AWS A5.36/A5.36M:2016
An American National Standard

Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

American Welding Society®

AWS A5.36/A5.36M:2016
An American National Standard

Approved by the
American National Standards Institute
May 06, 2016

Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

2nd Edition

Supersedes AWS A5.36/A5.36M:2012

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 and low-alloy steel flux cored electrodes for flux cored arc welding and metal cored electrodes for gas metal 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 diffusible hydrogen and to indicate conformance to special mechanical property requirements when the weld metal is deposited using low heat input, fast cooling rate and high heat input, slow cooling rate procedures. Additional requirements are included or referenced 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 and low-alloy steel flux cored and metal 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: 978-0-87171-887-7

Statement on the Use of American Welding Society Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society (AWS) are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute (ANSI). When AWS American National Standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

AWS American National Standards are developed through a consensus standards development process that brings together volunteers representing varied viewpoints and interests to achieve consensus. While AWS administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its standards.

AWS disclaims liability for any injury to persons or to property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this standard. AWS also makes no guarantee or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this standard available, AWS is neither undertaking to render professional or other services for or on behalf of any person or entity, nor is AWS undertaking to perform any duty owed by any person or entity to someone else. Anyone using these documents should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. It is assumed that the use of this standard and its provisions is entrusted to appropriately qualified and competent personnel.

This standard may be superseded by new editions. This standard may also be corrected through publication of amendments or errata, or supplemented by publication of addenda. Information on the latest editions of AWS standards including amendments, errata, and addenda is posted on the AWS web page (www.aws.org). Users should ensure that they have the latest edition, amendments, errata, and addenda.

Publication of this standard does not authorize infringement of any patent or trade name. Users of this standard accept any and all liabilities for infringement of any patent or trade name items. AWS disclaims liability for the infringement of any patent or product trade name resulting from the use of this standard.

AWS does not monitor, police, or enforce compliance with this standard, nor does it have the power to do so.

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the appropriate technical committee. Such requests should be addressed to the American Welding Society, Attention: Managing Director, Technical Services Division, 8669 NW 36 St # 130, Miami, FL 33166 (see Annex C). With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. These opinions are offered solely as a convenience to users of this standard, and they do not constitute professional advice. Such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

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.

This page is intentionally blank.

Foreword

This foreword is included for informational purposes only.
It is not part of AWS A5.36/A5.36M:2016, *Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding*

This specification is the second edition that combines the two specifications previously issued by the American Welding Society for the classification of carbon and low-alloy steel flux cored electrodes (AWS A5.20/A5.20M, *Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*, and AWS A5.29/A5.29M, *Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*). In addition, this specification includes provisions for the classification of carbon and low-alloy steel metal cored electrodes. Heretofore, carbon steel metal cored electrodes were classified under AWS A5.18/A5.18M, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding,* and low-alloy steel metal cored electrodes were classified under A5.28/A5.28M, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*. The user should be advised that the requirements for low-alloy metal cored electrodes classified under this specification may vary somewhat from those prescribed in AWS A5.28/A5.28M.

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 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, provides for interchangeability of products in both the U.S. Customary and SI Units.

This AWS A5.36/A5.36M specification utilizes a new, "open classification system" introduced in this document for the classification of carbon and low-alloy steel flux cored and metal cored electrodes. This new classification system facilitates the introduction of new products designed to meet the ever changing requirements of today's market. The open classification system uses designators to indicate electrode type (Usability Designator), welding position capability, tensile strength, notch toughness, shielding gas (with more options and new designations), condition of heat treatment, if any, and weld deposit composition. The change to an open classification system was made to allow for the classification of flux cored and metal cored electrodes with classification options which (1) better define the performance capabilities of the advanced electrode designs that have been developed, and (2) reflect the application requirements of today's marketplace. In addition, the provision was made in this document for the classification of metal cored electrodes (usability Designator T15) and two new electrode types (Usability Designators T16 and T17) for the classification of metal cored and flux cored electrodes designed for use with AC power sources with or without modified waveforms. The EXXT-2X classification was discontinued in the 2012 edition. Electrodes previously classified as EXXT-2X can now be classified under the new open classification system without requiring a unique "2" Usability Designator. The EXXT-13 electrode classification was discontinued in the 2012 edition due to lack of commercial significance.

