

**AWS A4.5M/A4.5:2012
(ISO 15792-3:2011 MOD)
An American National Standard**

Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld



American Welding Society®



AWS A4.5M/A4.5:2012 (ISO 15792-3:2011 MOD)
An American National Standard

Approved by the
American National Standards Institute
March 9, 2012

Standard Methods for Classification Testing
of Positional Capacity and Root Penetration
of Welding Consumables in a Fillet Weld

1st Edition

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 standard describes preparation and assessment of a fillet weld test piece.

Test conditions prescribed and results required should not be considered to be requirements or expectations for a procedure qualification.

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.



American Welding Society®
550 N.W. LeJeune Road, Miami, FL 33126

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M. D. Tumuluru	<i>U.S. Steel Corporation</i>
J. Zhang	<i>Indalco Alloys, Incorporated of Lincoln Electric</i>

Advisors to the AWS A5 Committee on Filler Metal and Allied Material

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J. E. Beckham	<i>Chrysler LLC</i>
M. L. Caruso	<i>Special Metals</i>
R. A. Daemen	<i>Consultant</i>
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E. S. Surian	<i>National University of Lomas de Zamora</i>
H. J. White	<i>Consultant</i>

Foreword

This foreword is not part of AWS A4.5M/A4.5:2012 (ISO 15792-3:2011 MOD), *Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld*, but is included for informational purposes only.

This document is the first adoption of ISO 15792-3:2011 with additional informative annexes.

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 The ISO decimal commas have been replaced by periods in this document for consistency.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 part of ISO 15792 may be the subject of patent rights. ISO 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, 550 N.W. LeJeune Road, Miami, FL 33126.

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Standard methods for classification testing of positional capacity and root penetration of welding consumables in a fillet weld

1 Scope

This standard specifies the preparation and assessment of fillet weld test pieces for conformity assessment of positional usability and root penetration requirements for consumables classification standards for welding non-alloy and fine grain steels, low alloy steels, stainless steels, and nickel base alloys.

This standard does not specify acceptance requirements.

Safety and Health issues and concerns are beyond the scope of this standard and are, therefore, not fully addressed herein. 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.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

AWS¹ A3.0, *Standard Welding Terms and Definitions*

3 General requirements

Samples of welding consumables (electrodes or wires) to be tested shall be representative of the manufacturer's products being classified. Test pieces shall be prepared and tested as specified in Clauses 5 and 6, as well as in the consumable classification standard. The test results shall fulfil the requirements of the classification standard.

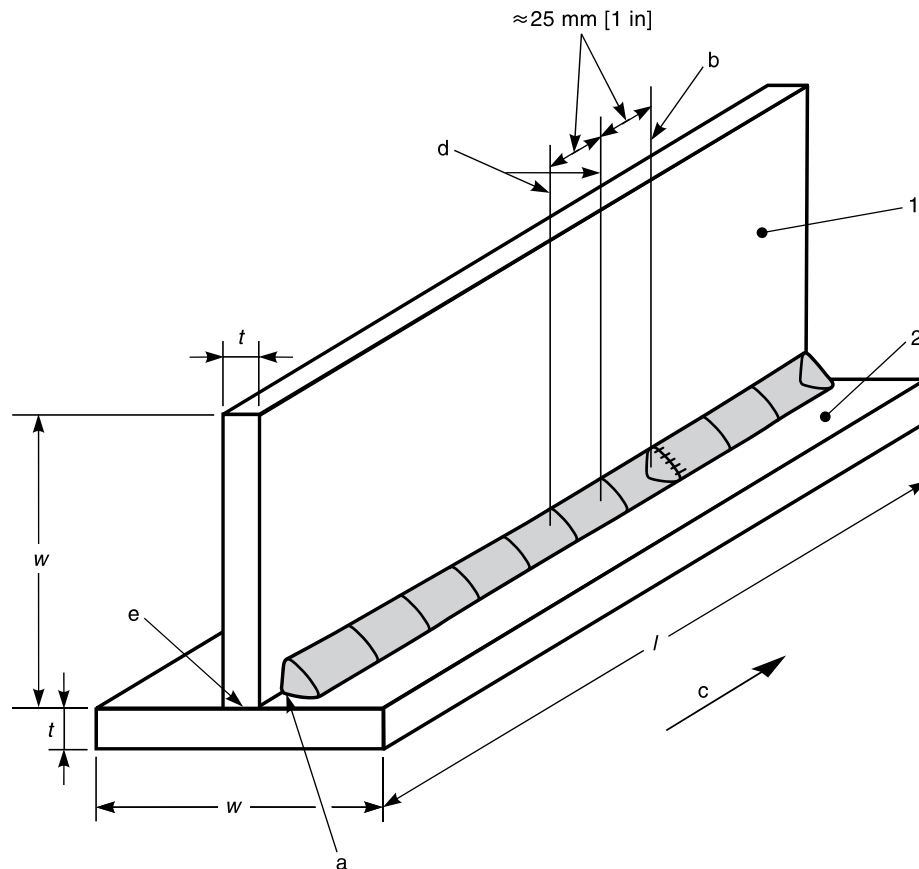
4 Test plate material

The plate material shall be selected from the range of materials and material thicknesses prescribed by the consumable classification standard. The surfaces to be welded shall be free of scale, rust, and other contaminants.

¹ AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

5 Preparation of the test piece

5.1 Before assembling, the web piece of the assembly shall have one edge of the web flat and square throughout its length so that, when the web is set on the flange, which shall be straight and smooth, there will be intimate contact along the entire length of the joint. The web and flange shall be assembled as shown in Figure 1. Both ends of the joint shall be secured by tack welds to maintain intimate contact along the length of the joint and to maintain the 90° angle between the web and flange. The web and flange dimensions shall be in accordance with those given in the consumable classification standard.



Key

- 1 Web
- 2 Flange

If not given in the consumable classification standard, the following values can be used:

$t = 10 \text{ mm } [3/8 \text{ in}] \text{ to } 12 \text{ mm } [1/2 \text{ in}]$;

$w = 75 \text{ mm min. } [3 \text{ in min.}]$;

$l = 300 \text{ mm min. } [12 \text{ in min.}]$.

^a Start

^b End of deposit made with first electrode (for SMAW electrodes only)

^c Direction of welding

^d Cut here for macrosection

^e Flange to be straight and in intimate contact with the flat square edge of web member along entire length

Figure 1—Preparation of fillet weld test piece

5.2 The position of welding and conditions of welding shall be as prescribed in the consumable classification standard for the classification and size of consumable under test, and as defined in *AWS A3.0*. A single pass fillet weld shall be deposited on one side of the joint for approximately the full length of the test piece. The minimum temperature of the assembly shall be 15 °C [60 °F]. For covered electrodes, at least one electrode (and as many more as the weld permits) shall be continuously consumed to within the permissible stub length of 50 mm [2 in]. For electrodes longer than 450 mm [18 in], designed specifically for use in gravity welding, the fillet weld may be made either manually or with a device designed specifically for gravity welding. For wire electrodes, tubular cored electrodes and wires, welding shall be continuous from start to finish of the fillet weld.

5.3 The fillet shall be deposited using travel speeds compatible with the consumable classification and tested to provide the fillet weld size required by the consumable classification standard.

5.4 If welding of the second side of the test piece is required by the consumable classification standard, the test piece shall be cooled to room temperature by any convenient means, before starting to weld the second side of the joint.

If water is used as the coolant, care shall be taken that all water has been thoroughly removed from the joint before beginning welding on the second side.

6 Examination of the test piece

6.1 *The completed fillet weld test piece shall be examined per the classification standard.* Leg length shall be measured at a minimum of three locations along the length of the weld using an appropriate gauge to demonstrate conformity with the requirements of the consumable classification standard. For test plates welded with covered electrodes, where two or more electrodes are used, a macrosection, approximately 25 mm [1 in] wide, shall be removed from a point approximately 25 mm [1 in] back from the crater end of the deposit made with the first electrode. For test plates welded with a continuous consumable or with only one covered electrode is used, a macrosection, approximately 25 mm [1 in] wide, shall be removed from approximately the midpoint of the weld length.

