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Replacing GB/T 18254-2000

High-carbon Chromium Bearing Steel

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Foreword

This Standard is a revision of GB/T 18254-2000 “High-carbon Chromium Bearing Steel”.

Compared with GB/T 18254-2000, the changes of main technical contents in this Standard are as follows:

— Provisions on the continuously cast steel were added;

— This Standard was re-drafted according to GB/T 1.1-2000 “Directives for Standardization-Part 1: Rules for the Structure and Drafting of Standards”.

Appendix A of this Standard is normative.

This Standard was proposed by the State Metallurgical Industry Bureau.

This Standard shall be under the jurisdiction of the National Technical Committee on Iron and Steel of Standardization Administration of China.

Responsible drafting organizations of this Standard: Baosteel Group Shanghai No.5 Steel Co., Ltd., LuoYang Bearing Research Institute, Metallurgical Industry Information and Standardization Institute, and Iron & Steel Research Institute.

Chief drafting staffs of this Standard: Shen Jianchang, Lei Jianzhong, Luan Yan, Wei Guoneng, and Wang Shentian.

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Participating drafting staffs of this Standard: Li Zheng, Wang Hongjun, Liu Kelin, Zhen Juan, and Mei Yali.

This Standard was issued in November 2000 for the first-time.

High-carbon Chromium Bearing Steel

[Translator Note: Text in red indicates the “Amendment 1”]

1 Scope

This Standard specifies the order contents, dimension, shape, technical requirements, test methods, inspection rules, packaging, marking and quality certificate of the high-carbon chromium bearing steel.

This Standard is applicable to the hot-rolled or forged round-steels, wire-rods, cold-drawn (cold-rolled) round-steels (straight-strip or disc-shaped) and steel-pipes that are made of high-carbon chromium bearing steel and used for manufacturing bearing ring and rolling body. The continuously cast steel is not recommended to be adopted as the steel for manufacturing steel balls.

Based on the agreement by both the supplier and the purchaser, steels and steel-billets of other varieties and specifications may also be supplied; and the specific requirements shall be indicated in the contract.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For dated reference, the subsequent amendments (excluding corrigendum) or revisions of these publications do not apply. However, all parties who enter into an agreement according to this Standard are encouraged to study whether the latest edition of these documents is applicable. For undated references, the latest edition of the normative document referred to applies.

GB/T 222 Method of Sampling Steel for Determination of Chemical Composition and Permissible Variations for Product Analysis

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 223.10 Methods for Chemical Analysis of Iron, Steel and Alloy - The Cupferron Separation - Chrome Azurol S Photometric Method for the

Determination of Aluminium Content

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 223.18 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 Methods for Chemical Analysis of Iron, Steel and Alloy - The Dimethylglyoxime Spectrophotometric Method for the Determination of Nickel Content

GB/T 223.24 Methods for Chemical Analysis of Iron, Steel and Alloy - The Extraction Separation - The Dimethylglyoxime Spectrophotometric Method for the Determination of Nickel Content

GB/T 223.26 Methods for Chemical Analysis of Iron, Steel and Alloy - The Thiocyanate Direct Photometric Method for the Determination of Molybderum Content

GB/T 223.27 Methods for Chemical Analysis of Iron, Steel and Alloy - The Thiocyanate-butyl Acetate Extraction Spectrophotometric Method for the Determination of Molybdenum Content

GB/T 223.29 Methods for Chemical Analysis of Iron, Steel and Alloy - The Xylenol Orange Photometric Method for Determination of Lead Content after Carrier Precipitation

GB/T 223.31 Methods for Chemical Analysis of Iron, Steel and Alloy - The Distillation-Molybdenum Blue Spectrophotometric Method for the Determination of Arsenic Content

GB/T 223.47 Methods for Chemical Analysis of Iron, Steel and Alloy - The Carrier Precipitation - Molybdenum Blue Photometric Method for the Determination of Antimony Content

GB/T 223.50 Methods for Chemical Analysis of Iron, Steel and Alloy - The phenylfuorone-CTMAB Direct Photometric Method for the Determination of Tin Content

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 (eqv ISO/DIS 4940)

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 (neq ISO R 629)

GB/T 223.64 Methods for Chemical Analysis of Iron, Steel and Alloy - The Flame Atomic Absorption Spectrometric Method for the Determination of Manganese Content

GB/T 223.67 Methods for Chemical Analysis of Iron, Steel and Alloy - The Reducing Distillation - Methylene Blue Photometric Method for the Determination of Sulfur 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 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 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 224 Determination of Depth of Decarburization of Steel (eqv ISO 3887)

