AEROSPACE MATERIAL SPECIFICATION

AMS7851™	REV. E

Issued	1966-03
Revised	2013-05
Reaffirmed	2017-01
Stabilized	2022-07

Superseding AMS7851D

Columbium (Niobium) Alloy Foil, Sheet, Strip, and Plate
10W - 2.5Zr
Recrystallized
(Composition similar to UNS R04217)

RATIONALE

AMS7851E has been declared "STABILIZED" by AMS Committee G Titanium and Refractory Metals Committee. This document will no longer be updated and may no longer represent standard industry practice.

NOTE: This document was stabilized because AMS Committee G can find no producers for this material. Previously, this document was reaffirmed. The last technical update of this document occurred in May, 2013. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to the specification, including exceptions listed on the certification. In many cases, the purchaser may represent a sub-tier supplier and not the cognizant engineering organization.

STABILIZED NOTICE

AMS7851 has been declared “STABILIZED” by SAE AMS Committee G Titanium and Refractory Metals Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AMS7851E/

1. SCOPE

1.1 This specification covers a columbium (niobium) alloy in the form of foil, sheet, strip, or plate.

1.2 Application

This material has been used typically for parts requiring exposure at ultra high-temperatures, but usage is not limited to such applications. Applications in oxidizing atmospheres necessitate a protective coating.

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 724-776-4970 (outside USA), www.sae.org.

AMS2242 Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate

AMS2809 Identification, Titanium and Titanium Alloy Wrought Products

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 E 8 / E 8M Tension Testing of Metallic Materials

ASTM E 21 Elevated Temperature Tension Tests of Metallic Materials

ASTM E 290 Bend Testing Material for Ductility

ASTM E 384 Knoop and Vickers Hardness of Metallic Materials

ASTM E 2626 Spectrometric Analysis of Reactive and Refractory Metals

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1. Metallic elements shall be determined by spectrochemical methods in accordance with ASTM E 2626 or by other analytical methods acceptable to purchaser, carbon shall be determined by the combustion method using an infrared detection system; oxygen, nitrogen and hydrogen shall be determined by the inert gas fusion technique, and columbium shall be determined by difference.

TABLE 1 – COMPOSITION

Element	min	max
Tungsten	9.0	11.0
Zirconium	2.0	3.0
Tantalum	--	0.15
Carbon	--	0.030
Silicon	--	0.02
Iron	--	0.02
Titanium	--	0.01
Oxygen	--	0.020 (200 ppm)
Nitrogen	--	0.010 (100 ppm)
Hydrogen	--	0.001 (10 ppm)
Columbium (Niobium)	Remainder	

3.2 Condition

Cold rolled or hot-cold rolled, descaled, and recrystallized.

3.3 Heat Treatment

Product shall be recrystallized by heating to a temperature within the range 2200 to 2400 °F (1204 to 1316 °C) under vacuum of absolute pressure less than 0.1 micron (0.1 µm) mercury or inert atmosphere or as agreed upon by purchaser and vendor.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 Tensile Properties

Product, 0.010 to 0.060 inch (0.25 to 1.52 mm), inclusive, in nominal thickness, shall meet the requirements of 3.4.1.1 and 3.4.1.2.

3.4.1.1 At Room Temperature

Shall be as shown in Table 2 for sheet and strip 0.010 to 0.060 inch (0.25 to 1.52 mm), inclusive, in nominal thickness, determined in accordance with ASTM E 8 / E 8M 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 and 0.05 inch/inch/minute (0.05 mm/mm/minute) and maintained within a tolerance of ±0.02 inch/inch/minute (±0.02 mm/mm/minute) above the yield strain to fracture.

TABLE 2 – MINIMUM TENSILE PROPERTIES AT ROOM TEMPERATURE

Property	Value
Tensile Strength	75 ksi (517 MPa)
Yield Strength at 0.2% Offset	60 ksi (414 MPa)
Elongation in 1 Inch (25.4 mm)	15%

3.4.1.2 At 2200 °F (1204 °C)

Product 0.010 to 0.060 inch (0.025 to 1 .52 mm), inclusive, in nominal thickness shall meet the requirements shown in Table 3 when heated to 2200 °F ± 10 (1204 °C ± 6) under vacuum (less than 0.1 micron mercury) or an inert atmosphere, held at heat for 15 minutes before testing, and tested at 2200 °F ± 10 (1204 °C ± 6) at a strain rate set at 0.05 inch/inch/minute (0.05 mm/mm/minute) and maintained within a tolerance of ±0.02 inch/inch/minute (0.02 mm/mm/minute) in accordance with ASTM E 21.

TABLE 3 – MINIMUM TENSILE PROPERTIES AT 2200 °F (1204 °C)

Property	Value
Tensile Strength	30.0 ksi (207 MPa)
Yield Strength at 0.2% Offset	25.0 ksi (172 MPa)
Elongation in 1 Inch (25.4 mm)	15%

3.4.2 Hardness

Shall be not higher than 225 HV30, or equivalent, determined in accordance with ASTM E 384.

3.4.3 Bending

Product shall have a test sample prepared nominally 0.750 inch (19.06 mm) in width with axis of bending parallel to the direction of rolling. The sample shall be bend tested in conformance with the guided bend test defined in ASTM E 290 through the angle shown in Table 4. The test fixture supports shall have a minimum contact radius of 0.010 inch (0.25 mm) and the plunger shall have a radius equal to one times the nominal thickness. The bent sample shall not show evidence of cracking when examined at 15 to 25X magnification.

TABLE 4 – MINIMUM BEND ANGLE

Nominal Thickness		Angle degree
Inches	Millimeters	
0.001 to 0.060, incl	0.025 to 1.52, incl	180
Over 0.060	Over 1.52	90

3.4.4 Microstructure

Product shall show a structure consisting essentially of recrystallized grains; additional standards for acceptance shall be as agreed upon by purchaser and vendor (See 8.4).