Designation: B 643 – 00$^{\epsilon 1}$

Standard Specification for Copper-Beryllium Alloy Seamless Tube[1]

This standard is issued under the fixed designation B 643; 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.

This standard has been approved for use by agencies of the Department of Defense.

ϵ[1] NOTE—Referenced Documents were editorially corrected in November 2003.

1. Scope*

1.1 This specification establishes requirements for copper-beryllium alloy seamless tube in straight lengths. Copper Alloy UNS C17200 will be the alloy furnished whenever Specification B 643 is specified.

1.2 *Units*—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 only to the test methods described in this specification.

1.4 *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 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:*

B 194 Specification for Copper-Beryllium Alloy Plate Sheet, Strip and Rolled Bar[2]

B 251 Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube[2]

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast[2]

B 846 Terminology for Copper and Copper Alloys[2]

E 3 Practice for Preparation of Metallographic Specimens[3]

E 8 Test Methods for Tension Testing of Metallic Materials[3]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[3]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[4]

E 112 Test Methods for Determining Average Grain Size[3]

E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition[5]

E 527 Practice for Numbering Metals and Alloys (UNS)[6]

3. General Requirements

3.1 The following sections of Specification B 251 (as noted) constitute a part of this specification:

3.1.1 Workmanship, Finish and Appearance,

3.1.2 Significance of Numerical limits,

3.1.3 Inspection,

3.1.4 Rejection and Rehearing,

3.1.5 Certification,

3.1.6 Mill Test Report, and

3.1.7 Packaging and Package Marking.

4. Terminology

4.1 *Definitions*—For terms relating to copper and copper alloys, refer to Terminology B 846.

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.

[1] 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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[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 14.02.

[5] *Annual Book of ASTM Standards*, Vol 03.05.

[6] *Annual Book of ASTM Standards*, Vol 01.01.

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

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:

5.1.1 Quantity, number of pieces or pounds,

5.1.2 Copper (Alloy) UNS number (see 1.1),

5.1.3 Temper (see Section 8),

5.1.4 Dimensions, including length if applicable,

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 or grain size, if required,

5.1.10 Special marking or packaging, if required,

5.1.11 Inspection, if required (see Specification B 251),

5.1.12 Certification, if required (see Specification B 251), and

5.1.13 Mill test report, if required (see Specification B 251).

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 B 251.

6. Materials and Manufacture

6.1 *Material*:

6.1.1 The material of manufacture shall be Alloy C17200, 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 and cold working, 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 requirements shown in Table 1.

TABLE 1 Chemical Requirements

Element	Composition, %
	Copper Alloy UNS No. C17200
Beryllium	1.80–2.00
Additive elements:	
Nickel + cobalt, min	0.20
Nickel + cobalt + iron, max	0.6
Aluminum, max	0.20
Silicon, max	0.20
Copper	remainder

7.2 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. Copper may be given as remainder and may be taken as the difference between the sum of all elements analyzed and 100 %. When all elements in Table 1 are analyzed, their sum shall be 99.5 % minimum.

8. Temper

8.1 Tempers available under this specification are solution heat-treated TB00 (A) and cold drawn hard TD04 (H), to be precipitation heat-treated by the user (see Table 2). Also available are products already precipitation heat-treated by the manufacturer, tempers TF00 (AT) and TH04 (HT). These products meet property requirements in Table 3 and normally require no further heat treatment by the user.

8.2 Tempers available under this specification are defined in Practice B 601.

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 When testing for conformance to the TF00(AT) and the TH04(HT) property requirements shown in Table 3 for products supplied in the TB00(A) and TD04(H) tempers, the appropriate test specimens shall be heat treated for times and temperatures within those stated in Table 4. The times and temperatures used by the manufacturer to qualify the material will be stated on the mill test report. The use of other times and temperatures, within the allowable ranges, shown in Table 4, may produce properties other than those stated on the mill test report. This will not be cause for rejection.

9.3 This material may be heat-treated at other times and temperature for specific applications. These special combinations of properties, such as increased ductility, dimensional accuracy, endurance life, may be obtained by special precipitation-hardening heat treatments. The mechanical requirements of Table 3 do not apply to such special heat

TABLE 2 Mechanical Property Requirements Before Precipitation Heat Treatment

Temper Designation[A]		Diameter Distance Between Cross-Sectional Parallel Surfaces, in. (mm)	Rockwell Hardness,[B] B Scale	Tensile Strength[C]	
Standard	Former			ksi[D]	(MPa)
TB00	Solution-heat treated (A)	¾ (19.1) and over	45–85	60–85	(410–570)
TD04	Hard (H)	¾ (19.1) and over	88–103	85–115	(590–800)

[A] Standard designations defined in Practice B 601.

[B] Hardness values shown apply only to direct determinations, not converted values.

[C] Hardness is the normal commercial acceptance criterion. Mechanical properties apply only when specifically required.

[D] ksi = 1000 psi.