Designation: B570 – 16

# Standard Specification for Copper-Beryllium Alloy (UNS Nos. C17000 and C17200) Forgings and Extrusions[1]

This standard is issued under the fixed designation B570; 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 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 B196/B196M (Section 2).

1.2 Unless otherwise specified, Copper Alloy UNS No. C17200 shall be the alloy furnished whenever Specification B570 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 provided for information only and are not considered standard.

1.4 The following safety hazard caveat pertains only to the test method(s) described in this 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 to determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

B196/B196M Specification for Copper-Beryllium Alloy Rod and Bar

B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

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

E112 Test Methods for Determining Average Grain Size

## 3. General Requirements

3.1 The following sections of Specification B249/B249M 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, above, appears in this specification, it contains additional requirements that supplement those appearing in Specification B249/B249M.

## 4. Terminology

4.1 *Definitions:*

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

4.1.2 *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 specified choices when placing orders for products under this specification, as applicable:

[1] 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. 1, 2016. Published November 2016. Originally approved in 1972. Last previous edition approved in 2010 as B570–06(2010). DOI: 10.1520/B0570-16.

[2] 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**

5.1.1 ASTM designation and year of issue,
5.1.2 Copper [Alloy] UNS No. designation (Section 1),
5.1.3 Temper (Section 8) or condition (Section 12),
5.1.4 Drawing showing the shape, dimensions, and tolerances, if required,
5.1.5 Quantity—total weight, or length, or number of pieces of each size,
5.1.6 If an extrusion: the length (or mass) required, straightness as required,

5.2 The following options are available but may not be included unless specified at the time of placing of the order, when required:
5.2.1 Tension tests (Section 11),
5.2.2 Finish (see Section 15),
5.2.3 Grain size (see Section 9), and
5.2.4 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements section of this specification) for additional requirements, if specified.

## 6. Material and Manufacture

6.1 *Material:*
6.1.1 The material of manufacture shall be cast or wrought billet of Copper Alloy UNS No. 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, when required, to meet the temper properties specified.

## 7. Chemical Composition

7.1 The material shall conform to the chemical composition requirements in Table 1 for the copper [alloy] UNS No. designation specified 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 the elements given in Table 1 are determined, the sum of the results shall be 99.5 % minimum.

**TABLE 1 Chemical Requirements**

| Element | Composition, % | |
|---|---|---|
| | Copper Alloy UNS No. C17000 | Copper Alloy UNS No. C17200 |
| Beryllium | 1.60–1.85 | 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 |

## 8. Temper

8.1 The standard tempers for products described in this specification are given in Tables 2 and 3.
8.1.1 The standard temper designations available under this specification and as prescribed in Classification B601 are TB00 solution heat-treated (A) and TF00 precipitation heat-treated (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 E112.

## 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*—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 Methods E18.

11.2 *Tensile*—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 E8/E8M.

## 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 Supplementary 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.

**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, max | |
| | | | | | B Scale | |
| TB00 | solution heat-treated (A) | all sizes | 85 (590) | 85 (590) | 85 | 85 |

[A] ksi = 1000 psi.
[B] See Appendix X1.

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

| Temper Designation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Standard | Former | In. | mm | Copper Alloy UNS No. | Tensile Strength, ksi[A] (MPa)[B, C] | Yield Strength, ksi (MPa), 0.2 % Offset, min | Elongation in 4×D,[D] min, % | Rockwell C Scale |
| TF00 | precipitation hardened (AT) | | | UNS C17000 | 150–190 (1030–1310) | 120 (820) | 3 | 32– |
| | | Up to 8, incl | up to 200; | | 165–200 (1140–1380) | 130 (890) | 3 | 36– |
| TF00 | precipitation hardened (AT) | Over 8 to 12, incl., | over 200 to 300; | UNS C17200 | 155–190 (1070–1310) | 130 (890) | 3 | 34– |
| | | Over 12 | over 300 | | 145–180 (1000–1240) | 125 (860) | 3 | 34– |

[A] ksi = 1000 psi.
[B] See Appendix X1.
[C] The upper limits in the tensile strength column are for design guidance only.
[D] 4×D = 4×Diameter.

## 15. Workmanship, Finish, and Appearance

15.1 The product shall be free of defects but blemishes of a nature that do not interfere with the intended application are acceptable.

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 the Annex of Specification B194.

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:*

B900 Practice for Packaging of Copper and Copper-Alloy Mill-Products for U.S. Government Agencies

S1.1.2 *Federal Standards:*[3]

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:* [3]

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,

[3] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

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 Practice B900.

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 $m/s^2$ ($N = kg \cdot m/s^2$). 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 ksi = 6 894 757 Pa, the metric equivalents are expressed as megapascal (MPa), which is the same as $MN/m^2$ and $N/mm^2$.

## SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B570 – 06(2010)) that may impact the use of this standard. (Approved Oct. 1, 2016.)

*(1)* There were no technical changes. The specification has had an editorial review and update.