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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 3086-2019

High carbon chromium stainless bearing steels

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Foreword

This Standard is drafted in accordance with the rules given in GB/T 1.1-2009. This Standard replaces GB/T 3086-2008 "High carbon chromium stainless bearing steels". Compared with GB/T 3086-2008, the main technical changes of this Standard are as follows: - ADD the classification according to steel's end use (see 3.2); - Specify the tolerances for steel wire's diameter (see 5.1.2); - Tighten requirements for sulfur and nickel content of chemical composition (see Table 4; Table 3 of the 2008 edition); - Delete the smelting method of induction furnace (

6.2 of the 2008 edition); - Delete the inspection requirements for upsetting and fracture (6.6.2 of the 2008 edition); - Modify the macrostructure evaluation standards and requirements (see 6.5.1;

6.6.1 of the 2008 edition); - Delete the provision that if the supplier can ensure the tower inspection is qualified, the tower inspection may be omitted (see

6.6.3 of the 2008 edition); - Modify the rating diagrams and methods for non-metallic inclusions and the qualification level of DS-type inclusions (see Table 8; Table 6 and Appendix B of the 2008 edition); - Modify the evaluation method of eutectic carbide and add the evaluation and requirements for eutectic carbide size (see 6.7;

6.8 of the 2008 edition); - Modify the requirements for depth of decarburization of steels (see 6.10;

6.11 of the 2008 edition); - ADD requirement for non-destructive testing (see 6.11); - Modify the lot grouping rules (see 8.2;

8.2 of the 2008 edition); - Modify the re-inspection and decision rules (see 8.4;

8.4 of the 2008 edition); - ADD a table for comparison of this Standard's designations with foreign standards' similar designations (see Appendix A); - Delete standard rating diagrams of macrostructure and non-metallic inclusions (see A.1~A.6 of the 2008 edition). This Standard was proposed by China Iron and Steel Association. This Standard shall be under the jurisdiction of National Technical Committee 183 on Steel of Standardization Administration of China (SAC/TC 183). Drafting organizations of this Standard. Dongbei Special Steel Group Co., Ltd., China Metallurgical Information and Standardization Institute, Pangang Group Jiangyou Changcheng Special Steel Co., Ltd., Jiangsu Shenyuan Group Co., Ltd., Heye Special Steel Co., Ltd. Main drafters of this Standard. Kang Ge, Gong Chunlin, Luan Yan, Li Peng, Hu Jin, Tu Yuguo, Zhang Beibei, Zhang Guofu, Wang Xinh. The previous editions of the standard replaced by this Standard were released as follows: - GB/T 3086-1982, GB/T 3086-2008. High carbon chromium stainless bearing steels

1 Scope

China's national standard for high carbon chromium stainless bearing steels, and the current edition of GB/T 3086, replacing the 2008 edition. It specifies the classification, the order content, the dimensions, shape and weight, the technical requirements, the test methods, the inspection rules, and the packaging, marking and quality certification for these steels. A high carbon chromium stainless bearing steel is what a rolling bearing is made from when it has to work in an environment that would corrode the ordinary bearing steel: food and pharmaceutical machinery, marine and offshore equipment, chemical plant, dental and surgical instruments, and any application where the bearing runs wet or is washed down. Its metallurgy is unusual and it is what makes the standard as demanding as it is. An ordinary martensitic stainless steel has enough chromium to resist corrosion; a bearing steel needs enough carbon to reach the hardness that a rolling contact requires. Combining the two means carrying a great deal of carbon and chromium in the same steel, and that promotes coarse eutectic carbides which segregate during solidification, resist being broken up by hot working, and act as fatigue crack initiation sites in exactly the loaded volume beneath a raceway. The whole quality specification for this steel is therefore about the carbide structure and the cleanness: macrostructure, non-metallic inclusions, eutectic

carbide distribution and size, banding, decarburisation depth. The 2019 revision tightens sulfur and nickel limits, deletes induction furnace melting, revises the macrostructure and inclusion rating systems, revises the eutectic carbide evaluation and adds a requirement on carbide size, revises decarburisation limits, and adds a requirement for non-destructive testing. Issued on 4 June 2019 and in force since 1 May 2020.

This Standard specifies the order content, dimensions, shape, weight, technical requirements, test methods, inspection rules, packaging, marking, and quality certification of high carbon chromium stainless bearing steels. This Standard applies to hot-rolled (forged), cold-drawn, peeled, and polished round steels with a nominal diameter of 5 mm~160 mm, round wire rods with a nominal diameter of 5 mm~40 mm, and round steel wires with a nominal diameter of 1 mm~16 mm (hereinafter referred to as "steels").

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

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 molybdosilicate spectrophotometric method

GB/T 223.11 Iron, steel and alloy - Determination of chromium content - Visual titration or potentiometric titration method

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 223.23 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

3 Classification

3.1 Steel, according to the processing method used, is divided into the following two categories. The processing method used for steel shall be indicated in the contract. If not indicated, it shall be supplied according to the steel for cut work.

3.2 Steel, according to the end use, is divided into the following two categories. The end use of steel shall be indicated in the contract. If not indicated, it shall be supplied according to the steel for ferrule.

4 Order content

The contract or order for ordering in accordance with this Standard shall include the following.

5.1 Dimensions, shape, and tolerances

5.1.1 The dimensions, shape, and tolerances of round steels and wire rods shall comply with the requirements of Table

1. Through consultation between the supplier and the purchaser, and indicated in the contract, the dimensions, shape, and tolerances of steel may be performed according to other dimensional accuracy.

5.1.2 The dimensions and tolerances of steel wires shall comply with the Grade h11 specified in Table 2.

5.2 Weight

5.2.1 Steel rods and wire rods are delivered according to actual weight.

6.1 Designation and chemical composition

6.1.1 The designation and chemical composition (heat analysis) of steel shall comply with the requirements of Table 4.

6.2 Smelting method Steel shall be smelted by electroslag remelting. According to the requirements of the purchaser and indicated in the contract, other methods may also be used for smelting.

6.4 Mechanical properties

6.4.1 The Brinell hardness of the annealed steel with a nominal diameter greater than 16 mm shall be 197 HBW~255 HBW.

6.5 Macrostructure

6.5.1 Etching macrostructure of steel is evaluated according to GJB 9443. The qualification level shall meet the requirements of Table 6.

6.5.2 Round steels shall be inspected for tower hairline. The sample for round steels with a nominal diameter of 16 mm~150 mm shall be made according to GB/T 15711.

6.6 Microstructure The microstructure of annealed steel shall be a uniformly-distributed fine-grained pearlite, allowing the presence of dispersed primary carbides, but no twin-crystal carbides shall be present (see Figure B.1 for a typical diagram).