The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4615E

Issued 4-1-43
Revised 4-1-88

Superseding AMS 4615D

SILICON BRONZE RODS AND BARS, 95.5Cu - 3.2Si, Hard Temper

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 21 October 1987. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "E" revision of the subject specification.

Noncurrent refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division does not recommend these as standard materials for future use in new designs. Each of these "Noncurrent" specifications is available on request.

This specification is under the jurisdiction of AMS Committee "D".

SAE The Engineering Resource For Advancing Mobility
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AEROSPACE MATERIAL SPECIFICATION

AMS 4615E
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Issued 4-1-43
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UNS C65500

SILICON BRONZE RODS AND BARS
95.5Cu - 3.2Si
Hard Temper

1. SCOPE:

1.1 Form: This specification covers one type of bronze in the form of rods and bars.

1.2 Application: Primarily for bearings and for fittings in hydraulic pressure lines using AMS 4665 tubing.

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 SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specificatons:

AMS 2221 - Tolerances, Copper and Copper Alloy Rods and Bars
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 B154 - Mercurous Nitrate Test for Copper and Copper Alloys
ASTM B249 - General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, and Shapes
ASTM E8 - Tension Testing of Metallic Materials
ASTM E54 - Chemical Analysis of Special Brasses and Bronzes
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

2.3 U.S. Government Publications: Aavailable 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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E54, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Copper	94.80	--
Silicon	2.80	3.50
Iron, Manganese, or Zinc	--	1.60
Tin	--	0.70
Lead	--	0.05
Total Named Elements	99.50	--

3.1.1 Lead in the range 0.20 - 0.80% may be added to the above composition when permitted by purchaser. In such case, lead shall be considered a specified element, and the minimum copper requirement may be reduced by an amount equal to that of the lead present.

3.2 Condition: Cold finished and stress-relieved if necessary, hard temper.

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

3.3.1 Tensile Properties: Shall be as specified in Tables I and II, determined in accordance with ASTM E8:

3.3.1.1 Rounds, Hexagons, Octagons, and Squares:

TABLE I

Nominal Diameter or Distance Between Paralles Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 0.250, incl	85,000	50,000	8
Over 0.250 to 1.500, incl	85,000	50,000	13

TABLE I(SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50 mm or 4D %, min
Up to 6.25, incl	585	345	8
Over 6.25 to 37.50, incl	585	345	13

3.3.1.1.1 Tensile property requirements for rounds, hexagons, octagons, and squares over 1.500 in. (37.50 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.1.2 Rectangles:

TABLE II

Nominal Thickness Inches	Tensile Strength psi, min	Elongation in 2 in. or 4D %, min
Up to 1.000, incl	65,000	25
Over 1.000 to 1.500, incl	60,000	25
Over 1.500 to 3.000, incl	50,000	25

TABLE II(SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Elongation in 50 mm or 4D %, min
Up to 25.00, incl	450	25
Over 25.00 to 37.50, incl	415	25
Over 37.50 to 75.00, incl	345	25

3.3.1.2.1 Tensile property requirements for rectangles over 3.000 in. (75.00 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.2 Bending: The product shall withstand, without cracking, bending at room temperature in accordance with ASTM E290 through an angle of 90 deg around a diameter equal to twice the nominal diameter or thickness of the product with axis of bend parallel to the direction of rolling.

3.3.3 Embrittlement: Specimens as in 4.3.3.1 shall withstand, without cracking, immersion in mercurous nitrate solution in accordance with ASTM B154, Procedure A.

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.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to AMS 2221 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 performing all required tests. Results of such tests shall be reported to the purchaser as ø 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 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1) embrittlement (3.3.2), and ø tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for bending (3.3.2) are classified as periodic tests and shall be performed at ø a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with ASTM B249 and the following:

4.3.1 Composition: One sample from each lot.

4.3.2 Tensile Properties: One sample from each lot.

4.3.2.1 The axis of tensile specimens from rectangles over 1.500 in. (37.50 mm) in nominal thickness shall be located approximately midway between center and surface.

4.3.2.2 The axis of tensile specimens from rectangles shall be parallel to the ø longitudinal grain direction.

4.3.3 Bending and Embrittlement: As agreed upon by purchaser and vendor.

4.3.3.1 Specimens for embrittlement test shall be full cross-section of the product and shall have length of approximately 6 in. (150 mm) or twice the nominal diameter or least distance between parallel sides, whichever is greater.