AWS A5.28/A5.28M:2026
An American National Standard

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

American Welding Society®

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An American National Standard

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. Optional supplemental designators are also included for lower temperature toughness requirements, diffusible hydrogen limits, reduced Mn + Ni levels in Cr-Mo compositions, and shielding gas ranges. 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 It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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.

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Foreword

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

This document 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* is 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 the U.S. Customary and SI Units.

This current document is the fifth revision of the initial AWS document issued in 1979. The evolution took place 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*

AWS A5.28/A5.28M:2005 (R2015), *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.28/A5.28M:2020, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.28/A5.28M:2022, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

Substantive changes included in this revision include:

- The addition of the J# designator indicating lower temperature impact properties.
- Removal of heat input requirement on the first layer of groove welds.
- Test conditions apply to all classifications.

These substantive changes are shown in *italic font.*

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.

Comments and suggestions for the improvement of this specification are welcome. They should be sent to the Secretary, Committee on Filler Metals and Allied Materials, American Welding Society, 8669 NW 36th 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 welding (GTAW) and plasma arc welding (PAW). 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 nonmandatory annex, Clauses B5 and B10.

Safety and Health information is available from the following sources:

American Welding Society:

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

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on AWS website

Material or Equipment Manufacturers:

(1) Safety Data Sheets supplied by material manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

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.

2. Normative References

The documents listed below are referenced within this publication and are mandatory to the extent specified herein. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

American Welding Society (AWS) Standards:

AWS A1.1, *Metric Practice Guide for the Welding Industry*

AWS A3.0M/A3.0, *Standard Welding Terms and Definitions, Including Terms for Additive Manufacturing, Adhesive Bonding, Brazing, Soldering, Thermal Cutting, Thermal Spraying, and Nondestructive Examination*

AWS A5.01M/A5.01 (ISO 14344:2010 MOD), *Welding and Brazing Consumables—Procurement of Filler Metals and Fluxes*

AWS A5.02/A5.02M, *Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes*

AWS A5.18/A5.18M, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.32M/A5.32 (ISO 14175: 2008 MOD), *Welding Consumables—Gases and Gas Mixtures for Fusion Welding and Allied Processes*

AWS A4.3, *Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding*

AWS B4.0, *Standard Methods for Mechanical Testing of Welds*

American National Standards Institutes (ANSI) document:

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

ASTM International (ASTM) documents:

ASTM A36/A36M, *Standard Specification for Carbon Structural Steel*

ASTM A203/A203M, *Standard Specification for Pressure Vessel Plates, Alloy Steel, Nickel*

ASTM A285/A285M, *Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength*

ASTM A335/A335M, *Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service*

ASTM A387/A387M, *Standard Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum*

ASTM A514/A514M, *Standard Specification for High-Yield-Strength, Quenched and Tempered, Alloy Steel Plate, Suitable for Welding*

ASTM A515/A515M, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service*

ASTM A516/A516M, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

ASTM A517/A517M, *Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered*

ASTM A537/A537M, *Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel*

ASTM A572/A572M, *Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel*

ASTM A588/A588M, *Standard Specification for High-Strength Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in [100 mm] Thick*

ASTM A1106/A1106M, *Standard Specification for Pressure Vessel Plate, Alloy Steel, Austenitic High Manganese for Cryogenic Application*

ASTM E23, *Standard Test Methods for Notched Bar Impact Testing of Metallic Materials*

ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

ASTM E350, *Standard Test Method for Chemical Analysis of Carbon Steel, Low Alloy Steel, Silicon Electrical Steel, Ingot Iron and Wrought Iron*

ASTM E353, *Standard Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys*

ASTM E1032, *Standard Test Method for Radiographic Examination of Weldments*

ASTM E2033, *Standard Test Method for Radiographic Examination Using Computed Radiography (Photostimulable Luminescence Method)*

ASTM E2698, *Standard Test Method for Radiographic Examination Using Digital Detector Arrays*

International Organization for Standardization (ISO) documents:

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

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

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

United States Department of Defense (DODSSP) publications:

MIL-S-16216, *Military Specification, Steel Plate, Alloy, Structural, High Yield Strength (HY-80 and HY-100)*

NAVSEA Technical Publication T9074-BD-GIB-010/0300, *Base Materials for Critical Applications: Requirements for Low Alloy Steel Plate, Forgings, Castings, Shapes, Bars, and Heads of HY-80/100/130 and HSLA-80/100, Appendix B (16216) Steel Plate, Alloy, Structural, High-Yield Strength (HY-80 and HY-100)*

American Petroleum Institute (API) document:

Spec 5L, *Specification for Line Pipe*

3. Classification

3.1 Solid Electrodes and Rods

3.1.1 The solid electrodes and rods covered by this A5.28 specification utilize a classification system based upon U.S. Customary Units as shown in Figure 1. They are classified according to the chemical composition of the electrode, as specified in Table 1, and the mechanical properties of the weld metal as specified in Tables 2 and 3 with the shielding gas specified in Table 2.

3.1.2 The solid electrodes and rods covered by this A5.28M specification utilize a classification system based upon the International System of Units (SI) as shown in Figure 1. They are classified according to the chemical composition of the electrode or rod as specified in Table 1, and the mechanical properties of the weld metal, as specified in Tables 2 and 3 with the shielding gas specified in Table 2.

3.1.3 Either one of the two GMAW weld assemblies in Figure 2, using shielding gas in Table 2, is required and sufficient to classify solid wires offered as an electrode or an electrode and rod. The GTAW groove weld in Figure 2 is required for solid wires offered as a rod only. The GTAW weld assembly may be requested in addition to the GMAW assembly as an option and as agreed upon between the purchaser and the supplier.

3.2 Composite Metal Cored and Composite Stranded Electrodes and Rods

3.2.1 The composite metal cored and composite stranded electrodes and rods covered by this A5.28 specification also utilize a classification system based upon U.S. Customary Units as shown in Figure 1. They are classified according to the chemical composition and mechanical properties of the weld metal as specified in Tables 2, 3, and 4 with the shielding gas specified in Table 2.