AWS A5.39/A5.39M:2026
An American National Standard

Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys

American Welding Society®

Approved American National Standard
ANSI

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Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys

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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 the classification of flux-electrode combinations used with submerged arc or electroslag joining or surfacing using stainless steel and nickel alloys. Electrode classification is per AWS A5.9/A5.9M for solid stainless steel electrodes, A5.14/A5.14M for solid nickel-alloy electrodes, A5.22/A5.22M for cored stainless steel electrodes and A5.34/A5.34M for cored nickel-alloy electrodes. Flux-electrode joining classification is based on the mechanical properties and the composition of weld metal produced with the flux and a specific electrode. Flux-electrode surfacing classification is based on the composition of the weld metal produced with the flux and a specific electrode. The form and usability of the flux are also included. A guide is appended to the specification as a source of information concerning the classification system employed and the intended use of submerged arc and electroslag fluxes and electrodes.

This specification makes use of both US 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 is the second edition of the A5.39/A5.39M specification. It makes use of both US 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 Condition for Filler Materials and Fluxes—Type of Products, Dimensions, Tolerances and Markings*, are used where suitable.

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.

Substantive changes in this edition are shown in *italic font*. Alloys have been added and chemical compositions modified to reflect those that appear in recent editions of A5.4/A5.4M, A5.9/A5.9M, A5.22/A5.22M, A5.11/A5.11M, A5.14/A5.14M and A5.34/A5.34M. In addition, the chemical composition tables for stainless steels and nickel alloys have been reformatted for improved clarity.

Document Evolution

AWS A5.39/A5.39M:2020 *Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys*

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.

The welding terms used in this specification shall be interpreted in accordance with the definitions given in the latest edition of AWS A3.0M/A3.0, *Standard Welding Terms and Definitions* unless specifically defined in this standard.

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Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys

1. Scope

1.1 This specification prescribes requirements for the classification of flux-electrode combinations using submerged arc or electroslag welding. Flux-electrode joining classifications include requirements for soundness, mechanical properties and weld metal composition. Flux-electrode cladding classifications include requirements for soundness and weld metal composition. Electrode classification is per AWS A5.9/A5.9M for solid stainless steel electrodes, A5.14/ A5.14M for solid nickel-alloy electrodes, A5.22/A5.22M for cored stainless steel electrodes and A5.34/ A5.34M for cored nickel-alloy electrodes. *Solid electrodes include wire, strip and stranded electrodes, as described in A5.9/A5.9M and A5.14/A5.14M.*

1.2 This specification makes use of both US 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 A5.39 uses US Customary Units. The specification with the designation A5.39M 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 specification A5.39 or A5.39M.

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 or revisions of the publications may not apply since the relevant requirements may have changed.

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 Examination*

AWS A4.2M, *Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal*

AWS A5.01M/A5.01, *Welding Consumables—Procurement of Filler Metals and Fluxes*

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

AWS A5.9/A5.9M, *Specification for Bare Stainless Steel Welding Electrodes and Rods*

AWS A5.14/A5.14M, *Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods*

AWS A5.22/A5.22M, *Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods*

AWS A5.34/A5.34M, *Specification for Nickel-Alloy Electrodes for Flux Cored Arc and Metal Cored Arc Welding*

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 A131/A131M, *Standard Specification for Structural Steel for Ships*

ASTM A240/A240M, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

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

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

ASTM A560, *Standard Specification for Castings, Chromium-Nickel Alloy*

ASTM B127, *Standard Specification for Nickel-Copper Alloy Plate, Sheet, and Strip*

ASTM B160, *Standard Specification for Nickel Rod and Bar*

ASTM B162, *Standard Specification for Nickel Plate, Sheet, and Strip*

ASTM B164, *Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire*

ASTM B166, *Standard Specification for Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, and Nickel-Iron-Chromium-Tungsten Alloy Rod, Bar, and Wire*

ASTM B167, *Standard Specification for Nickel-Chromium-Aluminum Alloys, Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, Nickel-Iron-Chromium-Tungsten Alloy, and Nickel-Chromium-Molybdenum-Copper Alloy Seamless Pipe and Tube*

ASTM B168, *Standard Specification for Nickel-Chromium-Aluminum Alloys (UNS N06699), Nickel-Chromium-Iron Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, N06045, and N06696), Nickel-Chromium-Cobalt-Molybdenum Alloy (UNS N06617), and Nickel-Iron-Chromium-Tungsten Alloy (UNS N06674), and Nickel-Chromium-Molybdenum-Copper Alloy (UNS N06235) Plate, Sheet, and Strip*

ASTM B333, *Standard Specification for Nickel-Molybdenum Alloy Plate, Sheet, and Strip*

ASTM B435, *Standard Specification for Heat and Corrosion Resistant High Temperature Alloy Plate, Sheet, and Strip*

ASTM B443, *Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy and Nickel-Chromium-Molybdenum-Silicon-Alloy Plate, Sheet, and Strip*

ASTM B446, *Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy, Nickel- Chromium-Molybdenum-Silicon Alloy, and Nickel-Chromium-Molybdenum-Tungsten Alloy Rod and Bar*

ASTM B575, *Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip*

ASTM B582, *Standard Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip*

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 E76, *Standard Test Methods for Chemical Analysis of Nickel-Copper Alloys*

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

ASTM E354, *Standard Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys*

ASTM E1019, *Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Inert Gas Fusion Techniques*

ASTM E1032, *Standard Test Method for Radiographic Examination of Weldments Using Industrial X-ray Film*

ASTM E1473, *Standard Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys*

ASTM E2033/E2033M, *Standard Practice for Radiographic Examination Using Computed Radiography (Photostimulable Luminescence Method)*

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

International Organization for Standardization (ISO) documents:

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

3. Definitions

The welding terms used in this specification shall be interpreted in accordance with the definitions given in the latest edition of AWS A3.0M/A3.0 with further detail as described in this standard.

4. Classification

4.1 The submerged arc and electroslag flux-electrode combinations covered by the A5.39 specification utilize a classification system based upon US Customary Units and are classified according to the following:

(1) For joining designations, classification requires mechanical properties of the weld metal obtained from a groove weld made with a combination of a particular flux and a particular classification of electrode, as specified in Tables 1 and 2.

(2) For joining and cladding designations, classification requires the chemical composition of the weld metal produced with a particular flux and a particular electrode, as specified in Tables 3*A and 3B* and the chemical composition of the electrode. Electrodes permitted in this specification shall be classified per AWS A5.9/A5.9M or AWS A5.14/A5.14M for solid electrodes and per AWS A5.22/A5.22M or AWS A5.34/A5.34M for cored electrodes. For joining designations, classification requires soundness testing as specified in Table 4.

(3) For cladding designations, classification requires soundness testing as specified in Table A1.

4.1M The submerged arc and electroslag flux-electrode combinations covered by the A5.39M specification utilize a classification system based upon the International System of Units (SI) and are classified according to the following: