
**Welding consumables — Rods for
gas welding of non-alloy and creep-
resisting steels — Classification**

*Produits consommables pour le soudage — Baguettes pour le
soudage aux gaz des aciers non alliés et des aciers résistant au fluage
— Classification*

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

This document is based on EN 12536⁽¹⁾ and AWS A5.2/A5M⁽²⁾.
(1) EN 12536:2011, <http://www.iso.org/obp/ui/#iso:code:31001:12536>
(2) AWS A5.2/A5M:2017, <http://www.iso.org/obp/ui/#iso:code:31001:12536-3b5b817fd4fa/iso-20378-2017>

Requests for official interpretations of any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 3 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Welding consumables — Rods for gas welding of non-alloy and creep-resisting steels — Classification

1 Scope

This document specifies a classification for the designation of rods for gas welding of non-alloy and creep-resisting steels in terms of the chemical composition of the rod.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 544, *Welding consumables — Technical delivery conditions for filler materials and fluxes — Type of product, dimensions, tolerances and markings*

ISO 80000-1:2009, *Quantities and units — Part 1: General*. Corrected by ISO 80000-1:2009/Cor 1:2011

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:

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

4 Classification

A rod shall be classified with the symbol for its chemical composition in accordance with [Table 1](#). Information about welding behaviour is given in [Annex A](#).

The classification is divided into two parts:

- a) the first part gives a symbol indicating the product/process to be identified;
- b) the second part gives a symbol indicating the chemical composition of the rod.

5 Symbols and requirements

5.1 Symbol for the product/process

The symbol for the rod used in the gas welding process shall be the letter “O”.

5.2 Symbol for the chemical composition of rods

The symbol in [Table 1](#) indicates the chemical composition of the rod, determined under conditions given in [Clause 6](#).

Table 1 — Symbols for chemical composition of rods

| Symbol | Chemical composition ^a % (by mass) | | | | | | | | | | |
|--------|--|--------------|--------------|-------|-------|--------------|--------------|--------------|-----------------|---------|--|
| | C | Si | Mn | P | S | Mo | Ni | Cr | Cu ^b | Others | |
| I | 0,03 to 0,12 | 0,01 to 0,20 | 0,35 to 0,65 | 0,030 | 0,025 | 0,3 | 0,3 | 0,15 | 0,35 | V 0,03 | |
| II | 0,03 to 0,20 | 0,05 to 0,25 | 0,50 to 1,20 | 0,025 | 0,025 | 0,3 | 0,3 | 0,15 | 0,35 | V 0,03 | |
| III | 0,05 to 0,15 | 0,05 to 0,25 | 0,95 to 1,25 | 0,020 | 0,020 | 0,3 | 0,35 to 0,80 | 0,15 | 0,35 | V 0,03 | |
| IV | 0,08 to 0,15 | 0,10 to 0,25 | 0,90 to 1,20 | 0,020 | 0,020 | 0,45 to 0,65 | 0,3 | 0,15 | 0,35 | V 0,03 | |
| V | 0,10 to 0,15 | 0,10 to 0,25 | 0,80 to 1,20 | 0,020 | 0,020 | 0,45 to 0,65 | 0,3 | 0,80 to 1,20 | 0,35 | V 0,03 | |
| VI | 0,03 to 0,10 | 0,10 to 0,25 | 0,40 to 0,70 | 0,020 | 0,020 | 0,90 to 1,20 | 0,3 | 2,00 to 2,20 | 0,35 | V 0,03 | |
| 45 | 0,08 | 0,10 | 0,50 | 0,035 | 0,040 | 0,20 | 0,30 | 0,20 | 0,30 | Al 0,02 | |
| 60 | 0,15 | 0,10 to 0,35 | 0,90 to 1,40 | 0,035 | 0,035 | 0,20 | 0,30 | 0,20 | 0,30 | Al 0,02 | |
| 65 | 0,15 | 0,10 to 0,70 | 0,90 to 1,60 | 0,035 | 0,035 | 0,20 | 0,30 | 0,40 | 0,30 | Al 0,02 | |
| 100 | 0,18 to 0,23 | 0,20 to 0,35 | 0,70 to 0,90 | 0,025 | 0,025 | 0,15 to 0,25 | 0,40 to 0,70 | 0,40 to 0,60 | 0,15 | Al 0,02 | |
| Z | Any other agreed composition ^c | | | | | | | | | | |

^a Single values shown in the table are maximum values.

^b Including coating.

^c Consumables for which the chemical composition is not listed in this table shall be symbolized with the prefix Z. The chemical composition ranges are not specified and therefore, it is possible that two electrodes with the same Z classification are not interchangeable.

6 Chemical analysis

Chemical analysis is performed on specimens of the rod. Any analytical technique can be used, but in case of dispute, reference shall be made to established published methods.

7 Rounding procedure

Actual test values obtained shall be subject to ISO 80000-1:2009, B.3, Rule A. If the measured values are obtained by equipment calibrated in units other than those of this document, the measured values shall be converted to the units of this document before rounding. If an average value is to be compared to the requirements of this document, rounding shall be done only after calculating the average. The rounded results shall fulfil the requirements of the appropriate table for the classification under test.

8 Retesting

If any test fails to meet the requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens for the retest may be taken from the original sample or from a new sample. For chemical analysis, retesting need be only for those specific elements that fail to meet its test requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this specification for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the sample or sample(s), or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether the test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of samples does not apply.

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9 Technical delivery conditions

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Technical delivery conditions shall meet the requirements given in ISO 544.

10 Designation

An example of a designation of a rod for gas welding which has a chemical composition within the limits for the alloy symbol III in accordance with [Table 1](#):

ISO 20378 - O III

where:

ISO 20378 = standard number;

O = the welding process (oxyfuel welding);

III = chemical composition of rod (see [Table 1](#)).

Annex A (informative)

Welding behaviour

Rods with symbol I to VI have different welding behaviour. In [Table A.1](#), the typical welding behaviour of different rods is listed.

Table A.1 — Welding behaviour of different rods

| Behaviour | Rod symbol | | | | | |
|-----------------------|--------------|------------|---------|----|---|----|
| | I | II | III | IV | V | VI |
| Fluidity | Highly fluid | Less fluid | Viscous | | | |
| Spatter | Much | Less | No | | | |
| Sensitive to porosity | Yes | Yes | No | | | |

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- [2] AWS A5.2/A5M:2007, *Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding*
- [3] ASTM E350, *Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron*
- [4] BS 6200-3, *Sampling of iron, steel and other ferrous metals — Part 3: Methods of analysis*
- [5] CEN/CR 10261/ECISS *information circular 11 — Iron and Steel — Review of available methods of chemical analysis*
- [6] Handbuch für Eisenhüttenlaboratorium, VdEh, Düsseldorf

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