



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

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 (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. | Nominal Composition, % | | |
|-------------------------|------------------------|--------|--------|
| | Beryllium | Cobalt | Nickel |
| C17500 | 0.59 | 2.6 | |
| C17510 | 0.40 | | 1.8 |

1.2 *Units*—The values stated in inch-pound units are standard. The values given in parentheses are mathematical conversions to SI units, which 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 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 Bar²
- B 249 Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings²
- B 441 Specification for Copper-Cobalt-Beryllium (UNS No. C17500) and Copper-Nickel Beryllium (UNS No. C17510) Rod and Bar²
- B 601 Classification for Temper Designations for Copper and Copper Alloys-Wrought and Cast²
- B 846 Terminology for Copper and Copper Alloys²
- E 8 Test Methods for Tension Testing of Metallic Materials³
- E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials³
- E 527 Practice for Numbering Metals and Alloys (UNS)⁴
- E 1004 Practice for Determining Electrical Conductivity

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 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.

Using the Electromagnetic (Eddy-Current) Method⁵

3. General Requirements

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

- 3.1.1 Material and Manufacture,
- 3.1.2 Sampling,
- 3.1.3 Number of Tests and Retests,
- 3.1.4 Specimen Preparation,
- 3.1.5 Significance of Numerical Limits,
- 3.1.6 Inspection,
- 3.1.7 Rejection and Rehearing,
- 3.1.8 Certification,
- 3.1.9 Test Reports, and
- 3.1.10 Packaging and Package Marking.

4. Terminology

4.1

4.1.1 For definitions of terms related to copper and copper alloys, see Terminology B 846.

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.

4.2.2 *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; round, oval, half round, geometric custom-ordered cross-sections, and asymmetrical 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.

5. Ordering Information

5.1 Include the following information in orders for product:

- 5.1.1 ASTM designation and year of 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

⁵ Annual Book of ASTM Standards, Vol 03.03.

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

5.1.5 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.

5.2.1 Tension tests (Section 10),

5.2.2 Special marking or packaging (Specification B 249),

5.2.3 Inspection (Specification B 249),

5.2.4 Certification (Specification B 249),

5.2.5 Mill test report (Specification B 249),

5.2.6 Finish (Section 14), and

5.2.7 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.

6. Materials and Manufacture

6.1 Materials:

6.1.1 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.

6.2 Manufacture:

6.2.1 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.

7. Chemical Composition

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

7.1.1 These composition 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.

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

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

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

TABLE 1 Chemical Requirements

| Element | Concentration, % | |
|---------------|-----------------------------|-----------------------------|
| | 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 |

9. Physical Property Requirements

9.1 *Electrical Conductivity*—Product supplied under this specification shall conform to the conductivity requirements prescribed in Table 2 after precipitation heat-treatment when tested in accordance with Practice E 1004.

10. Mechanical Property Requirements

10.1 *Hardness*—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.

10.2 *Tensile*—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 E 8

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 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.

12. Dimensions and Permissible Variations

12.1 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.

13. Workmanship, Finish, and Appearance

13.1 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.

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

14. Test Methods

14.1 Chemical Composition:

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

14.1.2 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.

15. Keywords

15.1 copper beryllium extrusions; copper beryllium forgings; UNS Alloy C17500; UNS Alloy C17510

TABLE 2 Electrical Conductivity

| Temper | IACS, min, % |
|-----------|--------------|
| TF00 (AT) | 45 |

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 ^A (690–897) | 80–100 ^A (550–690) | 92 min |
| | | Over 4 in. to 6 in. incl. | 95–125 ^A (655–863) | 75–95 ^A (517–656) | 92 min |
| | | Over 6 in. to 8 in. incl. | 90–120 ^A (620–828) | 70–90 ^A (483–620) | 92 min |
| | | Over 8 in. | 80–100 ^A (550–690) | 60–80 ^A (414–550) | 90 min |

^A The upper limits are for design guidance only.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B 870 - 96) that may impact the use of this standard.

(1) Document was revised to meet the requirements of *Form and Style for ASTM Standards* (Blue Book) and the Committee

B05 *Outline of Form of Specifications* (OFS).

(2) Added Test Methods E 8 to 2.1 and as reference in 10.2.

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