The AWS A5.36/A5.36M specification does not preclude the continued classification of carbon and low-alloy steel flux cored electrodes or carbon and low-alloy steel metal cored electrodes to AWS A5.20/A5.20M, AWS A5.29/A5.29M, AWS A5.18/A5.18M, or AWS A5.28/A5.28M, as applicable. It is recognized that many electrodes classified to the fixed requirements of these documents have gained wide acceptance for single and multiple pass applications. A number of the more widely used electrodes falling into this category have been retained in AWS A5.36/A5.36M with their existing designations and classification requirements. A listing of these electrode classifications with their requirements is given in Table A.1 in the Normative Annex A.

Additional changes to note are: (1) the Mn and Ni requirements for the K11 alloy type have been modified, (2) two new alloy types have been added, the K12 for high strength circumferential pipe welding and the K13 which is similar to the K2 alloy type but modified to allow for lower Mn content, (3) the heat input requirements for the "D" optional, supplemental designator for seismic applications have been changed to the requirements as specified in AWS A5.20/A5.20M:2005, (4) a protocol was introduced to allow the manufacturer to indicate conformance to impact requirements which are supplemental to and different from those used for electrode classification under this specification, (5) supplemental designators were provided to indicate more restrictive requirements for the Mn + Ni content of the B91 and B92 chromium-molybdenum weld deposits, and (6) a restriction was established prohibiting the use of the optional, supplemental diffusible hydrogen designator for self-shielded electrodes which produce weld deposits with greater than 1.3% aluminum content (Refer to A2.5 in Annex A).

Additionally, the format of this document has been modified for better clarity. The following items now appear in a Normative Annex: (1) a table listing existing electrode classifications having fixed requirements which are retained in this document, (2) optional, supplemental designators with their requirements, and (3) other special tests not required for classification.

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.

Document Development

This is the first revision of AWS A5.36/A5.36M specification that was issued initially in 2012. The history of the AWS A5.20 and AWS A5.29 specifications appear below:

AWS A5.20-69 ANSI W3.20-1973	*Specifications for Mild Steel Electrodes for Flux Cored Arc Welding*
ANSI/AWS A5.20-79	*Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*
ANSI/AWS A5.20-95	*Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*
AWS A5.20/A5.20M:2005	*Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*
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 A5.36/A5.36M:2012	*Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding*

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 36 St # 130, Miami, FL 33166.

Table of Contents

List of Figures

List of Tables

Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

1. Scope

1.1 This specification prescribes requirements for the classification of carbon and low-alloy steel flux cored electrodes for flux cored arc welding (FCAW), either with or without shielding gas, and carbon and low-alloy steel metal cored electrodes for gas metal arc welding (GMAW). Carbon and low-alloy flux cored electrodes had previously been classified solely under AWS A5.20/A5.20M, *Specification for Carbon Steel Electrodes for Flux Cored Arc Welding,* or AWS A5.29/A5.29M, *Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*. Carbon and low-alloy steel metal cored electrodes have previously been classified solely under AWS A5.18/A5.18M, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding*, or AWS A5.28/A5.28M, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*. Iron is the only element of the undiluted weld metal deposited by the electrodes classified under this specification whose content exceeds 10.5%.

1.2 Safety issues and concerns are addressed in this standard, although health issues and concerns are beyond the scope of this standard. Some safety and health information can be found in non-mandatory Annex Clauses B5 and B13. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1,[1] *Safety in Welding, Cutting, and Allied Processes,* 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 A5.36 uses U.S. Customary Units. The specification A5.36M uses the International System of Units (SI). 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 A5.36 and A5.36M specifications.

2. Normative References

The standards listed below contain provisions which, through reference in this text, constitute mandatory 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 AWS Standards[2]

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

(2) AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*

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

[1] ANSI Z49.1 is published by the American Welding Society, 8669 NW 36 St # 130, Miami, FL 33166.
[2] AWS standards are published by the American Welding Society, 8669 NW 36 St # 130, Miami, FL 33166.