Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 7850A
Superseding AMS 7850

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COLUMBIUM SHEET, STRIP, AND PLATE

1. SCOPE:

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

1.2 Application: Primarily for parts and assemblies 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 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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2242 - Tolerances, Corrosion and Heat Resistant Steel and Iron Base Alloy Sheet, Strip, and Plate and Titanium and Titanium Alloy Sheet, Strip, and Plate
AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tension Testing of Metallic Materials
ASTM E92 - Vickers Hardness of Metallic Materials
ASTM E195 - Chemical Analysis of Reactor and Commercial Columbium
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

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 E195 or by other approved analytical methods:

	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)
ø 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; tensile properties and hardness ø shall be determined in accordance with ASTM E8 and ASTM E92, respectively:

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 with the rate of strain maintained at 0.003 - ø 0.007 in. per in. per min. (0.003 - 0.007 mm/mm/min.) 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 In. (0.25 mm) and Over In Nominal Thickness:

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

3.3.2.1.2 Product Less Than 0.010 In. (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 but the product shall not be rejected on ø 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 E290 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, min	
Inch	(Millimetres)	deg	(rad)
Up to 0.249, incl	(Up to 6.32, incl)	180	(3.14)
Over 0.249 to 0.749, incl	(Over 6.32 to 19.02, incl)	90	(1.57)

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

3.4 Quality: The product, as received by the purchaser, shall be uniform in quality and condition, sound, 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 conform to all applicable requirements of AMS 2242.

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: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests.

4.3 Sampling: Shall be in accordance with the following; a lot shall be all product of the same nominal size 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 test specimens shall be taken with axis parallel to the 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 in. (25 mm).

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 or batch and for carbon, oxygen, nitrogen, hydrogen, tensile property, hardness, and bending requirements of each lot. This report shall include the purchase order number, heat or batch number, material specification number and its revision letter, size, and quantity from each heat or batch.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

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 Ø 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: The product shall be identified as follows:

5.1.1 Each sheet, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 7850A, heat or batch number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the product or its performance and shall be sufficiently stable to withstand normal handling.

5.1.1.1 Flat Strip 6 In. (152 mm) and Under in Width: Shall be marked in one or more lengthwise rows of Ø characters recurring at intervals not greater than 3 ft (914 mm).

5.1.1.2 Flat Sheet, Flat Strip Over 6 In. (152 mm) in Width, and Plate: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm), the rows being spaced not more Ø than 6 in. (152 mm) apart and alternately staggered.

5.1.1.3 Coiled Sheet and Strip: Shall be marked near both the outside and inside ends of the coil; the markings shall be applied as in 5.1.1 or shall appear on a durable tag or label attached to the coil and Ø marked with the information of 5.1.1. When the inside of the coil is inaccessible as when the product is wound on cores, the tag or label may be attached to the core.

Ø 5.1.2 Foil: As agreed upon by purchaser and vendor.

5.2 Packaging:

5.2.1 The product shall be prepared for shipment in accordance with commercial practice to ensure carrier Ø acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.2.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-163, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 will be acceptable if it meets the requirements of Level C.

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

7. REJECTIONS: Material not conforming to this specification or to authorized modifications will be subject to rejection.