



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 4982

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Revised

TITANIUM ALLOY BARS

45Cb

Annealed

1. SCOPE:

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

1.2 Application: Primarily for parts, such as fasteners, where cold formability is desirable or necessary and high strength-to-weight ratio up to 800° F (427° C) is required.

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

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

2.1.1 Aerospace Material Specifications:

AMS 2241 - Tolerances, Corrosion and Heat Resistant Steel Bars and Wire
and 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, Pennsylvania 19103.

ASTM E8 - Tension Testing of Metallic Materials

ASTM E112 - Estimating the Average Grain Size of Metals

ASTM E120 - Chemical Analysis of Titanium and Titanium-Base Alloys

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

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E120, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

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	min	max
Columbium	42.00	47.00
Oxygen	--	0.20
Carbon	--	0.04
Silicon	--	0.04
Nitrogen	--	0.03 (300 ppm)
Iron	--	0.03
Chromium	--	0.02
Magnesium	--	0.01
Manganese	--	0.01
Hydrogen	--	0.0035 (35 ppm)
Other 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: The product shall be supplied in the following condition:

3.2.1 Bars: Hot finished, with or without subsequent cold reduction, annealed, straightened, and descaled.

3.2.2 Wire: Hot finished, with or without subsequent cold reduction, annealed, and descaled.

3.3 Heat Treatment: The product shall be annealed by heating in a vacuum (less than 0.1 micron mercury) to a temperature within the range 1450° - 1600° F (787.8° - 871.1° C), holding at heat for sufficient time to produce a recrystallized structure which will meet the requirements of 3.4, and cooling as required.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8 with the rate of strain maintained at 0.003 - 0.007 in. per in. per min. (0.003 - 0.007 mm/mm/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. per in. per min. (0.005 mm/mm/min.) through the yield strength and a minimum crosshead speed of 0.10 in. per min. (2.5 mm/min.) above the yield strength.

Tensile Strength, min	65,000 psi (448 MPa)
Yield Strength at 0.2% Offset, min	60,000 psi (414 MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	15%
Reduction of Area, min	55%

3.4.1.1 Yield strength and reduction of area requirements do not apply to wire under 0.125 in. (3.18 mm) in diameter.

3.4.2 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.

3.5 Quality:

3.5.1 Material shall be produced by multiple melting using consumable electrode practice; at least one of the melting cycles shall be under vacuum, unless otherwise permitted.

3.5.2 The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

- 3.6 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2241. Tolerances for sizes not covered by AMS 2241 shall be as agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples 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 perform such confirmatory testing as he deems necessary to assure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.
- 4.3 Sampling: Shall be in accordance with the following; a lot shall be all material of the same nominal size from the same heat processed at the same time.
- 4.3.1 Composition: One sample from each heat except that for hydrogen determinations one sample from each lot.
- 4.3.2 Tensile Properties and Grain Size: At least one sample from each lot.
- 4.4 Reports:
- 4.4.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat in the shipment, the results of tests on each lot to determine conformance to the hydrogen, grain size, and tensile property requirements, and a statement that the product conforms to all other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number, size, specific annealing treatment used, and quantity from each heat.
- 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.
- 4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: The product shall be identified as follows:
- 5.1.1 Each straight bar over 0.500 in. (12.70 mm) in diameter or least width of flat surface shall be marked in a row of characters recurring at intervals not greater than 3 ft (914 mm) with AMS 4982, heat number, and manufacturer's identification. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid whose residue shall contain not more than traces of halogen-bearing compounds, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.