



AEROSPACE MATERIAL SPECIFICATION



AMS 7817B

Issued JAN 1964
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Cancelled APR 2003

Superseding AMS 7817A

MOLYBDENUM ALLOY SHEET, STRIP, AND PLATE 0.48Ti - 0.09Zr - 0.02C Arc Cast, Stress Relieved

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of April, 2003. By this action, this document will remain listed in the numerical section of the Index of Aerospace Material Specification.

This specification is not directly superseded by another document. However, ASTM B 386 alloy 363 covers a similar material. ASTM B 386 is available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

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1. SCOPE:

1.1 Form:

This specification covers an arc-cast molybdenum alloy in the form of sheet, strip, and plate.

1.2 Application:

Primarily for parts requiring high modulus and uniform strength up to 2300 °F (1260 °C). 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 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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

2.1.1 Aerospace Material Specifications:

AMS 2350 Standards and Test Methods

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 290 Semi-Guided Bend Test for Ductility of Metallic Materials

ASTM E 350 Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingots, Iron, and Wrought Iron

2.3 Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Federal Standards:

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

2.3.2 Military Standards:

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:**3.1 Composition:**

Shall conform to the following percentages by weight; carbon shall be determined in accordance with ASTM E 350, molybdenum by difference, gaseous elements by vacuum fusion, and other metallic elements by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	99.25	--	Check Analysis	
			Under Min or Max	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	--	0.0030 (30 ppm)	--	--
Nitrogen	--	0.0010 (10 ppm)	--	0.0005 (5 ppm)
Hydrogen	--	0.0005 (5 ppm)	--	--

3.2 Condition:

Hot-cold rolled, leveled, and stress-relieved, with chemically or mechanically cleaned surfaces; standards for acceptance shall be as agreed upon by purchaser and vendor.

3.3 Properties:

The product shall conform to the following requirements:

3.3.1 As Received:

3.3.1.1 Tensile Properties: Shall be as specified in Table I, determined in accordance with ASTM E 8 using strain rates of 0.002 - 0.005 in. per in. per min. (0.002 - 0.005 (mm/mm)/min.) through the 0.6% offset and 0.020 - 0.050 in. per in. per min. (0.020 - 0.050 (mm/mm)/min.) above the 0.6% offset to fracture, with axis of specimen transverse to the final rolling direction.

TABLE I

Nominal Thickness Inches		Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
0.010	to 0.025, incl	120,000	100,000	6
Over 0.025	to 0.060, incl	120,000	100,000	7
Over 0.060	to 0.090, incl	120,000	100,000	9
Over 0.090	to 0.500, incl	120,000	100,000	10
Over 0.500	to 1.000, incl	110,000	95,000	10
Over 1.000	to 1.500, incl	100,000	85,000	8

TABLE I (SI)

Nominal Thickness Millimeters		Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
0.25	to 0.64, incl	827	690	6
Over 0.64	to 1.52, incl	827	690	7
Over 1.52	to 2.29, incl	827	690	9
Over 2.29	to 12.70, incl	827	690	10
Over 12.70	to 25.40, incl	758	655	10
Over 25.40	to 38.10, incl	690	586	8

3.3.1.1.1 Tensile property requirements for product under 0.010 in. (0.25 mm) or over 1.500 in. (38.10 mm in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1.2 Bending: Product 0.060 in. (1.52 mm) and under in nominal thickness shall withstand, without cracking, bending in accordance with ASTM E 290 at room temperature through an angle of 105 deg around a diameter equal to 4 times the nominal thickness of the product with axes of bend parallel and perpendicular to the direction of rolling, using a ram speed of 10 - 18 in. per min. (254 - 457 mm/min.).

3.3.1.2.1 Bending requirements for product over 0.060 in. (1.52 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 After High-Temperature Exposure: Product shall meet the tensile property (3.3.1.1) and bending (3.3.1.2) requirements after being heated in a suitable protective atmosphere to 2100 °F + 25 (115 °C ± 15), held at heat for 30 min. ± 3, and cooled rapidly.

