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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4501B

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Superseding AMS 4501A

COPPER SHEET, STRIP, AND PLATE
Oxygen-Free, Light Cold Rolled

UNS C10200

1. SCOPE:

1.1 Form: This specification covers one type of copper in the form of sheet, strip, and plate.

1.2 Application: Primarily for parts requiring high electrical or thermal conductivity.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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.

2.1.1 Aerospace Material Specifications:

AMS 2222 - Tolerances, Copper and Copper Alloy Sheet, Strip, and Plate
MAM 2222 - Tolerances, Metric, Copper and Copper 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 B193 - Resistivity of Electrical Conductor Materials
ASTM B248 - General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B248M - General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric)
ASTM E8 - Tension Testing of Metallic Materials
ASTM E8M - Tension Testing of Metallic Materials (Metric)
ASTM E53 - Chemical Analysis of Copper
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

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

2.3.1 Military Specifications:

MIL-C-3993 - Copper and Copper-Base Alloy Mill Products, Packaging of

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be oxygen-free copper containing not less than 99.95% by Ø weight copper (including silver), determined by wet chemical methods in accordance with ASTM E353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

3.2 Condition: Cold rolled, light cold rolled (eighth hard) (Hoo) temper (See 8.2).

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

3.3.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8 or ASTM E8M:

Tensile Strength 32,000 - 40,000 psi (221 - 276 MPa)

3.3.2 Bending: Product 0.188 inch (4.78 mm) and under in nominal thickness shall withstand, without cracking, bending in accordance with ASTM E290 at room temperature through an angle of 180 degrees around a diameter equal to the nominal thickness of the product with axis of bend parallel to the direction of rolling. Bending requirements for product over 0.188 inch (4.78 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.3 Electrical Resistivity: Shall be not greater than 0.15775 $\Omega \cdot g/m^2$ at 20°C ± 2 (68°F ± 4), determined in accordance with ASTM B193.

3.3.4 Embrittlement: Product 0.188 inch (4.78 mm) and under in nominal thickness shall withstand not less than four 90 degree reverse bends without fracture after heating as in 3.3.4.1. Product over 0.188 inch (4.78 mm) in nominal thickness shall not show evidence of gassing or open-grain structure characteristic of embrittlement after heating in the same manner.

3.3.4.1 Specimens from the product shall be heated to 800° - 875°C (1472° - 1607°F) in a furnace containing a hydrogen atmosphere, held at heat for not less than 20 minutes, and cooled in such a manner as to prevent oxygen absorption during cooling. Specimens from product 0.188 inch (4.78 mm) and under in nominal thickness shall be clamped between jaws having edge radii equal to 2.5 times the nominal thickness of the specimen, bent through an angle of 90 degrees over one edge of the jaws, and returned to its original position; this constitutes one bend. Specimens shall then be bent through an angle of 90 degrees in the reverse direction and returned to its original position; this constitutes a second bend. Each successive bend shall be made in the opposite direction from the previous bend. Specimens from product over 0.188 inch (4.78 mm) in nominal thickness shall be polished, etched if desired, and examined at 75 - 200X magnification.

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 AMS 2222 or MAM 2222 as applicable to nonrefractory alloys.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Ø Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Ø Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.3 Sampling: Shall be in accordance with ASTM B248 or ASTM B248M and the following:

4.3.1 Specimens for tensile testing shall be taken with axis of specimen parallel to the direction of rolling.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment a report showing the results of tests for composition, tensile properties, and electrical resistivity of each lot and stating that the product conforms to the other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 4501B, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4501B, contractor or other direct supplier of product, part number, and quantity. When product for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of product to determine conformance to the requirements of this specification and shall include in the report either a statement that the product conforms or 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 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 in 5.1.1 unless line marking as in 5.1.2 is specified by purchaser.

5.1.1 Each sheet, strip, and plate shall be marked near one end, coils being marked near the outside end, with AMS 4501B, manufacturer's identification, and nominal thickness, using any suitable marking fluid. As an alternate method, individual pieces or bundles shall have attached a durable tag marked with the above information or shall be boxed and the box marked with the same information.

5.1.2 When specified by purchaser, each sheet, strip, and plate shall be marked on one face, in the respective location indicated below, with AMS 4501B, lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be 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. The specification number, manufacturer's identification, and nominal thickness shall be continuously line marked; the lot number may be included in the line marking or may be marked at one location on each piece.

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

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