

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 4955D

Issued SEP 1965
Revised AUG 1996

Superseding AMS 4955C

TITANIUM ALLOY, WELDING WIRE 8Al-1Mo-1V

UNS R54810

1. SCOPE:

1.1 Form:

This specification covers a titanium alloy in the form of welding wire.

1.2 Application:

This wire has been used typically as filler metal for gas-metal-arc and gas-tungsten-arc welding of titanium alloys, but usage is not limited to such applications.

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.

2.1 SAE Publications:

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

AMS 2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys

AMS 2813 Packaging and Marking of Packages of Welding Wire, Standard Method

AMS 2814 Packaging and Marking of Packages of Welding Wire, Premium Quality

AMS 2816 Identification, Welding Wire, Tab Marking Method

AMS 2819 Identification, Welding Wire, Direct Color Code System

ARP 1876 Weldability Test for Weld Filler Metal Wire

ARP4926 Alloy Verification and Chemical Composition Inspection of Welding Wire

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 1996 Society of Automotive Engineers, Inc.
All rights reserved.

Printed in U.S.A.

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 120 Chemical Analysis of Titanium and Titanium Alloys

ASTM E 1409 Determination of Oxygen in Titanium and Titanium Alloys by the Inert Gas Fusion Technique

ASTM E 1447 Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity Method

3. TECHNICAL REQUIREMENTS:

3.1 Wire Composition:

(R)

Shall conform to percentages by weight shown in Table 1; oxygen shall be determined in accordance with ASTM E 1409, hydrogen in accordance with ASTM E 1447, and other elements by wet chemical methods in accordance with ASTM E 120, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Aluminum	7.35	8.35
Molybdenum	0.75	1.25
Vanadium	0.75	1.25
Iron	--	0.30
Oxygen	--	0.12
Carbon	--	0.08
Nitrogen	--	0.05 (500 ppm)
Hydrogen	--	0.01 (100 ppm)
Yttrium (3.1.1)	--	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.

3.1.3 Except for hydrogen, nitrogen, and oxygen, chemical analysis of initial ingot, bar, or rod stock before drawing is acceptable provided the processes used for drawing or rolling, annealing, and cleaning are controlled to ensure continued conformance to chemical composition requirements and the facility employs procedures to ensure traceability of wire to the original analyzed source.

3.1.4 When ASTM E 1409 or ASTM E 1447 are used, sample sizes larger than those recommended (R) may be used.

3.2 Melting Practice:

Alloy shall be multiple melted; melting cycle(s) prior to final melting cycle shall be made using consumable electrode, nonconsumable electrode, electron beam, or plasma arc melting practices. The final melting cycle shall be made under vacuum using consumable electrode practice with no alloy additions permitted.

3.2.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be argon and/or (R) helium at an absolute pressure not higher than 1000 mm of mercury.

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

3.3 Condition:

(R) Cold drawn, bright finish, in a temper and with a surface finish which will provide proper feeding of the wire in machine welding equipment.

3.4 Fabrication:

3.4.1 In-process annealing between cold rolling or drawing operations shall be performed in a (R) protective atmosphere to prevent surface oxidation and absorption of other extraneous elements.

3.4.2 Butt welding is permissible provided both ends to be joined are alloy verified using a method or (R) methods capable of distinguishing the alloy from all other alloys processed within the facility, or the repair is made at the wire processing station. The butt weld shall not interfere with uniform, uninterrupted feeding of the wire in machine welding equipment.

3.4.3 Drawing compounds, oxides, dirt, oil, and other foreign materials shall be removed by cleaning processes which will neither result in pitting nor cause gas absorption by the wire or deposition of substances harmful to welding operations.

3.5 Properties:

Wire shall conform to the following requirements:

3.51 Weldability: Melted wire shall flow smoothly and evenly during welding and shall produce (R) acceptable welds. ARP1876 may be used to resolve disputes.

3.5.2 Spooled Wire: Shall conform to 3.5.2.1 and 3.5.2.2.

3.5.2.1 Cast: Wire, wound on standard 12-inch (305-mm) diameter spools, shall have imparted to it a (R) curvature such that a specimen sufficient in length to form a loop with a one-inch (25 mm) overlap, when cut from the spool and laid on a flat surface, shall form a circle 15 to 50 inches (381 to 1270 mm) in diameter.

- 3.5.2.2 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).

3.6 Quality:

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.

3.7 Size and Tolerances:

Wire shall be supplied in the sizes and to the tolerances shown in 3.7.1 and 3.7.2.

3.7.1 Diameter: Shall be as shown in Table 2.

(R)

TABLE 2A - Sizes and Diameter Tolerances, Inch/Pound Units

Form	Nominal Diameter Inch	Tolerance, Inch	
		Plus	Minus
Cut Lengths	0.030, 0.035, 0.045, 0.062	0.002	0.002
Cut Lengths	0.094, 0.125	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, 0.094	0.002	0.002

TABLE 2B - Sizes and Diameter Tolerances, SI Units

Form	Nominal Diameter Millimeters	Tolerance, mm	
		Plus	Minus
Cut Lengths	0.76, 0.89, 1.14, 1.57	0.05	0.05
Cut Lengths	2.39, 3.18	0.08	0.08
Spools	0.18, 0.25, 0.38, 0.51	0.013	0.013
Spools	0.76, 0.89, 1.14	0.025	0.05
Spools	1.57, 2.39	0.05	0.05

- 3.7.2 Length: Cut lengths shall be furnished in 18, 27, or 36 inch (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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), sizes and tolerances (3.7), and alloy verification (5.3.1) (R) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Weldability (3.5.1), cast (3.5.2.1), and helix (3.5.2.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be as follows; a lot shall be all wire of the same nominal size from the same heat processed at the same time:

4.3.1 For Acceptance Tests:

4.3.1.1 Composition: One sample from each heat, except that for hydrogen determinations one sample from each lot obtained after thermal and chemical processing is completed.

4.3.1.2 Other Requirements: Shall be acceptable to purchaser.

4.3.2 For Periodic Tests: Shall be acceptable to purchaser.

4.4 Reports:

The vendor of wire shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and for the hydrogen content of each lot, and stating that the wire conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS 4955D, nominal size, and quantity.

4.5 Resampling and Retesting: (R)

If any specimen used in the above tests fails to meet specified requirements, disposition of the wire may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet specified requirements shall be cause for rejection of the wire represented. Results of all tests shall be reported.