SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-7850 REV B

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Superseding AMS-7850A

Submitted for recognition as an American National Standard

COLUMBIUM SHEET, STRIP, PLATE, AND FOIL

UNS R04211

1. SCOPE:

1.1 Form: This specification covers columbium in the form of sheet, strip, plate, and foil.

1.2 Application: Primarily for parts requiring exposure to ultra-high temperatures. Applications in oxidizing atmospheres necessitate a protective coating.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS-2242 - Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
MAM-2242 - Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate
AMS-2809 - Identification, Titanium and Titanium Alloy Wrought Products

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

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 195 - Chemical Analysis of Reactor and Commercial Columbium
ASTM E 290 - Semi-Guided Bend Test for Ductility of Metallic Materials

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 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 determined by wet chemical methods in accordance with ASTM E 195 spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Tantalum	--	0.10
Oxygen	--	0.030 (300 ppm)
Zirconium	--	0.010 (100 ppm)
Iron	--	0.010 (100 ppm)
Nitrogen	--	0.010 (100 ppm)
Carbon	--	0.005 (50 ppm)
Silicon	--	0 005 (50 ppm)
Titanium	--	0.005 (50 ppm)
Hydrogen	--	0.002 (20 ppm)
Other Elements, each (3.1.1)	--	0.010
Other Elements, total (3.1.1)	--	0.15
Columbium	remainder	

3.1.1 Determination not required for routine acceptance.

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Sheet, Strip, and Foil: Cold rolled.

3.2.2 Plate: Cold rolled or hot-cold rolled, and descaled.

3.3 Properties: The product shall conform to the following requirements:

3.3.1 As Received: Shall be as agreed upon by purchaser and vendor.

3.3.2 After Annealing: Product, annealed under vacuum (less than 0.1 micron (0.1 µm) mercury, in inert atmosphere, or with suitable protective coating, shall have the following properties.

3.3.2.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E 8M with the rate of strain maintained at 0.003 - 0.007 inch/inch/minute (0.003 - 0.007 mm/mm/minute) through the yield strength and then increased so as to produce failure in approximately one additional minute.

3.3.2.1.1 Product 0.010 Inch (0.25 mm) and Over In Nominal Thickness:

Tensile Strength, minimum	30,000 psi	(207 MPa)
Elongation in 2 inches (50.8 mm) or 4D, minimum	18%	

3.3.2.1.2 Product Under 0.010 Inch (0.25 mm) In Nominal Thickness: As agreed upon by purchaser and vendor.

3.3.2.2 Hardness: Should be not higher than 160 HV30, or equivalent, determined in accordance with ASTM E 92, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.2.3 Bending: The product shall withstand, without evidence of cracking when examined at 20X magnification, bending in accordance with ASTM E 290 through the angle shown below around a diameter equal to the nominal thickness of the product with axis of bend parallel to the direction of rolling.

Nominal Thickness								Angle
Inch				Millimetres				deg, min
	Up	to	0.249, incl		Up	to	6.32, incl	180
Over	0.249	to	0.749, incl	Over	6.32	to	19.02, incl	90

3.3.2.3.1 Bending requirements for product over 0.749 inch (19.02 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.4 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.

3.5 Tolerances: Shall conform to all applicable requirements of AMS-2242 or 0 MAM-2242.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all 0 samples for vendor's test and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests for all technical requirements are acceptance 0 tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing: Shall be in accordance with the following; a lot shall 0 be all product of the same nominal thickness from the same heat (or batch if made by powder compacting) processed at the same time:

4.3.1 Composition: One sample from each heat, except that for carbon, oxygen, nitrogen, and hydrogen determinations one sample from each lot.

4.3.2 Tensile Property, Hardness, and Bending Requirements: One sample from each lot.

4.3.2.1 Tensile specimens shall be taken with axis parallel to direction of rolling.

4.3.2.2 For bend tests, minimum specimen width shall, when possible, be not less than 10 times nominal thickness; maximum width need not be greater than 1 inch (25 mm).

4.4 Reports: The vendor of the product shall furnish with each shipment a report showing the results of test for chemical composition of each heat or batch and for carbon, oxygen, nitrogen, and hydrogen content, tensile properties, hardness, and bending requirements of each lot. This report shall include the purchase order number, heat or batch number, lot number, AMS-7850B, size, and quantity.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be in accordance with AMS-2809, except foil shall be 0 identified as specified by purchaser,

5.2 Packaging:

5.2.1 The product shall be prepared for shipment in accordance with commercial 0 practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery.

5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-163, Commercial Level, unless Level A is specified in the request for procurement.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Product not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.