



Standard Specification for Copper-Beryllium Alloy (UNS No. C17000 and C17200) Forgings and Extrusions¹

This standard is issued under the fixed designation B 570; 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 produced from the following alloy.

Copper Alloy UNS No.	Nominal % Composition Beryllium
C17000	1.7
C17200	1.9

NOTE 1—Requirements for copper-beryllium alloy rod and bar appear in Specification B 196 (Section 2).

1.2 Unless otherwise specified, Copper Alloy UNS No. C17200 shall be the alloy furnished whenever Specification B 570 is specified without any alloy designation.

1.3 The values stated in inch-pound units are to be regarded as the standard. SI values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar²
- B 196 Specification for Copper-Beryllium Alloy Rod and Bar²
- B 249 Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes, and Forgings²
- B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast²
- B 846 Terminology for Copper and Copper Alloys²
- E 3 Methods of Preparation of Metallographic Specimens³
- 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 112 Test Methods for Determining Average Grain Size³

3. Terminology

3.1 Definitions:

3.1.1 See Terminology B 846 for additional definitions.

¹ This specification is under the jurisdiction of ASTM Committee B-5 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.

3.1.2 *extrusion*—a uniform metal shape, long in relation to its cross-sectional dimensions, produced by forcing a suitably preheated billet or preform through an orifice (die) of the desired cross section. Extrusions generally are furnished in straight lengths.

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

4. Ordering Information

4.1 Orders for product under this specification shall include the following information:

- 4.1.1 ASTM designation and year of issue (for example, B570 – 96).
- 4.1.2 Quantity: number of pieces or pounds,
- 4.1.3 Copper Alloy UNS No. (Section 1),
- 4.1.4 Temper (Section 7) or condition (Section 11),
- 4.1.5 Drawing showing the shape, dimensions, and tolerances, if required,
- 4.1.6 If an extrusion: the length (or mass) required, straightness as required,
- 4.2 The following are options and should be included in the contract or purchase order, when required:
 - 4.2.1 Tension tests (Section 10),
 - 4.2.2 Special tests such as grain size,
 - 4.2.3 Finish (see Section 14),
 - 4.2.4 Grain size (see Section 8), and
 - 4.2.5 When material is ordered for agencies of the U.S. Government.

5. Material and Manufacture

5.1 Material:

5.1.1 The material of manufacture shall be cast or wrought billet of C17000 or C17200 of such purity and soundness as to be suitable for processing into the products prescribed herein.

5.1.2 The product heat number shall appear on the Certification or Test Report.

5.2 Manufacture:

5.2.1 The product shall be manufactured by hot working and heat treating as may be necessary to meet the properties specified herein.

6. Chemical Composition

6.1 The product composition shall conform to the chemical

requirements shown in Table 1.

6.2 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 the purchaser.

6.3 Copper, given as remainder, is the difference between the sum of all elements analyzed and 100 %. When all the elements given in Table 1 are analyzed, the sum of the results shall be 99.5 % minimum.

7. Temper

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

8. Grain Size

8.1 The grain size, if required, shall be as agreed upon between the purchaser and the manufacturer and shall be determined in accordance with Test Methods E 112.

9. Physical Property Requirements

9.1 Microstructure:

9.1.1 The product in the TF00 (precipitation-hardened (AT)) condition shall have a microstructure with a minimum of second phase (beta) constituents. When present, beta shall be fine and well dispersed.

10. Mechanical Property Requirements

10.1 Hardness:

10.1.1 The product furnished under this specification shall conform to the hardness requirements prescribed in Table 2 for the solution heat-treated condition and Table 3 after precipitation heat treatment, unless tensile properties are required by the purchase order. Rockwell hardness shall be determined in accordance with Test Method E 18.

10.2 Tensile:

10.2.1 When specified in the contract or purchase order, the tensile properties of the product furnished shall conform with the properties in Table 2 or Table 3 depending upon temper required.

11. Heat Treatment

11.1 *Solution Heat Treatment—Temper TB00 (A)*—The product shall be heated to a uniform temperature, nominally 1450°F (788°C) and quenched commensurate with the required property and structural integrity of the configuration.

11.2 *Precipitation Heat Treatment—Temper TF00 (AT)*—

The product shall be heat treated to a uniform temperature in the range from 600 to 700°F (316 to 370°C) for a minimum of 2 to 3 h and then air-cooled. This is the heat treatment for the acceptance tests shown in Table 3.

11.3 Special combinations of properties may be obtained by special precipitation heat treatments. The requirements for these special heat treatments shall be agreed upon by the manufacturer or supplier and purchaser.

12. Purchases for the U.S. Government

12.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. Government shall conform to the special government regulations specified in the Supplemental Requirements section.

13. Dimensions and Permissible Variations

13.1 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.

14. Workmanship, Finish, and Appearance

14.1 The product shall be free of defects; however, blemishes that do not interfere with the intended application are acceptable.

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

15. Test Methods

15.1 Chemical Composition:

15.2 The chemical composition shall, in case of disagreement, be determined in accordance with the applicable method in Annex A1 of Specification B 194.

15.3 Test method(s) for the determination of element(s) required by contractual agreement shall be as agreed upon between the manufacturer and the purchaser.

