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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Copper-Beryllium Alloy Rod and Bar¹

This standard is issued under the fixed designation B 196; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers copper-beryllium alloy rod and bar in straight lengths. The following three alloys are covered.

Copper Alloy UNS No. ²	Previously Used Designations	Nominal Beryllium Content, %
C17000	Alloy 165	1.7
C17200	Alloy 25	1.9
C17300		1.9 +0.4 lead

1.2 Unless otherwise required, Copper Alloy UNS No. C17200 shall be the alloy furnished whenever Specification B 196 is specified without any alloy designation.

NOTE 1—A complete metric companion to Specification B 196 has been developed—B 196M; therefore, no metric equivalents are presented in this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:

B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip and Rolled Bar²

B 249 Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, and Shapes²

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast²

E 8 Test Methods of Tension Testing of Metallic Materials³

E 527 Practice for Numbering Metals and Alloys (UNS)⁴

3. Ordering Information

3.1 Orders for material under this specification should include the following information:

3.1.1 Quantity,

¹ This specification is under the jurisdiction of ASTM Committee B-5 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.02 on Rod, Bar, Wire, Shapes, and Forgings.

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² Annual Book of ASTM Standards, Vol 02.01.

³ Annual Book of ASTM Standards, Vol 03.01.

⁴ Annual Book of ASTM Standards, Vol 01.01.

3.1.2 Copper Alloy UNS No. (Section 1),

3.1.3 Form of material (rod or bar and cross section, such as round, hexagonal, etc.),

3.1.4 Temper (Section 5),

3.1.5 Dimensions (diameter or distance between parallel surfaces, and length),

3.1.6 Type of edge, if required (square corners, rounded corners, rounded edge, full-rounded edge (see section 11.5)),

3.1.7 How furnished (stock or specific lengths, with or without ends),

3.1.8 Tension Test or hardness as applicable (Section 6),

3.1.9 Specification number and date,

3.1.10 Certification, if required (see Specification B 249, Section 13),

3.1.11 Mill Test Report if required (see Specification B 249, Section 14).

3.2 When material is purchased for agencies of the U. S. Government, this shall be specified in the contract or purchase order, and the material shall conform to the Supplementary Requirements as defined in the current issue of Specification B 249.

4. Chemical Composition

4.1 The material shall conform to the requirements of Table 1 as to chemical composition.

4.2 These specification limits do not preclude the presence of other elements. Limits may be established by agreement between 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.

5. Temper

5.1 The standard temper designations available under this specification and as specified in Practice B 601 are solution heat treated TB00 (A) and cold drawn hard TD04 (H), (see Table 2) to be precipitation heat treated by the user. Also available are products already precipitation heat treated by the manufacturer, tempers TF00 (AT) and TH04 (HT). These products meet property requirements in Table 3 and normally require no further heat treatment by the user.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Copper Alloy UNS No.		
	C17000	C17200	C17300
Beryllium	1.60–1.79	1.80–2.00	1.80–2.00
Nickel + cobalt, min	0.20	0.20	0.20
Nickel + cobalt + iron, max	0.6	0.6	0.6
Aluminum, max	0.20	0.20	0.20
Silicon, max	0.20	0.20	0.20
Lead	...	...	0.20–0.6
Copper	remainder	remainder	remainder

6. Mechanical Requirements

6.1 The tension test shall be the standard test for rod (round, hexagonal, and octagonal) and bar (square) having a nominal diameter or distance between parallel surfaces up to $\frac{3}{8}$ in. incl. and other shapes having a nominal cross-sectional area up to 0.141 in.², incl. The tensile strength requirements shall be as prescribed in Table 2 and in Table 3 after precipitation heat treatment in accordance with 7.2.

6.2 Hardness shall be the standard test for round, hexagonal, octagonal, and square rod larger than $\frac{3}{8}$ in. nominal diameter or distance between parallel surfaces and other shapes having a nominal cross-sectional area exceeding 0.141 in.² The hardness requirements shall be as prescribed in Table 2 for solution heat treated or solution heat treated and cold worked and in Table 3 after prescribed heat treatment in accordance with 7.2. The tension test need not be made except when indicated by the purchaser.

6.3 Where agreement on Rockwell hardness tests cannot be reached the tensile strength requirements of Table 2 and Table 3 shall be the basis for acceptance or rejection.

7. Precipitation Heat Treatment

7.1 The precipitation heat treatment is performed on TB00 (A) and TD04 (H) tempers by the purchaser, after machining or forming.

7.2 Conformance to the TF00 (AT) and TH04 (HT) specification limits shown in Table 3, for products supplied in the TB00 (A) or the TD04 (H) tempers, shall be determined by testing test specimens heat treated at a uniform temperature of 600° to 675°F for the times shown in Table 4.

7.3 End products may be heat treated at other times and temperatures for specific applications. These special combinations of properties such as increased ductility, electrical conductivity, dimensional accuracy, endurance life, and resistance to elastic drift and hysteresis in springs, may be obtained by special precipitation-hardening heat treatments. The mechanical requirements of Table 3 do not apply to such special heat treatments. Specific test requirements as needed shall be agreed upon between the manufacturer or supplier and purchaser of the end product.

7.4 TF00 (AT) and TH04 (HT) tempers as standard mill hardened products have been precipitation heat-treated and tested by the manufacturer for conformance to the specification limits shown in Table 3. Further thermal treatments of these tempers are not normally required.

7.5 Material may be supplied with non-standard properties. Table 3 and Table 4 values would not apply. Specific test

requirements as needed shall be agreed upon between the manufacturer or supplier and purchaser of these end products.

8. Dimensions and Permissible Variations

8.1 The dimensions and tolerances for material covered by this specification shall be as prescribed in the current edition of Specification B 249, with particular reference to Section 4 and the following tables of that specification:

8.2 *Diameter or Distance Between Parallel Surfaces:*

8.2.1 *Rod, Round, Hexagonal, Octagonal*—See 4.2, Table 2.

8.2.2 *Rod, Hot-rolled, Round*—See 4.2, Table 6.

8.2.3 *Bar, Rectangular and Square*—See 4.2, Tables 9 and Tables 11.

8.3 *Length*—See 5.3, Tables 12 and Tables 14.

8.4 *Straightness*—See 5.4, Table 15.

8.5 *Edge Contours*—See 5.5.

9. General Requirements

9.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B 249.

10. Retests

10.1 If any lot of material fails to conform to the requirements of this specification due to inaccurate heat treatment, new samples of material may be resubmitted for test after proper heat treatment. Only two such reheat treatments shall be permitted.

11. Test Specimens

11.1 Tension test specimens, when required, shall be prepared in a full cross-sectional area if practicable, and in the direction of final working unless otherwise specified. Full cross section or machined specimens shall be as specified in Test Methods E 8.

NOTE 2—Mechanical property data determined on other than round cross sections, for sizes under 0.125 in. may be compromised, and be inaccurate due to the stress riser effect on the corner.

12. Method of Test

12.1 *Chemical analysis:*

12.1.1 The composition shall be determined, in case of disagreement, in accordance with the Annex in Specification B 194.

12.1.2 Test methods to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be agreed upon between the supplier and the purchaser.

13. Keywords

13.1 beryllium copper bar; beryllium copper rod; UNS alloy numbers C17000; C17200; and C17300