

**AWS A5.9/A5.9M:2017
(ISO 14343:2009 MOD)
An American National Standard**

Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels— Classification



**AWS A5.9/A5.9M:2017
(ISO 14343:2009 MOD)
An American National Standard**

**Approved by
American National Standards Institute
December 09, 2016**

Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels—Classification

9th Edition

Supersedes AWS A5.9/A5.9M: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 bare solid stainless steel electrodes (both as wire and strip) for gas metal arc welding, submerged arc welding, and other fusion welding processes. It also includes wire and rods for use in gas tungsten arc welding and plasma arc welding. Classification is based on chemical composition of the filler metal. A guide is appended to the specification as a source of information concerning the classification system employed and the intended use of the stainless steel filler metal.

This specification does not include any units other than weight percent. The specification's Annex A 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: 978-0-87171-905-8

© 2017 by American Welding Society

All rights reserved

Printed in the United States of America

Photocopy Rights. No portion of this standard may be reproduced, stored in a retrieval system, or transmitted in any form, including mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

Authorization to photocopy items for internal, personal, or educational classroom use only or the internal, personal, or educational classroom use only of specific clients is granted by the American Welding Society provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, tel: (978) 750-8400; Internet: <www.copyright.com>.

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, Standards Development, 8669 NW 36 St, # 130, Miami, FL 33166 (see Annex B). 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 Society, 8669 NW 36 St, # 130, Miami, FL 33166.

This page is intentionally blank.

Personnel

AWS A5 Committee on Filler Metals and Allied Materials

H. D. Wehr, Chair	<i>Arcos Industries LLC</i>
R. D. Fuchs, 2nd Vice Chair	<i>Voestalpine Bohler Welding USA Incorporated</i>
R. K. Gupta, Secretary	<i>American Welding Society</i>
T. Anderson	<i>ITW Welding North America</i>
J. C. Bundy	<i>Hobart Brothers Company</i>
J.L. Caron	<i>Haynes International, Incorporated</i>
G. L. Chouinard	<i>Stoody Company (a division of ESAB)</i>
D. D. Crockett	<i>Consultant</i>
R. V. Decker	<i>Weldstar</i>
D. M. Fedor	<i>The Lincoln Electric Company</i>
J. G. Feldstein	<i>Foster Wheeler North America</i>
D. A. Fink	<i>The Lincoln Electric Company</i>
G. L. Franke	<i>Consultant</i>
R. M. Henson	<i>Harris Products Group</i>
S. D. Kiser	<i>Consultant</i>
P. J. Konkol	<i>Concurrent Technologies Corporation</i>
D. J. Kotecki	<i>Damian Kotecki Welding Consultants</i>
L. G. Kvidahl	<i>Ingalls Shipbuilding</i>
A. Y. Lau	<i>Canadian Welding Bureau</i>
J. S. Lee	<i>Chevron</i>
J.R. Logan	<i>Babcock & Wilcox</i>
C. McEvoy	<i>Consultant</i>
T. Melfi	<i>The Lincoln Electric Company</i>
M. T. Merlo	<i>Consultant</i>
K. M. Merlo-Joseph	<i>Apeks Supercritical</i>
B. Mosier	<i>Polymet Corporation</i>
T. C. Myers	<i>Lutech Resources</i>
B. A. Pletcher	<i>Bechtel</i>
J. D. Praster	<i>NuWeld, Incorporated</i>
K. C. Pruden	<i>BP Americas</i>
K. Roossinck	<i>Ingalls Shipbuilding</i>
K. Sampath	<i>Chart Industries</i>
J. D. Schaefer	<i>Tri Tool, Incorporated</i>
F.A. Schweighardt	<i>Air Liquide Industrial US LP</i>
W. S. Severance	<i>Consultant</i>
M.F. Sinfield	<i>Naval Surface Warfare Center</i>
D. Singh	<i>GE Oil & Gas</i>
P. E. Staunton	<i>Shell EDG</i>
R. C. Sutherlin	<i>Consultant</i>
R. A. Swain	<i>Euroweld, Limited</i>
J. Zhang	<i>Indalco Alloys Inc of Lincoln Electric</i>

Advisors to AWS A5 Committee on Filler Metals and Allied Materials

D. R. Bajek	<i>Chicago Bridge & Iron</i>
J. E. Beckham	<i>Fiat Chrysler Automobiles</i>

J. M. Blackburn	<i>Naval Sea Systems Command</i>
K. P. Campion	<i>Central Wire Industries</i>
D. A. DelSignore	<i>Consultant</i>
J. DeVito	<i>Consultant</i>
W. D. England	<i>ITW Welding North America</i>
S. E. Ferree	<i>Consultant</i>
R. J. Fox	<i>Hobart Brothers Company</i>
O. Henderson	<i>Trinity Industries, Incorporated</i>
S. Imaoka	<i>Kobe Steel Limited</i>
S. J. Knostman	<i>Hobart Brothers Company</i>
W. A. Marttila	<i>WAMcom Consulting LLC</i>
R. Menon	<i>Stoody Company (a division of ESAB)</i>
R. A. Miller	<i>Kennametal, Incorporated</i>
M. A. Quintana	<i>The Lincoln Electric Company</i>
P. K. Salvesen	<i>Det Norske Veritas (DNV)</i>
M. J. Sullivan	<i>NASSCO-Natl Steel & Shipbuilding</i>
M. D. Tumuluru	<i>US Steel Corporation</i>
H. J. White	<i>PCC Energy Group</i>

