International Standard

ISO 16834

Welding consumables — Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels — Classification

Produits consommables pour le soudage — Fils-électrodes, fils, baguettes et dépôts pour le soudage à l'arc sous flux gazeux des aciers à haute résistance — Classification

Third edition
2025-02

Reference number
ISO 16834:2025(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 16834:2012), which has been technically revised.

The main changes are as follows:

— document has been reformatted in single column showing System A and System B in tables and separate clauses and subclauses, some which are new;

— In Clause 4, clarification that System A and System B are independent of each other and can produce different results;

— Table 2 – addition of a new system A symbol 96 for strength and elongation properties of all weld metal;

— Table 3 - addition of new symbols 7 and 8 for impact properties of all-weld metal;

— Table 4 – some classifications have been revised and new classifications, N2M31, N2CM2, N3CM2, N4CM3, N6C1M41 have been added, and footnotes have been revised;

— Tables 5, 7 and 8 – content has been added to the table and has been revised;

— Clause 13 has been updated to reflect changes.

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. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Introduction

This document recognizes that there are two somewhat different approaches in the global market to classifying a given wire electrode, wire, rod or deposit, and allows for either or both to be used to suit a particular market need. Application of either type of classification designation (or of both where suitable) identifies a product as classified in accordance with this document.

The classification in accordance with system A was originally based on EN 12534:1999 which has been withdrawn and replaced by this document. The classification in accordance with system B is mainly based upon standards used around the Pacific Rim. Future revisions will aim to merge the two systems into a single classification system.

This document provides a classification for the designation of wire electrodes, wires, rods and deposits in terms of their chemical composition and, where required, in terms of the yield strength, tensile strength and elongation of the all-weld metal. The ratio of yield to tensile strength of weld metal is generally higher than that of the parent metal. Users should note that matching weld metal yield strength to parent metal yield strength does not necessarily ensure that the weld metal tensile strength matches that of the parent material. Thus, where the application requires matching tensile strength, selection of the consumable should be made by reference to Table 2 System A or System B, as appropriate.

Welding consumables — Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels — Classification

1 Scope

This document specifies requirements for classification of wire electrodes, wires, rods and all-weld metal deposits in the as-welded condition and in the post-weld heat-treated (PWHT) condition for gas shielded metal arc welding and tungsten inert-gas welding of high-strength steels with a minimum yield strength greater than 500 MPa, or a minimum tensile strength greater than 570 MPa. One wire electrode can be tested and classified with different shielding gases.

This document is a combined specification providing for classification utilizing a system based upon the yield strength and the average impact energy of 47 J of all-weld metal, or utilizing a system based upon the tensile strength and the average impact energy of 27 J of all-weld metal.

a) Clauses, subclauses and tables which carry the suffix “System A” are applicable only to wire electrodes, wires, rods and deposits classified according to the system based upon the yield strength and the average impact energy of 47 J of all-weld metal under this document.

b) Clauses, subclauses and tables which carry the suffix “System B” are applicable only to wire electrodes, wires, rods and deposits classified according to the system based upon the tensile strength and the average impact energy of 27 J of all-weld metal under this document.

c) Clauses, subclauses and tables which do not have either the suffix “System A” or “System B” are applicable to all wire electrodes, wires, rods and deposits classified under this document.

Annex A gives information on the description of composition designations for electrodes in the classification system based upon tensile strength and average impact energy of 27 J – System B.

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 13916, *Welding — Measurement of preheating temperature, interpass temperature and preheat maintenance temperature*

ISO 14175:2008, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*

ISO 15792-1:2020, *Welding consumables — Test methods — Part 1: Preparation of all-weld metal test pieces and specimens in steel, nickel and nickel alloys*

ISO 80000-1:2022, *Quantities and units — Part 1: General*

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Classification

4.1 General

Classification designations are based upon two approaches to indicate the tensile properties and the impact properties of the all-weld metal obtained with a given wire electrode, wire or rod. The two designation approaches include additional designators for some other classification requirements, but not all, as is clear from the following clauses. In most cases, a given commercial product can be classified according to the classification requirements in both systems. Then either or both classification designations can be used for the product.

A wire electrode, wire or rod shall be classified in accordance with its chemical composition in Table 4. A weld deposit shall be classified with additional symbols in accordance with the mechanical properties of its all-weld metal, using a shielding gas from a specific group.

Since these are not equivalent, each system shall be used independently of the other, yet both may be used. Differences in welding parameters and PWHT conditions can result in significant differences in the strength and toughness of the weld metal.

4.2 Classification systems

Each classification system, A and B, is split into parts as given in Table 1.

