



Standard Specification for Copper-Zinc-Aluminum-Cobalt Alloy, Copper-Zinc-Tin-Iron Alloy Plate, Sheet, Strip, and Rolled Bar¹

This standard is issued under the fixed designation B592; 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 Alloy UNS C66300 and C68800 plate, sheet, strip, and rolled bar.²

NOTE 1—Since alloy C68800 is frequently used in a variety of applications where yield strength and stress-corrosion resistance may be critical, it is recommended that drawings or samples of the part to be fabricated and details of application be submitted for use in establishing temper and treatment of material.

NOTE 2—Alloy C66300 is covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

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, which are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards*:³

B193 Test Method for Resistivity of Electrical Conductor Materials

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

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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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.

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes (Withdrawn 2002)⁴

E75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys (Withdrawn 2010)⁴

E112 Test Methods for Determining Average Grain Size

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

E478 Test Methods for Chemical Analysis of Copper Alloys

3. General Requirements

3.1 The following sections of Specification **B248** constitute a part of this specification:

- 3.1.1 Terminology,
- 3.1.2 Materials and Manufacture,
- 3.1.3 Workmanship, Finish, and Appearance,
- 3.1.4 Sampling, except for chemical analysis,
- 3.1.5 Number of Tests and Retests,
- 3.1.6 Specimen Preparation,
- 3.1.7 Test Methods,
- 3.1.8 Significance of Numerical Limits,
- 3.1.9 Inspection,
- 3.1.10 Rejection and Rehearing,
- 3.1.11 Certification,
- 3.1.12 Test Reports,
- 3.1.13 Packaging and Package Marking, and
- 3.1.14 Supplementary Requirements.

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 which supplement those appearing in Specification **B248**.

4. Terminology

4.1 For definitions of terms related to copper and copper alloy, refer to Terminology **B846**.

5. Ordering Information

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

- 5.1.1 ASTM designation and year of issue,

⁴ The last approved version of this historical standard is referenced on www.astm.org.

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

- 5.1.2 Copper [Alloy] UNS No. designation,
- 5.1.3 Temper (Section 8),
- 5.1.4 Dimensions, thickness, width, length, and edges (Section 13),
- 5.1.5 How furnished: straight lengths or coils,
- 5.1.6 Quantity total weight or total length or number of pieces of each size, and
- 5.1.7 Intended application.

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 Heat identification or traceability details,
- 5.2.2 Certification,
- 5.2.3 Mill Test Report,
- 5.2.4 Type of edge, if required, (slit, sheared, sawed, square corners, round corners, rounded edges, or full rounded edges),
- 5.2.5 Type of width and straightness tolerances, if required (Section 13),
- 5.2.6 If product is purchased for agencies of the U.S. Government (see Supplementary Requirements section of Specification B248 for additional requirements).

6. Materials and Manufacture

6.1 Materials:

6.1.1 The material of manufacture shall be a form (cast bar, cake, slab, et cetera) of Copper Alloy UNS No. C66300 or C68800 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 that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 3—Due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify a specific casting analysis with a specific quantity of finished material.

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 finished size and subsequently annealed, 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.

7.2 These composition limits do not preclude the presence of other elements. By arrangement 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 the results shall equal at least 99.5 %.

7.4 For alloys in which zinc is listed as “remainder,” either copper or zinc may be taken as the difference between the sum of results of all other elements determined and 100 %. When all elements in Table 1 are determined, the sum of the results shall equal at least 99.5 %.

8. Temper

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

8.1.1 Cold-rolled tempers H01 to H14.

8.1.2 Annealed-to-temper O61 and O82.

9. Grain Size for Annealed Tempers

9.1 Although no grain size range has been established, the product must be fully recrystallized as determined by Test Methods E112.

10. Physical Property Requirements

10.1 Electrical Resistivity Requirement:

10.1.1 When specified in the contract or purchase order, the product furnished shall conform to the electrical mass resistivity requirement prescribed in Table 3, when tested in accordance with Test Method B193.

TABLE 1 Chemical Requirements

Element	Composition, %	Element	Composition, %
	Copper Alloy UNS No.		Copper Alloy UNS No.
	C68800		C66300
Copper, incl silver	remainder	Copper, incl silver	84.5–87.5
Aluminum	3.0–3.8	Aluminum	...
Zinc	21.3–24.1	Zinc	remainder
Zinc + aluminum	25.1–27.1	Zinc + aluminum	...
Cobalt	0.25–0.55	Cobalt	0.20 max
Nickel	...	Nickel	...
Lead	0.05 max	Lead	0.05 max
Iron	0.20 max	Iron	...
		Iron + Cobalt	1.4–2.4
		Tin	1.5–3.0
		Phos	0.35 max

TABLE 2 Mechanical Requirements

Temper Designation ^A		Tensile Strength, ksi ^B (MPa ^C)		Approximate Rockwell Hardness	
Code	Name	Min	Max	B Scale 0.020 in. (0.51 mm) and Over	30T Scale 0.012 in. (0.31 mm) and Over
Copper Alloy UNS No. C68800					
O61	annealed	77 (530)	87 (600)	...	63–74
Copper Alloy UNS No. C68800					
H01	quarter-hard	87 (600)	101 (695)	86–95	75–81
H02	half-hard	97 (670)	112 (770)	93–97	80–82
H04	hard	106 (730)	120 (825)	96–98	82–83
H06	extra-hard	113 (780)	127 (875)	97–99	82–84
H08	spring	123 (850)	133 (915)	98–100	83–84
H10	extra-spring	125 (860)	...	99	84
Copper Alloy UNS No. C66300					
O82	annealed to temper—1/2 hard	58 (400)	73 (505)	65–81	...
Copper Alloy UNS No. C66300					
H04	hard	76 (525)	91 (625)	84–91	68–77
H06	extra hard	88 (605)	103 (710)	87–94	75–83
H08	spring	95 (655)	110 (760)	92–96	79–87
H10	extra spring	100 (690)	114 (785)	94–97	82–88
H14	super spring	105 (725)		95 min	85 min

^A Standard designation defined in Classification **B601**.

