AEROSPACE MATERIAL SPECIFICATION

AMS4958™	REV. E

Issued 1988-04
Revised 2017-12

Superseding AMS4958D

Titanium Alloy Bars and Rods
3Al - 8V - 6Cr - 4Mo - 4Zr
Consumable Electrode Melted
Solution Heat Treated and Centerless Ground or Peeled and Polished
(Composition similar to UNS R58640)

RATIONALE

AMS4958E results from a Five-Year Review and update of this specification that adds ASTM E539 and ASTM E2994 (3.1), removal of sample size allowance for hydrogen of Table 1 (covered by ASTM E1447), adds testing of material outside limits (3.5.2.1.1), addition of AMS6279 (3.8) and AMS2368 for Sampling and Resampling (4.3 and 4.5) and revises reporting (4.4) and marking (5.1).

1. SCOPE

1.1 Form

This specification covers a titanium alloy in the form of bars and rods 1.00 inch (25.4 mm) and under in nominal diameter.

1.2 Application

These products have been used typically for coil springs requiring low solid height, high tensile strength, and corrosion resistance, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys

AMS2368 Sampling and Testing of Wrought Titanium Raw Material Except Forgings and Forging Stock

AMS2750 Pyrometry

AMS2809 Identification, Titanium and Titanium Alloy Wrought Products

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://standards.sae.org/AMS4958E

AS6279 Standard Practice for Production, Distribution, and Procurement of Metal Stock

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E112 Determining Average Grain Size

ASTM E539 Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry

ASTM E1409 Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by Inert Gas Fusion

ASTM E1417 Liquid Penetrant Testing

ASTM E1447 Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity/Infrared Detection Method

ASTM E1941 Determination of Carbon in Refractory and Reactive Metals and Their Alloys by Combustion Analysis

ASTM E2371 Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Plasma Atomic Emission Spectrometry

ASTM E2994 Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry

2.3 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B46.1 Surface Texture (Surface Roughness, Waviness and Lay)

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1; carbon shall be determined in accordance with ASTM E1941, hydrogen in accordance with ASTM E1447, oxygen and nitrogen in accordance with ASTM E1409, and other elements in accordance with ASTM E539, ASTM E2371 or ASTM E2994. Other analytical methods may be used if acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Aluminum	3.00	4.00
Vanadium	7.50	8.50
Chromium	5.50	6.50
Molybdenum	3.50	4.50
Zirconium	3.50	4.50
Iron	--	0.30
Oxygen	--	0.12
Carbon	--	0.05
Nitrogen	--	0.03
Hydrogen	--	0.030 (300 ppm)
Yttrium (3.1.1)	--	0.005 (50 ppm)
Other Elements, each (3.1.1)	--	0.15
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 applicable requirements of AMS2249.

3.2 Melting Practice

Alloy shall be multiple melted. The first melt shall be made by vacuum consumable electrode, nonconsumable electrode, electron beam cold hearth, or plasma arc cold hearth melting practice. The subsequent melt or melts shall be made using vacuum arc remelting (VAR) practice. Alloy additions are not permitted in the final VAR melt.

3.2.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be argon and/or 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

Hot rolled, solution heat treated and centerless ground or peeled and polished to size with surface removal sufficient to remove all surface defects and alpha case. In addition, acid pickle with not less than 0.0005 inch (12.7 µm) overall stock removal may be used. The solution heat treated product may be cold worked, not exceeding 5% total reduction, for sizing purposes prior to centerless grinding or peeling and polishing and surface removal. It shall have a surface texture not greater than Ra 63, determined in accordance with ASME B46.1. Bar shall not be cut from plate.

3.4 Heat Treatment

Product shall be solution heat treated by heating to a temperature within the range 1450 to 1600 °F (788 to 871 °C), holding at the selected temperature within ±25 °F (±14 °C) for sufficient time for solution heat treatment, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS2750.

3.5 Properties

Product shall conform to the following requirements:

3.5.1 As Solution Heat Treated

3.5.1.1 Average Grain Size

Shall be as follows, determined in accordance with ASTM E112:

3.5.1.1.1 Product 0.625 Inch (15.88 mm) and Under in Nominal Diameter

ASTM 5 or finer.

3.5.1.1.2 Product Over 0.625 to 1.00 Inch (15.88 to 25.4 mm), Inclusive in Nominal Diameter

ASTM 3 or finer.

3.5.2 After Aging

Product shall have the following properties after being aged by heating to a temperature within the range 850 to 1050 °F (454 to 566 °C), holding at the selected temperature within ±10 °F (±6 °C) for 6 to 30 hours, and cooling in air.

3.5.2.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E8/E8M with the rate of strain set at 0.005 inch/inch/minute (0.005 mm/mm/minute) and maintained within a tolerance of ±0.002 inch/inch/minute (0.002 mm/mm/minute) through the 0.2% offset yield strain.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	180 ksi (1241 MPa)
Elongation in 4D	8%
Reduction of Area	20%

3.5.2.1.1 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer.

3.6 Quality

Product, 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 product.

3.6.1 Product shall have a smooth finish free from pits and abrasions, shall be cylindrical, clean, even uniform cast, and free from kinks, twists, scrapes, splits, and other imperfections.

3.6.2 Bars and rods shall be nondestructively inspected by fluorescent penetrant inspection in accordance with ASTM E1417 or by electromagnetic (eddy current) inspection (see 8.4). Cracks, seams and other surface defects are not acceptable.

3.7 Tolerances

Shall conform to 3.7.1 and 3.7.2.

3.7.1 Diameter

Shall be as shown in Table 4.