SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 7819C

Issued JAN 1964
Revised JAN 2004

Superseding AMS 7819B

Molybdenum Alloy Bars
0.48Ti - 0.09Zr - 0.02C
Arc Cast, Stress Relieved

(Composition similar to UNS R03640))

1. SCOPE:

1.1 Form:

This specification covers an arc-cast molybdenum alloy in the form of round bars.

1.2 Application:

These bars have been used typically for parts requiring high modulus and uniform strength up to 2300 °F (1260 °C) but usage is not limited to such applications. This alloy is not recommended for use in oxidizing atmospheres above 1000 °F (540 °C) unless protected by a suitable 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 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 92	Vickers Hardness of Metallic Materials
ASTM E 350	Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

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

2.2 ASME Publications:

Available from ASME, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900 or 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 E350, molybdenum by difference, gaseous elements by vacuum fusion, and other metallic elements by spectrographic or other analytical methods acceptable to the purchaser:

TABLE 1 - Composition

Element	min	max	Check Analysis Under Min	Check Analysis Over Max
Molybdenum	99.25	--	--	--
Titanium	0.40	0.55	0.05	0.05
Zirconium	0.06	0.12	0.02	0.02
Carbon	0.010	0.030	0.005	0.005
Iron	--	0.020	--	0.002
Silicon	--	0.010	--	0.002
Nickel	--	0.010	--	0.001
Oxygen	--	0.030 (30 ppm)	--	--
Nitrogen	--	0.010 (10 ppm)	--	0.0005 (5 ppm)
Hydrogen	--	0.0005 (5 ppm)	--	--

3.2 Melting Practice:

Alloy shall be carbon deoxidized and vacuum arc melted using consumable electrode practice.

3.3 Condition:

Hot-cold worked, descaled, and stress-relieved; when so specified, bars shall be centerless ground before being stress-relieved. The surface texture of centerless ground bars shall be 90 microin. (2.3 m) or smoother, determined in accordance with ASME B46.1.

3.4 Properties:

Bars 0.125 to 4.500 inches (3.00 to 112.50 mm) inclusive, in nominal diameter shall conform to the following requirements:

3.4.1 As-Received:

3.4.1.1 Tensile Properties: Shall be as specified in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M with the rate of strain maintained at 0.002 to 0.005 in./in. per min. (0.002 to 0.005 mm/mm per min.) through the 0.6% offset and 0.002 to 0.05 in./in. per min. (0.02 to 0.05 mm/mm per min.) above the 0.6% offset to fracture.

TABLE 2A - Tolerances, Hot-Cold Worked, Inch/Pound Units

Nominal Diameter Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
0.125 to 0.875, incl	115	100	18
Over 0.875 to 1.875, incl	100	85	10
Over 1.875 to 2.875, incl	90	80	10
Over 2.875 to 3.500, incl	85	75	5
Over 3.500 to 4.500, incl	80	70	5

TABLE 2B - Tolerances, Hot-Cold Worked, SI Units

Nominal Diameter Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
3.00 to 22.00, incl	795	690	18
Over 22.00 to 47.00, incl	690	585	10
Over 47.00 to 72.00, incl	620	550	10
Over 72.00 to 87.50, incl	585	515	5
Over 87.50 to 112.50, incl	550	485	5

3.4.1.2 Hardness: Shall be as shown in Table 3, determined in accordance with ASTM E 92.

TABLE 3 - Maximum Hardness

Nominal Diameter Inch	Nominal Diameter Millimeters	Maximum Hardness HV10
0.125 to 0.875, incl	3.00 to 22.00, incl	320
Over 0.875 to 1.125, incl	Over 22.00 to 28.00, incl	310
Over 1.125 to 1.875, incl	Over 28.00 to 47.00, incl	300
Over 1.875 to 2.875, incl	Over 47.00 to 72.00, incl	290
Over 2.875 to 3.500, incl	Over 72.00 to 87.50, incl	285
Over 3.500 to 4.500, incl	Over 87.50 to 112.50, incl	280

3.4.2 After High-Temperature Exposure: Bars shall meet the tensile property (3.4.1.1) and hardness (3.4.1.2) requirements after being heated in a suitable protective atmosphere to 2100 °F ± 25 (1150 °C ± 15), held at heat for 30 min. ± 3, and cooled rapidly.

3.5 Quality:

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

3.6 Tolerances:

Shall be as follows:

3.6.1 Hot-Cold Worked and Descaled: Shall be as shown in Table 4.

TABLE 4A - Tolerances, Hot Worked, Inch/Round Units

Nominal Diameter Inches	Tolerance Inch Plus	Tolerance Inch Minus	Out of Round Inch
0.125 to 0.281, incl	0.002	0.002	0.004
Over 0.281 to 0.406, incl	0.003	0.003	0.006
Over 0.406 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
Over 3.500 to 4.500, incl	0.062	0.062	0.050

3.6.1 (Continued):

TABLE 4B - Tolerances, Hot Worked, SI Units

Nominal Diameter Millimeters	Tolerance Millimeters Plus	Tolerance Millimeters Minus	Out of Round Millimeters
3.00 to 7.00, incl	0.05	0.05	0.10
Over 7.00 to 10.00, incl	0.08	0.08	0.15
Over 10.00 to 15.00, incl	0.25	0.12	0.30
Over 15.00 to 22.00, incl	0.38	0.12	0.38
Over 22.00 to 25.00, incl	0.50	0.12	0.38
Over 25.00 to 34.00, incl	0.50	0.25	0.45
Over 34.00 to 37.50, incl	0.50	0.38	0.50
Over 37.50 to 40.00, incl	0.62	0.38	0.50
Over 40.00 to 50.00, incl	0.75	0.50	0.62
Over 50.00 to 62.50, incl	0.80	0.80	0.62
Over 62.50 to 81.00, incl	0.80	0.80	0.68
Over 81.00 to 87.50, incl	1.12	1.12	1.00
Over 87.50 to 112.50, incl	1.55	1.55	1.25

3.6.2 Centerless Ground: Shall be as shown in Table 5.

TABLE 5 -

Nominal Thickness Inch	Nominal Thickness Millimeters	Tolerance Plus and Minus Inch	Tolerance Plus and Minus Millimeter
0.0625 to 2.000, incl	1.500 to 50.00, incl	0.002	0.05
Over 2.000	Over 50.00 to incl	0.003	0.08

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of bars shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the bars conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.4.1.1), hardness (3.4.1.2), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.