



Designation: B248 – 22

Standard Specification for General Requirements for Wrought Copper and Copper- Alloy Plate, Sheet, Strip, and Rolled Bar¹

This standard is issued under the fixed designation B248; 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 general requirements common to several wrought product specifications. Unless otherwise specified in the purchase order or in an individual specification, these general requirements shall apply to copper and copper-alloy plate, sheet, strip, and rolled bar supplied under each of the following product specifications issued by ASTM: **B19**, **B36/B36M**, **B96/B96M**, **B101**, **B103/B103M**, **B121/B121M**, **B122/B122M**, **B130**, **B152/B152M**, **B169/B169M**, **B194**, **B370**, **B422/B422M**, **B465**, **B534**, **B591**, **B592**, **B694**, **B740**, **B747**, **B768**, **B888/B888M**, and **B936**.²

1.2 *Units*—This specification is the companion specification to SI Specification **B248M**; therefore, no SI equivalents are shown in this specification.

1.3 *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:³

¹ This specification is under the jurisdiction of the 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.

- [B19 Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks](#)
- [B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar](#)
- [B96/B96M Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels](#)
- [B100 Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use](#)
- [B101 Specification for Lead-Coated Copper Sheet and Strip for Building Construction](#)
- [B103/B103M Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar](#)
- [B121/B121M Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar](#)
- [B122/B122M Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy \(Nickel Silver\), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar](#)
- [B130 Specification for Commercial Bronze Strip for Bullet Jackets](#)
- [B152/B152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar](#)
- [B169/B169M Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar](#)
- [B193 Test Method for Resistivity of Electrical Conductor Materials](#)
- [B194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar](#)
- [B248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar \(Metric\)](#)
- [B370 Specification for Copper Sheet and Strip for Building Construction](#)
- [B422/B422M Specification for Copper-Aluminum-Silicon-Cobalt Alloy, Copper-Nickel-Silicon-Magnesium Alloy, Copper-Nickel-Silicon Alloy, Copper-Nickel-Aluminum-Magnesium Alloy, and Copper-Nickel-Tin Alloy Sheet and Strip](#)

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

B465 Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar

B534 Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

B591 Specification for Copper-Zinc-Tin and Copper-Zinc-Tin-Iron-Nickel Alloys Plate, Sheet, Strip, and Rolled Bar

B592 Specification for Copper-Zinc-Aluminum-Cobalt Alloy, Copper-Zinc-Tin-Iron Alloy Plate, Sheet, Strip, and Rolled Bar

B694 Specification for Copper, Copper-Alloy, Copper-Clad Bronze (CCB), Copper-Clad Stainless Steel (CCS), and Copper-Clad Alloy Steel (CAS) Sheet and Strip for Electrical Cable Shielding

B740 Specification for Copper-Nickel-Tin Spinodal Alloy Strip

B747 Specification for Copper-Zirconium Alloy Sheet and Strip

B768 Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Strip and Sheet

B820 Test Method for Bend Test for Determining the Formability of Copper and Copper Alloy Strip

B846 Terminology for Copper and Copper Alloys

B888/B888M Specification for Copper Alloy Strip for Use in Manufacture of Electrical Connectors or Spring Contacts

B936 Specification for Copper-Chromium-Iron-Titanium Alloy Plate, Sheet, Strip and Rolled Bar

E8/E8M Test Methods for Tension Testing of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials

E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry (Withdrawn 2022)⁴

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

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)⁴

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

E106 Test Methods for Chemical Analysis of Copper-Beryllium Alloys (Withdrawn 2011)⁴

E112 Test Methods for Determining Average Grain Size

E118 Test Methods for Chemical Analysis of Copper-Chromium Alloys (Withdrawn 2010)⁴

E121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys (Withdrawn 2010)⁴

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

E478 Test Methods for Chemical Analysis of Copper Alloys

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

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

2.3 *ASME Code*:⁵

ASME Boiler and Pressure Vessel Code

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lengths, mill, n*—straight lengths, including ends, that can be conveniently manufactured in the mills. Full-length pieces are usually 8 ft, 10 ft, or 12 ft and subject to established length tolerances.

