



Designation: **B870–08 (Reapproved 2014) B870 – 21**

Standard Specification for Copper-Beryllium Alloy Forgings and Extrusions Alloys (UNS Nos. ~~C17500~~ C17500, C17510, and ~~C17510~~ C17540)¹

This standard is issued under the fixed designation B870; 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.

1. Scope*

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

Copper Alloy UNS No.	Beryllium	Nominal Composition, %		Nickel
		Cobalt		
C17500	0.50	2.6	...	
C17510	0.40	...	1.8	
C17540	0.50	1.5	1.5	

1.2 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazard caveat pertains to Sections 10 and 11 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- ~~B194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar~~
- ~~B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings~~
- ~~B441 Specification for Copper-Cobalt-Beryllium, Copper-Nickel-Beryllium, and Copper-Nickel-Lead-Beryllium Rod and Bar (UNS Nos. C17500, C17510, and C17465)~~
- ~~B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast~~
- ~~B846 Terminology for Copper and Copper Alloys~~
- ~~B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys~~
- ~~E8/E8M Test Methods for Tension Testing of Metallic Materials~~

¹ This specification is under the jurisdiction of ASTM Committee B05 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 For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

E18 Test Methods for Rockwell Hardness of Metallic Materials

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

E1004 Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy Current) Method

3. General Requirements

3.1 The following sections of Specification B249/B249M form a part of this specification:

3.1.1 Terminology,

3.1.2 Material and Manufacture,

3.1.3 Sampling,

3.1.4 Number of Tests and Retests,

3.1.5 Specimen Preparation,

3.1.6 Significance of Numerical Limits,

3.1.7 Inspection,

3.1.8 Rejection and Rehearing,

3.1.9 Certification,

3.1.10 Test Reports, and

3.1.11 Packaging and Package Marking.

3.2 In addition, when a section with a title identical to that referenced in 3.1, above, appears in this specification, it contains additional requirements that supplement those appearing in Specification B249/B249M.

4. Terminology

4.1 For definitions of terms related to copper and copper alloys, see Terminology B846.

4.2 *Definitions of Terms Specific to This Standard:*

4.2.1 *extrusion, n*—~~a uniform metal shape, long in relation to its cross-sectional dimensions, produced by forcing a suitably preheated billet or pre-formed shape through an orifice (die) of the desired cross section.~~

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

NOTE 1—~~Forged and extruded shapes in the context of this specification are generally construed to be large-section products;~~ large-section products that are round, oval, half round, geometric custom-ordered cross-sections, and asymmetrical metal shapes. This is to generally differentiate products supplied according to this document in accordance with this specification as opposed to forged and extruded “Rod and Bar” in Specification B441.

5. Ordering Information

5.1 Include the following ~~information-specified choices~~ when placing orders for product under this specification, as applicable:

5.1.1 ASTM designation and year of ~~issue~~; issue;

5.1.2 Copper Alloy UNS No. (Section 1);

5.1.3 Temper (Section 8) or condition (Section 11);

~~5.1.4 Drawing, when required, and~~ Dimensions, including thickness, width, length, and edges for flat products or diameter, distance between flat surfaces, and edges for round products. Dimensions may be specified on a drawing;

5.1.5 Dimensional tolerances shall be as agreed upon between the manufacturer or supplier and purchaser; and

5.1.6 Quantity: number of pieces or pounds.

~~5.2 The following requirements are optional under this specification and shall be included in the contract or purchase order, when specified; options are available and, when required, shall be specified at the time of placing the order:~~

~~5.2.1 Tension tests test or hardness (Section 10),~~

~~5.2.2 Special marking or packaging (Specification packaging, B249/B249M);~~

~~5.2.3 Inspection (Specification Report, B249/B249M);~~

~~5.2.4 Certification (Specification Certification, B249/B249M);~~

~~5.2.5 Mill test report (Specification Test report, B249/B249M);~~

~~5.2.6 Finish (Section 1314), and~~

~~5.2.7 When material If product 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 edition of Specification B249/B249M.~~

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture ~~should~~ shall 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.

6.2 *Manufacture:*

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

7. Chemical Composition

7.1 The material shall conform to the chemical composition requirements in **Table 1** for the ~~alloy specified~~ copper alloy UNS No. specified in the ordering information.

TABLE 1 Chemical Requirements

Element	Concentration; Composition, %		
	Copper Alloy UNS No. C17500	Copper Alloy UNS No. C17510	Copper Alloy UNS No. C17540
Beryllium	0.4–0.7	0.2–0.6	0.4–0.7
Cobalt	2.4–2.7	0.3 max	0.8–1.3
Nickel	...	1.4–2.2	0.8–1.3
Iron, max	0.10	0.10	0.20
Aluminum, max	0.20	0.20	...
Silicon, max	0.20	0.20	0.20
Copper	Remainder	Remainder	Remainder

7.1.1 These composition limits do not preclude the presence of other elements. ~~Limits—By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements by agreement between the manufacturer and purchaser—elements.~~

7.1.2 Copper, given as ~~the remainder~~, “remainder,” is the difference between the sum of results of all elements determined and 100 %. When all elements in Table 1 are determined, the sum of results shall be 99.5 % minimum.

7.1.3 ~~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.~~

8. ~~Temper~~Tempers

8.1 The standard ~~temper designations~~ tempers available under this specification and as prescribed in Classification B601 are solution heat treated TB00 (A) and precipitation heat treated TF00 (AT).

9. Physical Property Requirements

9.1 ~~Electrical Conductivity—~~Conductivity Requirement:

9.1.1 Product supplied under this specification shall conform to the conductivity requirements prescribed in Table 2 after precipitation heat-treatment when tested in accordance with Test Method E1004.

10. Mechanical Property Requirements

10.1 ~~Hardness—Rockwell Hardness Requirements:~~ The product furnished under this specification shall conform to the hardness requirements prescribed in Table 3, when tested in accordance with Test Methods E18.

10.1.1 The product furnished under this specification shall conform to the hardness requirements prescribed in Table 3, unless tensile properties are required by the purchase order. Rockwell hardness shall be determined in accordance with Test Methods E18.

10.2 ~~Tensile—Tensile Strength Requirements:~~ When specified in the contract or purchase order, the product furnished shall conform to the tensile properties in Table 3, when tested in accordance with Test Methods E8/E8M.

10.2.1 When specified in the contract or purchase order, the product furnished shall conform to the tensile properties in Table 3, when tested in accordance with Test Methods E8/E8M.

10.2.2 The tensile properties in Table 3 shall be measured in the longitudinal direction.

10.2.3 When tensile properties are specified in the contract or purchase order, acceptance or rejection based upon mechanical properties shall depend on tensile strength and yield strength requirements of Table 3.

11. Heat Treatment

11.1 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~~800 °F to ~~900~~900 °F (~~427~~427 °C to ~~482~~482 °C) for ~~3 h~~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.~~

11.2 Special combinations of properties may be obtained by special heat treatments. These requirements shall be agreed upon by the manufacturer or supplier and purchaser.

TABLE 2 Electrical Conductivity

Temper	IACS, min, %
TF00 (AT)	45