GB/T 231 Metallic Materials - Brinell Hardness Test - Part 1: Test Method (eqv ISO 6508.1)

GB/T 233 Metallic Materials - Forging Test

GB/T 702 Hot-rolled Round and Square Steel Bars - Dimension, Shape, Weight and Tolerance

GB/T 905 Dimension, Shape, Weight and Tolerance for Cold-drawn Round, Square and Hexagonal Steels

GB/T 908 Forged Round and Square Steels - Dimension, Shape, Weight and Tolerance

GB/T 1814 Inspection Method for Steel Work Fractures

GB/T 2101 General Requirement of Acceptance Packaging, Marking and Certification for Section Steel

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

GB/T 4336 Method for Photoelectric Emission Spectroscopic Analysis of Carbon Steel and Medium and Low Alloy Steel

GB/T 11261 Methods for Chemical Analysis of High Carbon Chromium Bearing Steel - The Pulse Heating Inert Gas Fusion - Infra-red Absorption Method for the Determination of Oxygen Content

GB/T 14981 Dimensions, Shape, Mass and Tolerances for Hot-rolled Wire-rods

3 Order Contents

The order contract under this Standard shall include the following technical contents:

a) Product name (or brand name);

b) Designation;

c) Number of standard;

d) Specification;

e) Weight and/or quantity;

f) Casting method (according to transverse casting where it is noted);

g) Processing purpose;

h) Delivery condition;

i) Items or indices that shall be negotiated between the supplier and the purchaser and indicated in the contract (selected by the supplier if not indicated);

j) Other specific requirements proposed by the purchaser, for instance, special specification requirements, special surface quality requirements and other contents.

4 Dimension and Shape

4.1 Dimension

4.1.1 Dimension of steels and its tolerance

4.1.1.1 The dimension of hot-rolled round-steel and its tolerance shall meet those specified in Group 2 of GB/T 702-1986. Hot-rolled round-steel may also be delivered according to the provisions of Group 1 based on the agreement by both the supplier and the purchaser, and being indicated in the contract.

4.1.1.2 The dimension of forged round-steel and its tolerance shall meet those specified in Group 1 of GB/T 908-1987.

4.1.1.3 The dimension of wire-rods and its tolerance shall meet the provisions on Class B accuracy in GB/T 14981-1994, and the wire-rods may also be delivered according to the Class B accuracy based on the agreement by both the supplier and the purchaser, and being indicated in the contract.

4.1.1.4 The dimension of cold-drawn round-steel (straight-strip or disc-shaped) and its tolerance shall meet the provisions of Class h11 in GB/T 905-1994. They may also be delivered according to the provisions of other classes based on the agreement by both the supplier and the purchaser, and being indicated in the contract.

4.1.1.5 The outer diameter, wall thickness and tolerance of the steel-pipes shall be in accordance with those specified in Table 1.

diameter of one end, and the specific requirements shall be indicated in the contract.

5 Technical Requirements

5.1 Designation and chemical composition

5.1.1 The designation and chemical composition (heat analysis) of steel shall be in accordance with those specified in Table 3.

5.1.2 As required by the purchaser and indicated in the contract, the supplier shall analyze residual elements such as Sn, As, Ti, Sb, Pb and Al; the specific indices shall be determined by the supplier and the purchaser through negotiation.

5.1.3 The residual copper mass fraction (heat analysis) of the steel used for bearing steel-pipe shall not be larger than 0.20%.

5.1.4 The sulfur mass fraction (heat analysis) of the steel used for wire-rods shall not be larger than 0.020%.

5.1.5 Tolerance for chemical composition of finished steel: The tolerance for the chemical composition of steel-billets or steels shall be in accordance with those specified in Table 4. Only when it is required by the purchaser, the manufacturer may conduct the analysis on finished steel. The purchaser may carry out product analysis on steel-billets or steels according to their furnace batch.

5.1.6 Inspection by spark method: The steels shall be inspected one by one by using the spark method or spectroscope.

5.2 Smelting process

The steel shall be treated by vacuum degassing.

5.3 Delivery condition

5.3.1 The steel products shall be provided according to the following several delivery conditions; the specific delivery condition shall be indicated in the contract.