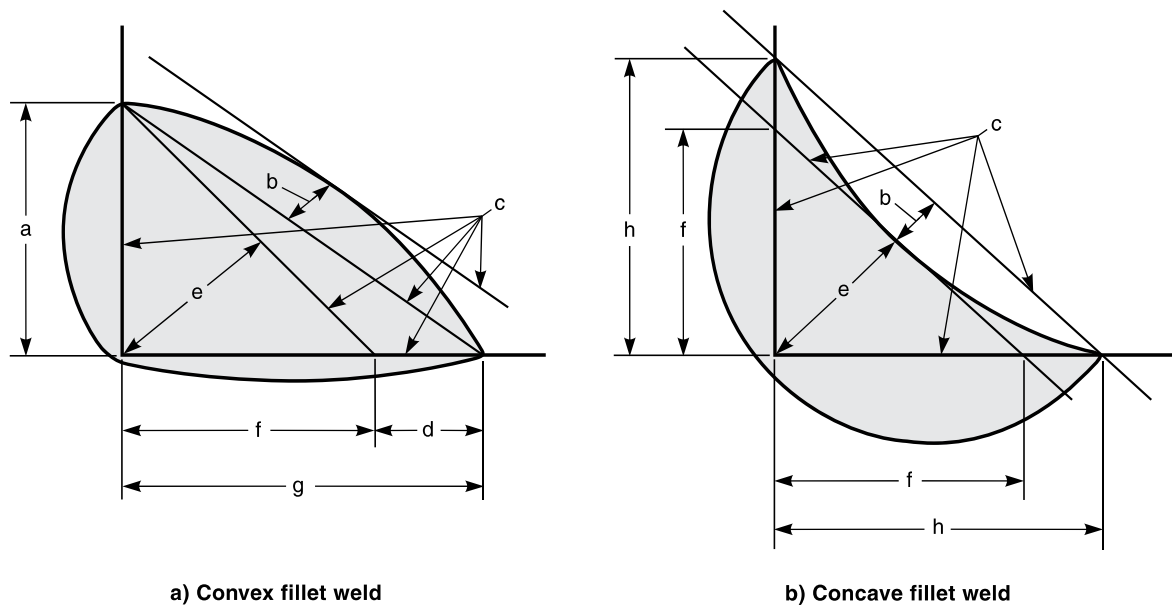
6.2 One surface of the macrosection shall be polished, etched, and scribed as shown in Figure 2. The convexity or concavity, and leg lengths of the fillet weld shall be determined to the nearest 0.5 mm [1/64 in] by actual measurement of the polished and etched macrosection.

If fillet welds are required by the consumable classification standard on both sides of the test piece, then both fillet welds shall be measured on the same macrosection.

6.3 For fillet weld test pieces welded from one side only, when required by the consumable classification standard, the remaining two joint sections shall be broken longitudinally through the fillet weld by a force exerted in the direction shown in Figure 3. If, during bending, the weld pulls out of the test plate, it shall be considered as a no test, and the test shall be repeated without penalty.

6.4 If necessary to facilitate fracture through the throat of the fillet weld, one or more of the following procedures may be used:

- a) reinforcing welds, as shown in Figure 3 a), may be added to each leg of the weld;
- b) the position of the web on the flange may be changed as shown in Figure 3 b);
- c) the face of the weld may be notched as shown in Figure 3 c);
- d) the test piece may be cooled down below 0 °C [32 °F].

