SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4532F

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Superseding AMS 4532E

Copper-Beryllium Alloy, Sheet and Strip
98Cu - 1.9Be
Half Hard (TD02)

(Composition similar to UNS C17200)

1. SCOPE:

1.1 Form:

This specification covers one type of copper-beryllium alloy in the form of sheet and strip.

1.2 Application:

This product has been used typically for parts requiring high strength with good electrical conductivity or lack of magnetic susceptibility, but usage is not limited to such applications. These products have higher strength and lower ductility than AMS 4530.

1.3 Safety-Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2222	Tolerances, Copper and Copper Alloy Sheet, Strip and Plate
AMS 4530	Copper-Beryllium Alloy Sheet, Strip and Plate Solution Heat Treated (UNS C17200)

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM B 194	Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B 194	Annex- Chemical Analysis of Copper-Beryllium Alloys
ASTM B 248	General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B 601	Temper Designations of Copper and Copper Alloys-Wrought and Cast
ASTM E 3	Preparation of Metallographic Specimens
ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 478	Chemical Analysis of Copper Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM B 194 and/or ASTM E 478, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Beryllium	1.8	2.00
Cobalt	0.20	--
Nickel + Cobalt + Iron	--	0.6
Other Elements, total	--	0.50
Copper (3.1.2)	remainder	

3.1.1 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer or supplier and purchaser.

3.1.2 Copper may be reported as ‘remainder’, or as the difference between the sum of results for all listed elements and 100%, or as the result of direct analysis.

3.2 Condition:

Solution heat treated and cold rolled to half-hard temper. (Temper TB02).

3.3 Properties:

As Solution Heat Treated and Cold Rolled: The product shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8; elongation requirements apply only to product 0.004 inch (0.10 mm) and over in nominal thickness.

TABLE 2 - Tensile Properties

Property	Value
Tensile Strength	85.0 to 100 ksi (586 to 690 MPa)
Elongation in 2 inches (50.8 mm) or 4D, minimum	5%

3.3.2 Microstructure: Product shall reveal a minimum of beta phase constituent, determined at 100X magnification on specimens prepared in accordance with ASTM E 3. Any beta phase present shall be as agreed upon by purchaser and vendor. Product may be precipitation heat treated before examination.

3.3.3 Grain Count and Grain Size: Shall be as specified in Table 3, determined in accordance with ASTM B 194. Product may be precipitation heat treated as in 3.4 prior to examination.

TABLE 3A - Grain Count/Size, Thickness in Inch/Pound Units

Nominal Thickness Inches	Grain Count Minimum	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 3B - Grain Count/Size, Thickness in SI Units

Nominal Thickness Millimeters	Grain Count Minimum	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

3.3.4 Response to Precipitation Heat Treatment: Product shall have the properties shown in Table 4 after being precipitation heat treated by heating to 600 to 675 °F (315 to 330 °C), holding at heat for 2 to 3 hours and cooling in air.

3.3.4.1 Tensile Properties: Shall be as specified in Table 4, determined in accordance with ASTM E 8.

TABLE 4A - Tensile Properties, Inch/Pound Units

Nominal Thickness Inches	Tensile Strength ksi, min	Tensile Strength ksi, max	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %, min
Up to 0.004, incl	185	--	160	--
Over 0.004 to 0.020, incl	185	--	160	1
Over 0.020 to 0.188, incl	185	210	160	1

TABLE 4B- Tensile Properties, SI Units

Nominal Thickness Inches	Tensile Strength ksi, min	Tensile Strength ksi, max	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %, min
Up to 0.10, incl	1276	--	1103	--
Over 0.10 to 0.51, incl	1276	--	1103	1
Over 0.51 to 4.76, incl	1276	1448	1103	1

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:

Unless otherwise specified 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 for vendor's tests 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 ASTM B 248 or ASTM B 248M and the following:

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

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the results of tests for composition, and the numerical results of tensile properties, and grain count or grain size for sheet or strip of each lot, and stating that the product conforms to the any other technical requirements of this specification. This report shall include the purchase order number, lot number, AMS 4532F, 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:

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 4532F, lot number, manufacturer's identification, and nominal thickness, using any suitable marking fluid. As an alternate method, individual pieces of bundles shall have attached a durable tag or label 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 4532F, lot 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. 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.