AEROSPACE MATERIAL SPECIFICATION

AMS4633™	REV. C

Issued 1992-07
Reaffirmed 2012-02
Revised 2023-03

Superseding AMS4633B

Bronze, Aluminum Silicon, Rods, Bars, and Forgings
90Cu - 7.0Al - 1.8Si
Drawn and Stress Relieved (HR50)
(Composition similar to UNS C64200)

RATIONALE

AMS4633C results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (3.3.1.1.2, 3.6, 8.4), residual stress test nomenclature (previously embrittlement) (3.3.1.3, 4.2.2, 4.3.1.2, 4.3.2.1), update applicable documents (Section 2), composition (3.1), sampling and testing for bars and rods (4.3.1), ordering information (8.5), similar specifications (8.6), and update language regarding use of the immediate prior specification revision (8.3).

1. SCOPE

1.1 Form

This specification covers one type of aluminum silicon bronze in the form of rods and bars up to 3.00 inches (76.2 mm), inclusive, in nominal diameter or distance between parallel sides, and forgings and forging stock of any size (see 8.5).

1.2 Application

This product has been used typically for parts requiring strength and wear resistance at moderate temperatures, but usage is not limited to such applications.

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.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2221 Tolerances, Copper and Copper Alloy Bars and Rods

AMS2808 Identification, Forgings

AS7766 Terms Used in Aerospace Metals Specifications

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**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4633C/

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B154	Mercurous Nitrate Test for Copper and Copper Alloys
ASTM B249/B249M	General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings
ASTM B601	Temper Designations for Copper and Copper Alloys—Wrought and Cast
ASTM B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B858	Ammonia Vapor Test for Determination Susceptibility to Stress Corrosion Cracking in Copper Alloys
ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E10	Brinell Hardness of Metallic Materials
ASTM E18	Rockwell Hardness of Metallic Materials
ASTM E478	Chemical Analysis of Copper Alloys

2.3 Definitions

Terms used in AMS are defined in AS7766.

2.3.1 Copper temper designations are defined in ASTM B601.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E478 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element (3.1.1)	Min	Max
Aluminum	6.3	7.6
Silicon	1.5	2.2
Zinc	--	0.50
Iron	--	0.30
Nickel (Including Cobalt)	--	0.25
Tin	--	0.20
Arsenic	--	0.09
Manganese	--	0.10
Lead	--	0.05
Copper (Including Silver) (3.1.2)	remainder	
Sum of Named Elements (3.1.3)	99.5	

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 (see 8.5).

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

3.1.3 When all the elements in the table are analyzed, the sum shall be 99.5%, minimum, but such determination is not required for routine acceptance of each lot.

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 2.3.1).

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 shown in Table 2, determined in accordance with ASTM E8/E8M.

Table 2A - Minimum tensile properties, inch/pound units

Nominal Diameter Distance Between Parallel Sides Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 4D %
Up to 0.5, incl	90.0	45.0	9
Over 0.5 to 1.0, incl	85.0	45.0	12
Over 1.0 to 2.0, incl	80.0	42.0	12
Over 2.0 to 3.0, incl	75.0	35.0	15

Table 2B - Minimum tensile properties, SI units

Nominal Diameter Distance Between Parallel Sides Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %
Up to 12.7, incl	621	310	9
Over 12.7 to 25.4, incl	586	310	12
Over 25.4 to 50.8, incl	552	290	12
Over 50.8 to 76.2, incl	517	241	15

3.3.1.1.2 Mechanical property requirements for product outside of the range covered by 1.1, shall be agreed upon between purchaser and producer and reported per 4.4.2 (see 8.5).

3.3.1.1.3 Forgings

Shall be as agreed upon by purchaser and producer.

3.3.1.2 Hardness

Shall be as follows:

3.3.1.2.1 Surface

Not lower than 130 HB/10/1000, determined in accordance with ASTM E10, or not lower than 72 HRB, 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 Residual Stress

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, or the ammonia vapor test in accordance with ASTM B858.

3.3.2 Forging Stock

Shall be as agreed upon by purchaser and producer.

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 AMS2221 as applicable to refractory alloys.

3.6 Exceptions

Any exceptions shall be authorized by purchaser and reported as in 4.4.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer'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

4.2.1 Acceptance Tests

The following requirements are 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 of each lot of forgings when specified (3.3.1.1.2).

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 for residual stress (3.3.1.3) and forging stock (3.3.2) for properties when specified are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with the following:

4.3.1 Bars and Rods

ASTM B249/B249M and ASTM E8/E8M.

4.3.1.1 The tensile specimen shall be prepared in accordance with ASTM E8/E8M.

4.3.1.2 Specimens for residual stress test shall be the full cross-section of the product and shall have length of approximately 6 inches (152 mm) or twice the diameter or least distance between parallel sides, whichever is greater.

4.3.2 Forgings

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

4.3.2.1 Specimens for residual stress test shall be an entire forging. Acceptance standards shall be established by purchaser.

4.4 Reports

4.4.1 The producer of bar, rods, and forgings shall furnish with each shipment a report showing the results of tests for chemical composition of each heat, and for tensile properties and hardness of each lot and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS4633C, size or part number, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.4.2 When material produced to this specification is beyond the sizes allowed in the scope of tables, or other exceptions are taken to the technical requirements listed in Section 3 (see 5.1.1.1), the report shall contain a statement "This material is certified as AMS4633C(EXC) because of the following exceptions:" and the specific exceptions shall be listed.

4.4.3 The producer of forging stock shall furnish with each shipment a report showing the results of tests for chemical composition of each heat. This report shall include the purchase order number, AMS4633C, 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 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. Results of all tests shall be reported.