

AWS A5.20/A5.20M:2005 (R2015)
An American National Standard

Specification for Carbon Steel Electrodes for Flux Cored Arc Welding



**AWS A5.20/A5.20M:2005 (R2015)
An American National Standard**

**Approved by the
American National Standards Institute
July 28, 2015**

**Specification for
Carbon Steel Electrodes for
Flux Cored Arc Welding**

Supersedes ANSI/AWS A5.20-95

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 carbon steel electrodes for flux cored arc welding. The requirements include chemical composition and mechanical properties of the weld metal and certain usability characteristics. The AWS A5.20/A5.20M specification also includes optional, supplemental designators for improved toughness and diffusible hydrogen and to indicate conformance to special mechanical property requirements when the weld metal is deposited using both low heat input, fast cooling rate and high heat input, slow cooling rate procedures. 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 carbon 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.



ISBN: 978-0-87171-868-6
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Foreword

This foreword is not part of AWS A5.20/A5.20M:2005 (R2015), *Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*, but is intended for informational purposes only.)

This document is the first of the A5.20 specifications which 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 554, *Welding consumables—Technical delivery conditions for welding filler metals—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, provides for interchangeability of products in both the U.S. Customary and SI Units.

The current document is the third revision of the initial joint ASTM/AWS document issued in 1969. Since it was developed by a subcommittee of the AWS Committee on Filler Metals and Allied Materials, the use of flux cored electrodes has been stimulated by developments in electrode manufacturing technology that have permitted the production of smaller diameter electrodes and by improvements in formulation of the core ingredients. This 2005 revision includes the following significant changes:

- (1) Heat input limits are now applied to the preparation of mechanical property test assemblies.
- (2) Maximum tensile strength limits have been added for all multiple pass classifications.
- (3) Mechanical property tests are required on additional electrode sizes.
- (4) Chemical composition limits have been modified.
- (5) Welding parameters are specified for diffusible hydrogen testing.
- (6) Optional supplemental designators (D and Q) have been added to identify high and low cooling rate mechanical property testing for FEMA and Navy applications.

The evolution took place as follows:

Historical Background

AWS A5.20-69	<i>Specifications for Mild Steel Electrodes for Flux Cored Arc Welding</i>
ANSI W3.20-1973	
ANSI/AWS A5.20-79	<i>Specification for Carbon Steel Electrodes for Flux Cored Arc Welding</i>
ANSI/AWS A5.20-95	<i>Specification for Carbon Steel Electrodes for Flux Cored Arc Welding</i>
AWS A5.20/A5.20M:2005	<i>Specification for Carbon Steel Electrodes for Flux Cored Arc Welding</i>

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.

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Specification for Carbon Steel Electrodes for Flux Cored Arc Welding

1. Scope

1.1 This specification prescribes requirements for the classification of carbon steel electrodes for flux cored arc welding (FCAW) either with or without shielding gas. (Metal cored carbon steel electrodes are classified according to AWS A5.18/A5.18M.)¹

1.2 Safety and health issues and concerns are beyond the scope of this standard and, therefore, are not fully addressed herein. Some safety and health information can be found in the informative Annex Clauses A5 and A9. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1² and applicable federal and state regulations.

1.3 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 A5.20 uses U.S. Customary Units. The specification A5.20M 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 A5.20 and A5.20M specifications.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this AWS standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreement based on this AWS standard are encouraged to investigate the possibility of applying the most recent editions of the documents shown below. For undated references, the latest edition of the standard referred to applies.

2.1 The following AWS standards are referenced in the mandatory sections of this document:

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

(2) AWS A5.01, *Filler Metal Procurement Guidelines*.

(3) AWS A5.32/A5.32M, *Specification for Welding Shielding Gases*.

(4) AWS B4.0 or B4.0M, *Standard Methods for Mechanical Testing of Welds*.

2.2 The following ANSI standard is referenced in the mandatory sections of this document:

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

2.3 The following ASTM standards³ are referenced in the mandatory sections of this document:

(1) ASTM A36/A36M, *Specification for Carbon Structural Steel*.

¹ AWS standards are published by the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

² This ANSI standard is published by the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

³ ASTM standards are published by ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

(2) ASTM A285/A285M, *Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength*.

(3) ASTM A515/A515M, *Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service*.

(4) ASTM A516/A516M, *Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*.

(5) ASTM A830/A830M, *Standard Specification for Plates, Carbon Steel, Structural Quality, Furnished to Chemical Composition Requirements*.

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

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

(8) ASTM E350, *Standard Test Methods for Chemical Analysis of Carbon Steel, Low Alloy Steel, Silicon Electrical Steel, Ingot Iron and Wrought Iron*.

(9) ASTM E1032, *Standard Test Method for Radiographic Examination of Weldments*.

2.4 The following ISO standard⁴ is referenced in the mandatory sections of this document.

(1) ISO 544, *Welding consumables—Technical delivery conditions for welding filler metals—Type of product, dimensions, tolerances and marking*.

2.5 The following FEMA (Federal Emergency Management Agency) document⁵ is referenced in the mandatory sections of this document.

(1) FEMA 353, *Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications*.

3. Classification

3.1 The flux cored electrodes covered by the A5.20 specification utilize a classification system based upon the U.S. Customary Units and are classified according to the mechanical properties of the weld metal as specified in Table 1U as shown in Figure 1.

3.1M The flux cored electrodes covered by the A5.20M specification utilize a classification system based upon the International System of Units (SI) and are classified according to the mechanical properties of the weld metal as specified in Table 1M as shown in Figure 1.

3.1.1 Flux cored electrodes classified for multiple-pass welding are classified according to the following:

(1) The as-welded mechanical properties of the weld metal obtained with a particular shielding gas, if any, as specified in Table 1U [Table 1M].

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

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

3.1.2 Flux cored electrodes classified for single pass welding are classified in the as-welded condition according to the following:

(1) The tensile properties of the weld metal obtained with a particular shielding gas, if any, as specified in Table 1U [Table 1M].

(2) The positions of welding for which the electrode is suitable, as shown in Figure 1.

⁴ISO standards are published by the International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

⁵FEMA documents are published by FEMA Publications, P.O. Box 2012, Jessup, MD 20794.