



Designation: **B937 – 04 (Reapproved 2010) B937 – 15**

## 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~~ 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](#)

[E8/E8M 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;~~ Terminology,

3.1.2 ~~Number of Tests and Retests;~~ Test Specimens,

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

3.1.7 Packaging and Package ~~Marking.~~ Marking, and

3.1.8 ~~Mill Test Report.~~

<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.

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

#### 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 in~~ orders for product under this specification, as applicable:

5.1.1 ~~Quantity, number of pieces or pounds, ASTM designation and year of issue,~~

5.1.2 ~~Copper Alloy UNS No. designation (see (1.1),~~

5.1.3 ~~Temper (see section Section 8),~~

5.1.4 ~~Quantity, pounds or number of pieces,~~

5.1.5 ~~Dimensions, including length if applicable. For tube or pipe specify either OD/ID, OD/wall, or ID/wall,~~

5.1.6 ~~How furnished: stock lengths with or without ends, specific lengths with or without ends,~~

5.1.7 ~~ASTM designation and year of issue, When product is purchased for ASME Boiler and Pressure Vessel Code Application, and~~

5.1.8 ~~When product is purchased for agencies of the U.S. government,~~

5.1.9 ~~Special tests or exceptions, if any,~~

5.1.10 ~~Hardness tests, if required,~~

5.1.11 ~~Special tests such as tension Tensile strength test, if required,~~

5.1.12 ~~Special marking or packaging, if required,~~

5.1.13 ~~Inspection, if required (see Specification B251),~~

5.1.14 ~~Certification, if required Certification (see Specification B251),~~

5.1.15 ~~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~~ 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.

#### 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.

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

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.

9.3 End products may be heat-treated at other times and temperatures for specific applications. These special combinations of properties such as increased ductility, dimensional accuracy, and endurance strength may be obtained by special precipitation-hardening heat treatments. The mechanical requirements of Table 2 do not apply to such special heat treatment. Specific test requirements as needed shall be agreed upon between the manufacturer or the supplier and the purchaser of the end product.

9.4 TF00 (AT) and TH04 (HT) tempers as standard mill-hardened products has been precipitation heat-treated and tested by the manufacturer. An appropriate time and temperature has been used to produce properties within the specification limits shown in Table 2. Table 3 does not apply. Further thermal treatment of these tempers is not normally required.

9.5 Material may be supplied with nonstandard properties. Table 2 values would not apply. Specific test requirements as needed shall be agreed upon between the manufacturer or supplier and the purchaser of these end products.

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

Standard	Temper Designation		Tensile Strength Ksi <sup>B</sup> (MPa <sup>C</sup> )	As-Supplied	
	Former			Rockwell Hardness, B-Scale	Electrical Conductivity IACS min, %
TB00	Solution heat-treated (A)		35-55 (240-380)	50 max	20
TD04	Solution heat-treated and cold-worked hard (H)		65-80 (450-550)	60-80	20
After Precipitation Heat Treatment					
TF00	Precipitation hardened (AT)		100-130 (690-895) <sup>D</sup>	92-100	45
TH04	Hard and precipitation heat-treated (HT)		110-140 (760-965) <sup>D</sup>	95-102	48

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

Standard	Temper Designation		Tensile Strength ksi <sup>B</sup> (MPa <sup>C</sup> )	Yield Strength ksi (MPa) min	As Supplied	
	Former				Rockwell Hardness, B Scale	Elongation min, %
TB00	A		35-55 (240-380)		50 max	20
TD04	H		65-80 (450-550)		60-80	20
After Precipitation Heat Treatment						
TF00	AT		100-130 (690-895) <sup>D</sup>	80 (550)	92-100	45
TH04	HT		110-140 (760-965) <sup>D</sup>		95-102	48

<sup>A</sup> These values apply to mill products. See Section 4011 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.