^B ksi = 1000 psi.

^C See **Appendix X1**.

TABLE 3 Electrical Resistivity

Copper Alloy UNS C66300		
Temper	Electrical Resistivity at 20°C (68°F), $\Omega \cdot \text{g}/\text{m}^2$	Equivalent Conductivity at 20°C (68°F), % IACS
H04, H06, H08, H10, H14	0.6148	25 % min
O82	0.6148	25 % min
Copper Alloy UNS C68800		
Temper	Electrical Resistivity at 20°C (68°F), $\Omega \cdot \text{g}/\text{m}^2$	Equivalent Conductivity at 20°C (68°F), % IACS
H01 H02, H04, H06, H08, H10	0.5768	18 % min
O61	0.5768	18 % min

11. Mechanical Property Requirements

11.1 Tensile Strength Requirements:

11.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in **Table 2**, when tested in accordance with Test Methods **E8/E8M**.

11.1.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

11.2 Rockwell Hardness Requirement:

11.2.1 The approximate Rockwell hardness values given in **Table 2** are for general information and assistance in testing and shall not be used as a basis for product rejection.

NOTE 4—The Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper, tensile strength, and grain size.

12. Other Requirements

12.1 Purchases for U.S. Government:

12.1.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. Government shall conform to the additional requirements prescribed in the Supplementary Requirements section of Specification **B248**.

13. Dimensions, Mass, and Permissible Variation

13.1 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:

13.1.1 *Thickness*—Table 1.

13.1.2 *Width*:

13.1.2.1 *Slit Metal and Slit Metal with Rolled Edges*—Table 4.

13.1.2.2 *Square Sheared Metal*—Table 5.

13.1.2.3 *Sawed Metal*—Table 6.

13.1.3 *Length*:

13.1.3.1 *Length Tolerance for Straight Lengths*—Table 7.

13.1.3.2 *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends*—Table 8.

13.1.3.3 *Length Tolerance for Square Sheared Metal*—Table 9.

13.1.3.4 *Length Tolerance for Sawed Metal*—Table 10.

13.1.4 *Straightness*:

13.1.4.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled*—Table 11.

13.1.4.2 *Squared Sheared Metal*—Table 12.

13.1.4.3 *Sawed Metal*—Table 13.

13.1.5 *Edges Contours*:

13.1.5.1 *Square Corners*—Table 14.

13.1.5.2 *Rounded Corners*—Table 15.

13.1.5.3 *Rounded Edges*—Table 16.

13.1.5.4 *Full-Rounded Edges*—Table 17.

14. Sampling

14.1 Refer to sampling section in Specification **B248**.

14.2 *Chemical Analysis*:

14.2.1 The sample for chemical analysis shall be taken from the pieces selected and combined into one composite sample in

accordance with Practice **E255** for product in its final form. The minimum weight of the composite sample shall be 150 g.

14.2.2 Instead of sampling as directed in **14.2.1**, the manufacturer shall have the option of sampling at the time castings are poured or from the semifinished product. The number of samples taken for the determination of composition shall be as follows:

14.2.2.1 When samples are taken at the time the castings are poured, at least one sample shall be taken for each group of castings poured from the same source of molten metal.

14.2.2.2 When samples are taken from semifinished product, a sample shall be taken to represent each 10 000 lbs (5000 kg) or fraction thereof, except that not more than one sample shall be required per piece.

14.2.2.3 Only one sample needs to be taken from the semifinished product of one cast bar from a single melt charge continuously processed.

14.2.3 When composition of the material has been determined during manufacture, sampling of the finished product by the manufacturer is not required.

15. Test Methods

15.1 Chemical Analysis:

15.1.1 In cases of disagreement, test methods for chemical analysis shall be subject to agreement between the manufac-

turer or supplier and the purchaser. The following table is a list of published methods, some of which may no longer be viable, which along with others not listed, may be used subject to agreement:

Element	ASTM Test Methods
Aluminum	E478
Cobalt	E75 (Photometric)
Copper	E478
Iron	E54
Lead	E478 (AA)
Nickel	E478 (Photometric)
Zinc	E478 (AA)

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

16. Keywords

16.1 copper-zinc-aluminum-cobalt alloy plate; copper-zinc-aluminum-cobalt alloy rolled bar; copper-zinc-aluminum-cobalt alloy sheet; copper-zinc-aluminum-cobalt alloy strip; copper-zinc-tin-iron alloy plate; copper-zinc-tin-iron alloy rolled bar; copper-zinc-tin-iron alloy sheet; copper-zinc-tin-iron alloy strip; UNS No. C66300; UNS No. C68800

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 one kilogram gives it an acceleration of one metre per second squared ($N = \text{kg} \cdot \text{m}/\text{s}^2$). 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 $1 \text{ ksi} = 6\,894\,757 \text{ Pa}$ 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 principal changes to this specification that have been incorporated since the 2011 issue as follows:

(1) Made editorial corrections to the standard to ensure it conforms to proper form and style.

(2) Corrected the H04 max Tensile strength from 630 MPa to 625 MPa as it was incorrect.



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