



# Standard Specification for Copper-Beryllium Alloy (UNS No. C17000 and C17200) Forgings and Extrusions<sup>1</sup>

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 ( $\epsilon$ ) 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 alloys.

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/B 196M (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 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units, which are for information only and are not considered standard.

1.4 The following hazard statement pertains only to the test method portions of the specification:

1.4.1 *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 Bar<sup>2</sup>
- B 196/B 196M Specification for Copper-Beryllium Alloy Rod and Bar<sup>2</sup>
- B 249/B 249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings<sup>2</sup>
- B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast<sup>2</sup>

<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 B05.02 on Rod, Bar, Wire, Shapes, and Forgings.

Current edition approved Oct. 10, 2001. Published January 2002. Originally published as B 570 – 72. Last previous edition B 570 – 96.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.01.

B 846 Terminology for Copper and Copper Alloys<sup>2</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>3</sup>

E 112 Test Methods for Determining Average Grain Size<sup>3</sup>

## 3. General Requirements

3.1 The following sections of Specification B 249/B 249M form a part of this specification.

- 3.1.1 Terminology,
- 3.1.2 Materials and Manufacture,
- 3.1.3 Sampling,
- 3.1.4 Number of Tests and Retests,
- 3.1.5 Sample Preparation,
- 3.1.6 Test Methods,
- 3.1.7 Significance of Numerical Limits,
- 3.1.8 Inspection,
- 3.1.9 Rejection and Rehearing,
- 3.1.10 Certification,
- 3.1.11 Mill Test Report,
- 3.1.12 Packaging, Marking, Shipping and Preservation.

3.2 In addition, when a section with a title identical to that referenced in 3.1, appears in this specification, it contains additional requirements that supplement those appearing in Specification B 249/B 249M.

## 4. Terminology

### 4.1 Definitions:

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

4.1.2 *extrusion, n*—a uniform metal shape, long in relation to its cross-sectional dimensions, produced by forcing a suitably preheated billet or preformed piece through an orifice (die) of the desired cross section.

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

## 5. Ordering Information

5.1 Include the following information in orders for products:

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.

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

- 5.1.1 ASTM designation and year of issue,
- 5.1.2 Quantity: number of pieces or pounds,
- 5.1.3 Copper Alloy UNS No. (Section 1),
- 5.1.4 Temper (Section 8) or condition (Section 12),
- 5.1.5 Drawing showing the shape, dimensions, and tolerances, if required,

5.1.6 If an extrusion: the length (or mass) required, straightness as required,

5.2 The following are options and should be included in the contract or purchase order, when required:

- 5.2.1 Tension tests (Section 11),
- 5.2.2 Special tests such as grain size,
- 5.2.3 Finish (see Section 15),
- 5.2.4 Grain size (see Section 9), and
- 5.2.5 When material is ordered for agencies of the U.S. government.

## 6. Material and Manufacture

### 6.1 Material:

6.1.1 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.

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

### 6.2 Manufacture:

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

## 7. Chemical Composition

7.1 The product composition shall conform to the chemical requirements shown in Table 1.

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 the purchaser.

7.3 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.

## 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).

## 9. Grain Size

9.1 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.

## 10. Physical Property Requirements

### 10.1 Microstructure:

10.1.1 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.

## 11. Mechanical Property Requirements

### 11.1 Hardness:

11.1.1 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.

### 11.2 Tensile:

11.2.1 When specified in the contract or purchase order, the tensile properties of the product furnished shall conform to the properties in Table 2 or Table 3 depending upon temper required. Tensile properties shall be determined in accordance with Test Methods E 8.

## 12. Heat Treatment

12.1 *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.

12.2 *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.

12.3 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.

## 13. Purchases for the U.S. Government

13.1 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.

## 14. Dimensions and Permissible Variations

14.1 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.

## 15. Workmanship, Finish, and Appearance

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

**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) <sup>A,B</sup> , max		Rockwell Hardness, max B Scale		
TB00	solution heat-treated (A)	all sizes	85 (590)	85 (590)	85	85

<sup>A</sup>ksi = 1000 psi.  
<sup>B</sup>See Appendix X1.

**TABLE 3 Mechanical Properties After Precipitation Heat Treatment**

Temper Designation		Tensile Strength, ksi <sup>A</sup> (MPa) <sup>B,C</sup>	Yield Strength, ksi (MPa), 0.2 % Offset, min	Elongation in 2 in. (50 mm), min, %	Rockwell Hardness, min
Standard	Former				C Scale
TF00	precipitation hardened (AT)	150–190 (1030–1310)	Copper Alloy UNS No. C17000 120 (820)	3	32–
TF00	precipitation hardened (AT)	165–200 (1140–1380)	Copper Alloy UNS No. C17200 130 (890)	3	36–

<sup>A</sup>ksi = 1000 psi.  
<sup>B</sup>See Appendix X1.  
<sup>C</sup>The upper limits in the tensile strength column are for design guidance only.

15.2 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.

**16. Test Methods**

16.1 *Chemical Composition:*

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

16.3 Test method(s) for the determination of element(s)

required by contractual agreement shall be as agreed upon between the manufacturer and the purchaser.

**17. Keywords**

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

**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 *ASTM Standard:*

B 900 Practice for Packaging of Copper and Copper-Alloy Mill-Products for U.S. Government Agencies<sup>4</sup>

S1.1.2 *Federal Standards:*<sup>5</sup>

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

S1.1.3 *Military Standards:*<sup>5</sup>

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

MIL-STD-129 Marking for Shipment and Storage

**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

<sup>4</sup> Annual Book of ASTM Standards, Vol 02.01.  
<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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 Practice B 900.

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.

## 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<sup>2</sup> (N = kg·m/s<sup>2</sup>). The derived SI

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

#### SUMMARY OF CHANGES

This section identifies principle changes to this specification since the 1996 issue as follows:

(I) Document was revised to meet the requirements of *Form and Style for ASTM Standards* and the Committee B05 *Outline of Form of Specifications* (OFS).

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*