Designation: B768 – 11

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 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:

Copper Alloy UNS No.[2]	Nominal Composition, %		
	Beryllium	Cobalt	Nickel
C17410	0.3	0.5	. . .
C17450	0.3	. . .	0.8
C17460	0.3	. . .	1.2

1.2 *Units*—Values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units, which 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 and health practices and determine the applicability of regulatory limitations prior to use.*

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:*[3]

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

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

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

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 constitutes 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.
4.1.9 Inspection.
4.1.10 Rejection and Rehearing.
4.1.11 Certification.
4.1.12 Test Report.
4.1.13 Packaging and Marking.
4.1.14 Supplementary Requirements.

[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] The UNS system for copper and copper alloys (see Practice E527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix "C" and a suffix "00." The suffix can be used to accommodate composition variations of the base alloy.

[3] 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.**

4.2 In addition, when a section with a title identical to that referenced in 5.1 appears in this specification, it contains additional requirements which supplement those appearing in Specification B248.

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 (1.1),

5.1.3 Form of material: strip or sheet,

5.1.4 Temper (Section 8),

5.1.5 Tension test, if required (Section 9),

5.1.6 Dimensions: thickness and width, and length as applicable (Section 11),

5.1.7 How furnished: rolls, stock lengths with or without ends, specific lengths with or without ends (Section 11),

5.1.8 Type of edge, if required: slit, sheared, sawed, square corners, rounded corners, rounded edges, or full rounded edges (see 11.6),

5.1.9 Special thickness tolerances, if required (Section 11),

5.1.10 Hardness test, if required,

5.1.11 Special marking or packaging, if required,

5.1.12 Mill test report, if required,

5.1.13 Special tests or exceptions, if any, and

5.1.14 Certification, if required.

5.2 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements as defined in the current issue of Specification B248 for additional requirements, if specified).

6. Materials and Manufacture

6.1 *Materials*—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 soundness and purity as to be suitable for processing into the products prescribed herein.

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 heat-treated when required, to meet the temper properties specified.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Copper Alloy UNS Number		
	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

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 given as remainder, copper is the difference between the sum of all the elements analyzed and 100 %. When all the elements in Table 1 are analyzed, 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.

8.1.1 Copper Alloy UNS No. C17410 Strip and Sheet is offered in the TH02 (½ HT) and TH04 (HT) tempers.

8.1.2 Copper Alloy UNS No. C17450 Strip and Sheet is offered in TH02 (½ HT) Temper.

8.1.3 Copper Alloy UNS No. C17460 Strip and Sheet is offered in the TH03 (¾ HT) and TH04 (HT) tempers.

9. Physical Properties

9.1 *Electrical Conductivity*:

9.1.1 The product furnished shall conform to the electrical conductivity prescribed in Table 3.

10. Mechanical Properties

10.1 *Tensile Strength Requirements*:

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	
	Standard	Former				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

10.1.1 Product under .075 in. (1.905 mm) in thickness furnished under this specification shall conform to the tensile requirements prescribed in Table 2, when tested in accordance with Test Method E8/E8M.

10.1.2 Tensile test specimens shall be taken so that their longitudinal axis is parallel to the direction of rolling.

10.1.3 Acceptance or rejection, under .075 in. (1.905 mm) in thickness, based upon mechanical properties shall depend only on tensile strength.

10.2 *Rockwell Hardness Requirements*:

10.2.1 Product .075 in. (1.905 mm) and over in thickness furnished under this specification shall conform to the Rockwell hardness requirements prescribed in Table 2, when tested in accordance with Test Method E18.

10.2.2 Acceptance or rejection, .075 in. (1.905 mm) and over in thickness, based upon mechanical properties shall depend only on Rockwell hardness.

11. Dimensions and Permissible Variations

11.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248, 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 lbs. 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 lbs. 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.

14. Number of Tests and Retests

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

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.

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.

16. Test Methods

16.1 The test methods for determining the mechanical and physical properties are detailed in Specification B248.

16.2 The test method for determining chemical analysis for compliance and preparation to certifications and test reports shall be at the discretion of the reporting laboratory.

16.2.1 In case of dispute, the test method in the Annex of Specification B194 shall be used for determining chemical requirements in Table 1.

16.3 When analysis for unnamed or residual elements is required in the purchase order, the method of analysis shall be mutually agreed upon between the manufacturer or supplier and the purchaser.

17. Keywords

17.1 beryllium copper strip; copper UNS number C17410; copper UNS number C17450; copper UNS number C17460

SUMMARY OF CHANGES

Committee B05 has identified the principal changes to this specification that have been incorporated since the 1999 (2004) issue as follows:

(*1*) This specification received an editorial five-year update. Rewording and additions were made in accordance with the new "Outline of Form."

(*2*) Copper remainder was added to Table 1.