
Chemical analysis of steel — Order of listing elements in steel standards

*Analyse chimique des aciers — Ordre de report des éléments dans les
normes d'acier*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The sequence in which elements are listed in steel specifications has not yet been standardized and varies considerably between different steel standards and organizations. This has always been a potential source of confusion. The cost and inconvenience due to a non-standardized order are difficult to measure, nevertheless they exist and these expenses could be saved.

The modern tendency towards international standardization and the use of computers for storing, processing and retrieving information has greatly increased the case for standardizing the order of listing elements. This is particularly so when data from several sources are processed by a single computer. Consequently, there is a growing awareness of the long-term advantages of national and international standardization.

This document is especially important for ISO/TC 17/SC 4 as it is concerned with documents on numerous heat treatable and stainless steel grades. A certain level of international agreement has already been achieved in steel specifications developed by ISO/TC 17/SC 4 for the first five elements and this has been incorporated into the recommendations given in this document.

In addition, the number of digits to be mentioned for each element have been fixed based on ASTM A751.

This document is based on withdrawn ISO/TR 6306:1989.

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Chemical analysis of steel — Order of listing elements in steel standards

1 Scope

This document specifies an order for listing elements within the chemical composition of steels and most other iron-based alloys, excluding foundry irons.

NOTE This document has been developed and is used by ISO/TC 17/SC 4, but can also be used by other ISO/TC 17 subcommittees.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Order of listing elements in steel standards

The elements are divided into three groups. These groups have no real technical significance but they are considered to provide the easiest means of readily remembering the following order.

Group 1 includes five elements that are regarded as the most important in all types of steel (C, Si, Mn, P and S). Also included in this group are the four elements of the next greatest importance in alloy steels and stainless steels (Cr, Ni, Mo and N).

Group 2 is reserved for any element not assigned in group 1 or group 3. When more than one such element is determined, they should be arranged in alphabetical order of their chemical symbols. Usually these are the following 12 elements: Al, As, B, Co, Cu, Nb, Pb, Sn, Ti, V, W and Zr, which are commonly determined in a wide variety of commercial steels.

Group 3 is reserved for hydrogen H.

The recommended order thus becomes:

- C, Si, Mn, P, S, (Ni), Cr, (Ni), Mo, (Ni), N;
- other elements determined, in alphabetical order of their chemical symbols, such as Al, As, B, Co, Cu, Nb, Pb, Sn, Ti, V, W, Zr;
- H.

With the exception of hydrogen, elements should be reported in % mass fraction irrespective of the content. Hydrogen should be reported in mg/kg mass fraction.

NOTE The position of Ni in group 1 is subject to habits that can be different depending on the various regions. Therefore, the position of Ni is not yet fixed, but it is commonly placed at one of the positions indicated with brackets above.

Maximum values in the tables for the chemical composition shall be mentioned per se without max. or smaller equal symbol. Therefore, a footnote shall be added in the tables which gives the following explanation: "Maximum values unless indicated otherwise."

When writing the content in % mass fraction of each element into the table of chemical composition, the number of digits shown in [Table 1](#) should be mentioned.

Table 1 — Number of digits to the right of the decimal point

Chemical composition in % mass fraction	Number of digits to the right of the decimal point
Up to and excluding 0,010 %	0,xxxx (or for H expressed in mg/kg)
0,010 % up to and excluding 0,10 % ^a	0,xxx
0,10 % to 3,00 %	x,xx
Over 3,0 % ^b	x,x
^a For carbon, the following rule applies: over 0,030 % up to and excluding 0,10 % the number of digits is 0,xx.	
^b In Japanese standards sometimes x,xx is used.	