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

GB/T 8731-2025

Replacing GB/T 8731-2008

Free-cutting structural steels

易切削结构钢

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Foreword

This Document was drafted as per the rules specified in GB/T 1.1-2020 Directives for Standardization - Part

1. Rules for the Structure and Drafting of Standardizing Documents. This Document replaced GB/T 8731-2008 Free-Cutting Structural Steel. Compared with GB/T 8731-2008, the major technical changes of this Document are as follows besides the structural adjustments and editorial modifications.

- a) Change the definition of free-cutting structural steel (see Clause 3 of this Edition; Clause 3 of the 2008 Edition);
- b) Change the expression method of the designation (see Clause 4 of this Edition);
- c) Change the ordering contents (see Clause 5 of this Edition; Clause 5 of the 2008 Edition);
- d) Change the designations of Y08, Y15, and Y45, and the chemical composition ranges of Y15Mn, Y35Mn, and Y40Mn (see Table 1 of this Edition; Table 1 of the 2008 Edition); and add the designations of Y15MnS, Y40MnS, Y50, and Y100S (see Table 1 of this Edition);
- e) Change the designation of Y45MnSPb (see Table 2 of this Edition; Table 2 of the 2008 Edition);
- f) Add the designation of Y08MnBi, a bismuth-series free-cutting structural steel (see Table 5 of this Edition);
- g) Add the permissible deviations in the chemical composition of finished products containing lead, bismuth and calcium (see 7.1.3 of this Edition)
- h) Add inspection requirements and methods for sulfide inclusions (see 7.6, Appendix C of this Edition);
- i) Add the requirements for microstructure, ultrasonic testing, iron oxide scale, and machinability (see 7.7~7.10 of this Edition);
- j) Add surface quality requirements for hot-rolled wire rod, hot-rolled steel bar, and forged steel bar (see

1 Scope

GB/T 8731-2025 is the Chinese national standard covering the steels made deliberately dirty so they machine well - the sulfur, lead, bismuth or calcium added to break the chip, the

grades and their composition, the mechanical properties that suffer for it, and the anisotropy the inclusions cause. It replaces GB/T 8731-2008, under the China Iron and Steel Association. In force from 1 May 2026. Issued on 31 October 2025, it has been in force since 1 May 2026, replacing GB/T 8731-2008.

This Document specifies the expression methods of designation, ordering contents, manufacturing processes, technical requirements, test methods, inspection rules, packaging, marking, and quality certificate for free-cutting structural steel. This Document applies to free-cutting structural steel bars, wire rods, wires, sheets, and strips (hereinafter referred to as steels) for machining. The chemical composition also applies to steel ingots, billets, and their products.

2 Normative References

The provisions in following documents become the essential provisions of this Document through reference in 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) is applicable to this Document.

GB/T 222 Permissible tolerances for chemical composition of steel products GB/T 223 (all parts) Methods for chemical analysis of iron, steel and alloy

GB/T 224 Determination of the depth of decarburization of steels

GB/T 226 Test method for macrostructure and defect of steel by etching

GB/T 228.1 Metallic materials - Tensile testing - Part

3 Terms and Definitions

For the purposes of this Document, the terms and definitions given in GB/T 20566 and the following apply.

3.1 Free-cutting structural steel Structural steel with good machinability due to the addition of one or more high contents of sulfur, lead, tin, calcium, bismuth and other free-machining elements.

4 Expression Method of Designation

The designation of free-cutting structural steel consists of the following three parts.

- a) First part. The symbol "Y" for free-cutting structural steel;
- b) Second part. The average carbon content (in parts per ten thousand) is represented by two Arabic numerals;
- c) Third part. The material series is represented by the symbols for free-cutting elements.

sulfur, lead, tin, calcium, and bismuth. For sulfur-series free-cutting steels (see EXAMPLE 1), if the average sulfur content (in parts per ten thousand) is less than 0.20%, the "S" mark is omitted to indicate a lower sulfur content (see EXAMPLE 2); for lead, tin, calcium, and bismuth-series free-cutting structural steels, if sulfur is added in combination, only the symbols for free-cutting elements Pb, Sn, Ca, and Bi are retained, and the "S" mark is omitted (see EXAMPLES 3 and 5). In addition, if the average manganese content (in parts per ten thousand) is no less than 1.0%, then Mn is marked before the free-cutting element symbol to indicate a higher manganese content (see

5 Ordering Contents

The contract or order placed according to this Document shall include the following.

- a) Product Name;
- b) This Document number;
- d) Nominal dimensions;
- e) Accuracy Levels of dimensions and shape;
- f) Delivery weight and quantity;
- g) Processing method;
- h) Delivery condition;
- i) Other special requirements.

6 Manufacturing Process

6.1 Smelting method Unless otherwise specified by the purchaser, the smelting method shall be selected by the supplier.

6.2 Processing method Unless otherwise specified by the purchaser, the processing method shall be selected by the supplier.

6.3 Delivery condition Steel shall be delivered in hot-rolled, hot-forged, cold-rolled, cold-drawn, or bright silver condition. The specific delivery condition shall be specified in the contract.

7.1 Designation and chemical composition

7.1.1 The designation and chemical composition (smelting analysis) of the steel shall conform to the provisions of Tables 1 to 5.

7.3 Low magnification Upon the request of the purchaser, the low magnification of the steels may be inspected. The acid-etching low magnification test piece on the cross-section