



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 4530E

Superseding AMS 4530D

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UNS C17200

COPPER-BERYLLIUM ALLOY SHEET, STRIP, AND PLATE

98Cu - 1.9Be (CDA 172)

Solution Heat Treated

1. SCOPE:

- 1.1 Form: This specification covers one type of copper-beryllium alloy in the form of sheet, strip, and plate.
- 1.2 Application: Primarily for parts requiring high strength with good electrical conductivity or lack of magnetic susceptibility.

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 2222 - Tolerances, 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 B194 - Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

ASTM B248 - General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

ASTM E8 - Tension Testing of Metallic Materials

ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

ASTM E106 - Chemical Analysis of Copper-Beryllium Alloys

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

2.3.1 Federal Standards:

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

2.3.2 Military Specifications:

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

REAFFIRMED

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3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E106, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

		min	max
Ø	Beryllium	1.8	- 2.0
	Cobalt	0.20	--
	Nickel + Cobalt + Iron	--	0.60
	Other Elements, total	--	0.50
	Copper	remainder	

- 3.2 Condition: Solution heat treated.

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

3.3.1 As Solution Heat Treated:

- 3.3.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8; elongation requirements apply only to product 0.004 in. (0.10 mm) and over in nominal thickness:

Tensile Strength	60,000 - 78,000 psi (414 - 538 MPa)
Elongation, in 2 in. (50 mm) or 4D, min	35%

- 3.3.1.2 Hardness: Should be as follows, or equivalent, determined in accordance with ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.1.1 are met.

Nominal Thickness		Hardness
Inches	(Millimetres)	
0.010 to 0.030, incl	(0.25 to 0.76, incl)	75 - 85 HR15T
Over 0.030 to 0.050, incl	(Over 0.76 to 1.27, incl)	46 - 67 HR30T
Over 0.050 to 0.075, incl	(Over 1.27 to 1.90, incl)	83 - 102 HRF
Over 0.075	(Over 1.90)	45 - 78 HRB

- 3.3.1.2.1 Hardness requirements for product less than 0.010 in. (0.25 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

- 3.3.1.3 Microstructure: Product shall reveal a minimum of beta phase constituent. Any beta phase present shall be fine and well dispersed and shall not be in the form of stringers. Standards for acceptance shall be as agreed upon by purchaser and vendor. Product may be precipitation heat treated as in 3.3.2 before examination.

- 3.3.1.4 Grain Count and Grain Size: Shall be as specified in Table I and 3.3.1.4.1, determined in accordance with ASTM B194. Product may be precipitation heat treated as in 3.3.2 before examination.

TABLE I

Nominal Thickness Inch	Grain Count min	Average Grain Size mm, max
Over 0.004 to 0.006, incl	6	--
Over 0.006 to 0.008, incl	7	--
Over 0.008 to 0.010, incl	8	--
Over 0.010 to 0.030, incl	--	0.035
Over 0.030 to 0.090, incl	--	0.045
Over 0.090 to 0.188, incl	--	0.060

TABLE I (SI)

Nominal Thickness Millimetres	Grain Count min	Average Grain Size mm, max
Over 0.10 to 0.15, incl	6	--
Over 0.15 to 0.20, incl	7	--
Over 0.20 to 0.25, incl	8	--
Over 0.25 to 0.76, incl	--	0.035
Over 0.76 to 2.29, incl	--	0.045
Over 2.29 to 4.78, incl	--	0.060

3.3.1.4.1 Grain count requirements for product less than 0.004 in. (0.10 mm) in nominal thickness and grain size requirements for product over 0.188 in. (4.78 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 After Precipitation Heat Treatment: Product shall have the following properties after being precipitation heat treated by heating to 600° - 625° F (315° - 330° C), holding at heat for 3 hr $\pm$ 0.25, and cooling in air:

3.3.2.1 Tensile Properties: Shall be as specified in Table II, determined in accordance with ASTM E8.

TABLE II

Ø	Nominal Thickness Inches	Tensile Strength psi		Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
		min	max		
	Up to 0.004, incl	165,000	--	140,000	--
	Over 0.004 to 0.020, incl	165,000	--	140,000	3
	Over 0.020	165,000	190,000	140,000	3

TABLE II (SI)

Nominal Thickness Millimetres	Tensile Strength MPa		Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
	min	max		
Up to 0.10, incl	1138	--	965	--
Over 0.10 to 0.51, incl	1138	--	965	3
Over 0.51	1138	1310	965	3

- 3.3.2.2 Hardness: Should be as specified in Table III and 3.3.2.2.1, determined in accordance with ASTM E18, but the product shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.2.1 are met.

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TABLE III

Nominal Thickness		Hardness
Inches	(Millimetres)	
0.010 to 0.020, incl	(0.25 to 0.51, incl)	78 - 82 HR15N
Over 0.020 to 0.065, incl	(Over 0.51 to 1.65, incl)	56 - 61 HR30N
Over 0.065	(Over 1.65)	36 - 42 HRC

- 3.3.2.2.1 Hardness requirements for product less than 0.010 in. (0.25 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

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- 3.4 Quality: The product, as received by 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.

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- 3.5 Tolerances: Unless otherwise specified, tolerances shall conform to AMS 2222 as applicable to refractory alloys.

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.

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- 4.2 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.

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- Ø 4.3 Sampling: Shall be in accordance with ASTM B248 and the following:

- 4.3.1 Specimens for tensile tests of widths 9 in. (229 mm) and over shall be taken with the axis of the specimen perpendicular to the direction of rolling; for widths less than 9 in. (229 mm), specimens shall be taken with the axis parallel to the direction of rolling.

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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, tensile properties, hardness, and grain count or grain size 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, material specification number and its revision letter, size, and quantity.