

AWS A5.28/A5.28M:2020
An American National Standard

Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding



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Approved by the
American National Standards Institute
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Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding

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Prepared by the
American Welding Society (AWS) A5 Committee on Filler Metals and Allied Materials

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification prescribes the requirements for classification of solid low-alloy steel electrodes and rods, composite stranded low-alloy steel electrodes *and rods*, and composite metal cored low-alloy steel electrodes and rods for gas shielded *welding processes including gas metal arc welding, gas tungsten arc welding, and plasma arc welding*. Classification is based on chemical composition of the electrode for solid electrodes and rods, chemical composition of weld metal for composite stranded and composite metal cored electrodes *and rods*, and the as-welded or postweld heat treated mechanical properties of the weld metal for each. Additional requirements are included for manufacture, sizes, lengths, and packaging. A guide is appended to the specification as a source of information concerning the classification system employed and the intended use of the electrodes and rods.

This specification makes use of both U.S. Customary Units and the International System of Units (SI). Since these units are not equivalent, each system must be used independently of the other.



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This standard is subject to revision at any time by the AWS A5 Committee on Filler Metals and Allied Materials. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS A5 Committee on Filler Metals and Allied Materials and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS A5 Committee on Filler Metals and Allied Materials to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

Foreword

This foreword is not part of this standard but is included for informational purposes only.

This current document is the third revision of the initial AWS document issued in 1979. This 2020 edition includes the following major substantive changes which are shown in *Italic* font in this document.

(1) Twenty-four new solid and composite metal cored electrode or rod alloy types are included in this revision along with the corresponding electrode or rod classification designations and requirements. Included with these changes are the following:

(a) The ER90S-B91 [ER62S-B91] and E90C-B91 [E62C-B91] classifications have been added and replace the ER90S-B9 [ER62S-B9] and E90C-B9 [E62C-B9] classifications.

(b) The following chromium-molybdenum alloy types have been added: B2Si, B2Mn, B23, B23Mn, B24, B3Mn, B3Si, B3MnSi, B91C, B91CMn, B92, and B92Co.

(c) The D3 composition has been added to the manganese-molybdenum alloy types.

(d) The Ni4 and Ni5 compositions have been added to the nickel steel alloy types.

(e) The following nickel-molybdenum alloy types have been added: F3, M1, M5, M6, M7, and M8

(f) Two 20% Mn types (Mn1 and Mn2) have been included in this document.

(2) Added “B (boron)” reporting requirement in Table 1 and Table 4.

(3) Rounding procedure (Clause 6) has been revised to bring it in line with the ISO procedure.

(4) Packaging information has been replaced by the reference of AWS A5.02/A5.02M, Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes. The use of A5.02/A5.02M will now require positive identification of all cut length rods by imprinting, embossing, tagging, etc.

(5) The GTAW groove weld test has been moved from the informative annex to the body of the specification.

(6) Modifications have been made to the welding procedures used for classification of solid GMAW electrodes to better reflect sound welding practice. Test conditions have been replaced by heat input requirements that fully align with the heat input range that the test conditions could produce.

(7) Two supplemental designators to be added to the composition designator are established to indicate tighter limits for the Mn +Ni content of electrodes or rods or weld deposits of certain chromium-molybdenum alloy types. Refer to 14.2, Figure 1, and A2 in Annex A.

(8) A “J” optional, supplemental designator has been added to this revision to indicate that the weld metal of the deposit will meet the minimum impact energy requirement at a test temperature 20°F [10°C] lower than the temperature shown for that classification in Table 3. See 14.3, Figure 1, and A3 in Annex A.

(9) This document has been organized for better clarity and ease of navigation. A normative annex (Annex A) has been created for optional, supplemental tests and for other tests not required for electrode (rod) classification.

(10) Allow the techniques of computed radiography or digital radiography to be used on welds in place of film radiography although still in conjunction with ASTM E1032.

NOTE: The user’s attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from the standards developer.

The history of A5.28 may be summarized as follows:

AWS A5.28-79 *Specification for Low Alloy Steel Filler Metals for Gas Shielded Metal Arc Welding*

AWS A5.28-96 *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.28/A5.28M:2005 *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

Comments and suggestions for the improvement of this specification are welcome. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

All errata to a standard shall be published in the *Welding Journal* and posted on the AWS website.

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Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding

1. Scope

1.1 *This specification prescribes requirements for the classification of low-alloy steel electrodes (solid, composite stranded, and composite metal cored) for gas metal arc welding (GMAW) and low-alloy steel rods (solid, composite stranded, and composite metal cored) for gas tungsten arc (GTAW) and plasma arc (PAW) welding. With two exceptions (the 20% manganese types “Mn1” and “Mn2”), iron is the only element whose content exceeds 10.5% in undiluted weld metal deposited by these electrodes or rods, as applicable.*

1.2 This specification makes use of both U.S. Customary Units and the International System of Units (SI). The measurements are not exact equivalents; therefore, each system must be used independently of the other, without combining values in any way. In selecting rational metric units, AWS A1.1, *Metric Practice Guide for the Welding Industry* and ISO 544, *Welding consumables — Technical delivery conditions for welding filler materials and fluxes — Type of product, dimensions, tolerances and markings*, are used where suitable. Tables and figures make use of both U.S. Customary and SI Units which, with the application of the specified tolerances, provide for interchangeability of products in both U.S. Customary and SI Units. The specification with the designation A5.28 uses U.S. Customary Units. The specification A5.28M uses SI Units. The latter are shown within brackets [] or in appropriate columns in tables and figures. Standard dimensions based on either system may be used for sizing of electrodes or packaging or both under the A5.28 or A5.28M specifications.

1.3 Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided, but such issues are not fully addressed herein. Some safety and health information can be found in the non-mandatory Annex B, Clauses B5 and B10.

Safety and Health information is available from the following sources:

American Welding Society:

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

AWS Safety and Health Fact Sheets

Other safety and health information on AWS website

Material or Equipment Manufacturers:

Safety Data Sheets supplied by material manufacturers

Operating Manuals supplied by equipment manufacturers

Applicable Federal and State Regulations

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.