

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 4951F

Issued MAR 1958  
Revised JUL 1990  
Reaffirmed APR 1994

Superseding AMS 4951E

## Titanium Welding Wire Commercially Pure Environment Controlled Packaging

UNS R50550

### 1. SCOPE:

#### 1.1 Form:

This specification covers one grade of commercially pure titanium in the form of welding wire.

#### 1.2 Application:

Primarily for use as filler metal for gas-metal-arc and gas-tungsten-arc welding.

#### 1.3 Classification:

Product covered by this specification is classified by melting practice as follows:

Type I - Multiple melted with at least one of the melting cycles under vacuum.

Type II - Electron beam melted.

#### 1.3.1 Unless a specific type is ordered, either type may be supplied.

### 2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright 1999 Society of Automotive Engineers, Inc.  
All rights reserved.

Printed in U.S.A.

QUESTIONS REGARDING THIS DOCUMENT:

TO PLACE A DOCUMENT ORDER:

SAE WEB ADDRESS:

(724) 772-7154  
(724) 776-4970  
<http://www.sae.org>

FAX: (724) 776-0243  
FAX: (724) 776-0790

## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

## 2.1.1 Aerospace Material Specifications:

AMS 2249	Chemical Check Analysis Limits, Titanium and Titanium Alloys
AMS 2814	Packaging of Welding Wire, Premium Quality
AMS 2815	Identification, Welding Wire, Line Code System
AMS 2816	Identification, Welding Wire, Color Code System

## 2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 120	Chemical Analysis of Titanium and Titanium Alloys

## 3. TECHNICAL REQUIREMENTS:

## 3.1 Wire Composition:

Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 120, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Iron	--	0.20
Oxygen	--	0.18
Carbon	--	0.08
Nitrogen	--	0.05
Hydrogen	--	0.005 (50 ppm)
Residual Elements, each (3.1.1)	--	0.10
Residual Elements, total (3.1.1)	--	0.40
Titanium	remainder	

3.1.1 Determination not required for routine acceptance.

3.1.2 Check Analysis: Composition variations shall meet the requirements of AMS 2249.

### 3.2 Condition:

As drawn, having tensile strength not higher than 130,000 psi (896 MPa), determined in accordance with ASTM E 8 or ASTM E 8M, and descaled.

### 3.3 Properties:

Wire shall conform to the following requirements:

3.3.1 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce acceptable welds, determined by a procedure agreed upon by purchaser and vendor.

3.3.2 Spooled Wire: Shall conform to 3.3.2.1 and 3.3.2.2.

3.3.2.1 Cast: Wire, wound on standard 12-inch (305-mm) diameter spools, shall have imparted to it a curvature such that a specimen sufficient in length, 4 - 8 feet (1.2 - 2.4 m), to form one loop, when cut from the spool and laid on a flat surface, shall form a circle 15 - 30 inches (381 - 762 mm) in diameter.

3.3.2.2 Helix: The specimen on which cast was determined, when laid on a flat surface and measured between adjacent turns, shall show a vertical separation not greater than 1 inch (25 mm).

### 3.4 Quality:

3.4.1 Alloy shall be electron beam melted or shall be multiple melted with at least one of the melting cycles under vacuum. When multiple melted, the first melt shall be by consumable electrode, nonconsumable electrode, electron beam, or plasma arc melting practice. The subsequent melt or melts shall be made using vacuum consumable electrode practice with no alloy additions permitted in the last consumable electrode melt.

3.4.1.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be inert gas at a pressure not higher than 250 mm of mercury.

3.4.1.2 The electrode tip for nonconsumable electrode melting shall be water-cooled copper.

3.4.2 Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to welding operations, operation of welding equipment, or properties of the deposited weld metal.

### 3.5 Sizes and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.5.1 and 3.5.2.

## 3.5.1 Diameter:

TABLE I

Form	Nominal Diameter Inch	Tolerance, Inch	
		Plus	Minus
Cut Lengths	0.030, 0.045, 0.062, 0.078	0.002	0.002
Cut Lengths	0.094, 0.125, 0.156, 0.188	0.003	0.003
Spools	0.007, 0.010, 0.015, 0.020	0.0005	0.0005
Spools	0.030, 0.035, 0.045	0.001	0.002
Spools	0.062, 0.078, 0.094	0.002	0.002

TABLE I (SI)

Form	Nominal Diameter Millimeters	Tolerance, Millimeter	
		Plus	Minus
Cut Lengths	0.76, 1.14, 1.57, 1.98	0.05	0.05
Cut Lengths	2.39, 3.18, 3.96, 4.78	0.08	0.08
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.03	0.05
Spools	1.57, 1.98, 2.39	0.05	0.05

3.5.2 Length: Cut lengths shall be furnished in 12, 18, 27, or 36 inch (305, 457, 686, or 914 mm) lengths, as ordered, and shall not vary more than +0, -0.5 inch (-13 mm) from the length ordered.

## 4. QUALITY ASSURANCE PROVISIONS:

## 4.1 Responsibility for Inspection:

The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to the requirements of this specification.

## 4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for Composition (3.1), condition (3.2), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Tests for weldability (3.3.1), cast (3.3.2.1), and helix (3.3.2.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.