



Designation: B937 – 04(Reapproved 2010)

# Standard Specification for Copper-Beryllium Seamless Tube (UNS Nos. C17500 and C17510)<sup>1</sup>

This standard is issued under the fixed designation B937; 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 seamless tube in straight lengths. Copper-cobalt-beryllium alloy UNS No. C17500 and copper-nickel-beryllium alloy UNS No. C17510 will be the alloys furnished whenever this specification is specified.

1.2 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 only to the test method(s) described in 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 to determine the applicability of regulatory limitations prior to use.*

## 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*:<sup>2</sup>

**B193** Test Method for Resistivity of Electrical Conductor Materials

**B194** Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

**B251** Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube

**B601** Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

**B846** Terminology for Copper and Copper Alloys

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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<sup>2</sup> 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.

**E8** Test Methods for Tension Testing of Metallic Materials

**E18** Test Methods for Rockwell Hardness of Metallic Materials

**E255** Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

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

## 3. General Requirements

3.1 The following sections of Specification **B251** (as noted) constitute a part of this specification:

3.1.1 Workmanship, Finish, and Appearance,

3.1.2 Number of Tests and Retests,

3.1.3 Significance of Numerical Limits,

3.1.4 Inspection,

3.1.5 Rejection and Rehearing,

3.1.6 Certification,

3.1.7 Mill Test Report, and

3.1.8 Packaging and Package Marking.

## 4. Terminology

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

4.2 *Definitions of Terms Specific to This Standard*:

4.2.1 *average diameter (for round tubes only), n*—the average of the maximum and minimum outside diameters, or maximum and minimum inside diameters, whichever is applicable, as determined at any one cross section of the tube.

4.2.2 *lengths, n*—straight pieces of the product

4.2.2.1 *ends, n*—straight pieces, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specific lengths. They are subject to minimum length and maximum weight requirements.

4.2.2.2 *specific, adj*—straight lengths that are uniform in length, as specified, and subject to established length tolerances.

4.2.2.3 *specific with ends, adj*—specific lengths, including ends.

4.2.2.4 *stock, n*—straight lengths that are mill cut and stored in advance of orders. They are usually 8, 10, 12, or 20 ft (2.44, 3.05, 3.66, or 6.10 m) and subject to established length tolerances.

4.2.2.5 *stock with ends, adj*—stock lengths, including ends.

4.2.3 *tube, n*—a hollow product of round or any other cross section having a continuous periphery.

4.2.3.1 *tube, seamless, adj*—a tube produced with a continuous periphery in all stages of the operations.

**5. Ordering Information**

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

- 5.1.1 Quantity, number of pieces or pounds,
- 5.1.2 Copper Alloy UNS No. designation (see 1.1),
- 5.1.3 Temper (see section 8)
- 5.1.4 Dimensions, including length if applicable. For tube or pipe specify either OD/ID, OD/wall, or ID/wall.
- 5.1.5 How furnished: stock lengths with or without ends, specific lengths with or without ends,
- 5.1.6 ASTM designation and year of issue,
- 5.1.7 Special tests or exceptions, if any,
- 5.1.8 Hardness tests, if required,
- 5.1.9 Special tests such as tension test, if required,
- 5.1.10 Special marking or packaging, if required,
- 5.1.11 Inspection, if required (see Specification B251),
- 5.1.12 Certification, if required (see Specification B251),
- 5.1.13 Mill test report, if required (see Specification B251).

5.2 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 B251.

**6. Materials and Manufacture**

6.1 *Materials:*

6.1.1 The material of manufacture shall be UNS Alloy No. C17500 or C17510, cast and worked into tubular form, and of such purity and soundness as to be suitable for processing into the products prescribed herein.

6.1.2 The tube shall have heat traceable identity.

6.2 *Manufacture:*

6.2.1 The product shall be manufactured by a combination of hot working or cold working, or both; annealing; or precipitation heat treatment, or both, as to produce a uniform wrought structure in the finished product, to meet the temper specified.

**TABLE 1 Chemical Composition**

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

**7. Chemical Composition**

7.1 The material shall conform to the chemical composition requirements in Table 1 for the copper alloy designated in the ordering information.

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

7.3 For alloys in which copper is listed as “Remainder,” copper 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 % min.

**8. Temper**

8.1 Tempers, as described in Classification B601, available under this specification are: TB00 (solution treated (A)), TF00 (precipitation hardened (AT)), TD04 (solution heat-treated and cold worked: hard (H)), and TH04 (hard and precipitation heat-treated (HT)). These products meet property requirements in Table 2.

**9. Precipitation Heat Treatment**

9.1 When material is purchased in the TB00 (A) or the TD04 (H) tempers, the precipitation heat treatment is performed by the purchaser.

9.2 Conformance to the TF00 (AT) and TH04 (HT) specification limits shown in Table 2, 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 850 to 900°F for the times shown in Table 3.

**TABLE 2 Tensile Strength and Rockwell Hardness Requirements<sup>A</sup>**

Standard	Temper Designation	Former	Tensile Strength Ksi <sup>B</sup> (MPa <sup>C</sup> )	As Supplied	
				Rockwell Hardness, B Scale	Electrical Conductivity IACS min, %
TB00	Solution heat-treated (A)	Solution heat-treated and cold-worked hard (H)	35-55 (240-380)	50 max	20
TD04				60-80	20
				After Precipitation Heat Treatment	
TF00	Precipitation hardened (AT)	Hard and precipitation heat-treated (HT)	100-130 (690-895) <sup>D</sup>	92-100	45
TH04				95-102	48

<sup>A</sup> These values apply to mill products. See Section 10 for exceptions in end products.  
<sup>B</sup> ksi = 1000 psi.  
<sup>C</sup> See Appendix.  
<sup>D</sup> The upper limits in the tensile strength column are for design guidance only.