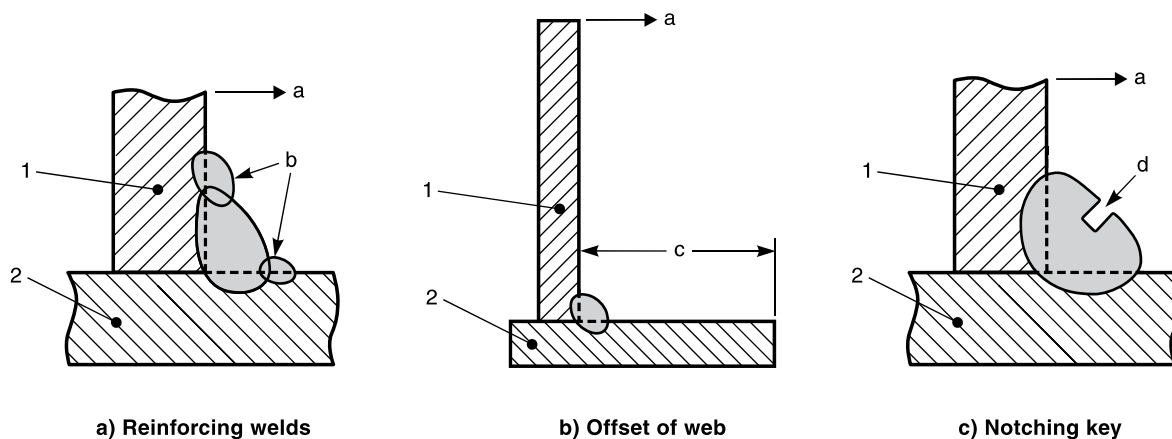


Size of fillet weld — leg length of largest inscribed isosceles right angle. Fillet weld size, convexity and leg lengths shall be determined by actual measurement (to nearest 0.5 mm [1/64 in]) on a section laid out with scribe lines as shown.

Key

- ^a Leg length = fillet weld size
- ^b Convexity or concavity
- ^c Scribe lines
- ^d Difference in leg length
- ^e Theoretical throat
- ^f Fillet weld size
- ^g Leg length $\neq$ fillet weld size
- ^h Leg of fillet

Figure 2 — Dimensions of fillet welds



Key

- 1 Web
- 2 Flange
- ^a Fracturing force
- ^b Reinforcing welds
- ^c 3/4 width of flange
- ^d Maximum depth of notch = 1/2 actual throat

Figure 3 — Alternative methods for facilitating fillet weld fracture

7 Test report

The test report shall include all of the following items as applicable:

a) welding consumable(s) and test assembly:

- the consumable classification standard to which the consumable(s) is (are) being tested;
- base metal from which the test piece is made;
- the trade name(s) and intended classification(s) of the consumable(s) being tested;
- heat or lot number(s) of the consumable(s) being tested;
- redrying conditions for the consumable(s);

b) welding conditions:

- welding process;
- power source;
- electrode diameter;
- electrode polarity;
- welding current;
- wire feed speed;
- arc voltage;
- travel speed;
- contact-tip-to-work distance;
- type and flow rate of shielding gas;
- preheat and interpass temperature;
- position of welding;

c) any deviations from this standard;

d) test results:

- visual examination;
- fillet leg lengths and difference(s) in leg lengths;
- convexity or concavity of the fillet;
- dimension(s) of any incomplete fusion along the length of fillet weld;
- any discontinuities or flaws on the fracture surface.

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Annex A (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex is not part of AWS A4.5/A4.5M:2012 (ISO 15792-3:2011 MOD), *Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld*, but is included for informational purposes only.

A1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

A2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

A2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

A2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

A2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

A2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

A3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

A4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

A5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The *AWS Board Policy Manual* requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

A6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

Annex B (Informative)

List of Deviations from ISO 15792-3:2011

This annex is not part of AWS A4.5/A4.5M:2012 (ISO 15792-3:2011 MOD), *Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld*, but is included for informational purposes only.

Technical Changes:

Replaced “ISO 6817, Level B” with “the classification standard” in 6.3, and removed ISO 6817 from Clause 2 Normative References.

First sentence was added in 6.1

Editorial Changes:

Added U.S. Customary Units

Changed commas used for decimals to periods.

Changed title of the standard from “Welding consumables — Test methods — Part 3: Classification testing of positional capacity and root penetration of welding consumables in a fillet weld”

Added “Safety and Health issues and concerns are beyond the scope of this standard and are, therefore, not fully addressed herein. 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” in the Scope.

Deleted “Members of ISO and IEC maintain registers of currently valid International Standards” from Clause 2.

Changed “part of ISO 15792” to “Standard” throughout the document

Replaced “ISO 6947, Welds — Working positions — Definition of angles of slope and rotation.” with “AWS A3.0, Standard Welding Terms and Definitions” in Clause 2 with footnote 1.

