Designation: B768 – 22

Standard Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Strip and Sheet[1]

This standard is issued under the fixed designation B768; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification establishes the requirements for copper-cobalt-beryllium and copper-nickel-beryllium strip and sheet of the following alloys:

	Nominal Composition, %		
Copper Alloy UNS No.	Beryllium	Cobalt	Nickel
C17410	0.3	0.5	. . .
C17450	0.3	. . .	0.8
C17460	0.3	. . .	1.2

1.2 *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.

1.3 The following safety hazard caveat pertains only to the test methods described in this specification:

1.3.1 *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.*

1.4 *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 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:*[2]

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

B248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

B248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric)

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

E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

E1004 Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy Current) Method

3. Terminology

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

4. General Requirements

4.1 The following sections of Specification B248 or B248M constitute a part of this specification:

4.1.1 Terminology
4.1.2 Materials and Manufacture
4.1.3 Workmanship, Finish, and Appearance
4.1.4 Sampling
4.1.5 Number of Tests and Retests
4.1.6 Specimen Preparation
4.1.7 Test Methods
4.1.8 Significance of Numerical Limits

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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[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**

4.1.9 Inspection
4.1.10 Rejection and Rehearing
4.1.11 Certification
4.1.12 Test Report
4.1.13 Product Identification
4.1.14 Packaging and Package Marking
4.1.15 Supplementary Requirements

4.2 In addition, when a section with a title identical to that referenced in 4.1 appears in this specification, it contains additional requirements which supplement those appearing in Specification B248 or B248M.

5. Ordering Information

5.1 Include the following information when placing orders for product 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 Form of material: strip or sheet;
5.1.4 Temper;
5.1.5 Dimensions: thickness and width, and length, as applicable;
5.1.6 How furnished: straight lengths or coils;
5.1.7 Quantity – total weight or total length, as applicable;
5.1.8 Tension test or hardness, as applicable, in accordance with Section 10.

5.2 The following options are available and, when required, shall be specified at the time of placing the order:
5.2.1 Type of edge: slit, sheared, sawed, square corners, rounded corners, rounded edges, or full rounded edges;
5.2.2 Special thickness tolerances;
5.2.3 Special width or straightness tolerances;
5.2.4 Special tests or exceptions;
5.2.5 Heat identification;
5.2.6 Test report;
5.2.7 Certification;
5.2.8 Special marking or packaging.
5.2.9 If product is purchased for agencies of the U.S. government, see the Supplementary Requirements section of Specification B248 or B248M for additional requirements.

6. Materials and Manufacture

6.1 *Materials:*
6.1.1 The material of manufacture shall be cast billets or slabs of one of the alloys cited in Section 1 of this specification. The cast material shall be of such purity and soundness as to be suitable for processing into the products prescribed herein.
6.1.2 When specified in the contract or purchase order, the heat identification or traceability is required, the purchaser shall specify the details required.

6.2 *Manufacture:*
6.2.1 The product shall be manufactured by such hot working, cold working, and annealing processes as to produce a uniform wrought structure in the finished product.
6.2.2 The product shall be hot or cold worked to the finish size, and subsequently heat-treated when required, to meet the temper properties specified.

6.3 *Edges:*
6.3.1 Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

7. Chemical Composition

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

8. Temper

8.1 The standard tempers for products described in this specification are given in Table 2.

9. Physical Property Requirements

9.1 *Electrical Conductivity Requirement:*
9.1.1 The product furnished shall conform to the electrical conductivity prescribed in Table 3, when tested in accordance with Test Method E1004.

10. Mechanical Property Requirements

10.1 *Tensile Strength Requirements:*
10.1.1 Tensile strength for product less than 0.075 in. (1.905 mm) in thickness shall be an accept/reject requirement when tested in accordance with Test Methods E8/E8M.
10.1.2 The tensile strength requirements are given in Table 2.

10.2 *Yield Strength Requirements:*
10.2.1 Yield strength for product less than 0.075 in. (1.905 mm) in thickness shall be an accept/reject requirement when tested in accordance with Test Methods E8/E8M.
10.2.2 The yield strength requirements are given in Table 2.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Copper Alloy UNS No.		
	C17410	C17450	C17460
Beryllium	0.15–0.50	0.15–0.50	0.15–0.50
Cobalt	0.35–0.6	...	...
Nickel	...	0.50–1.0	1.0–1.4
Iron, max	0.20	0.20	0.20
Zirconium, max	...	0.50	0.50
Tin, max	...	0.25	0.25
Silicon, max	0.20	0.20	0.20
Aluminum, max	0.20	0.20	0.20
Copper	remainder	remainder	remainder
Copper + sum of named elements	99.5 % min	99.5 % min	99.5 % min

