AWS A5.1/A5.1M:2012
An American National Standard

Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

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ANSI

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Specification for Carbon Steel Electrodes for Shielded Metal 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 establishes the requirements for classification of carbon steel electrodes for shielded metal arc welding. The requirements include mechanical properties of weld metal, weld metal soundness, and usability of electrode. Requirements for composition of the weld metal, moisture content of low-hydrogen electrode coverings, standard sizes and lengths, marking, manufacturing, and packaging are also included. A guide to the use of the standard is included in an annex.

Optional supplemental requirements include improved toughness and ductility, lower moisture contents, and diffusible hydrogen limits.

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 AWS A5.1/A5.1M:2012, *Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*, but is included for informational purposes only.

This specification is the latest revision of the first filler metal specification issued over 70 years ago. The initial 1940 document and the three revisions within the next five years were prepared by a joint committee of the American Society for Testing and Materials and the American Welding Society. However, they were issued with only an ASTM specification designation. The 1948 revision was the first specification issued with the AWS designation appearing on the document. The 1969 revision was the first time that the document was issued without the ASTM designation.

This document is the second of the A5.1 specifications which makes use of both U.S. Customary Units and the International System of Units (SI). The dimensions are not exact equivalents in the two systems. Previous A5.1 specifications showed an approximate conversion to SI units for informational purposes only. This practice is discontinued. Instead SI units used are hard conversions to rational units. In selecting rational metric units, AWS A1.1, *Metric Practice Guide for the Welding Industry*, and International Standard ISO 544, *Welding consumables — Technical delivery conditions for welding filler materials — 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.

Substantive changes in this revision include adding of boron reporting requirement in Table 7, and updating Clause 6, Rounding-Off Procedure. These changes are shown in *italic* font.

Document Development:

ASTM A 233-40T	*Tentative Specifications for Iron and Steel Arc-Welding Electrodes*
ASTM A 233-42T	*Tentative Specifications for Iron and Steel Arc-Welding Electrodes*
ASTM A 233-43T	*Tentative Specifications for Iron and Steel Arc-Welding Electrodes*
ASTM A 233-45T	*Tentative Specifications for Iron and Steel Arc-Welding Electrodes*
ASTM A 233-48T AWS A5.1-48T	*Tentative Specifications for Mild Steel Arc Welding Electrodes*
ASTM A 233-55T AWS A5.1-55T	*Tentative Specifications for Mild Steel Arc Welding Electrodes*
ASTM A 233-58T AWS A5.1-58T	*Tentative Specification for Mild Steel Arc Welding Electrodes*
AWS A5.1-64T ASTM A 233-64T	*Tentative Specification for Mild Steel Covered Arc Welding Electrodes*
AWS A5.1-69 ANSI W3.1-1973	*Specification for Mild Steel Covered Arc Welding Electrodes*
ANSI/AWS A5.1-78	*Specification for Carbon Steel Covered Arc-Welding Electrodes*
ANSI/AWS A5.1-81	*Specification for Carbon Steel Covered Arc-Welding Electrodes*
ANSI/AWS A5.1-91	*Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*
AWS A5.1/A5.1M:2004	*Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*

Comments and suggestions for the improvement of this standard are welcomed. They should be sent to the Secretary, AWS A5 Committee on Filler Metals and Allied Materials, American Welding Society, 8669 Doral Blvd., Doral, FL 33166.

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Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

1. Scope

1.1 This specification prescribes requirements for the classification of carbon steel electrodes for shielded metal arc welding.

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 Informative Annex Clauses A5 and A10. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*,[1] 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 material properties. The specification with the designation A5.1 uses U.S. Customary Units. The specification A5.1M 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 filler metal or packaging or both under A5.1 or A5.1M specifications.

Part A
General Requirements

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 referenced applies.

The following documents are referenced in the mandatory sections of this document:

(1) ASTM E29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*[2]

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

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

[1] ANSI Z49.1 is published by the American Welding Society, 8669 Doral Blvd., Doral, FL 33166.
[2] ASTM standards are published by ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.