# AEROSPACE MATERIAL SPECIFICATION

| AMS7850 | REV. E |
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Issued 1960-06
Reaffirmed 2006-07
Revised 2013-10

Superseding AMS7850E

## Columbium (Niobium) Sheet, Strip, and Foil
## (Composition similar to UNS R04211)

RATIONALE

AMS7850E is a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

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

1.2 Application

This material has been used typically for parts requiring exposure to ultra-high temperatures, but usage is not limited to such applications. Applications in oxidizing atmospheres necessitate a protective coating. Although produced in the cold rolled condition, this material is intended to be used in the annealed condition.

1.3 This alloy is frequently, and equivalently, called Niobium.

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2242 Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate

AMS2809 Identification, Titanium and Titanium Alloy Wrought Products





**TO PLACE A DOCUMENT ORDER:** **Tel: 877-606-7323 (inside USA and Canada)**
**Tel: +1 724-776-4970 (outside USA)**
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**SAE values your input. To provide feedback on this Technical Report, please visit**
**http://www.sae.org/technical/standards/AMS7850E**

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19248-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 8 / E 8M Tension Testing of Metallic Materials

ASTM E 290 Bend Testing of Material for Ductility

ASTM E 2626 Spectrometric Analysis of Reactive and Refractory Metals

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1. Metallic elements shall be determined by spectrochemical methods in accordance with ASTM E 2626 or by other analytical methods acceptable to purchaser, carbon shall be determined by the combustion method using an infrared detection system; oxygen, nitrogen and hydrogen shall be determined by the inert gas fusion technique; nitrogen may also be determined by the Kjeldahl technique.

TABLE 1 - COMPOSITION

| Element | 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 (Niobium) | 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 Capability 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 / E 8M with the rate of strain the rate of strain set at 0.005 inch/inch/minute (0.005 mm/mm/minute) and maintained within a tolerance of ±0.002 inch/inch/minute (0.002 mm/mm/minute) through the 0.2% offset yield strain and 0.05 inch/inch/minute (0.05 mm/mm/minute) and maintained within a tolerance of ±0.02 inch/inch/minute (±0.02 mm/mm/minute) above the yield strain to fracture.

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

Shall be as shown in Table 2.

TABLE 2 - MINIMUM TENSILE PROPERTIES

| Property | Value |
|---|---|
| Tensile Strength | 30.0 ksi (207 MPa) |
| Elongation in 2 inches (50.8 mm) or 4D | 18% |

3.3.2.2 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 in Table 3 around a diameter equal to the nominal thickness of the product with axis of bend parallel to the direction of rolling.

TABLE 3 - MINIMUM BEND ANGLE

| Nominal Thickness Inch | Nominal Thickness Millimeters | Angle Degrees |
|---|---|---|
| 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 |

3.4 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 AMS2242.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of the product shall supply all samples for vendor's test 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 product conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance 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 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 Properties 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 producer of the product shall furnish with each shipment a report showing the producer identity and country where the metal was melted (i.e., final melt in the case of metal processed by multiple melting operations) and the results of test for composition of each heat or batch and for carbon, oxygen, nitrogen, and hydrogen content, tensile properties, and bending requirements of each lot and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat or batch number, lot number, AMS7850E, product form, 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 two 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. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be in accordance with AMS2809, except foil shall be identified as specified by purchaser.

5.2 Packaging

The product shall be prepared for shipment in accordance with commercial 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.

6. ACKNOWLEDGMENT

A vendor shall include 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.