AEROSPACE STANDARD

AS81021™ REV. B

Issued 2002-02
Revised 2016-05
Reaffirmed 2022-06

Superseding AS81021A

Copper-Beryllium Alloy (Copper Alloy Numbers C17500 and C17510), Strip

RATIONALE

AS81021B results from a Limited Scope Ballot to correct an error in the minimum tensile strength in the HT condition (Table 2).

AS81021B has been reaffirmed to comply with the SAE Five-Year Review policy.

NOTICE

The initial SAE publication of this document was taken directly from U.S. Military Standard MIL-C-81021A, Notice 1. This SAE Standard may retain the same part numbers established by the original military document.

Any requirements associated with Qualified Products Lists (QPLs) may continue to be mandatory for DoD contracts. Requirements relating to QPLs have not been adopted by the SAE for this standard and are not part of this SAE document.

1. SCOPE

1.1 Scope

This specification covers the requirements for the acquisition of two alloys of copper-beryllium alloy strip, having higher electrical conductivity than copper-beryllium alloy strip normally used (see 6.1). All sizes of strip are covered by this specification.

1.2 Tempers

Copper alloy numbers C17500 and C17510 strip shall be furnished flat or coiled in the following tempers, as specified in 6.2:

A - Cold rolled and solution heat treated (also designated TB00).

1/2H - Hot or cold rolled, solution heat treated, and cold rolled half-hard (also designated TD02).

H - Hot or cold rolled, solution heat treated, and cold rolled full-hard (also designated TD04).

AT - Temper A followed by precipitation hardening (also designated TF00).

1/2HT - Temper 1/2H followed by precipitation hardening (also designated TH02).

HT - Temper H followed by precipitation hardening (also designated TH04).

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/AS81021B/

2. APPLICABLE DOCUMENTS

The following publications form a part of this document 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. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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.

AMS2222 Tolerances, Copper and Copper Alloy Sheet, Strip, and Plate

AMS-H-7199 Heat Treatment of Wrought Copper-Beryllium Alloys, Process for (Copper Alloys: Numbers C17000, C17200, C17300, C17500, and C17510)

AMS-STD-185 Identification Marking of Copper and Copper Base Alloy Mill Products

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 B193 Resistivity of Electrical Conductor Materials

ASTM B194 Copper-Beryllium Alloy Plate, Sheet, Strip and Rolled Bar

ASTM B194 Annex - Chemical Analysis of Copper-Beryllium Alloys

ASTM B534 Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

ASTM D3951 Packaging, Commercial

ASTM E8 Tension Testing 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 Documents

Copies of these documents are available online at http://quicksearch.dla.mil.

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

MIL-STD-129 Marking for Shipment and Storage

3. REQUIREMENTS

3.1 Chemical Composition

The chemical composition of the alloys shall conform to the requirements shown in Table 1. These specification limits do not preclude the presence of other elements. Limits may be established by agreement between material manufacturer or supplier and purchaser for these unnamed elements. Copper is customarily given as remainder, but may be taken as the difference between the sum of all elements analyzed and 100%. When all the elements in the table are analyzed, their sum shall be 99.5% minimum.

Table 1 - Chemical requirements

Elements	Composition %	
	Copper Alloy UNS No. C17500	Copper Alloy UNS No. C17510
Beryllium	0.4 - 0.7	0.2 - 0.6
Cobalt	2.4 - 2.7	----------
Nickel	---------	1.4 - 2.2
Copper plus main alloying element and beryllium, Total, Min.	99.5 1/	99.5 2/

1/ Main alloying element- Cobalt
2/ Main alloying element- Nickel

3.1.1 An analysis of each lot of strip shall be furnished by the material supplier. The analysis shall be certified by the supplier when a check analysis is not specified in the procurement document (see 6.2).

3.2 Mechanical Properties

The mechanical properties of the strip, as supplied, shall conform to the requirements of 3.2.1 and 3.2.2. Tensile requirements, unless otherwise specified in the contract or order (see 6.2), shall be waived for thickness greater than 0.015 inch provided the strip meets the hardness requirements; for strip 0.015 inch or less in thickness, the tensile requirements are mandatory. In cases of dispute, tension tests shall be the basis of acceptance.

3.2.1 Heat Treatable Strip

Heat treatable strip supplied in A, 1/2H, and H tempers shall conform to the mechanical properties listed in Table 2. Such strip, when precipitation hardened in accordance with the prescribed minimum heat treating requirements of AMS-H-7199, shall be capable of developing mechanical properties conforming to tempers AT, 1/2HT, and HT listed in Table 3.

3.2.2 Heat-Treated Mill-Supplied Strip

Heat-treated mill-supplied strip shall conform to the specified mechanical properties of tempers AT, 1/2HT, and HT listed in Table 2.

3.3 Electrical Resistivity

The electrical resistivity of the strip for all sizes and tempers shall conform to the requirements of Table 3.

3.4 Dimensional Tolerances

Shall conform to AMS2222 as applicable to refractory alloys.

3.4.1 Coiled Lengths

When coiled strip is specified (see 6.2), coils shall consist of not more than three pieces, each of which shall be over 10 feet in length.

3.4.2 Flatness

Cut lengths and coiled strip shall be commercially flat so as not to interfere with normal stamping and forming operations.

