temperature;

GB/T 229 Metallic materials - Charpy pendulum impact test method;

GB/T 232 Metallic materials - Bend test;

GB/T 247 General rules of acceptance, package, mark and certification for steel sheets and strips;

GB/T 706 Hot rolled section steel;

GB/T 709 Dimension, shape, weight and tolerances for hot rolled sheets and strips;

GB/T 2101 General requirements of acceptance packaging marking and certification for section steel;

GB/T 2970 Method for ultrasonic testing of thicker steel plates

GB/T 2975 Steel and steel products – Location and preparation of test pieces for mechanical testing;

GB/T 4336 Carbon and low-alloy steel – Determination of multi-element contents - Spark discharge atomic emission spectrometric method (Routine method);

GB/T 5313 Steel plates with through-thickness characteristics;

GB/T 8170 Rules for rounding off for numerical values & expression and judgement of limiting values;

GB/T 11263 Hot-rolled H and cut T section steel;

GB/T 14977 General requirements for surface condition of hot-rolled steel plates;

GB/T 17505 Steel and steel products - General technical delivery requirements;

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 (Routine method);

GB/T 20125 Low-alloy steel - Determination of multi-element contents - Inductively coupled plasma atomic emission spectrometric method;

first letter of the Chinese phonetic alphabet of the bridge character, the quality grade symbol, and so on.

Example: Q420qD. Wherein:

Q - The first letter of the Chinese phonetic alphabet “qu” of the yield strength of bridge steel [Translator note: “qu” represents “yield strength”];

420 - The specified minimum yield strength value, in the unit of MPa;

q - The first letter of the Chinese phonetic alphabet “qiao” of the bridge steel [Translator note: “qiao” represents “bridge”];;

D - The quality grade is D.

As for the grade D steel sheet which is delivered in thermo-mechanical rolling state, if it has the weather resistance and thickness direction properties, then after the aforementioned designation, respectively ADD the performance level code of the weather resistance (NH) and the thickness direction (Z direction).

Example: Q420qDNHZ15.

5 Order content

When ordering, the buyer shall provide the following information in the contract or order:

- a) This standard number;
- b) The product name (steel sheet, steel strip or section steel);
- c) Designations;
- d) Specifications;
- e) Dimension and shape accuracy requirements;
- f) Weight (quantity);
- g) Delivery status;
- h) Special requirements.

further cut a group of samples (3) for the test. The arithmetical mean of the 6 samples shall not be less than the specified value; it is allowed for 2 samples to be below the specified value, BUT it is only allowed for 1 sample to be less than 70% of the specified value.

7.4.5 The cross section shrinkage rate of Z-direction steel sheet along the thickness direction shall comply with the provisions of GB/T 5313.

7.4.6 As for the recommended yield strength ratio of steel, SEE Appendix B.

7.5 Process performance

The bending test of steel shall comply with the provisions of Table 9. If the supplier guarantees, it may not be subjected to bending test.

Table 9 Process performance

180° bending test		
Thickness ≤ 16mm	Thickness > 16mm	Bending results
D = 2a	D = 3a	There shall be no visible cracks on the outer surface of the sample
Note: D – Bending head diameter; a – Sample thickness.		

7.6 Surface quality

7.6.1 The steel surface shall not have bubbles, scarring, cracks, folding, inclusions, included oxide scale, and other harmful effects which may adversely affect use. The steel shall not have visible delamination.

7.6.2 It is allowed for the steel surface to have a thin layer of oxide scale, rust and inconspicuous surface roughness, textures, scratches and other local imperfections due to inclusion of the oxide scales and rollers, which do not affect the surface defect inspection. However, their depth shall not be over half of the steel thickness tolerance, AND it shall ensure the allowable minimum thickness of the steel.

7.6.3 It is allowed for the surface defects of the steel to be removed by the means of grinding and other methods. The clean-up place shall be smooth and free from edges and corners. The depth of cleaning shall not be greater than the negative deviation of the thickness of the steel material, AND it shall ensure the allowable minimum thickness of the steel.

7.6.4 It is allowed for the steel strip to have defects, BUT the defective portion shall be not more than 6% of the total length of each coil of strip.

7.6.5 Through negotiation between the supplier and the buyer, the steel surface quality may follow the provisions of GB/T 14977.

6	Non-destructive testing	One by one	-	GB/T 2970 or as negotiated
7	Surface quality	One by one	-	Visual inspection and measurement
8	Size and shape	One by one	-	Appropriate gauge

9 Inspection rules

9.1 Inspection and acceptance

The inspection and acceptance of the steel products shall be conducted by the technical supervision department of the supplier.

9.2 Batching

9.2.1 The steel shall be inspected and accepted in batches. Each batch shall be composed of the steels of same designation, same furnace number, same specifications, same rolling system, and same heat treatment system, AND the mass of each batch shall be not more than 60 t. The steel sheet and continuous rolled sheet more than 30 t of coil mass can be batched into two rolling coils.

9.2.2 The test batch quantities of the mechanical property test along the thickness direction shall comply with the provisions of GB/T 5313.

9.3 Re-inspection and judgement rules

9.3.1 When the impact test results of steel do not comply with the requirements of 7.4.4, the sampled steel shall not be accepted; RE-TAKE another two sample products from the remaining portion of this test unit, respectively TAKE a group of 3 samples from each product, AND the test results of these two groups of sample shall be qualified; otherwise this batch of steel shall be rejected.

9.3.2 The re-test and judgement of the tensile test and bending test of the steel shall comply with the provisions of GB/T 17505.

9.3.3 The re-test and judgement of the shrinkage ratio of the Z-direction steel along thickness direction shall comply with the provisions of GB/T 5313.

9.4 Rounding off of mechanical properties and chemical composition test results

Appendix C

(Informative)

Guidance for the assessment of atmospheric corrosion resistance of weathering bridge steels

C.1 Scope

This Appendix provides a method of assessing the atmospheric corrosion resistance performance of low-alloy steels through chemical composition. With reference to this appendix, it can assess the relative size of the corrosion resistance performance of the steel of different designations. In the relevant ASTM standards, when the steel has good resistance to atmospheric corrosion, it is required that, in accordance with this Appendix, the calculated corrosion index shall be 6.0 or above.

The method uses a prediction equation which is based on the chemical composition of steel to calculate the corrosion resistance index of the steel.

Since a variety of corrosion resistance indices are used in the world, when selecting one indicator, it is necessary to take into account the different application environments and the chemical composition of the steel. Depending on the environment of use and the chemical composition of the steel, any index may not be applicable; therefore, it is necessary for the supplier and the buyer to jointly determine which index to use and which size to use in the intended use environment.

C.2 Definitions

C.2.1

Low alloy steel

Low alloy steels are the carbon steels containing more than 1% but less than 5% total alloying elements.

Note: Most "low alloy weathering steels" contain added Cr and Cu elements, AND may also contain added Si, Ni, P, or other alloying elements that enhance atmospheric corrosion resistance.

C.3 Methodology