Changed “5 °C [40 °F]” to “15 °C [60 °F].”

Deleted “Throat thickness and” from 6.1

Changed “points” to “locations” in 6.1

Added “test plates welded with” in third sentence in 6.1

Changed last sentence of 6.1 to “For test plates welded with a continuous consumable or with only one covered electrode

Deleted “throat,” from 6.2

Deleted “Dimensions in millimeters” from top of Figure 1.

Added “or concavity” in the legend “b” of Figure 2.

Added “(for SMAW electrodes only)” to Note b of Figure 1.

Changed “lack of root penetration” to “incomplete fusion” in 7.

7 d: Deleted —“theoretical throat of the fillet;”

Added “or flaws” in 7d

Additional Informative Annexes:

Annex A, Guidelines for the Preparation of Technical Inquiries

Annex B, List of Editorial Deviations from ISO 15792-3:2011

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AWS Filler Metal Specifications by Material and Welding Process

	OFW	SMAW	GTAW GMAW PAW	FCAW	SAW	ESW	EGW	Brazing
Carbon Steel	A5.2	A5.1	A5.18, A5.36	A5.36	A5.17	A5.25	A5.26	A5.8, A5.31
Low-Alloy Steel	A5.2	A5.5	A5.28, A5.36	A5.36	A5.23	A5.25	A5.26	A5.8, A5.31
Stainless Steel		A5.4	A5.9, A5.22	A5.22	A5.9	A5.9	A5.9	A5.8, A5.31
Cast Iron	A5.15	A5.15	A5.15	A5.15				A5.8, A5.31
Nickel Alloys		A5.11	A5.14	A5.34	A5.14	A5.14		A5.8, A5.31
Aluminum Alloys		A5.3	A5.10					A5.8, A5.31
Copper Alloys		A5.6	A5.7					A5.8, A5.31
Titanium Alloys			A5.16					A5.8, A5.31
Zirconium Alloys			A5.24					A5.8, A5.31
Magnesium Alloys			A5.19					A5.8, A5.31
Tungsten Electrodes			A5.12					
Brazing Alloys and Fluxes								A5.8, A5.31
Surfacing Alloys	A5.21	A5.13	A5.21	A5.21	A5.21			
Consumable Inserts			A5.30					
Shielding Gases			A5.32	A5.32			A5.32	

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AWS Filler Metal Specifications and Related Documents

Designation	Title
FMC	<i>Filler Metal Comparison Charts</i>
IFS	<i>International Index of Welding Filler Metal Classifications</i>
UGFM	<i>User's Guide to Filler Metals</i>
A4.2M (ISO 8249 MOD)	<i>Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal</i>
A4.3	<i>Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding</i>
A4.4M	<i>Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings</i>
A4.5M/A4.5 (ISO 15792-3 MOD)	<i>Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld</i>
A5.01M/A5.01 (ISO 14344 MOD)	<i>Procurement Guidelines for Consumables—Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes</i>
A5.02/A5.02M	<i>Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes</i>
A5.1/A5.1M	<i>Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding</i>
A5.2/A5.2M	<i>Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding</i>
A5.3/A5.3M	<i>Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding</i>
A5.4/A5.4M	<i>Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding</i>
A5.5/A5.5M	<i>Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding</i>
A5.6/A5.6M	<i>Specification for Copper and Copper-Alloy Electrodes for Shielded Metal Arc Welding</i>
A5.7/A5.7M	<i>Specification for Copper and Copper-Alloy Bare Welding Rods and Electrodes</i>
A5.8/A5.8M	<i>Specification for Filler Metals for Brazing and Braze Welding</i>
A5.9/A5.9M	<i>Specification for Bare Stainless Steel Welding Electrodes and Rods</i>
A5.10/A5.10M	<i>Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods</i>
A5.11/A5.11M	<i>Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding</i>
A5.12M/A5.12 (ISO 6848 MOD)	<i>Specification for Tungsten and Oxide Dispersed Tungsten Electrodes for Arc Welding and Cutting</i>
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