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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 4982A

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Superseding AMS 4982

TITANIUM ALLOY WIRE
44.5Cb

UNS R58450

1. SCOPE:

1.1 Form: This specification covers a titanium alloy in the form of wire.

1.2 Application: Primarily for parts, such as fasteners, where cold formability is desirable or necessary and requiring a high strength-to-weight ratio up to 800°F (425°C).

1.3 Classification: This specification covers two types of wire based upon condition supplied, as follows:

Type 1 - Annealed
Type 2 - As drawn

1.3.1 Type 1 shall be supplied unless Type 2 is specified.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

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2.1.1 Aerospace Material Specifications:

AMS 2241 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
MAM 2241 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS 2249 - Chemical Check Analysis Limits, Titanium and Titanium Alloys
AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E112 - Determining Average Grain Size
ASTM E120 - Chemical Analysis of Titanium and Titanium Alloys

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-81200 - Heat Treatment of Titanium and Titanium Alloys

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, Ø determined by wet chemical methods in accordance with ASTM E120 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Columbium	42.00 -	47.00
Oxygen	--	0.16
Carbon	--	0.04
Silicon	--	0.03
Nitrogen	--	0.03 (300 ppm)
Iron	--	0.03
Chromium	--	0.02
Magnesium	--	0.01
Manganese	--	0.01
Hydrogen	--	0.0035 (35 ppm)
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 except that no check analysis limits apply for columbium.

3.2 Condition:
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3.2.1 Type 1 wire shall be supplied cold finished and annealed.

3.2.2 Type 2 wire shall be supplied cold finished, with or without drawing lubricant removed, as specified by purchaser.

3.3 Heat Treatment: Type 1 wire shall be annealed by heating in vacuum (less
Ø than 0.1 μm mercury) to a temperature within the range 1450° - 1600°F (790° - 870°C), holding at heat for sufficient time to produce a recrystallized structure which will meet the requirements of 3.4, and cooling as required. Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-81200.

3.4 Properties: Wire shall conform to the following requirements:

3.4.1 Type 1 Annealed Wire:

3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with
Ø ASTM E8 with the rate of strain maintained at 0.003 - 0.007 in./in. per min. (0.003 - 0.007 mm/mm per min.) through the yield strength and then increased so as to produce failure in approximately one additional minute. When a dispute occurs between purchaser and vendor over the yield strength values, a referee test shall be performed on a machine having a strain rate pacer using a rate of 0.005 in./in. per min. (0.005 mm/mm per min.) through the yield strength and a minimum cross-head speed of 0.10 in. (2.5 mm) per min. above the yield strength.

Tensile Strength, min	65,000 psi (450 MPa)
Yield Strength at 0.2% Offset, min	60,000 psi (415 MPa)
Elongation in 2 in. (50 mm) or 4D, min	10%
Reduction of Area, min	50%

3.4.1.1.1 Yield strength and reduction of area requirements do not apply to wire under 0.125 in. (3.12 mm) in diameter.

3.4.1.2 Grain Size: Shall be 5 or finer with occasional grains as large as 4 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

3.4.2 Type 2 As-Drawn Wire: Shall be as agreed upon by purchaser and vendor
Ø except that Type 2 wire annealed as in 3.3 shall also meet the requirements of 3.4.1.1 and 3.4.1.2.

3.5 Quality:

3.5.1 Alloy shall be produced by multiple melting using consumable electrode practice; at least one of the melting cycles shall be under vacuum.

3.5.2 Wire, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the wire.

3.6 Tolerances: Shall conform to all applicable requirements of AMS 2241 or MAM 2241. Tolerances for sizes not covered by AMS 2241 or MAM 2241 shall be as agreed upon by purchaser and vendor.

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. Results of such tests shall be reported to the purchaser as required by 4.4. 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 to determine conformance to the following Ø requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 Type 1:
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4.2.1.1.1 Composition (3.1) of each heat.

4.2.1.1.2 Hydrogen content (3.1), tensile properties (3.4.1), grain size (3.4.2) and tolerances (3.6) of each lot.

4.2.1.2 Type 2:
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4.2.1.2.1 Composition (3.1) of each heat.

4.2.1.2.2 Tolerances (3.6) of each lot.

4.2.2 Periodic Tests: Tests of Type 2 wire to demonstrate ability to develop Ø required properties (3.4.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with the following; 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 Type 1:
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4.3.1.1.1 Composition: One sample from each heat except that for hydrogen determinations one sample from each lot, obtained after thermal and chemical processing is completed.

4.3.1.1.2 Tensile Properties and Grain Size: At least one sample from each lot.