16. General Requirements

16.1 The following sections of Specification B 249 form a part of this specification.

- 16.1.1 Terminology,
- 16.1.2 Materials and Manufacture,
- 16.1.3 Sampling,
- 16.1.4 Number of Tests and Retests,
- 16.1.5 Sample Preparation,
- 16.1.6 Test Methods,
- 16.1.7 Significance of Numerical Limits,
- 16.1.8 Inspection,
- 16.1.9 Rejection and Rehearing,
- 16.1.10 Certification,
- 16.1.11 Mill Test Report,
- 16.1.12 Packaging, Marking, Shipping and Preservation.

16.2 An identical section in this Specification supplements the Referenced Section.

17. Keywords

17.1 copper beryllium; extrusions; forgings; UNS C17000; UNS C17200

TABLE 1 Chemical Requirements

Element	Composition, %	
	Copper Alloy UNS No. C17000	Copper Alloy UNS No. C17200
Beryllium	1.60–1.79	1.80–2.00
Additive Elements:		
Nickel + cobalt, min	0.20	0.20
Nickel + cobalt + iron, max	0.6	0.6
Aluminum, max	0.20	0.20
Silicon, max	0.20	0.20
Copper	remainder	remainder

TABLE 2 Mechanical Properties as Solution Heat Treated

Temper Designation		Diameter or Thickness, in. (mm)	Copper Alloy UNS No.			
			C17000	C17200	C17000	C17200
Standard	Former		Tensile Strength, ksi (MPa) ^{A,B} , max		Rockwell Hardness, B Scale, max	
TB00	solution heat-treated (A)	all sizes	85 (590)	85 (590)	85	85

^Aksi = 1000 psi.
^BSee Appendix.

TABLE 3 Mechanical Properties After Precipitation Heat Treatment

Temper Designation		Copper Alloy UNS No. C17000			
Standard	Former	Tensile Strength, ksi ^A (MPa) ^{B,C}	Yield Strength, ksi (MPa), 0.2 % Offset, min	Elongation in 2 in. (50 mm), min, % ^D	Rockwell Hardness, min C Scale
			TF00	precipitation hardened (AT)	150–190 (1030–1310)
TF00	precipitation hardened (AT)	165–200 (1140–1380)	Copper Alloy UNS No. C17200		36–
			130 (890)	3	

^Aksi = 1000 psi.
^BSee Appendix X1.
^CThe upper limits in the tensile strength column are for design guidance only.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. Government.

S1. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S1.1.1 *Federal Standards:*⁴

Fed. Std. No. 102 Preservation, Packaging and Packing Levels

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

Fed. Std. No. 185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S1.1.2 *Military Standards:*⁴

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-129 Marking for Shipment and Storage

S1.1.3 *Military Specification:*⁴

MIL-C-3993 Packaging of Copper and Copper-Base Alloy Mill Products

S2. Quality Assurance

S2.1 *Responsibility for Inspection:*

S2.1.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer may use his own or any other suitable facilities

for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

S3. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with Fed. Std. No. 185 except that the ASTM specification number and the alloy number shall be used.

S4. Preparation for Delivery

S4.1 *Preservation, Packaging, Packing:*

S4.1.1 *Military Agencies*—The material shall be separated by size, composition, grade or class and shall be preserved and packaged, Level A or C, packed Level A, B, or C as specified in the contract or purchase order, in accordance with the requirements of MIL-C-3993.

S4.1.2 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S4.2 *Marking:*

S4.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S4.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

APPENDIX

(Nonmandatory Information)

X1. METRIC EQUIVALENTS

X1.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which when applied to a body having a mass of 1 kg gives it an acceleration of 1 m/s^2 ($N = \text{kg}\cdot\text{m/s}^2$). The derived

SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since $1 \text{ ksi} = 6\,894\,757 \text{ Pa}$, the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2 .

SUMMARY OF CHANGES

This section identifies principle changes to this specification since the last issue.

The document received a five-year review with extensive form and style changes.

- (1) Reworded Scope.
- (2) Section 1.2 added, with adjusted SI note.
- (3) Section 2.1, B 194, B 249 and Terminology B 846 added and E 29, E 88, and E 106 deleted.
- (4) Section 16 added General Requirements Section with subsequent sections renumbered, or rearranged, or both.
- (5) Section 3.1.1 Added reference to B 846.
- (6) Section 4 Ordering Information reorganized to reflect the new Form and Style Guide.
- (7) Section 5 Materials of Manufacture reworded likewise.
- (8) Section 6 Chemical Composition adjusted wording.

(9) Sections 8 and 9 made Grain Size a separate section.

(10) Section 10 Mechanical Properties reworded.

(11) Section 14.1 Reworded.

(12) Section 15 Added 15.3.

(13) Removed old Sections 13. Sampling, 14. Retest, 15. Test Specimens, 16. Test Methods, 17. Significance of Numerical Limits, 18. Inspection, 19. Rejection, 20. Certification, 21. Mill Test Report. 22. Packaging and Package Marking. Per Form and Style Guide, they are in the General Requirements Section reference in B 249.

(14) Added footnote to Table 2 and Table 3, “... upper limit in the tensile strength...for design guidance only.” Added Key-words and Summary of Changes Sections.

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