TABLE 2 Mechanical Property Requirements for Strip and Sheet Precipitation Heat Treated

Copper Alloy UNS No.	Temper Designation		Tensile Strength, ksi (MPa)	Yield Strength, ksi (MPa), 0.2 % offset	Elongation, 2 in. (50 mm), %	Rockwell Hardness	
	Code	Name				B	30T
C17410	TH02	½ HT	95–115 (655–790)	80–100 (550–690)	10–20	89–98	76–81
	TH04	HT	110–130 (760-895)	100–120 (690-830)	7–17	95–100	79–86
C17450	TH02	½ HT	95–115 (655–790)	80–100 (550–690)	12 min	88–99	75–82
C17460	TH03	¾ HT	115–135 (790–930)	95–115 (655–790)	11 min	98–105	81–88
	TH04	HT	120–140 (825–965)	105–125 (720–860)	10 min	99–106	82–89

TABLE 3 Electrical Conductivity

Copper Alloy UNS No.	Temper	Percent IACS, min
C17410	TH02, TH04	45
C17450	TH02	50
C17460	TH03, TH04	50

10.2.3 Acceptance or rejection for product less then 0.075 in. (1.905 mm) in thickness shall depend only on tensile strength and yield strength.

10.3 *Rockwell Hardness Requirements:*

10.3.1 Rockwell hardness for product 0.075 in. (1.905 mm) and greater in thickness shall be the standard test when tested in accordance with Test Methods E18.

10.3.2 The Rockwell hardness requirements are given in Table 2.

10.3.3 Acceptance or rejection for product 0.075 in. (1.905 mm) and greater in thickness shall depend only on Rockwell hardness.

10.4 In cases of disagreement with Rockwell hardness results, the acceptance or rejection shall be the tensile properties when tested in accordance with Test Methods E8/E8M.

11. Dimensions and Permissible Variations

11.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 or B248M, with particular reference to the following tables and related paragraphs:

11.2 *Thickness*—See 5.2.2, Table 2, and for special tolerances, Table 3.

11.3 *Width:*

11.3.1 *Slit Metal and Slit Metal with Rolled Edges*—See 5.3.1 and Table 4.

11.4 *Length:*

11.4.1 *Specific and Stock Lengths with and without Ends*—See 5.4.1.

11.4.2 *Schedule of Lengths (Specific and Stock) with Ends*—See 5.4.2 and Table 8.

11.5 *Straightness:*

11.5.1 *Slit Metal or Edge-Rolled Metal*—See 5.5.1 and Table 11.

11.6 *Edges*—See 5.6.

11.6.1 *Square Edges*—See 5.6.1 and Table 15.

11.6.2 *Rounded Corners*—See 5.6.2 and Table 16.

11.6.3 *Rounded Edges*—See 5.6.3 and Table 17.

11.6.4 *Full-Rounded Edges*—See 5.6.4 and Table 18.

12. Workmanship, Finish, and Appearance

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

13. Sampling

13.1 *Sampling*—The lot size, portion size, and selection of samples pieces shall be as follows:

13.1.1 *Lot Size*—An inspection lot shall be 10 000 lb or less material of the same mill form, alloy, temper, and nominal dimensions, subject to inspection at one time or shall be the product of one cast bar from a single melt charge, whose weight shall not exceed 25 000 lb that has been continuously processed and subject to inspection at one time.

13.1.2 *Portion Size*—A portion shall be two representative samples taken from the product of one cast bar that has been continually processed to the finished temper and dimensions.

13.1.3 *Chemical Analysis*—sample pieces for chemical analysis shall be in accordance with section 7.1.2.1 of Specification B248 or B248M.

14. Number of Tests and Retests

14.1 The number of tests and retests shall be in accordance with Section 8 of Specification B248 or B248M.

15. Specimen Preparation

15.1 *Chemical Analysis*—Sample preparation shall be in accordance with Practice E255.

15.2 *Tensile Tests*—Sample preparation shall be in accordance with Section 9 of Specification B248 or B248M. The test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling.

15.3 *Rockwell Hardness*—The test specimens shall be of a size and shape to permit testing by the available test equipment and shall be taken to permit testing in a plane parallel to the direction of deformation given to the product.

15.3.1 The surface of the test specimens shall be sufficiently smooth and even to permit the accurate determination of hardness.

15.3.2 The specimen shall be free of scale and foreign matter and care shall be taken to avoid any change in condition, that is, heating or cold working.