3.4 Quality:

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

3.4.2 The product, as received by purchaser, shall be uniform in quality and condition, sound, smooth, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

3.5 Tolerances:

Unless otherwise specified, tolerances shall be as follows for product 0.010 in. (0.25 mm) to 1.500 in. (38.10 mm) in nominal thickness; tolerances for product less than 0.010 in. (0.25 mm) or over 1.500 in. (38.10 mm) in nominal thickness shall be as agreed upon by purchaser and vendor:

3.5.1 Thickness:

TABLE II

Nominal Thickness (T) Inches			Tolerance, Inch, Plus and Minus For Width Ranges Shown, Inches	
			Up to 12, incl	Over 12 to 24, incl
	0.010	to 0.019, incl	0.0015	--
Over	0.019	to 0.029, incl	0.002	--
Over	0.029	to 0.039, incl	0.0025	0.003
Over	0.039	to 0.049, incl	0.003	0.0035
Over	0.049	to 0.070, incl	0.004	0.004
Over	0.070	to 0.187, incl	0.075T	0.075T
Over	0.187	to 0.500, incl	0.04T	0.04T
Over	0.500	to 1.500, incl	0.05T	--

TABLE II (SI)

Nominal Thickness (T) Millimeters			Tolerance, Millimeters, Plus and Minus For Width Ranges Shown, Millimeters	
			Up to 305, incl	Over 305 to 610, incl
	0.25	to 0.48, incl	0.038	--
Over	0.48	to 0.74, incl	0.05	--
Over	0.74	to 0.99, incl	0.064	0.08
Over	0.99	to 1.24, incl	0.08	0.089
Over	1.24	to 1.78, incl	0.10	0.10
Over	1.78	to 4.75, incl	0.075T	0.075T
Over	4.75	to 12.70, incl	0.04T	0.04T
Over	12.70	to 38.10, incl	0.05T	--

3.5.2 Width and Length:

TABLE III

Nominal Thickness Inches	Width Tolerance Inch		Length Tolerance Inch
	plus	minus	plus only
0.010 to 0.187, incl	1/16	1/16	1/8
Over 0.187 to 1.000, incl	1/8	0	1/8
Over 1.000 to 1.500, incl	3/16	0	3/16

TABLE III (SI)

Nominal Thickness Millimeter	Width Tolerance Millimeters		Length Tolerance Millimeters
	plus	minus	plus only
0.25 to 4.75, incl	1.6	1.6	3.2
Over 4.75 to 25.40, incl	3.2	0	3.2
Over 25.40 to 38.10, incl	4.8	0	4.8

3.5.3 Flatness: The total deviation from flatness shall not exceed the values shown in Table IV, determined by the formula:

$$\% \text{ Flatness Deviation} = \frac{H}{L} \times 100 \quad (\text{Eq. 1})$$

where, H = Maximum vertical distance between a flat surface and the lower surface of the product

L = Minimum horizontal distance between the highest point on the product and the point of contact with a flat surface

TABLE IV

Nominal Thickness Inches	Flatness Tolerance	
	(Millimeters)	%
0.10 to 0.500, incl	(0.25 to 12.70, incl)	4
Over 0.500 to 1.000, incl	(Over 12.70 to 25.40, incl)	5
Over 1.000 to 1.500, incl	(Over 25.40 to 38.10, incl)	6

3.5.3.1 If a gradual bow in the sheet can be eliminated by a slight pressure without the ends coiling or an "oil can" effect resulting, the sheet shall be acceptable.

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 ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1.1), bending (3.3.1.2), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for tensile and bending properties after high-temperature exposure (3.3.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling:

Shall be as follows:

4.3.1 Acceptance Tests:

4.3.1.1 Composition: One specimen from each heat.

4.3.1.2 Tensile and Bend Tests: One specimen from each thickness from each heat.

4.3.1.2.1 Specimens for bend testing shall be not less than 0.50 in. (12.7 mm) wide by not less than 2 in. (50 mm) long and shall be deburred.

4.3.2 Periodic Tests: As agreed upon by purchaser and vendor.

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 and for tensile and bending properties of each thickness from each heat. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat.