

**AWS A5.10/A5.10M:1999 (R2007)**  
**An American National Standard**



# **Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods**



**American Welding Society**

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**Key Words**—Bare aluminum, filler metal, aluminum rods, aluminum electrodes, gas metal arc welding, gas tungsten arc welding, cast aluminum alloys, oxyfuel gas welding, plasma arc welding, classification, specification

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American National Standards Institute  
November 23, 1999**

# **Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods**

**Supersedes ANSI/AWS A5.10-92**

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 requirements for the classification of bare, wrought and cast aluminum-alloy electrodes, and rods for use with the gas metal arc, gas tungsten arc, oxyfuel gas, and plasma arc welding processes. 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**

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## Foreword

This foreword is not part of AWS A5.10/A5.10M:1999 (R2007), *Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods*, but is included for informational purposes only.

This document is the first of the A5.10 specifications which 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 values in any way. In selecting rational metric units, the *Metric Practice Guide for the Welding Industry* (ANSI/AWS A1.1), and International Standard ISO 864, *Solid Wires for Gas Shielded Metal Arc Welding of Mild Steel—Dimensions of Wires, Spools, Rims and Coils*, 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.

A5.10/A5.10M:1999 represents the seventh revision of the first bare aluminum filler metal specification issued in 1954 as a joint ASTM/AWS specification. After two revisions and publication as a joint specification, ASTM agreed to accept AWS as the sole society responsible for the development and publication of filler metal specifications.

In recent years, AWS filler metal specifications have been recognized by the American National Standards Institute. The evolution of this specification is shown below.

ASTM B285-54T AWS A5.10-54T	<i>Tentative Specification for Aluminum and Aluminum Alloy Welding Rods and Bare Electrodes</i>
ASTM B285-57T AWS A5.10-57T	<i>Tentative Specification for Aluminum and Aluminum Alloy Welding Rods and Bare Electrodes</i>
AWS A5.10-61T ASTM B285-61T	<i>Tentative Specification for Aluminum and Aluminum Alloy Welding Rods and Bare Electrodes</i>
AWS A5.10-69 ANSI W5.10-1973	<i>Specification for Aluminum and Aluminum Alloy Welding Rods and Bare Electrodes</i>
ANSI/AWS A5.10-80	<i>Specification for Aluminum and Aluminum Alloy Bare Electrodes and Rods</i>
ANSI/AWS A5.10-88	<i>Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods</i>
ANSI/AWS A5.10-92	<i>Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods</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, 550 N.W. LeJeune Road, Miami, FL 33126.

# Table of Contents

	<b>Page No.</b>
<i>Personnel (Reaffirmed)</i> .....	v
<i>Personnel (Original)</i> .....	vii
<i>Foreword</i> .....	ix
<i>List of Tables</i> .....	xii
<i>List of Figures</i> .....	xii
<b>1. Scope</b> .....	1
<b>2. Normative References</b> .....	1
<b>3. Classification</b> .....	1
<b>4. Acceptance</b> .....	4
<b>5. Certification</b> .....	4
<b>6. Units of Measure and Rounding-Off Procedure</b> .....	4
<b>7. Summary of Tests</b> .....	4
<b>8. Retest</b> .....	4
<b>9. Weld Test Assemblies</b> .....	5
<b>10. Chemical Analysis</b> .....	5
<b>11. Radiographic Test</b> .....	5
<b>12. Bead-on-Plate Test</b> .....	7
<b>13. Method of Manufacture</b> .....	7
<b>14. Standard Sizes</b> .....	7
<b>15. Finish and Uniformity</b> .....	8
<b>16. Standard Package Forms</b> .....	8
<b>17. Winding Requirements</b> .....	9
<b>18. Filler Metal Identification</b> .....	9
<b>19. Packaging</b> .....	9
<b>20. Marking of Packages</b> .....	11
Annex A (Informative)—Guide to AWS Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods .....	15
Annex B (Informative)—Guidelines for the Preparation of Technical Inquiries.....	27
AWS Filler Metal Specifications by Materials and Welding Process.....	29
AWS Filler Metal Specifications and Related Documents .....	31