5.3.1.1 Hot-rolled and hot-forged un-annealed round-steel (abbreviated as: hot-rolled, and hot-forged)……..……WHR

5.3.1.2 Hot-rolled and hot-forged softening annealed round-steel (abbreviated as: hot-rolled softening annealed, hot-forged softening annealed)……..……WHSTAR

5.3.1.3 Hot-rolled spheroidized round-steel (abbreviated as: hot-rolled spheroidized)……WHTGR

of the mold-stool at the start, middle and end of casting of every steel furnace; if only two mold-stools are casted in one steel furnace, then the manufacturer shall take one ingot from the first mold-stool and two ingots from the second mold-stool, totally three ingots; take one test specimen respectively from the head and tail of every ingot. If only one mold-stool is casted in one steel furnace, then the manufacturer shall taken any three steel ingots and take one test specimen respectively from the head and tail of every ingot. The test specimens shall be cut off from the corresponding positions at the rolled (forged) billet (steel) before sawing. If the macrostructure inspection is carried out on steels, then respectively one test specimen shall be taken from any one end of any 6 steels for the inspection.

6.4.2 The test specimens for the quenching fracture inspection shall be cut off according to those specified in 6.4.1.

6.4.3 The test specimens for the annealing fracture inspection shall be cut off from any one end of different finished steels.

6.4.4 For the macrostructure test, the test specimen shall be immersed in the 65°C~80°C, 50% (mass fraction) hydrochloric acid (industrial use) aqueous solution for 25min~40min; the pickling time is subject to the correct displaying of steel macrostructures; then the test specimen shall be observed visually or by using the magnifier not larger than 10 times; other inspection methods may also be adopted if the supplier is able to guarantee the macrostructure being qualified.

6.5 Depth measurement of dephosphorized layer

The depth measurement of the decarburized layer on steel surface shall be carried out according to the metallurgical method of GB/T 224-1987.

The decarburized layer depth on the surface of cold-drawn steels may also be adopted with the method of measuring the hardness of quenched test specimen. The quenching system of test specimen is the same as those specified in 6.10. When measuring the quenching hardness, the surface shall be removed to make the depth to reach the allowable decarburized layer depth as specified in this Standard; the surface hardness shall not be less than HRC62.

6.6 Inspection of nonmetallic inclusion

6.6.1 The manufacturer shall take one test specimen (total 6) for the purpose of nonmetallic inclusion inspection respectively from the head and tail of any one steel ingot of the mold-stool at the start, middle and end of casting of every steel furnace; if only two mold-stools are casted in one steel furnace, then the manufacturer shall take one ingot from the first mold-stool and two ingots from the second mold-stool, totally three ingots; then take one test specimen respectively from the head and tail of every ingot. If only one mold-stool is casted in one steel furnace, then the manufacturer shall taken any three steel ingots and take one test specimen

respectively from the head and tail of every ingot. The test specimen shall be cut off from the middle position between the center and the external surface of such rolled (forged) billet (steel) with diameter side length of 100mm. The test specimen may also be cut off from the corresponding position on the rolled (forged) billet (steel) of which the diameter or side length is 80mm~120mm. As agreed by the supplier and the purchaser, the test specimen may also be cut off from the larger or smaller cross sections.

For the continuously cast steel, respectively one test specimen shall be taken for inspection from any one end of any six steels.

6.6.2 The test specimen size shall be 10mm×20mm; the polished surface shall be parallel with the rolling direction; the test specimen shall be observed by amplifying 100 times.

6.7 Microstructure inspection

6.7.1 The transverse (perpendicular to the rolling, forging or extending direction) test specimens shall be adopted

6.7.2 The thickness of test specimen shall be 10mm~15mm; the size of the grinding disc of test specimen shall be:

All the cross section, if the steels' diameter ≤25mm;

1/2 of the cross section, if the steels' diameter >25mm~40mm;

1/4 of the cross section, if the steels' diameter >40mm~60mm.

6.7.3 The polished surface shall be pickled by 2% nitric acid alcohol solution and be observed by amplifying 500 times.

6.8 Carbide non-uniformity inspection

6.8.1 The carbide net-shaped shall be assessed on the transverse quenched specimen. The test specimen, after polishing, shall be pickled by 4% nitric acid alcohol solution; then be assessed by amplifying 500 times. The supplier may also assess the carbide net-shaped on longitudinal specimen, however, the assessment on transverse specimen shall prevail.

6.8.2 The carbide ribbon shall be assessed on the longitudinal quenched specimen. The test specimen shall be polished and deep etched; then the aggregation degree, size and shape of carbide shall be assessed; the assessment shall be carried by the combination of 100 times amplification and 500 times amplification.

6.8.3 The carbide liquation shall be assessed on the longitudinal quenched

specimen. The test specimen shall be pickled in 4% nitric acid alcohol solution; then it shall be assessed by amplifying 100 times.

