



Designation: B570 – 22

# Standard Specification for Copper-Beryllium Alloy Forgings and Extrusions (UNS Nos. C17000 and C17200)<sup>1</sup>

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 ( $\epsilon$ ) 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 Copper Alloy UNS Nos. C17000 and C17200.

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 an 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 that 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[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](#) constitute 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 Specimen 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 Test Report

3.1.12 Packaging and Package Marking

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.

<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. 1, 2022. Published October 2022. Originally approved in 1972. Last previous edition approved in 2016 as B570–16. DOI: 10.1520/B0570-22.

<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

## 5. Ordering Information

5.1 Include the following specified choices when placing orders for products under this specification, as applicable:

- 5.1.1 ASTM designation and year of issue;
- 5.1.2 Copper Alloy UNS No. designation;
- 5.1.3 Temper (Section 8) or condition (Section 12);
- 5.1.4 Dimensions: thickness, width, length, and edges for flat products; diameter, length, distance between flat surfaces, if any, and edges for all other products. Dimensions may be specified on a drawing;

5.1.5 For extrusions: diameter, length (or mass), and straightness as required;

5.1.6 Dimensional tolerances shall be as agreed upon between the manufacturer or supplier and purchaser;

5.1.7 Quantity—total weight, or total length, or number of pieces of each size.

5.2 The following options are available and, when required, shall be specified at the time of placing the order.

- 5.2.1 Tension test or hardness (Section 11),
- 5.2.2 Finish (Section 14),
- 5.2.3 Grain size (Section 9),
- 5.2.4 Inspection report,
- 5.2.5 Test report,
- 5.2.6 Certification,
- 5.2.7 Special marking or packaging,
- 5.2.8 If product is purchased for agencies of the U.S. government, see the general requirements section of Specification B249/B249M 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 such hot working and heat treating processes as to produce a uniform wrought structure in the finished product.

6.2.2 The product shall be hot worked to the finish size and subsequently heat treated 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. specified

**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

in the ordering information.

7.1.1 Results of analysis on a check sample shall conform to the composition requirements within the permitted analytical variance specified in Table 1.

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.

## 8. Temper

8.1 The standard tempers for products described in this specification are as follows:

- 8.1.1 *M30*—As Hot Extruded.
- 8.1.2 *TB00*—Solution Heat Treated (A), Table 2.
- 8.1.3 *TF00*—Precipitation Hardened (AT), Table 3.

8.2 The standard temper designations available under this specification are as prescribed in Classification B601.

## 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.

**TABLE 2 Mechanical Properties as Solution Heat Treated**

Temper Designation Code	Name	Diameter or Thickness, in. (mm)	Copper Alloy UNS No.		Rockwell Hardness, max B Scale
			C17000	C17200	
TB00	solution heat-treated (A)	all sizes	85 (590)	85 (590)	85

<sup>A</sup> ksi = 1000 psi.

<sup>B</sup> See Appendix X1.

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

Code	Name	Temper Designation		Copper Alloy UNS No.	Tensile Strength, ksi <sup>A</sup> (MPa) <sup>B, C</sup>	Yield Strength, ksi (MPa), 0.2 % Offset, min	Elongation in 4xD, <sup>D</sup> min, %	Rockwell C Scale, min
		Diameter or Thickness						
		in.	mm					
TF00	precipitation hardened (AT)	all sizes	all sizes	UNS C17000	150–190 (1030–1310)	120 (820)	3	32
TF00	precipitation hardened (AT)	Up to 8, incl	up to 200	UNS C17200	165–200 (1140–1380)	130 (890)	3	34
		Over 8 to 12, incl	Over 200 to 300		155–190 (1070–1310)	130 (890)	3	34
		Over 12	Over 300		145–180 (1000–1240)	125 (860)	3	34

<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.

<sup>D</sup> 4xD = 4xDiameter.

## 11. Mechanical Property Requirements

### 11.1 Tensile Strength Requirements:

11.1.1 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 E8/E8M.

### 11.2 Rockwell Hardness Requirements:

11.2.1 When specified in the contract or purchase order, the product shall conform to the Rockwell hardness requirements prescribed in Table 2 for the solution heat-treated condition and Table 3 after precipitation heat treatment. When tensile properties are required by the purchase order, hardness values are for reference only. Rockwell hardness shall be determined in accordance with Test Methods E18.

## 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 °F to 700 °F (316 °C to 370 °C) for a minimum of 2 h 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. Dimensions and Permissible Variations

13.1 The dimensions and tolerances for product in the M30 temper shall be as specified in the appropriate tables of Specification B249/B249M or as agreed upon between the manufacturer and the purchaser.

13.2 The dimensions and tolerances for the product in the TB00 and TF00 tempers shall be those shown in the appropriate tables of Specification B249/B249M or 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 but blemishes of a nature 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, pickling, or machining.

## 15. Test Methods

### 15.1 Chemical Analysis:

15.1.1 In case of disagreement, test methods for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser. The method in the Annex of Specification B194, which may no longer be valid, is provided for reference.

15.1.2 Test method(s) to be followed for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

### 15.2 Other Tests:

15.2.1 The product furnished shall conform to specified requirements when subjected to test in accordance with the following table:

Test	Method
Tensile Properties	E8/E8M
Hardness	E18
Grain Size	E112

## 16. Keywords

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