3.2.2 *lengths, stock, n*—straight lengths that are mill cut and stored in advance of orders. They are usually 8 ft, 10 ft, or 12 ft and subject to established length tolerances.

3.2.3 *rolled bar, n*—a rolled flat product over 0.188 in. thick and up to and including 12 in. wide, with sheared, sawed, or machined edges, in straight lengths or coils (rolls).

4. Materials and Manufacture

4.1 *Materials:*

4.1.1 The material of manufacture shall be a cast bar, cake, or slab of such purity and soundness as to be suitable for processing into the products to the product specification listed in Section 1.

4.1.2 When specified in the contract or purchase order that heat identification or traceability is required, the purchaser shall specify the details desired.

4.2 *Manufacture:*

4.2.1 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.

4.2.2 The product shall be hot- or cold-worked to the finished size and subsequently annealed, when required, to meet the temper properties specified.

4.3 *Edges*—The edges shall be slit, sheared, sawed, or rolled edges, as specified. Slit edges shall be furnished unless otherwise specified in the contract or purchase order. See **5.6** for edge descriptions and corresponding tables for tolerances.

5. Dimensions, Weights, and Permissible Variations

5.1 *General*—For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting values for any dimension may be cause for rejection.

NOTE 1—Blank spaces in the tolerance tables indicate either that the material is not available or that no tolerances have been established.

5.2 *Thickness*—The standard method of specifying thickness shall be in decimal fractions of an inch. For material

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

⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

0.021 in. and under in thickness, it is recommended that the nominal thicknesses be stated not closer than the nearest half-thousandth. (For example, specify 0.006 in. or 0.0065 in., but not 0.0063 in.) For material over 0.021 in. in thickness, it is recommended that the nominal thicknesses be stated not closer than the nearest thousandth. (For example, specify 0.128 in. or 0.129 in., but not 0.1285 in.) A list of preferred thicknesses is shown in **Appendix X1**. The thickness tolerances shall be those shown in **Tables 1-3** for the product specification indicated:

5.2.1 **Table 1**—Thickness tolerances applicable to Specifications **B36/B36M**, **B103/B103M**, **B121/B121M**, **B152/B152M**, **B465**, **B591**, **B592**, **B747**, and **B888/B888M**.

5.2.2 **Table 2**—Thickness tolerances applicable to Specifications **B96/B96M**, **B122/B122M**, **B169/B169M**, **B194**, **B422/B422M**, **B534**, **B740**, and **B768**.

5.2.3 **Table 3**—Special thickness tolerances applicable to Copper Alloy UNS No. C72500 when ordered to Specification **B122/B122M**, and to Specifications **B194**, **B534**, **B740**, and **B768** as noted in the table.

5.3 **Width**—The width tolerances shall be those shown in **Tables 4-6**, depending on the type of edge required (see **5.3.1**, **5.3.2**, and **5.3.3**):

5.3.1 **Table 4**—Width tolerances for slit metal and slit metal with rolled edges.

5.3.2 **Table 5**—Width tolerances for square-sheared metal.

5.3.3 **Table 6**—Width tolerances for sawed metal.

5.4 **Length**—The material shall be furnished in coils or straight lengths of plate, sheet, strip, or rolled bar as specified. The length tolerances for straight lengths shall be those shown in **Tables 7-10**, depending on the method of cutting required

(see **5.4.1 – 5.4.4**). When ends are permitted, the length and quantity of the ends shall be in accordance with the schedule in **Table 8**.

5.4.1 **Table 7**—Length tolerances, for straight lengths.

5.4.2 **Table 8**—Schedule of minimum length and maximum weight of ends for mill lengths specific lengths with ends, and stock lengths with ends.

5.4.3 **Table 9**—Length tolerances for square-sheared metal in all widths 120 in. and under.

5.4.4 **Table 10**—Length tolerances for sawed metal.

5.5 **Straightness**—The straightness tolerances, which are the maximum edgewise curvature (depth of arc) in any 72-in. portion of the total length, shall be those shown in **Tables 11-13**, depending on the type of edge required.

5.5.1 **Table 11**—Straightness tolerances for metal as slit, or as slit and straightened, or as slit and edge-rolled, or metal with drawn edges.