AWS A5D Subcommittee on Stainless Steel Filler Metals

D. J. Kotecki, Chair	<i>Damian Kotecki Welding Consultants</i>
F. B. Lake, Vice Chair	<i>Stoody Company (a division of ESAB)</i>
R. K. Gupta, Secretary	<i>American Welding Society</i>
R. V. Decker	<i>Weldstar</i>
D. A. DelSignore	<i>Consultant</i>
T. J. Eckardt	<i>Select-Arc, Incorporated</i>
J. G. Feldstein	<i>Foster Wheeler North America</i>
R. D. Fuchs	<i>Voestalpine Bohler Welding USA Incorporated</i>
M. James	<i>The Lincoln Electric Company</i>
S. J. Knostman	<i>Hobart Brothers</i>
W. P. Koegel	<i>R-V Industries, Inc.</i>
G. A. Kurisky	<i>Consultant</i>
M. T. Merlo	<i>Consultant</i>
S. J. Merrick	<i>The Lincoln Electric Company</i>
R. A. Swain	<i>Euroweld, Limited</i>
G. P. Villemez	<i>Kobelco Welding of America</i>
H. D. Wehr	<i>Arcos Industries, LLC</i>
J. M. Zawodny	<i>Voestalpine Bohler Welding USA, Inc.</i>

Advisors to the AWS A5D Subcommittee on Stainless Steel Filler Metals

F. S. Babish	<i>Sandvik Materials Technology</i>
K. P. Campion	<i>Central Wire Industries</i>
R. E. Cantrell	<i>Constellation Energy Nuclear Group</i>
K. K. Gupta	<i>Westinghouse Electric Corp</i>
S. Imaoka	<i>Kobe Steel Ltd</i>
I. K. Ishizaki	<i>Kobelco Welding of America Inc.</i>
S. R. Jana	<i>Consultant</i>
J. S. Ogborn	<i>The Lincoln Electric Company</i>
J. G. Wallin	<i>Stoody Company (a division of ESAB)</i>
Y. Yokota	<i>Kobelco Welding of America Inc.</i>

Foreword

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

The first specification for bare stainless steel electrodes and rods was prepared in 1953 by a joint committee of the American Society for Testing and Materials and the American Welding Society. The joint committee also prepared the 1962 revision. The first revision prepared exclusively by the AWS A5 Committee on Filler Metal and Allied Materials was published in 1969. This is the first revision with modified adoption of ISO 14343.

Document Development

The current revision is the ninth revision of the original 1953 document. The evolution took place as follows:

ASTM A371-53T	<i>Tentative Specifications for Corrosion Resisting Chromium and</i>
AWS A5.9-53T	<i>Chromium-Nickel Steel Welding Rods and Bare Electrodes</i>
ASTM A371-62T	<i>Tentative Specifications for Corrosion Resisting Chromium and</i>
AWS A5.9-62T	<i>Chromium-Nickel Steel Welding Rods and Bare Electrodes</i>
AWS A5.9-69	<i>Specification for Corrosion-Resisting Chromium and</i>
ANSI W3.9-1973	<i>Chromium-Nickel Steel Welding Rods and Bare Electrodes</i>
AWS A5.9-Add 1-75	<i>Addenda to Specification for Corrosion-Resisting Chromium and</i>
	<i>Chromium-Nickel Steel Welding Rods and Bare Electrodes</i>
AWS A5.9-77	<i>Specification for Corrosion Resisting Chromium and Chromium-Nickel Steel Bare and</i>
	<i>Composite Metal Cored and Stranded Arc Welding Electrodes and Welding Rods</i>
AWS A5.9-81	<i>Specification for Corrosion Resisting Chromium and Chromium-Nickel Steel Bare and</i>
	<i>Composite Metal Cored and Stranded Welding Electrodes and Welding Rods</i>
AWS A5.9-93	<i>Specification for Bare Stainless Steel Welding Electrodes and Rods</i>
AWS A5.9/A5.9M:2006	<i>Specification for Bare Stainless Steel Welding Electrodes and Rods</i>
AWS A5.9/A5.9M:2012	<i>Specification for Bare Stainless Steel Welding Electrodes and Rods</i>

This is the first revision of AWS A5.9/A5.9M that includes classifications from ISO 14343. Numerous classifications used in Europe or in countries around the Pacific Rim are added by this adoption of the ISO standard. Please note that ISO uses commas (,) and AWS uses periods (.) for decimals. The ISO decimal commas have been replaced by periods in this document for consistency.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO or AWS shall not be held responsible for identifying any or all such patent rights.

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.

This page is intentionally blank.

Introduction

It is recognized that there are two somewhat different approaches in the global market to classifying a given stainless steel welding consumable, and that either or both can be used to suit a particular market need. One is the *nominal composition* approach, which uses designators to indicate the principal alloying elements at their nominal levels, in a particular sequence, and which is sometimes followed by chemical element symbols to indicate compositional modifications to the original grade. The other is the *alloy type* approach, which uses tradition-based three- or four-digit designations for certain original grades, sometimes followed by one or more chemical element symbols indicating compositional modifications of the original. In both approaches, classification is based upon the chemical composition of the product. In many cases, a given product can be classified using both approaches, because the composition ranges, although slightly different, overlap to a considerable extent between the two.

Designation by either type of classification, or both where suitable, identifies a product as being classified according to this AWS standard. Many, but not all, commercial products addressed by this AWS standard can be classified using both approaches, and suitable products can be so marked. Classification according to system A, by nominal composition, is based mainly on the European standard EN 12072 *Welding consumables—Wire electrodes, wires, and rods for arc welding of stainless and heat-resisting steels—Classification*, while that of system B, by alloy type, is mainly based upon standards used around the Pacific Rim including AWS A5.9/A5.9M:2012 *Specification for Bare Stainless Steel Welding Electrodes and Rods*.

For stainless steel welding consumables, there is no unique relationship between the product form (wire electrode, strip electrode, wire, or rod) and the welding process used (gas-shielded metal arc welding, gas tungsten arc welding, plasma arc welding, submerged arc welding, electroslag welding, and laser beam welding). For this reason, the wire electrodes, strip electrodes, wires, or rods can be classified on the basis of any of the above product forms and can be used, as appropriate, for more than one of the above processes.

This page is intentionally blank.

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>	vii
<i>Introduction</i>	ix
<i>List of Tables</i>	xiii
<i>List of Figures</i>	xiii
1. Scope	1
2. Normative References	1
3. Terms and Definitions	2
4. Classification	2
5. Acceptance	6
6. Certification	6
7. Rounding Procedure	6
8. Summary of Tests	7
9. Retest	7
10. Properties of All-Weld Metal	7
11. Chemical Analysis	7
12. Method of Manufacture	7
13. Technical Delivery Conditions	7
14. Examples of AWS Classification/Designation	8
Annex A (Informative)—Guide to AWS A5.9/A5.9M:2017 (ISO 14343:2009 MOD)	
Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc	
Welding of Stainless and Heat Resisting Steels—Classification	9
Annex B (Informative)—Guidelines for the Preparation of Technical Inquiries	33
Annex C (Informative)—List of Deviations from ISO 14343:2009	35
AWS Filler Metal Specifications by Material and Welding Process	36
AWS Filler Metal Specifications and Related Documents	37

This page is intentionally blank.

List of Tables

Table		Page No.
1	Chemical Composition Requirements	3
A.1	Variations of Alloying Elements for Submerged Arc Welding of Stainless Steel	14
A.2	Traditional AWS A5.9 Alloy Designations with Corresponding UNS Numbers and Nearest Nominal Composition Designations	17
A.3	Expected (Typical) Minimum All-Weld-Metal Mechanical Property Requirements from AWS A5.4/A5.4M:2012 and/or ISO 3581:2003	28
A.4	Discontinued Classifications	29

List of Figure

Figure		Page No.
A.1	WRC-1992 Diagram for Stainless Steel Weld Metal	15

This page is intentionally blank.

Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels—Classification

1. Scope

1.1 This specification prescribes requirements for the classification of bare stainless steel wire electrodes (*including stranded wire in which all wires in the strand are from one heat*), strip electrodes, wires, and rods for gas metal arc welding, gas tungsten arc welding, plasma arc welding, submerged arc welding, electroslag welding, and laser beam welding of stainless and heat resisting steels. The classification of the wire electrodes, strip electrodes, wires, and rods is based upon their chemical composition. The chromium content of these filler metals is not less than 10.5% and the iron content exceeds that of any other element. For purposes of classification, the iron content shall be derived as the balance element when all other elements are considered to be at their minimum specified values.

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 A6 and A12. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal and state regulations.

1.3 This specification's Annex A makes use of both U.S. Customary Units and the International System of Units (SI). The measurements are not exact equivalents. The specification designated A5.9 uses U.S. customary units in its Annex A and the specification designated A5.9M uses SI units in its Annex A. The latter units are shown within brackets [] or in appropriate columns in tables and figures.

2. Normative References

2.1 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.

2.2 The following AWS standards¹ are referenced in the normative sections of this document.

1. AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*
2. AWS A5.01M/A5.01 (ISO 14344 MOD), *Welding Consumables—Procurement of Filler Metals and Fluxes*
3. AWS A5.02/A5.02M, *Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes*
4. AWS F3.2, *Ventilation Guide for Welding Fume*

2.3 The following ANSI standard² is referenced in the normative sections of this document.

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

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

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