Table 1 — Parts of the classification systems, A and B

Part of classification designation	Classification system	
	System A **Classification by yield strength and 47 J impact energy**	**System B** **Classification by tensile strength and 27 J impact energy**
1	symbol indicating the product/process to be identified (see 5.1)	
2	symbol indicating the strength and elongation of all-weld metal (see Table 2)	symbol indicating the strength and elongation of the all-weld metal in either the as-welded or post-weld heat-treated condition (see Table 2 and 5.6.2)
3	symbol indicating the impact properties of all-weld metal (see Table 3);	symbol indicating the impact properties of all-weld metal in the same condition as specified for the tensile strength (see Table 3). The letter “U” after this designator indicates that the deposit meets an average optional requirement of 47 J at the designated Charpy test temperature.
4	symbol indicating the shielding gas used (see 5.4)	
5	symbol indicating the chemical composition of the wire electrode, wire or rod used (see Table 4);	
6	symbol indicating the post-weld heat treatment in case this is applied (see 5.6.1).	—

5 Symbols and requirements

5.1 Symbols for the product/process

The symbol for the wire electrode, wire or rod used in the arc welding process shall be the letter G (gas shielded metal arc welding) and/or W (gas shielded arc welding with non-consumable tungsten electrode).

5.2 Symbols for strength and elongation properties of all-weld metal

5.2.1 Classification by yield strength and 47 J impact energy – System A

For classification by yield strength and 47 J impact energy , the symbol in Table 2 indicates yield strength, tensile strength and elongation of the all-weld metal in the as-welded condition determined in accordance with Clause 6 and Clause 7.

5.2.2 Classification by tensile strength and 27 J impact energy – System B

For classification by tensile strength and 27 J impact energy, the symbol in Table 2 indicates yield strength, tensile strength and elongation of the all-weld metal in the as-welded condition or in the post-weld heat-treated condition determined in accordance with Clause 6 and Clause 7.

Table 2 — Symbols for strength and elongation properties of all-weld metal

System A — Classification by yield strength and 47 J impact energy				System B — Classification by tensile strength and 27 J impact energy			
Symbol	Minimum yield strength[a] MPa	Tensile strength MPa	Minimum elongation[b] %	Symbol[c]	Tensile strength MPa	Minimum yield strength[a] MPa	Minimum elongation[b] %
55	550	640 to 820	18	59X	590 to 790	490	16
62	620	700 to 890	18	62X	620 to 820	530	15
69	690	770 to 940	17	69X	690 to 890	600	14
79	790	880 to 1 080	16	76X	760 to 960	680	13
89	890	940 to 1 180	15	78X	780 to 980	680	13
96	960	980 to 1 220	13	83X	830 to 1 030	745	12

[a] For yield strength, the lower yield strength, R_{eL}, is used when yielding occurs, otherwise the 0,2 % proof strength, $R_{p0,2}$, is used.
[b] Gauge length is equal to five times the test specimen diameter.
[c] X is "A", "P" or "AP"; see 5.6.2.

NOTE Post-weld heat treatment can alter the strength of the weld metal from that obtained in the as-welded condition.

5.3 Symbol for impact properties of all-weld metal

5.3.1 Classification by yield strength and 47 J impact energy – System A

The symbols in Table 3 indicate the temperature at which an impact energy of 47 J is achieved under the conditions given in Clause 6 and Clause 7. Three test specimens shall be tested. Only one individual value may be lower than 47 J but not lower than 32 J.

5.3.2 Classification by tensile strength and 27 J impact energy – System B

The symbols in Table 3 indicate the temperature at which an impact energy of 27 J is achieved in the as-welded condition or in the post-weld heat-treated condition under the conditions given in Clause 6 and Clause 7.

Five test specimens shall be tested. The lowest and highest values obtained shall be disregarded. Two of the three remaining values shall be greater than the specified 27 J level, one of the three may be lower but shall not be less than 20 J. The average of the three remaining values shall be at least 27 J.

The addition of the optional symbol U, immediately after the symbol for condition of heat treatment, indicates that the supplemental requirement of 47 J impact energy at the normal 27 J impact test temperature has also been satisfied. For the 47 J impact requirement, the number of specimens tested and values obtained shall meet the requirement of 5.3.1.

Table 3 — Symbol for impact properties of all-weld metal

Symbol	Temperature for minimum average impact energy of 47 J[a,b] or 27 J[b] °C
Z	No requirements
A[a] or Y[b]	+20
0	0
2	−20
3	−30
4	−40
5	−50
6	−60
7	−70
8	−80
NOTE When an all-weld metal has been classified for a certain temperature, it automatically covers any higher temperature.	
[a] See 5.3.1.	
[b] See 5.3.2.	

5.4 Symbol for shielding gas

The symbols for shielding gases shall be in accordance with ISO 14175:2008, for example:

— The symbol I1 shall be used when the classification has been performed with shielding gas ISO 14175-I1, 100 % argon;

— The symbol M12, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M12, but without helium;

— The symbol M13 shall be used when the classification has been performed with shielding gas ISO 14175-M13;

— The symbol M20, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M20, but without helium;

— The symbol M21, for mixed gases, shall be used when the classification has been performed with shielding gas ISO 14175-M21, but without helium;

— The symbol C1 shall be used when the classification has been performed with shielding gas ISO 14175-C1, carbon dioxide;

— The symbol Z is used for an unspecified shielding gas.