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

**GB/T 222-2025**

Replacing GB/T 222-2006

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**Steels and alloys - Permissible deviations of product analyzed  
chemical composition**

钢及合金 成品化学成分允许偏差

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### Foreword

This document was drafted in accordance with the rules given in GB/T 1.1-2020 "Directives for standardization - Part

1.Rules for the structure and drafting of standardizing documents". This document replaces GB/T 222-2006 "Permissible tolerances for chemical composition of steel products" and GB/T 25829-2010 "Permissible tolerances for chemical composition of steel products". This document is based on GB/T 222-2006 and incorporates the content of GB/T 25829-2010. Compared with GB/T 222-2006, apart from structural adjustments and editorial changes, the main technical changes in this document are as follows:

- a) Added a classification of permissible deviations for sulfur in non-alloy steel and low-alloy steel (see Table 1);
- b) Added a classification of permissible deviations for sulfur and aluminum in alloy steel, as well as permissible deviations for nitrogen and calcium (see Table 2);
- c) Added permissible deviations of product analyzed chemical composition for wrought corrosion-resistant alloy (see Table 4);
- d) Added permissible deviations of product analyzed chemical composition for high-temperature alloy (see Table 5). Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The issuing authority shall not be held responsible for identifying any or all such patent rights. This document was proposed by China Iron and Steel Association. This document shall be under the jurisdiction of National Technical Committee on Steel of Standardization Administration of China (SAC/TC 183). The drafting organizations of this document. Metallurgical Industry Information and Standardization Research Institute, Fushun Special Steel Co., Ltd., and Hunan Valin Xiangtan Iron & Steel Co., Ltd. Main drafters of this document. Wang Lin, Yan Chengming, Gu Qiang, Tang Qingjun, Wang Xinhe, Chen Qingxin, Wang Zhi, Duan Yuqi.

Versions of standard substituted by this document are. - GB/T 222.first published in 1984, first revised in 2006. - GB/T 25829.first published in 2010. Steels and alloys -- Permissible deviations of product analyzed chemical composition

## 1 Scope

GB/T 222-2025 is the Chinese national standard on steels and alloys - permissible deviations of product analyzed chemical composition, in the field of metallurgy. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 29 August 2025 by the State Administration for Market Regulation; Standardization Administration of China, and has been in force since 1 December 2025. Classification: ICS 77.080.20, CCS H40. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This document specifies the permissible deviations of the chemical composition of products (including billets) for non-alloy steel, low-alloy steel, alloy steel, stainless steel, heat-resistant steel, wrought corrosion-resistant alloys and high-temperature alloys from the specified limits of smelting chemical composition. It provides definitions for related terms. This document applies to the permissible deviations of product analyzed chemical composition as specified in product standards and technical agreements for steel and alloys.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 20066, Steel and iron -- Sampling and preparation of samples for the determination of chemical composition

GB/T 20566, Terminology of steel and alloy

## 3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 20566 as well as the followings apply.

3.1 heat analysis; cast analysis; ladle analysis Sample ingots are taken during the steel and alloy smelting process, then test specimens are prepared and chemically analyzed. NOTE.

The analysis results represent the average chemical composition of steel and alloys from the same furnace.

**3.2 product analysis** Samples are taken from the product (including blanks) and then subjected to chemical analysis. NOTE. Due to the uneven distribution (segregation) of elements during the crystallization process of steel and alloys, the composition values in the product analysis sometimes differ from those in the smelting analysis. Product analysis is mainly used to verify the chemical composition. It is also known as verification analysis.

**3.3 permissible deviations of product analyzed chemical composition** The value of deviation allowed from the limit value of the product analysis (3.2) compared to the melting analysis (3.1) specified in the standard.

## **4 Sampling and sample preparation methods for product analysis**

The sampling and sample preparation for product analysis shall be carried out in accordance with the methods specified in GB/T 20066 or other methods agreed upon by the supplier and the purchaser.

## **5 Permissible deviations of product analyzed chemical**

**5.1** The permissible deviations of product analyzed chemical composition shall conform to the provisions of Tables 1 to

5. Table 1 applies to non-alloy steel and low-alloy steel. Table 2 applies to alloy steel (excluding stainless steel and heat-resistant steel). Table 3 applies to stainless steel and heat-resistant steel. Table 4 applies to wrought corrosion-resistant alloys. Table 5 applies to high-temperature alloys. The deviation values in Tables 1 and 2 apply to steel (or billets) with a cross-sectional area not exceeding 65000 mm<sup>2</sup>. The permissible deviations in the chemical composition of steel (or billets) with a cross-sectional area greater than 65000 mm<sup>2</sup> may be appropriately increased. Specific values can be found in Tables A.1 and A.2 of Annex A, or may be determined through negotiation between the supplier and the purchaser.

**5.2** The residual elements specified in the product standard do not apply to the permissible deviations of product analyzed chemical composition specified in Tables 1~5.

**5.3** If the product standard has different (reduced or increased) requirements for the permissible deviation of one or more elements in the chemical composition of the product compared with the provisions in Tables 1~5, the provisions of the product standard shall prevail.

**5.4** When the product standard adopts the permissible deviations of product analyzed chemical composition specified in this document, only one table can be used for the permissible deviations of product analyzed chemical composition of a steel (or alloy), and

two tables cannot be used at the same time.

5.5 The values obtained from the product analysis shall not exceed the upper limit of the chemical composition (heat analysis) limit specified in the product standard plus the deviation, or shall not exceed the lower limit of the chemical composition (heat analysis) limit specified in the product standard minus the downward deviation. For the same melting batch, only a single deviation is allowed for the same element in the product analysis. Both upper and lower deviations are not allowed simultaneously. When only an upper limit value is specified for a certain element, only an upper deviation is permitted. Example 1. For example, GB/T 699-2015 specifies that the carbon content of high-quality carbon structural steel No. 20 has a limit of 0.23% and a lower limit of 0.17% in its smelting chemical composition. If, during chemical analysis of the finished steel, a smelting batch shows a carbon content of 0.25%, this exceeds the standard upper limit of 0.02%. According to Table 1 of this document, a deviation of +0.02% from the upper limit is permissible; therefore, the carbon content of the steel is acceptable. If the carbon content of steel from another smelting batch is 0.15%, it means that it exceeds the lower limit of the standard by 0.02%. According to Table 1 of this document, a deviation of -0.02% is allowed in the lower limit. Therefore, the carbon content of the steel is also qualified. Example 2. For example, GB/T 20878-2024 specifies that the nickel content in the smelting chemical composition of 022Cr19Ni10 stainless steel has an upper limit of 12.00% and a lower limit of 8.00%. When performing chemical analysis on the product, if a smelting batch of stainless steel shows a nickel content of 12.13%, this indicates an excess of 0.13% above the standard upper limit. According to Table 3 of this document, a deviation of +0.15% from the upper limit is permissible; therefore, the nickel content of the steel is acceptable.