AWS A5.29/A5.29M:2026
An American National Standard

Specification for Low-Alloy Steel Electrodes for Flux Cored 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 for Flux Cored 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 low-alloy steel electrodes for flux cored arc welding. The requirements include chemical composition and mechanical properties of the weld metal and certain usability characteristics. Optional supplemental designators are also included for improved toughness, diffusible hydrogen, and shielding gas range. Additional requirements are included for standard sizes, marking, manufacturing, and packaging. A guide is appended to the specification as a source of information concerning the classification system employed and the intended use of low-alloy steel flux cored electrodes.

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



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Foreword

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

This document uses both U.S. Customary Units and the International System of Units (SI) throughout. 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 the U.S. Customary and SI Units.

The current document is the sixth revision of the initial ANSI/AWS document issued in 1980. Substantive changes in this document are shown in Italic font and include updates to the Normative References, a revision to subclause 3.2, revisions to Table 3, revised notes to Figure 4, and replacement of the legacy "J" designator for a new "J#" designator indicating lower temperature impact properties.

The document evolution took place as follows:

ANSI/AWS A5.29-80	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
ANSI/AWS A5.29:1998	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
AWS A5.29/A5.29M:2005	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
AWS A5.29/A5.29M:2010	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
AWS A5.29/A5.29M:2021	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*
AWS A5.29/A5.29M:2022	*Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*

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 standard 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.

Table of Contents

Page No.

Personnel v
Foreword vii
List of Tables x
List of Figures x

1. Scope 1
2. Normative References 1
3. Classification 3
4. Acceptance 3
5. Certification 4
6. Rounding Procedure 4
7. Summary of Tests 4
8. Retest 4
9. Test Assemblies 4
10. Chemical Analysis 6
11. Radiographic Test 6
12. Tension Test 7
13. Impact Test 7
14. Fillet Weld Test 8
15. Optional Supplemental Tests and Requirements 8
16. Method of Manufacture 10
17. Standard Sizes 10
18. Finish and Uniformity 10
19. Standard Package Forms 10
20. Winding Requirements 10
21. Filler Metal Identification 10
22. Packaging 10
23. Marking of Packages 11

Annex A (Informative)—Guide to AWS Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding 29
Annex B (Informative)—Requesting an Official Interpretation on an AWS Standard 45

AWS Filler Metal Specifications by Material and Welding Process 47
AWS Filler Metal Specifications and Related Documents 49

List of Tables

Table		Page No.
1	A5.29 [A5.29M] Mechanical Property Requirements	12
2	Usability Designators and General Description of Electrode Types	16
3	Weld Metal Composition Requirements	17
4	Tests Required for Classification	19
5	Base Metal for Test Assemblies	20
6	Heat Input Requirements and Suggested Pass and Layer Sequence	21
7	Preheat, Interpass, and PWHT Temperatures	22
8	Dimensional Requirements for Fillet Weld Usability Test Specimens	23
9	Optional Diffusible Hydrogen Requirements	23
10	Shielding Gas Requirements for Oxygen Equivalent Gas Range Designator	24
11	*Test Temperature Requirements for Optional Impact Test Designator (J#)–A5.29*	24
11M	*Test Temperature Requirements for Optional Impact Test Designator (J#)–A5.29M*	24
A.1	Comparison of Similar Classifications for ISO 17632	43
A.2	Comparison of Similar Classifications for ISO 17634	44
A.3	Comparison of Similar Classifications for ISO 18276	45

List of Figures

Figure		Page No.
1	A5.29/A5.29M Classification System	25
2	Test Assembly for Mechanical Properties and Soundness of Weld Metal	26
3	Pad for Chemical Analysis of Deposited Weld Metal.	27
4	Fillet Weld Test Assembly and Positions	28
5	Radiographic Standards for Test Assembly in Figure 2	29

Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding

1. Scope

1.1 This specification prescribes requirements for the classification of low-alloy steel electrodes for flux cored arc welding (FCAW), either with or without shielding gas. 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.

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 in any way when referring to weld metal properties. The specification with the designation A5.29 uses U.S. Customary Units. The specification A5.29M 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 the sizing of electrodes or packaging or both under the A5.29 and A5.29M 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 Clauses A5 and A11 in Annex A.

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. Unless otherwise defined in this document, welding terms are as defined in AWS A3.0M/A3.0. 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) documents:

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 Testing*

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 A4.5M/A4.5 (ISO 15792-3 MOD), *Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld*

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

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

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

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

American National Standards Institute (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 A204/A204M, *Standard Specification for Pressure Vessel Plates, Alloy Steel, Molybdenum*

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

ASTM A302/A302M, *Standard Specification for Pressure Vessel Plates, Alloy Steel, Manganese-Molybdenum and Manganese-Molybdenum-Nickel*

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

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

ASTM A588/A588M, *Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point with Atmospheric Corrosion Protection*

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

ASTM DS-56 (SAE HS-1086), *Metals & Alloys in the Unified Numbering System*

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 Methods 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 Practice for Computed Radiology (Photostimulable Luminescence Method)*

ASTM E2698, *Standard Practice for Radiological Examination Using Digital Detector Arrays*

International Organization for Standardization (ISO) document:

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

United States Department of Defense (DODSSP) publications:

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

MIL-S-24645, *Specification for Steel Plate, Sheet, or Coil, Age-Hardening Alloy, Structural, High Yield Strength (HSLA-80 and HSLA-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*

3. Classification

3.1 The flux cored electrodes covered by this A5.29 specification utilize a classification system based upon U.S. Customary Units. The flux cored electrodes covered by this A5.29M specification utilize a classification system based upon the International System of Units (SI).

Both are classified according to:

(1) The mechanical properties of the weld metal, as specified in Table 1.

(2) The positions of welding for which the electrodes are suitable, as shown in Figure 1 and Table 2.

(3) Certain usability characteristics of the electrode (including the presence or absence of a shielding gas), as specified in Figure 1 and Table 2.

(4) Chemical composition of the weld metal, as specified in Table 3.

3.2 Electrodes classified under one classification shall not be classified under any other classification in this specification with the following exceptions:

(1) Gas-shielded electrodes may be classified with 100% CO_2 shielding gas ("C" designator) and with a 75% to 80% Ar/balance CO_2 shielding gas ("M" designator).

(2) Electrodes may be classified with both a defined chemical composition designator and a "-G" composition designator provided that all of the requirements for both classifications are met.

Electrodes may be classified under A5.29 using U.S. Customary Units, and/or under A5.29M using the International System of Units (SI). Electrodes classified under either classification system must meet all requirements for classification under that system. The classification system is shown in Figure 1.

3.3 The electrodes classified under this specification are intended for flux cored arc welding either with or without an external shielding gas. Electrodes intended for use without external shielding gas or with the shielding gases specified in Figure 1 are not prohibited from use with any other process or shielding gas for which they are found suitable. See 15.4 and A8.4 for information on optional shielding gas range designators.

4. Acceptance

Acceptance of the welding electrodes shall be in accordance with the provisions of AWS A5.01M/A5.01. See Clause A3 in Annex A for further information concerning acceptance, testing of the material shipped, and AWS A5.01M/A5.01.