Table 2 - Mechanical properties, alloy numbers C17500 and C17510

Temper	Tensile Strength, psi	Yield Strength, 0.2%, psi	Elongation in 2 inches, %	1/ Rockwell Hardness	
				2/ B Scale	3/ 30T Scale
A	55000 max	20 - 30000	20 - 35	20 - 45	29 - 46
1/2H	60 - 75000	50 - 70000	5 - 10	65 - 76	60 - 68
H	70 - 85000	55 - 80000	2 - 8	78 - 88	69 - 75
AT	100 - 120000	80 - 100000	8 - 15	92 min	77 - 82
1/2HT	110 - 130000	95 - 120000	5 - 12	95 min	79 - 83
HT	110 - 130000	100 - 120000	5 - 12	95 min	79 - 83

1/ Hardness requirements are applicable subject to the conditions of 3.2.
2/ Values are applicable to strip not less than 0.032 inch thick.
3/ Values are applicable to strip not less than 0.016 inch thick.

Table 3 - Electrical resistivity, alloy numbers C17500 and C17510

Tempers	Resistivity, microhm-cm, max
A	8.6
1/2H	6.9
H	6.9
AT	3.9
1/2HT	3.6
HT	3.6

3.5 Identification Marking

When specified in the procurement document, identification marking shall be in accordance with AMS-STD-185 (see 6.2).

3.6 Workmanship

The strip shall be uniform in quality and condition. The surfaces shall be free from scale, cracks, scratches, seams, laps or folds, slivers, burrs, and imbedded foreign matter so as to impair neither the usability nor affect the electrical conductivity of the strip for the intended applications.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the material supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot

A lot shall consist of all strip of the same size, temper, and melt, submitted for inspection and acceptance at one time.

4.3 Sampling

4.3.1 Chemical Test

From each lot, four individual lengths or units shall be selected at random to provide a composite sample of a minimum of 50 g. If the lot consists of less than four lengths or units, a composite sample shall be prepared from a piece taken from each length or unit (see 4.5.1).

4.3.1.1 Check Analysis

When specified (see 6.2), sampling preparation shall be performed in accordance with 4.3.1 so as to provide three composite samples of 50 g each: one for the manufacturer or vendor, one for the procuring activity and one for a referee, if necessary.

4.3.2 Mechanical Properties

4.3.2.1 Tension Test

For heat treated strip, a total of three tensile test samples, each 8 inches long by 3/4 inch wide, shall be taken either longitudinally or transversely to the direction of rolling from three individual lengths or units selected at random from the lot. If the lot consists of less than three lengths or units, a sample shall be taken from each length or unit. For heat treatable strip, six samples shall be taken (see 4.5.2.1).

4.3.2.2 Hardness Test

For heat treated strip, a total of three specimens, each 2 to 3 inches long, shall be taken from three individual lengths or units selected at random from the lot. If the lot consists of less than three lengths or units, a sample shall be taken from each length or unit. For heat treatable strip, six samples shall be taken (see 4.5.2.2).

4.3.3 Electrical Resistivity

A total of three samples, each 15 inches long by 1 inch wide, shall be taken either longitudinally or transversely to the direction of rolling from three individual lengths or units selected at random from the lot. If the lot consists of less than three lengths or units, a sample shall be taken from each length or unit (see 4.5.3).

4.3.4 Visual and Dimensional Examination

From each lot, seven cut lengths or coils shall be selected. 10% of each of these seven lengths or coils shall be used as the sample for visual and dimensional examination.

4.4 Examination

4.4.1 Visual and Dimensional Examination

Strips selected in accordance with 4.3.4 shall be visually examined to determine compliance with 3.5 and dimensionally examined to determine conformance to dimensional requirements of 3.4.

4.4.2 Preparation for Delivery

The entire lot shall be visually examined to assure compliance with the packaging requirements of Section 5 of this specification.

4.5 Tests

4.5.1 Chemical Analysis

The analysis furnished by the manufacturer or vendor from the sample taken in 4.3.1 for the lot can be accepted as defining the composition of the material. This analysis shall conform to the requirements of 3.1 when determined by wet chemical methods in accordance with ASTM B194 and/or ASTM E478, by spectrochemical methods, or by other analytical methods acceptable to the purchaser.

4.5.1.1 Check Analysis

The chemical analysis, as determined from the sample obtained in 4.3.1.1 for the lot, shall conform to the requirements of 3.1 when checked in accordance with the procedures of 4.5.1.

4.5.2 Mechanical Properties Tests

4.5.2.1 Tension Test

Samples selected in accordance with 4.3.2.1 shall be tested in accordance with the requirements of ASTM E8 using standard sheet type rectangular test specimens, to assure conformance of heat treated lots to the tensile requirements of 3.2.2 and of heat treatable lots to the tensile requirements and precipitation hardening response of 3.2.1.

4.5.2.2 Hardness Test

Specimens selected in accordance with 4.3.2.2 shall be tested in accordance with the requirements of ASTM E18 to assure conformance of heat treated lots to the hardness requirements of 3.2.2 and of heat treatable lots to the hardness requirements and precipitation hardening response of 3.2.1.

4.5.3 Electrical Resistivity

Samples selected in accordance with 4.3.3 shall be tested for electrical resistivity in accordance with the requirements of ASTM B193 to assure conformance of the lot to the requirements of 3.3.

4.6 Rejection

4.6.1 Examination Defects

Material not conforming to this specification, or to authorized modifications, will be subject to rejection.

4.6.2 Test Failures

A lot shall be rejected for failure to meet any of the test requirements when tested in accordance with 4.5, subject to the retest provisions of 4.6.2.1.

4.6.2.1 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 two additional specimens for each 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.

5. PACKAGING

5.1 Preservation

The levels of preservation shall be level A or Industrial as specified (see 6.2).