

ALUMINUM SILICON BRONZE BARS, RODS, AND FORGINGS
90Cu - 7.0Al - 1.9Si
Drawn and Stress Relieved (HR50)

UNS C64200

1. SCOPE:

- 1.1 Form: This specification covers one type of aluminum silicon bronze in the form of bars, rods, forgings, and forging stock.
- 1.2 Application: Primarily for parts requiring strength and wear resistance at moderate temperatures. This material has slightly better corrosion resistance than AMS 4630.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications 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 2221 - Tolerances, Copper and Copper Alloy Bars and Rods
MAM 2221 - Tolerances, Metric, Copper and Copper Alloy Bars and Rods
AMS 2350 - Standards and Test Methods
AMS 2808 - Identification, Forgings

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2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

- ASTM B154 - Mercurous Nitrate Test for Copper and Copper Alloys
- ASTM B249 - Wrought Copper and Copper-Alloy Rod, Bar, and Shapes
- ASTM B249M - Wrought Copper and Copper-Alloy Rod, Bar, and Shapes (Metric)
- ASTM E8 - Tension Testing of Metallic Materials
- ASTM E8M - Tension Testing of Metallic Materials (Metric)
- ASTM E10 - Brinell Hardness of Metallic Materials
- ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E478 - Chemical Analysis of Copper Alloys

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 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E478, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Aluminum	6.3	7.6
Silicon	1.5	2.3
Zinc	--	0.50
Iron	--	0.30
Nickel plus Cobalt	--	0.25
Tin	--	0.20
Arsenic	--	0.15
Manganese	--	0.10
Lead	--	0.05
Residual Elements, Total	--	0.50
Copper plus Sum of Named Elements (See 3.1.1)	99.5	--
Copper plus Silver	remainder	

3.1.1 Applicable when copper is not determined by analysis. The reported (certified) value is the difference between the sum of all other specified elements and 100%; and will therefore include unnamed elements. Limits for unnamed elements may be established by agreement between purchaser and manufacturer or supplier.

3.1.2 Applicable only when copper is determined by direct analysis.

3.2 Condition: The product shall be supplied in the following condition:

3.2.1 Bars and Rods: Drawn and stress relieved (HR50) temper. (See 8.1).

3.2.2 Forgings: Stress relieved.

3.2.3 Forging Stock: As ordered by the forging manufacturer.

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

3.3.1 Bars, Rods, and Forgings:

3.3.1.1 Longitudinal Tensile Properties:

3.3.1.1.1 Bars and Rods: Shall be as specified in Table I and 3.3.1.1.1.1, determined in accordance with ASTM E8 or ASTM E8M.

TABLE I

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, minimum	Elongation in 4D %, minimum
Up to 0.5, incl	90,000	45,000	19
Over 0.5 to 1.0, incl	85,000	44,000	12
Over 1.0 to 2.0, incl	80,000	42,000	12
Over 2.0 to 3.0, incl	75,000	35,000	15

TABLE I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, minimum	Elongation in 4D %, minimum
Up to 13, incl	621	310	19
Over 13 to 25, incl	586	303	12
Over 25 to 51, incl	552	290	12
Over 51 to 76, incl	517	241	15

3.3.1.1.1.1 Tensile property requirements for bars and rods over 3.0 inches (76 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.1.1.2 Forgings: Shall be as agreed upon by purchaser and vendor.

3.3.1.2 Hardness: Should be as follows but the product shall not be rejected on the basis of hardness if the tensile property requirements are met:

3.3.1.2.1 Surface: Not lower than 130 HB/10/1000, determined in accordance with ASTM E10 or not lower than 72 RB, determined in accordance with ASTM E18; on rounds, a flat, as necessary for accuracy, may be made.

3.3.1.2.2 Internal: Not lower than 80 HRB, or equivalent, determined in accordance with ASTM E18 at mid-radius or quarter thickness.

3.3.1.3 Embrittlement: Specimens as in 4.3.1.2 and 4.3.2.1 shall withstand, without cracking, immersion in mercurous nitrate solution in accordance with ASTM B154, Procedure A.

3.3.2 Forging Stock: Shall be as agreed upon by purchaser and vendor.

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: Bars and rods shall conform to AMS 2221 or MAM 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 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 the following requirements are classified as acceptance tests and shall be performed on each heat or lot as applicable:

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Tensile properties (3.3.1.1.1) of each lot of bars and rods and each lot of forgings when specified.

4.2.1.3 Hardness (3.3.1.2) of each lot of bars, rods, and forgings.

4.2.1.4 Tolerances (3.5) of bars and rods.

4.2.2 Periodic Tests: Tests of bars, rods, and forgings to determine conformance to requirements for embrittlement (3.3.1.3) and of forging stock to determine conformance to specified properties are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars and Rods: ASTM B249 or ASTM B249M and the following: