Designation: B 592 – 01

Standard Specification for Copper-Zinc-Aluminum-Cobalt Alloy, Copper-Zinc-Tin-Iron Alloy Plate, Sheet, Strip, and Rolled Bar[1]

This standard is issued under the fixed designation B 592; 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 covers the requirements for plate, sheet, strip, and rolled bar in alloys C66300 and C68800.[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 headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

1.2 Values stated in inch-pound units are to be regarded as the standard. Values given in parentheses are for information only.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast[3]

B 846 Terminology for Copper and Copper Alloys[3]

E 8 Test Methods forTension Testing of Metallic Materials[4]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[4]

E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys[5]

E 76 Test Methods for Chemical Analysis of Nickel-Copper Alloys[5]

E 112 Test Methods for Determining Average Grain Size[4]

E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition[5]

E 478 Test Methods for Chemical Analysis of Copper Alloys[6]

E 527 Practice for Numbering Metals and Alloys (UNS)

3. General Requirements

3.1 The following sections of Specification B 248 constitute a part of this specification:

3.1.1 Terminology—Definitions,
3.1.2 Materials and Manufacturing,
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, except for chemical analysis,
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 (Mill),
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 B 248.

4. Terminology

4.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology B 846.

4.2 *Definition of Term Specific to This Standard:*

4.2.1 *capable of*—having the properties necessary for conformance to specification requirements when subjected to a referenced test method.

5. Ordering Information

5.1 Contracts or purchase orders for product under this specification should include the following information:

[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 American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights are entirely their own.

[3] *Annual Book of ASTM Standards,* Vol 02.01.

[4] *Annual Book of ASTM Standards,* Vol 03.01.

[5] *Annual Book of ASTM Standards,* Vol 03.05.

[6] *Annual Book of ASTM Standards,* Vol 03.06.

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

5.1.1 ASTM designation and year of issue (for example, B 592 - XX),

5.1.2 Copper Alloy UNS No. designation (for example, C68800),

5.1.3 Temper (see Section 8),

5.1.4 Dimensions, that is, thickness, width, length, etc. (see Section 13),

5.1.5 Form, that is, plate, sheet, strip, or rolled bar,

5.1.6 How furnished, that is, coils, specific lengths or stock lengths, with or without ends,

5.1.7 Quantity, that is, total weight each form, temper, and size, and

5.1.8 Whether material is purchased for agencies of the U.S. Government (see Section 12).

5.2 The following options are available under this specification and should be specified in the contract or purchase order when required:

5.2.1 Type of edge, that is, slit, sheared, sawed, square corners, round corners, rounded edges, or full rounded edges, and

5.2.2 Width and straightness tolerances (see Section 13).

6. Material and Manufacture

6.1 *Material*:

6.1.1 The material of manufacture shall be a cast bar, cake, slab, etc., of Copper Alloy UNS C66300 or C68800 of such purity and soundness as to be suitable for process in to the products prescribed herein.

6.1.2 In the event 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 *Manufacturer*:

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.

6.2.3 *Edges*—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 specified in Table 1.

7.2 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer and the purchaser.

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 %.

8. Temper

8.1 Products fabricated from these alloys are available in the tempers listed in Table 2 as defined in Classification B 601.

8.1.1 *Rolled (H)*—The standard tempers for rolled material are as designated in Table 2 with the prefix "H". Former designations and the standard designations as defined in Classification B 601 are shown.

8.1.2 *Anneal to Temper (O)*—The standard tempers of annealed-to-temper material are as designated in Table 2 with the prefix "O". Former designations and the standard designations as defined in Practice B 601 are shown.

9. Grain Size for Annealed Tempers

9.1 Although no grain size has been established, the product must be fully recrystallized as determined by Test Method E 112.

10. Physical Property Requirements

10.1 The electrical resistivity requirement of Copper Alloys UNS C66300 and UNS C68800 are listed in Table 3 for information only.

11. Mechanical Property Requirements

11.1 *Tensile Strength Requirements*:

11.1.1 Product furnished under this specification will conform to the tensile requirements prescribed in Table 2 when tested in accordance with Test Methods E 8.

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

11.2 *Rockwell Hardness Requirements*—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 as determined by Test Methods

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	.35 max

TABLE 2 Mechanical Requirements

Temper Designation[A]		Tensile Strength, ksi[B] (MPa[C])		Approximate Rockwell Hardness	
Standard	Former	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 (863)	. . .	99	84
		Copper Alloy UNS No. C66300			
O82	annealed to temper–½hard	58 (400)	73 (503)	65–81	. . .
		Copper Alloy UNS No. C66300			
H04	hard	76 (524)	91 (627)	84–91	68–77
H06	extra hard	88 (607)	103 (710)	87–94	75–83
H08	spring	95 (655)	110 (758)	92–96	79–87
H10	extra spring	100 (689)	114 (786)	94–97	82–88
H14	super spring	105 (724)		95 min	85 min

[A] Standard designation defined in Practice B 601.
[B] ksi = 1000 psi.
[C] See Appendix X1.

TABLE 3 Electrical Resistivity

Copper Alloy UNS C66300		
Temper	Electrical Resistivity at 20 °C (68 °F), $\Omega \cdot g/m^2$	Equivalent Conductivity at 20 °C (68 °F), % IACS
H04, H06, H08, H10, H14	0.6148	25 % min
HR04, HR08, HR10	0.6148	25 % min
O82 (½ HD ATT)	0.6148	25 % min
Copper Alloy UNS C68800		
Temper	Electrical Resistivity at 20 °C (68 °F), $\Omega \cdot g/m^2$	Equivalent Conductivity at 20 °C (68 °F), % IACS
H01 H02, H04, H06, H08, H10	0.5768	18 % min
O61	0.5768	18 % min

E 18 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 Agencies*—When identified in the contract or purchase order, product purchased for agencies of the U.S. Government shall conform to the special government requirements stipulated in the supplemental requirements given in Specification B 248.

13. Dimension, Mass, and Permissible Variations

13.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B 248 with particular reference to the following tables and related paragraphs in that specification:

13.1.1 *Thickness*—Tolerances, Table 1.

13.1.2 *Width*:

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

13.1.2.2 *Tolerances for Square Sheared Metal*—Table 5.

13.1.2.3 *Tolerances for Sawed Metal*—Table 6.

13.1.3 *Length*:

13.1.3.1 *Tolerances for Straight Lengths*—Table 7.

13.1.3.2 *Schedule of Minimum Lengths with Ends*—Table 8.

13.1.3.3 *Tolerances for Square Sheared Metal*—Table 9.

13.1.3.4 *Tolerances for Sawed Metal*—Table 10.

13.1.4 *Straightness*:

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

13.1.4.2 *Tolerances for Squared-Sheared Metal*—Table 12.

13.1.4.3 *Tolerances for Sawed Metal*—Table 13.

13.1.5 *Edges*:

13.1.5.1 *Tolerances for Radius of Square Edges*—Table 14.

13.1.5.2 *Tolerances for Radius of Round Corners*—Table 15.

13.1.5.3 *Tolerances for Radius of Rounded Edges*—Table 16.

13.1.5.4 *Tolerances for Radius of Full-Rounded Edges*—Table 17.

14. Sampling

14.1 *Chemical Analysis*:

14.1.1 The sample for chemical analysis shall be taken from the pieces selected and combined into one composite sample in accordance with Practice E 255 for product in its final form. The minimum weight of the composite sample shall be 150 g.

14.1.2 Instead of sampling in accordance with Practice E 255, the manufacturer shall have the option of taking samples at the time the castings are poured or by taking samples from the semi-finished product.

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

14.1.3 The number of samples to be taken for determination

of chemical composition shall be as follows:

14.1.3.1 When sampled 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.

14.1.3.2 When sampled from the semi-finished product, at least one sample shall be taken to represent each 10 000 lb, or fraction thereof, except that not more than one sample shall be required per piece.

14.1.3.3 Only one sample need be taken from the semi-finished product of one cast bar from a single furnace melt charge continuously processed.

15. Test Methods

15.1 *Chemical Analysis*—Chemical composition shall, in case of disagreement, be determined as follows:

Element	ASTM Test Method
Aluminum	E 478
Cobalt	E 75 (Photometric)
Copper	E 478
Iron	E 76 (AA)
Lead	E 478 (AA)
Nickel	E 478 (Photometric)
Zinc	E 478 (AA)

15.1.1 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 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

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 ($N = kg \cdot m/s^2$). 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 (B 592 – 98) that may impact the use of this standard.

(*1*) Alloy C66300 was added to the scope of this standard.
(*2*) Alloy C66300 tempers were added to Table 2
(*3*) Alloy C66300 chemistry was added to Table 1.
(*4*) Table 3 was added.