## List of Tables

<b>Table</b>		<b>Page No.</b>
1	Chemical Composition Requirements for Aluminum Electrodes and Rods.....	2
2	Required Tests.....	4
3	Base Metal for Test Assemblies.....	7
4	Standard Sizes.....	11
5	Typical Sizes of Flattened Rods.....	11
6	Standard Packages, Dimensions, and Weights.....	12
A1	Designation Reference Guide.....	16
A2	Guide to the Choice of Filler Metal for General Purpose Welding.....	20
A3	Discontinued Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.....	22

## List of Figures

<b>Figure</b>		<b>Page No.</b>
1	Groove Weld Test Assembly for Radiographic Test.....	6
2A	Radiographic Acceptance Standards for Test Assemblies—Overhead Welding Position.....	8
2B	Radiographic Acceptance Standards for Test Assemblies—Overhead Welding Position.....	9
3	Radiographic Acceptance Standard for Test Assemblies—Flat Position Welding.....	10
4	Dimensions of 4, 8, and 12 in. [100, 200, and 300 mm] Diameter Spools.....	13
5	Dimensions of Standard 13-1/2 in. [340 mm] Diameter Spool.....	14

# Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods

## 1. Scope

This specification prescribes requirements for the classification of bare aluminum and aluminum-alloy welding electrodes and rods for use with the gas metal arc, gas tungsten arc, oxyfuel gas, and plasma arc welding processes.

## 2. Normative References

**2.1** The following ANSI/AWS<sup>1</sup> standard is referenced in the mandatory sections of this document:

ANSI/AWS A5.01, *Filler Metal Procurement Guidelines*.

**2.2** The following ASTM<sup>2</sup> standards are referenced in the mandatory sections of this document:

ASTM E 29, *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*.

ASTM E 34, *Standard Methods for Chemical Analysis of Aluminum and Aluminum Alloys*.

ASTM B 108, *Standard Specification for Aluminum Alloy Permanent Mold Castings*.

ASTM E 142, *Standard Method for Controlling Quality of Radiographic Testing*.

ASTM B 209, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate*.

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

<sup>2</sup> ASTM standards are published by the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

**2.3** The following ISO standard<sup>3</sup> is referenced in the mandatory sections of this document:

ISO 864, *Arc Welding—Solid and Tubular Cored Wires which Deposit Carbon and Carbon Manganese Steel—Dimension of Wires, Spools, Rims, and Coils*.

## 3. Classification

**3.1** The electrodes and rods covered by A5.10/A5.10M specification are classified using a system that is independent of U.S. Customary Units and the International System of Units (SI). Classification is according to the chemical composition of the filler metal as specified in Table 1 and their respective usability either as an electrode or rod as specified in Section 9, Weld Test Assemblies, and Table 2.

**3.2** Any filler metal tested and classified as an electrode shall also be classified as a welding rod. Filler metal tested and classified only as a welding rod shall not be classified as an electrode.

**3.3** The electrodes and rods classified under this specification are intended for gas metal arc, gas tungsten arc, oxyfuel gas, and plasma arc welding, but that is not to prohibit their use with any other process for which they are found suitable.

**3.4** Filler metal containing more than 0.0008 percent by weight of beryllium shall not be classified as electrode and should not be used as an electrode (see A12.3).

<sup>3</sup> ISO standards are published by the International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland.

**Table 1**  
**Chemical Composition Requirements for Aluminum Electrodes and Rods**

AWS Classification	UNS Number <sup>c</sup>	Weight Percent <sup>a,b</sup>									Other Elements		
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Each	Total	Al
ER1100	A91100	d	d	0.05–0.20	0.05	—	—	—	0.10	—	0.05 <sup>e</sup>	0.15	99.00 min <sup>f</sup>
R1100	A91100	d	d	0.05–0.20	0.05	—	—	—	0.10	—	0.05 <sup>e</sup>	0.15	99.00 min <sup>f</sup>
ER1188 <sup>g</sup>	A91188	0.06	0.06	0.005	0.01	0.01	—	—	0.03	0.01	0.01 <sup>e</sup>	—	99.88 min <sup>f</sup>
R1188 <sup>g</sup>	A91188	0.06	0.06	0.005	0.01	0.01	—	—	0.03	0.01	0.01 <sup>e</sup>	—	99.88 min <sup>f</sup>
ER2319 <sup>h</sup>	A92319	0.20	0.30	5.8–6.8	0.20–0.40	0.02	—	—	0.10	0.10–0.20	0.05 <sup>e</sup>	0.15	Remainder
R2319 <sup>h</sup>	A92319	0.20	0.30	5.8–6.8	0.20–0.40	0.02	—	—	0.10	0.10–0.20	0.05 <sup>e</sup>	0.15	Remainder
ER4009	A94009	4.5–5.5	0.20	1.0–1.5	0.10	0.45–0.6	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
R4009	A94009	4.5–5.5	0.20	1.0–1.5	0.10	0.45–0.6	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
ER4010	A94010	6.5–7.5	0.20	0.20	0.10	0.30–0.45	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
R4010	A94010	6.5–7.5	0.20	0.20	0.10	0.30–0.45	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
R4011 <sup>k</sup>	A94011	6.5–7.5	0.20	0.20	0.10	0.45–0.7	—	—	0.10	0.04–0.20	0.05	0.15	Remainder
ER4043	A94043	4.5–6.0	0.8	0.30	0.05	0.05	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
R4043	A94043	4.5–6.0	0.8	0.30	0.05	0.05	—	—	0.10	0.20	0.05 <sup>e</sup>	0.15	Remainder
ER4047	A94047	11.0–13.0	0.8	0.30	0.15	0.10	—	—	0.20	—	0.05 <sup>e</sup>	0.15	Remainder
R4047	A94047	11.0–13.0	0.8	0.30	0.15	0.10	—	—	0.20	—	0.05 <sup>e</sup>	0.15	Remainder
ER4145	A94145	9.3–10.7	0.8	3.3–4.7	0.15	0.15	0.15	—	0.20	—	0.05 <sup>e</sup>	0.15	Remainder
R4145	A94145	9.3–10.7	0.8	3.3–4.7	0.15	0.15	0.15	—	0.20	—	0.05 <sup>e</sup>	0.15	Remainder
ER4643	A94643	3.6–4.6	0.8	0.10	0.05	0.10–0.30	—	—	0.10	0.15	0.05 <sup>e</sup>	0.15	Remainder
R4643	A94643	3.6–4.6	0.8	0.10	0.05	0.10–0.30	—	—	0.10	0.15	0.05 <sup>e</sup>	0.15	Remainder
ER5183	A95183	0.40	0.40	0.10	0.50–1.0	4.3–5.2	0.05–0.25	—	0.25	0.15	0.05 <sup>e</sup>	0.15	Remainder
R5183	A95183	0.40	0.40	0.10	0.50–1.0	4.3–5.2	0.05–0.25	—	0.25	0.15	0.05 <sup>e</sup>	0.15	Remainder
ER5356	A95356	0.25	0.40	0.10	0.05–0.20	4.5–5.5	0.05–0.20	—	0.10	0.06–0.20	0.05 <sup>e</sup>	0.15	Remainder
R5356	A95356	0.25	0.40	0.10	0.05–0.20	4.5–5.5	0.05–0.20	—	0.10	0.06–0.20	0.05 <sup>e</sup>	0.15	Remainder
ER5554	A95554	0.25	0.40	0.10	0.50–1.0	2.4–3.0	0.05–0.20	—	0.25	0.05–0.20	0.05 <sup>e</sup>	0.15	Remainder
R5554	A95554	0.25	0.40	0.10	0.50–1.0	2.4–3.0	0.05–0.20	—	0.25	0.05–0.20	0.05 <sup>e</sup>	0.15	Remainder
ER5556	A95556	0.25	0.40	0.10	0.50–1.0	4.7–5.5	0.05–0.20	—	0.25	0.05–0.20	0.05 <sup>e</sup>	0.15	Remainder
R5556	A95556	0.25	0.40	0.10	0.50–1.0	4.7–5.5	0.05–0.20	—	0.25	0.05–0.20	0.05 <sup>e</sup>	0.15	Remainder

(continued)