

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

400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS 4700B

Issued 1 NOV 1969
Revised 1 OCT 1993
Superseding AMS 4700A

Submitted for recognition as an American National Standard

**COPPER WIRE, BARE
High Purity**

UNS C10100

1. SCOPE:

1.1 Form:

This specification covers one type of copper in the form of wire.

1.2 Application:

This wire has been used typically as electronic component leads which must be resistance welded to produce high quality weld joints, but usage is not limited to such applications.

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 publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2224 Tolerances, Copper and Copper Alloy Wire
MAM 2224 Tolerances, Metric, Copper and Copper Alloy Wire

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 193 Resistivity of Electrical Conductor Materials
ASTM B 250 General Requirements for Wrought Copper-Alloy Wire
ASTM B 250M General Requirements for Wrought Copper-Alloy Wire (Metric)
ASTM E 3 Preparation of Metallographic Specimens
ASTM E 53 Chemical Analysis of Copper

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

AMS 4700B

SAE

AMS 4700B

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-C-3993 Copper and Copper-Base Alloy Mill Products, Packaging of

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

(R)

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 53, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	Min	Max
Copper (3.1.1)	99.99	--
Sulfur	--	0.0018 (18 ppm)
Lead	--	0.0010 (10 ppm)
Bismuth (3.1.2)	--	0.0010 (10 ppm)
Selenium (3.1.2)	--	0.0010 (10 ppm)
Tellurium (3.1.2)	--	0.0010 (10 ppm)
Phosphorus	--	0.0003 (3 ppm)
Zinc	--	0.0001 (1 ppm)
Cadmium	--	0.0001 (1 ppm)
Mercury	--	0.0001 (1 ppm)
Arsenic (3.1.2)	--	0.0005 (5 ppm)
Antimony (3.1.2)	--	0.0004 (4 ppm)
Tin (3.1.2)	--	--
Manganese (3.1.2)	--	--

3.1.1 Copper shall be determined by taking the difference between 100% and the sum of the other elements listed.

3.1.2 The sum of the bismuth, selenium, tellurium, arsenic, antimony, tin, and manganese shall not exceed 0.0040% (40 ppm).

3.2 Condition:

Cold-drawn or cold-rolled, annealed, and cleaned.

3.3 Properties:

Wire shall conform to the following requirements:

AMS 4700B

SAE

AMS 4700B

- 3.3.1 Resistivity: The weight resistivity, determined in accordance with ASTM B 193, shall not exceed 0.15328 ohm-gram per square meter at $20\text{ }^{\circ}\text{C} \pm 2$ ($68\text{ }^{\circ}\text{F} \pm 4$), which corresponds to a conductivity of not less than 100% IACS (International Annealed Copper Standard) (58 MS/m).
- 3.3.2 Embrittlement: Wire shall withstand a minimum of 10 bends without cracking or breaking, when tested as in 3.3.2.1 and then subjected to additional bending until failure occurs.
- 3.3.2.1 Specimens shall be cleaned by any suitable method and then heated at $850\text{ }^{\circ}\text{C} \pm 25$ ($1562\text{ }^{\circ}\text{F} \pm 45$) for not less than 30 minutes in an atmosphere containing not less than 10% hydrogen. Specimen shall then be clamped between jaws having edge radii equal to 2.5 times the nominal diameter of the wire. Specimen, held under a tension of approximately 3000 psi (21 MPa), shall be bent 90 degrees over the edge of one jaw and returned to its initial position; this constitutes one bend. Specimen shall then be bent 90 degrees in the reverse direction and returned to its initial position; this constitutes another bend. Each bend shall be made in the opposite direction from that of the preceding bend.
- 3.3.2.1.1 Specimens shall be examined at the bend after 10 bends and at the broken area after failure under 10X magnification. The bend shall have no surface cracks or blisters. The break shall show a necked-down section, characteristic of a ductile material, with no evidence of grain faces or boundaries.
- 3.3.3 Microstructure: Specimens, prepared as specified in ASTM E 3, from wire heated as in 3.3.2.1, when suitably etched to reveal the structure and examined at 100X magnification, shall show no evidence of copper oxide or other inclusions.
- 3.4 Quality:
- Wire, as received by purchaser, shall be uniform in quality and condition, sound, smooth, and free from foreign materials and from imperfections detrimental to usage of the wire.
- 3.5 Tolerances:
- Shall conform to AMS 2224 or MAM 2224 as applicable to copper and non-refractory alloys.
4. QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection:
(R)
- The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to the requirements of this specification.

AMS 4700B

SAE

AMS 4700B

4.2 Classification of Tests:

Tests for all technical requirements are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing:

(R)

Shall be in accordance with ASTM B 250 or ASTM B 250M.

4.4 Reports:

The vendor of wire shall furnish with each shipment a report showing the results of tests to determine conformance to all technical requirements. This report shall include the purchase order number, lot number, AMS 4700B, size, and quantity.

4.5 Resampling and Retesting:

(R)

If any specimen used in the above tests fails to meet the specified requirements, disposition of the wire 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 wire represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Wire shall be supplied on spools or in coils except when straight lengths are ordered.

5.2 Identification:

5.2.1 Spools and Coils: Shall be legibly marked, by a durable tag or label, with not less than the manufacturer's identification, purchase order number, AMS 4700B, nominal size, and quantity; boxes or drums shall be marked with the same information.

5.2.2 Straight Lengths: Shall have attached to each bundle or enclosed in each box a durable tag or label legibly marked with the information of 5.2.1; when boxed, the box shall be marked with the same information.

5.3 Packaging:

5.3.1 Spools and Coils: Coils shall be individually wrapped with waterproof paper or packed in waterproof drums. Spools, when ordered, shall be boxed.

5.3.2 Straight Lengths: Shall be bundled or boxed.

5.3.3 Wire shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the wire to ensure carrier acceptance and safe delivery.

(R)