SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7855C

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Superseding AMS 7855B

Columbium (Niobium) Alloy Bars, Rods, and Wire
10W - 2.5Zr
Recrystallized

(Composition similar to UNS R04271)

1. SCOPE:

1.1 This specification covers a columbium alloy in the form of bars, rods, or wire.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2809 Identification, Titanium and Titanium Alloy Wrought Products

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 8 Tension Testing of Metallic Materials
ASTM E 8M Tension Testing of Metallic Materials (Metric)
ASTM E 21 Elevated Temperature Tension Testing of Metallic Materials
ASTM E 92 Vickers Hardness of Metallic Materials

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

2.3 ANSI Publications:

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002 or www.ansi.org.

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

The product shall conform to the percentages by weight shown in Table 1. Metallic elements shall be determined by spectrochemical methods, carbon shall be determined by conductometric methods, oxygen shall be determined by the vacuum fusion or conductometric method, nitrogen shall be determined by the Kjeldahl method, and hydrogen shall be determined by the vacuum extraction method, or by other methods acceptable to purchaser:

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:

Hot-cold worked, descaled, and recrystallized or, if specified, hot-cold worked, descaled, recrystallized, and centerless ground.

3.2.1 The surface finish of centerless ground bars shall be 90 microinches or smoother, determined in accordance with ANSI B46.1.

3.3 Heat Treatment:

Product shall be recrystallized at a temperature between 2200 and 2400 °F (1204 and 1316 °C) under vacuum (less than 0.1 micron (0.1 µm) of 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: Shall be in accordance with 3.4.1.1 and 3.4.1.2.

3.4.1.1 At Room Temperature: Round bars, rods, and wires 0.050 to 0.500 inch (1.27 to 12.7 mm), inclusive, in diameter shall conform to the requirements shown in Table 2 determined in accordance with ASTM E 8 or ASTM E 8M using strain rates of 0.003 to 0.007 inch/inch/minute (0.003 to 0.007 mm/mm/minute) through the yield strength and 0.03 to 0.07 inch/inch/minute (0.03 to 0.07 mm/mm/minute) above the yield strength.

Table 2 – Minimum Tensile Properties

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)	20%
Reduction of Area	30%

3.4.1.2 At 2200 °F (1204 °C): Round bars, rods, and wire 0.050 to 0.500 inch, (1.27 to 12.70 mm), inclusive, in nominal diameter shall meet the requirements of Table 3 when heated to 2200 °F ± 10 (1204 °C ± 6) in vacuum under 0.1 micron of mercury or an inert atmosphere, held at heat for 15 minutes before testing, and tested in accordance with ASTM E 21 at 2200 °F ± 10 (1204 °C ± 6) at a strain rate of 0.03 to 0.07 inch/inch/minute (0.03 to 0.07 mm/mm/minute).

Table 3 – Minimum Tensile Properties at 2200°F (1204°C)

Property	Value
Tensile Strength	25.0 ksi (172 MPa)
Yield Strength at 0.2% Offset	20.0 ksi (138 MPa)
Elongation in 1 Inch (25.4 mm)	20%

3.4.2 Hardness: Shall be not higher than 225 HV30, or equivalent, determined in accordance with ASTM E 92.

3.4.3 Microstructure: Product recrystallized as in 3.3. 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).

3.5 Quality:

The 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 Tolerances:

Shall conform to the following:

3.6.1 Hot-Cold Worked and Descaled:

3.6.1.1 Round Rod and Wire: Shall be as specified in Table 4.

Table 4A – Diameter Tolerances, Round Rod and Wire, Inch/Pound Units

Nominal Diameter Inches					Tolerance, Inch Plus	Tolerance, Inch Minus	Out of Round, Inch
	0.016	to	0.030,	incl	0.0005	0.0005	--
Over	0.030	to	0.062,	incl	0.001	0.001	--
Over	0.062	to	0.281,	incl	0.002	0.002	0.004
Over	0.281	to	0.422,	incl	0.010	0.005	0.008
Over	0.422	to	0.625,	incl	0.010	0.005	0.012
Over	0.625	to	0.875,	incl	0.015	0.005	0.015
Over	0.875	to	1.000,	incl	0.020	0.005	0.015
Over	1.000	to	1.375,	incl	0.020	0.010	0.018
Over	1.375	to	1.500,	incl	0.020	0.015	0.020
Over	1.500	to	1.625,	incl	0.025	0.015	0.020
Over	1.625	to	2.000,	incl	0.030	0.020	0.025
Over	2.000	to	2.500,	incl	0.032	0.032	0.025
Over	2.500	to	3.250,	incl	0.032	0.032	0.027
Over	3.250	to	3.500,	incl	0.045	0.045	0.040

Table 4B – Diameter Tolerances, Round Rod and Wire, SI Units

Nominal Diameter Millimeters					Tolerance, mm Plus	Tolerance, mm Minus	Out of Round, Millimeters
	0.41	to	0.76,	incl	0.013	0.013	--
Over	0.76	to	1.57,	incl	0.03	0.03	--
Over	1.57	to	7.14,	incl	0.05	0.05	0.10
Over	7.14	to	10.72,	incl	0.25	0.13	0.20
Over	10.72	to	15.88,	incl	0.25	0.13	0.30
Over	15.88	to	22.22,	incl	0.38	0.13	0.38
Over	22.22	to	25.40,	incl	0.51	0.13	0.38
Over	25.40	to	34.92,	incl	0.51	0.25	0.46
Over	34.92	to	38.10,	incl	0.51	0.38	0.51
Over	38.10	to	41.28,	incl	0.64	0.38	0.51
Over	41.28	to	50.80,	incl	0.76	0.51	0.64
Over	50.80	to	63.50,	incl	0.81	0.81	0.64
Over	63.50	to	82.55,	incl	0.81	0.81	0.69
Over	82.55	to	88.90,	incl	1.14	1.14	1.02

3.6.1.2 Square and Rectangular Bar: Shall be as specified in Table 5.

Table 5A – Tolerances, Square and Rectangular Bar, Inch/Pound Units

Nominal Thickness (T) Inches	Thickness Tolerance, Inch Plus and Minus	Width Tolerance, Inch Plus	Width Tolerance, Inch Minus
0.187 to 0.500, incl	0.10T	10%	0
Over 0.500	0.062	10%	0

Table 5B – Tolerances, Square and Rectangular Bar, SI Units

Nominal Thickness Millimeters	Thickness Tolerance, mm Plus and Minus	Width Tolerance, mm Plus	Width Tolerance, mm Minus
4.75 to 12.70, incl	0.10T	10%	0
Over 12.70	1.57	10%	0

3.6.1.3 Centerless Ground: Shall be as specified in Table 6.

Table 6A – Tolerances, Centerless Ground, Inch/Pound Units

Nominal Diameter, Inches	Tolerance, Inch Plus	Tolerance, Inch Minus
0.188 to 0.250, incl	0.002	0.002
Over 0.250 to 0.500, incl	0.004	0.004
Over 0.500 to 1.000, incl	0.005	0.005
Over 1.000	0.010	0

Table 6B – Tolerances, Centerless Ground, SI Units

Nominal Diameter, Millimeters	Tolerance, mm Plus	Tolerance, mm Minus
4.78 to 6.35, incl	0.05	0.05
Over 6.35 to 12.70, incl	0.10	0.10
Over 12.70 to 25.40, incl	0.13	0.13
Over 25.40	0.25	0.0