


**AWS A5.16/A5.16M:2007**  
**An American National Standard**



# **Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods**



**American Welding Society**

---



**AWS A5.16/A5.16M:2007  
An American National Standard**

**Approved by the  
American National Standards Institute  
August 17, 2007**

# **Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods**

**5th Edition**

**Supersedes AWS A5.16/A5.16M:2004**

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**

AWS A5.16/A5.16M:2007 is a revision of the titanium welding electrode document last revised in 2004. The compositions specified for each classification represent the state of the art. The specification contains testing procedures, standard sizes and forms, and identification and marking practices.

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

## Foreword

This foreword is not part of AWS A5.16/A5.16M:2007, *Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods*, but is included for informational purposes only.

This document is the second of the A5.16 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, 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.

The current document is the fourth revision of the initial joint ASTM/AWS document issued in 1961. The evolution took place as follows: The first specification for titanium electrodes and welding rods was developed more than 40 years ago by a joint committee of the American Welding Society and the American Society for Testing and Materials. The 1970 revision was the first version of this specification to be published entirely by AWS. Three years later, it was recognized by the American National Standards Institute.

The following new electrode classifications were added: ERTi-19, ERTi-20, ERTi-21, ERTi-36, and ERTi-38. The current ERTi-9 composition requirements conform to the previous requirements of ERTi-9ELI. A new requirement (subclause 15.1) was added requiring positive identification on each cut length rod.

All new requirements within this document are italicized.

### Document Development

AWS A5.16-61T ASTM B382-61T	<i>Tentative Specification for Titanium Alloy Bare Welding Rods and Electrodes</i>
AWS A5.16-70 ANSI W3.16-1973	<i>Specification for Titanium and Titanium Alloy Bare Welding Rods and Electrodes</i>
ANSI/AWS A5.16-90	<i>Specification for Titanium and Titanium Alloy Bare Welding Rods and Electrodes</i>
ANSI/AWS A5.16-90R	<i>Specification for Titanium and Titanium Alloy Welding Rods and Electrodes, reaffirmed in 1997</i>
AWS A5.16/A5.16M:2004	<i>Specification for Titanium and Titanium-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</i> .....	v
<i>Foreword</i> .....	vii
<i>List of Tables</i> .....	x
<i>List of Figures</i> .....	x
<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. Rounding-Off Procedure</b> .....	4
<b>7. Summary of Tests</b> .....	4
<b>8. Retest</b> .....	4
<b>9. Chemical Analysis</b> .....	4
<b>10. Method of Manufacture</b> .....	4
<b>11. Standard Sizes and Lengths</b> .....	4
<b>12. Finish and Uniformity</b> .....	4
<b>13. Standard Package Forms</b> .....	5
<b>14. Winding Requirements</b> .....	5
<b>15. Filler Metal Identification</b> .....	7
<b>16. Packaging</b> .....	7
<b>17. Marking of Packages</b> .....	7
Annex A (Informative)—Guide to AWS Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods.....	9
Annex B (Informative)—Guidelines for the Preparation of Technical Inquiries.....	21
AWS Filler Metal Specifications by Material and Welding Process.....	23
American Welding Society (AWS) List of Filler Metal Specifications and Related Documents.....	25

## List of Tables

<b>Table</b>		<b>Page No.</b>
1	Chemical Composition Requirements for Titanium and Titanium-Alloy Electrodes and Rods.....	2
2	Standard Sizes and Length .....	5
3	Standard Packages, Dimensions, and Weights.....	5
A.1	Specification Cross Index—Including Discontinued Titanium Electrodes .....	10
A.2	Guide to Choice of Filler Metal for General Purpose Titanium Welding.....	14

## List of Figures

<b>Figure</b>		<b>Page No.</b>
1	Dimensions of Standard 4 in, 8 in, and 12 in [100 mm, 200 mm, and 300 mm] Diameter Spools .....	6

# Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods

## 1. Scope

**1.1** This specification prescribes requirements for the classification of titanium and titanium-alloy electrodes and rods for gas tungsten arc, gas metal arc, and plasma arc welding.

**1.2** Safety and health issues and concerns are beyond the scope of this standard and are therefore not fully addressed herein. Some safety and health information can be found in the 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*, 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 filler metal properties. The specification with the designation A5.16 uses U.S. Customary Units. The specification A5.16M 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 electrodes or packaging or both under A5.16 or A5.16M specifications.

## 2. Normative References

The standards listed below contain provisions, which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

**2.1** American National Standards Institute (ANSI) standard:<sup>1</sup>

<sup>1</sup>This ANSI standard is published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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

**2.2** American Welding Society (AWS) standard:<sup>2</sup>

AWS A5.01, *Filler Metal Procurement Guidelines*

**2.3** American Society for Testing and Materials (ASTM) standard:<sup>3</sup>

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

**2.4** International Organization for Standardization (ISO) standard:<sup>4</sup>

ISO 544, *Welding consumables — Technical delivery conditions for welding filler metals — Type of product, dimensions, tolerances, and markings*

## 3. Classification

**3.1** The welding materials covered by this A5.16/A5.16M 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 chemical composition as specified in Table 1.

**3.2** Materials labeled under one classification shall not be listed under any other classification of the specification except where reported chemical composition meets the narrow range of overlap between corresponding grades. An electrode or rod may be classified under both

<sup>2</sup>AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

<sup>3</sup>ASTM standards are published by the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

<sup>4</sup>ISO standards are published by International Organization of Standardization, 1 rue de Varembé, Case postale 56, CH-1211 Geneva 20, Switzerland.