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AMERICAN SOCIETY FOR TESTING AND MATERIALS  
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# Standard Specification for Copper-Beryllium Alloy Forgings and Extrusions Alloys C17500 and C17510<sup>1</sup>

This standard is issued under the fixed designation B 870; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification establishes the requirements for copper-beryllium alloy forgings and extrusions. The following alloys are covered:

Copper Alloy UNS No.	Nominal Composition, %		
	Beryllium	Cobalt	Nickel
C17500	0.59	2.6	
C17510	0.40		1.8

1.2 The values stated in inch-pound units are the standard. Values given in parentheses are for information only.

1.3 The following safety hazard caveat pertains to Sections 9 and 10 of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar<sup>2</sup>

B 249 Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings<sup>2</sup>

B 441 Specification for Copper-Cobalt-Beryllium (UNS No. 17500) and Copper-Nickel Beryllium (UNS No. 17510) Rod and Bar<sup>2</sup>

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast<sup>2</sup>

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>3</sup>

E 527 Practice for Numbering Metals and Alloys (UNS)<sup>4</sup>

## 3. Terminology

### 3.1 Definitions—General:

3.1.1 See Terminology B 846.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *extrusion, n*—a uniform metal shape, long in relation to its cross-sectional dimensions, produced by forcing a suit-

ably preheated billet or preform through an orifice (die) of the desired cross section. Extrusions generally are furnished in straight lengths.

3.2.2 *forging, n*—a metal part worked to a predetermined shape by one or more such processes as hammering, upsetting, pressing, rolling, etc.

NOTE 1—Forged and extruded shapes in the context of this specification are generally construed to be large section sized products; round, oval, half round, geometric custom ordered cross-sections, and nonsymmetrical metal shapes. This is to generally differentiate products supplied according to this document as opposed to forged and extruded “Rod and Bar” in Specification B 441.

## 4. Ordering Information

4.1 The contract or purchase order for product under this specification should include the following information:

4.1.1 ASTM designation and year of issue (for example, B 870 – 96),

4.1.2 Copper Alloy UNS No. (Section 1),

4.1.3 Temper (Section 7) or condition (Section 10),

4.1.4 Drawing, when required, and

4.1.5 Quantity: number of pieces or pounds.

4.2 The following requirements are optional under this specification and should be included in the contract or purchase order.

4.2.1 Tension tests (Section 9),

4.2.2 Special marking or packaging (Section 23),

4.2.3 Inspection (Section 19),

4.2.4 Certification (Section 21),

4.2.5 Mill test report (Section 22),

4.2.6 Finish (Section 14), and

4.2.7 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.

## 5. Materials and Manufacture

### 5.1 Materials:

5.1.1 The material of manufacture should be a cast billet conforming to the chemical composition requirements for the alloy specified in the ordering information and shall be of such purity and soundness as to be suitable for processing into the product prescribed herein.

<sup>1</sup> 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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<sup>2</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>4</sup> Annual Book of ASTM Standards, Vol 01.01.

**5.2 Manufacture:**

5.2.1 The product shall be manufactured by hot working or extrusion, solution heat treating, precipitation hardening and straightening as may be necessary to meet the properties specified.

**6. Chemical Composition**

6.1 The material shall conform to the chemical composition in Table 1 for the alloy specified.

6.1.1 These compositional limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer and purchaser.

6.1.2 Copper, given as the *remainder*, is the difference between the sum of results of all elements determined and 100 %.

6.1.3 When all elements listed in Table 1 for the alloy specified in the ordering information are determined the sum of results shall be 99.5 % minimum.

**7. Temper**

7.1 The standard temper designations available under this specification and as prescribed in Practice B 601 are solution heat treated TB00 (A) and precipitation heat treated TF00 (AT).

**8. Physical Properties**

8.1 *Electrical Conductivity*—Product supplied under this specification shall conform to the conductivity requirements prescribed in Table 2 after precipitation heat treatment.

**9. Mechanical Property Requirements**

**9.1 Hardness:**

9.1.1 The product furnished under this specification shall conform to the hardness requirements prescribed in Table 3 when tested in accordance with Test Method E 18.

**9.2 Tensile:**

9.2.1 When specified in the contract or purchase order, the product furnished shall conform with the tensile properties in Table 3.

**TABLE 1 Chemical Requirements**

Element	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	0.3 max
Nickel	...	1.4–2.2
Iron, max	0.10	0.10
Aluminum, max	0.20	0.20
Silicon, max	0.20	0.20
Copper	Remainder	Remainder

**TABLE 2 Electrical Conductivity**

Temper	IACS, Min, %
TF00 (AT)	45

**10. Heat Treatment**

10.1 The majority of the product supplied under this specification is in the TF00 (AT) temper. When product is purchased in the TB00 (A) temper it should be heat treated to a uniform temperature in the range from 800 to 900°F (454 to 482°C) for 3 h and then air cooled.

NOTE 2—Special combination of properties may be obtained by special heat treatments. These requirements shall be agreed upon by the manufacturer or supplier and purchaser.

**11. Dimensions and Permissible Variations**

11.1 The dimensions and tolerances for these product forms shall be those shown on the drawing that forms a part of each order, or as agreed upon between the manufacturer and the purchaser.

**12. Workmanship, Finish, and Appearance**

12.1 The product forms shall be of uniform quality and condition and shall not have laps, cracks, bursts, or other injurious defects that interfere with normal applications.

12.2 The purchaser shall specify in the order the condition or finish required, such as, hot worked, hot worked and cleaned by blasting or pickling, or machined.

**13. Test Methods**

**13.1 Chemical Composition:**

13.1.1 The chemical composition shall, in case of disagreement, be determined in accordance with the applicable method in Annex A2 of Specification B 194.

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

**14. General Requirements**

14.1 The following sections of Specification B 249 form a part of this specification:

- 14.1.1 Material and Manufacture,
- 14.1.2 Sampling,
- 14.1.3 Specimen Preparation,
- 14.1.4 Significance of Numerical Limits, and
- 14.1.5 Packaging and Marking.

**15. Keywords**

15.1 alloy C17500; alloy C17510; copper beryllium extrusions; copper beryllium forgings



**TABLE 3 Mechanical Properties**

Temper Designation		Size	Tensile Strength, ksi (MPa)	Yield Strength, ksi (MPa)	Rockwell Hardness B Scale
Standard	Former				
TB00 Solution heat-treated	(A)	All	30–55 (207–380)	10–30 (69–207)	50 max
TF00 Precipitation hardened	(AT)	Up to 4 in. incl.	100–130 <sup>A</sup> (690–897)	80–100 <sup>A</sup> (550–690)	92 min
		Over 4 in. to 6 in. incl.	95–125 <sup>A</sup> (655–863)	75–95 <sup>A</sup> (517–656)	92 min
		Over 6 in. to 8 in. incl.	90–120 <sup>A</sup> (620–828)	70–90 <sup>A</sup> (483–620)	92 min
		Over 8 in.	80–100 <sup>A</sup> (550–690)	60–80 <sup>A</sup> (414–550)	90 min

<sup>A</sup> The upper limits are for design guidance only.

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