SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4631 | REV. E

Issued 1946-11
Revised 1978-01
Noncurrent 1988-04
Reaf. Noncur. 2011-11

Superseding AMS 4631D

Aluminum Bronze Rods, Bars, and Forgings 90.5Cu - 7.5Al - 1.95: Stress Relieved

RATIONALE

This document has been reaffirmed to comply with the SAE five-year review policy.

NONCURRENT NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of April 1988. It is recommended, therefore, that this specification not be specified for new designs.

“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, however, does not recommend these as standard materials for future use in new designs. Each of these “NONCURRENT” specifications is available from SAE upon request.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4631E

1. SCOPE:

1.1 Form:

This specification covers one type of aluminum bronze in the form of rods, bars, 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 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 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS 2221	Tolerances, Copper and Copper Alloy Rods and Bars
AMS 2350	Standards and Test Methods
AMS 2808	Identification, Forgings

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 E10	Brinell Hardness of Metallic Materials
ASTM E18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E478	Chemical Analysis of Copper-Base 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

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 spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Copper	89.00	--
Aluminum	6.50	8.50
Silicon	1.60	2.25
Other Elements, each	--	0.05
Other Elements, total	--	0.50

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Rods and Bars: Hot rolled or drawn, or extruded, cold finished if necessary, and stress relieved.

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 Rods, Bars, and Forgings:

3.3.1.1 Tensile Properties:

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

TABLE 1

Nominal Diameter or Distance Between Parallel Sides Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Up to 0.500, incl	90,000	45,000	15
Over 0.500 to 1.000, incl	88,000	44,000	15
Over 1.000 to 2.000, incl	85,000	42,000	20
Over 2.000 to 3.000, incl	75,000	37,500	30

TABLE 1 (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min
Up to 12.70, incl	621	310	15
Over 12.70 to 25.40, incl	607	303	15
Over 25.40 to 50.80, incl	586	290	20
Over 50.80 to 76.20, incl	517	259	30

3.3.1.1.1.1 Tensile property requirements for rods and bars over 3.000 in. (76.20 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 or equivalent, determined in accordance with ASTM E10; 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 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 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.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests of the product to determine conformance to composition (3.1) requirements, of rods, bars, and forgings to determine conformance to tensile property (3.3.1.1), hardness (3.3.1.2) requirements, and of rods and bars to determine conformance to tolerance (3.5) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests of rods, bars, and forgings to determine conformance to embrittlement (3.3.1.3) requirements and of forging stock to determine conformance to specified properties are classified as periodic tests.

4.3 Sampling:

Shall be in accordance with the following:

4.3.1 Rods and Bars: ASTM B249 and the following:

4.3.1.1 Specimens for tensile testing of rods and bars over 1.500 in. (38.10 mm) in nominal diameter or distance between parallel sides shall have their axes located approximately midway between center and surface.

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

4.3.2 Forgings: Two samples from each lot; a lot shall be all forgings of one part number processed consecutively and presented for vendor's inspection at one time.

4.3.2.1 Specimens for embrittlement test shall be of any convenient size and shape agreed upon by purchaser and vendor or an entire forging may be used.

4.4 Reports:

4.4.1 The vendor of rods, bars, and forgings shall furnish with each shipment three copies of a report showing the results of tests for chemical composition, tensile properties, and hardness 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, material specification number and its revision letter, size or part number, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall be included in the report.

4.4.2 The vendor of forging stock shall furnish with each shipment three copies of a report stating that the chemical composition of the stock conforms to the specified requirements. This report shall include the purchase order number, material specification number and its revision letter, size, and quantity.

4.4.3 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include 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 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.