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Atmospheric corrosion resisting structural steel

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Foreword

This standard refers to EN 10025-5:2004 "Hot rolled products of structural steels - Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance" ISO 4952:2006 "Structural steels with improved atmospheric corrosion resistance", ISO 5952:2005 "Continuously hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance", ASTM A242/A242M-04 "Standard specification for high-strength low-alloy steel", ASTM A588/A588M-05 "Standard specification for high-strength low-alloy structural steel, up to 50 ksi [345 MPa] minimum yield point, with atmospheric corrosion resistance", ASTM A606-04 "Standard specification for steel, sheet and strip, high-strength low-alloy, hot-rolled and cold-rolled, with improved atmospheric corrosion resistance", ASTM A871/A871M-03 "Standard specification for high-strength low-alloy structural steel plate with atmospheric corrosion resistance", JIS G 3114:2004 "Hot-rolled atmospheric corrosion resisting steels for welded structure", JIS G 3125:2004 "Superior atmospheric corrosion resisting rolled steel", combines the development and application conditions of domestic atmospheric resistance steel, AND integrate and revise GB/T 4171-2000 "Superior atmospheric corrosion resisting structural steel", GB/T 4172-2000 "Atmospheric corrosion resisting steel for welded structure", and GB/T 18982-2003 "Corrosion resistant steel plates and strips for container".

This standard replaces GB/T 4171-2000 "Superior atmospheric corrosion resisting structural steel", GB/T 4172-2000 "Atmospheric corrosion resisting steel for welded structure", and GB/T 18982-2003 "Corrosion resistant steel plates and strips for container".

As compared with the above three standards, in this standard, the following main technical contents are modified:

- RE-DEVELOP the standard name;
- RE-DEVELOP the steel designation;
- RE-ESTABLISH the chemical composition and mechanical properties of each designation;
- ADD an appendix to assess the relative level of atmospheric corrosion resistance.

Appendix A, B, C and D of this standard are informative appendixes.

This standard was proposed by the China Iron and Steel Association.

Atmospheric corrosion resisting structural steel

1 Scope

This standard specifies the dimension, shape, mass and allowable deviations, technical requirements, test methods, inspection rules, packaging, marking and quality certificates of atmospheric corrosion resisting structural steels.

This standard applies to hot-rolled and cold-rolled steel plates, strips and sections with atmospheric corrosion properties for vehicles, bridges, containers, buildings, towers and other structures. The atmospheric corrosion resisting structural steels can also be used to produce the structural parts for bolted, riveted and welded connection.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) 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 Steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdosilicate spectrophotometric method

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 - Visible titration or potentiometric titration method

GB/T 223.14 Methods for chemical analysis of iron, steel and alloy - The N-Benzoy-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 223.19 Methods for chemical analysis of iron, steel and alloy - The copper (II)-tetrachloride-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 223.26 Iron, steel and alloy - Determination of molybdenum content - The thiocyanate spectrophotometric method

GB/T 223.30 Methods for chemical analysis of iron, steel and alloy - The arsenazo III spectrophotometric method for the determination of zirconium content after separation by p-bramomandelic acid

GB/T 223.40 Iron, steel and alloy - Determination of niobium content by the Sulphochlorophenol S spectrophotometric method

GB/T 223.59 Iron and steel alloys - Determination of phosphorus content - Bismuth phosphomolybdate blue spectrophotometric method and antimony phosphomolybdate blue 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 223.61 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 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 223.67 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 Iron, steel and alloy - Determination of carbon contents - Gas-volumetric method after combustion in the pipe furnace

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 223.76 Methods for chemical analysis of iron, steel and alloy - The flame atomic absorption spectrometric method for the determination of vanadium content

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 1481:2006, MOD)

GB/T 232 Metallic materials - Bend test (GB/T 232-1999, eqv ISO 7438:1985)

GB/T 247 General rules of package mark and certification for steel plates (sheets) and strips

GB/T 708 Dimension, shape, weight, and tolerance for cold-rolled steel plate

GB/T 709 Dimension, shape, weight, and tolerance for hot-rolled steel sheets and strips

GB/T 2101 General provisions on acceptance, package, marking and quality certificates of the profiled steel

GB/T 2975 Steel and steel products – Location and preparation of test pieces for mechanical testing (GB/T 2975-1998, eqv ISO377:1997)

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

GB/T 6394 Metal-methods for estimating the average grain size

9 Inspection rules

9.1 Batching rules

Steel shall be subjected to acceptance in batches. Each batch is composed of steel of same designation, same heat, same specification, same rolling system, and same supply state; AND the mass of each batch of cold-rolled product shall not exceed 30 t.

9.2 Re-inspection

9.2.1 If the impact test results do not meet the requirements, it shall, from the same sampling products, re-take 3 test specimens for test, AND the mean value of the 6 test specimens shall be not less than the value as specified in Table 5; it is allowed for the value of the 2 test specimens to be less than the specified value, BUT it is only allowed to have 1 test specimen which is less than 70% of the specified value.

9.2.2 The other re-inspection items of steel shall comply with GB/T 17505 or GB/T 2101.

9.3 Rounding off of values

Unless otherwise specified in the contract or order, when it is needed to assess whether the test results meet the specified value, the rounding off method shall follow the provisions of YB/T 081.

10 Packaging, marking and quality certificates

The packaging, marking and quality certificate of steel shall comply with GB/T 247 or GB/T 2101.

Appendix C

(Informative)

Additional information to improve the atmospheric corrosion resistance steel

The corrosion resistance effect of self-protection oxide layer is related to its composition and the alloying element and their components in the steel. The atmospheric corrosion resistance performance depends on the alternating wet and dry climates during which the self-protection oxide layer of the substrate is formed. The protection effect provided is related to the environment, its location in the structure, and other conditions.

In the design and production process of structural parts, it shall specify the formation and regeneration of the surface self-protection oxide layer. For the designer, it shall consider the corrosion of the exposed steel in the calculation process, OR improve the product thickness to compensate for the erosion.

When the air contains certain special chemicals OR the structural parts are exposed to water for long period of time, always exposed in wet air, or used in maritime climates, it is recommended to use the conventional surface protection. Before painting, it is required to remove the surface oxide scale from the product. Under the same conditions, the corrosion sensitivity of atmospheric corrosion resistance steel after painting is less than that of ordinary structural steel.

The surface of the unexposed structural part is associated with the manufacturing process, AND it is required for ventilation. Otherwise, it shall use appropriate surface protection. The degree of protection is related to the most sensitive climatic conditions and the validity of the structural parts in the corrosion process. Therefore, as for the issue of selecting appropriate product based on different applications, the user shall consult with the manufacturer.

Appendix D

(Informative)

Guidelines for assessing atmospheric corrosion resistance of low-alloy steels

This appendix is translated from the abstract from Appendix A of ISO 5952:2005, AND the details related to this can be found in ASTM G101. With reference to this appendix, it can assess the relative level of the corrosion resistance of each designation. In relevant ASTM standards, when the steel has good atmospheric corrosion resistance performance, it is required that the corrosion resistance index as calculated in accordance with this appendix shall be 6.0 or above.

D.1 Scope

This appendix provides a method of assessing the atmospheric corrosion resistance of low-alloy steels from chemical composition data.

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

Since a variety of corrosion resistance indices are used in the world, it is necessary to take into account the different environments and the chemical composition of the steel when selecting an index. Any index may not be applicable based on the environment of use and the chemical composition of the steel, so it is necessary for the supplier and the purchaser to jointly determine which index to use and the requirement levels of that index for the expected environment.

D.2 Terminology

Low-alloy steel means carbon steels containing more than 1% but less than 5% by mass, of total alloying elements.

Note: Most “low-alloy atmospheric corrosion resistance steels” contain additions of both chromium and copper, and can also contain additions of silicon, nickel, phosphorous, or other elements which enhance atmospheric corrosion resistance.

D.3 Method

D.3.1 Equations for predicting the corrosion penetration of low-alloy steels after 15.5 years of exposure to various atmospheres, based on the chemical

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