6.9 Micro cavity inspection

The micro cavity shall be assessed by amplifying 100 times on the polished surface of longitudinal quenched specimen.

6.10 Heat treating system of test specimens

The test specimens used for the inspection of nonmetallic inclusion, carbide net-shaped, carbide ribbon-shaped, carbide liquation, micro cavity, quenching hardness and quenching fracture shall be treated according to the following rules:

Heating temperature for quenching: 820°C~840°C (840°C~880°C for the molybdenum steel)

Heating time for quenching: thermal insulation for 1.5min according to every 1mm of the diameter or thickness of test specimen

Coolant: oil cooling

Tempering temperature: about 150°C

Tempering time: 1h~2h

6.11 Test methods for hardness and upsetting

The test methods for the hardness and upsetting shall be in accordance with those specified in Table 11.

6.12 Grading principle

All the microscopic inspection and macroscopic inspection shall take the most serious viewing field and area on the inspection surface of test specimen as the grading basis.

7 Inspection Rules

7.1 Inspection and acceptance

7.1.1 The quality of steels shall be carried out for exit-factory inspection by the quality department of the supplier. The purchaser is entitled to carry out acceptance on the steels according to provisions of this Standard.

7.1.2 The customer may delegate inspectors to the steel mill at any time as required. The steel mill shall provide necessary convenience for the work of the

customer's inspectors, so as to let them confirm the delivered steels meeting the requirements of this Standard. The customer's inspectors shall not influence the production operation of steel mill without reason.

7.2 Group-batch rules

The steels shall be carried out with inspection and acceptance according to batch; each batch shall be composed of steels of the same-furnace (tank) number, same-designation, same-variety, same-size, same-rolling system and same-heat treating system.

7.3 Sampling quantity and position

The sampling quantity and sampling position for different inspection items of each batch of steels shall be in accordance with those specified in Table 11.

7.4 Re-inspection and judgement rules

During the inspection of all items, if any item is unqualified (excluding white spot and nonmetallic inclusion), the test specimens may be taken to re-inspect the unqualified item; the resampling quantity shall be same as that of primary inspection (excluding oxygen content). If the unqualified item is qualified in re-inspection, then this batch of steels shall be judged as qualified; if not, then this batch of steels shall be judged as unqualified.

~~However, when the oxygen content is unqualified, three test specimens may be randomly taken from the steel (billet) for the re-inspection; the average value of inspection results must not be larger than 15×10^{-6}; in which, it is allowed that one of the test specimen is larger than 15×10^{-6}, but not larger than 20×10^{-6}.~~

However, when the oxygen content is unqualified, three test specimens may be randomly taken from the steel (billet) for the re-inspection; the inspection results: the average value of moulded steel (billet) shall not be larger than 15×10^{-4}%; in which, it is allowed that one of the test specimens is larger than 15×10^{-4}%, but not larger than 20×10^{-4}%; the average value of continuously cast steel (billet) shall not be larger than 12×10^{-4}%; in which, it is allowed that one of the test specimens is larger than 12×10^{-4}%, but not larger than 17×10^{-4}%.

When the quantity of unqualified test specimens in primary inspection exceeds one half of the inspected specimens, it indicates that this batch of steel has poor quality; then re-inspection is not allowed, so as to ensure the quality of delivered steels. However, the supplier may retreat and re-batch the steels as a new batch for inspection and acceptance.

2. The diameter of hot rolled (forged) round-steel listed in Table 10 was modified to 5.5-9.5 from 5.0-9.5.

3. The second paragraph in Section 7.4 “However, when the oxygen content is unqualified, three test specimens may be randomly taken from the steel (billet) for the re-inspection; the average value of inspection results must not be larger than 15×10^{-6}; in which, it is allowed that one of the test specimen is larger than 15×10^{-6}, but not larger than 20×10^{-6}.” was modified to “However, when the oxygen content is unqualified, three test specimens may be randomly taken from the steel (billet) for the re-inspection; the inspection results: the average value of moulded steel (billet) shall not be larger than 15×10^{-4}%; in which, it is allowed that one of the test specimens is larger than 15×10^{-4}%, but not larger than 20×10^{-4}%; the average value of continuously cast steel (billet) shall not be larger than 12×10^{-4}%; in which, it is allowed that one of the test specimens is larger than 12×10^{-4}%, but not larger than 17×10^{-4}%.”

4. Appendix A - The Grade 6 diagram microstructure

Grade 1 picture was changed to Grade 2 picture

Grade 2 picture was changed to Grade 1 picture

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