5.5.2 **Table 12**—Straightness tolerances for square-sheared metal.

5.5.3 **Table 13**—Straightness tolerances for sawed metal.

5.6 **Edges**—When rolled edges are required, they may be produced by either rolling or drawing to one of the following specified edge contours:

5.6.1 **Square Edges (Square Corners)**—Edges shall have commercially squared corners and with a maximum corner radius as prescribed in **Table 14**.

5.6.2 **Rounded Corners**—Edges shall have rounded corners as shown in **Fig. 1** with a radius as prescribed in **Table 15**.

5.6.3 **Rounded Edges**—Edges shall be rounded as shown in **Fig. 2** with a radius as prescribed in **Table 16**.

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<https://standards.iteh.ai/catalog/standards/sist/248-22-2021/4278-49b8-ba80-b363bed6b46/astm-b248-22>

TABLE 1 Thickness Tolerances

(Applicable to Specifications **B36/B36M**, **B103/B103M**, **B121/B121M**, **B152/B152M**, **B465**, **B591**, **B592**, **B747**, **B888/B888M**, and **B936**)

Thickness, in.	Thickness Tolerances, plus and minus, ^A in.								
	Strip					Sheet			
	8 in. and Under in Width	Over 8 to 12 in., incl, in Width	Over 12 to 14 in., incl, in Width	Over 14 to 20 in., incl, in Width	Over 20 to 24 in., incl, in Width	Over 24 to 28 in., incl, in Width	Over 28 to 36 in., incl, in Width	Over 36 to 48 in., incl, in Width	Over 48 to 60 in., incl, in Width
0.004 and under	0.0003	0.0006	0.0006	...	...	...	...	...	...
Over 0.004 to 0.006, incl	0.0004	0.0008	0.0008	0.0013	...	...	...	...	...
Over 0.006 to 0.009, incl	0.0006	0.0010	0.0010	0.0015	...	...	...	...	...
Over 0.009 to 0.013, incl	0.0008	0.0013	0.0013	0.0018	0.0025	0.0025	0.003	0.0035	0.004
Over 0.013 to 0.017, incl	0.0010	0.0015	0.0015	0.002	0.0025	0.0025	0.003	0.0035	0.0045
Over 0.017 to 0.021, incl	0.0013	0.0018	0.0018	0.002	0.003	0.003	0.0035	0.004	0.005
Over 0.021 to 0.026, incl	0.0015	0.002	0.002	0.0025	0.003	0.003	0.0035	0.004	0.005
Over 0.026 to 0.037, incl	0.002	0.002	0.002	0.0025	0.0035	0.0035	0.004	0.005	0.006
Over 0.037 to 0.050, incl	0.002	0.0025	0.0025	0.003	0.004	0.004	0.005	0.006	0.007
Over 0.050 to 0.073, incl	0.0025	0.003	0.003	0.0035	0.005	0.005	0.006	0.007	0.008
Over 0.073 to 0.130, incl	0.003	0.0035	0.0035	0.004	0.006	0.006	0.007	0.008	0.010
Over 0.130 to 0.188, incl	0.0035	0.004	0.004	0.0045	0.007	0.007	0.008	0.010	0.012
					Rolled Bar		Plate		
Over 0.188 to 0.205, incl	0.0035	0.004	0.004	0.0045	0.007	0.007	0.008	0.010	0.012
Over 0.205 to 0.300, incl	0.004	0.0045	0.0045	0.005	0.009	0.009	0.010	0.012	0.014
Over 0.300 to 0.500, incl	0.0045	0.005	0.005	0.006	0.012	0.012	0.013	0.015	0.018
Over 0.500 to 0.750, incl	0.0055	0.007	0.007	0.009	0.015	0.015	0.017	0.019	0.023
Over 0.750 to 1.00, incl	0.007	0.009	0.009	0.011	0.018	0.018	0.021	0.024	0.029
Over 1.00 to 1.50, incl	0.022	0.022	0.022	0.022	0.022	0.022	0.025	0.029	0.036
Over 1.50 to 2.00, incl	0.026	0.026	0.026	0.026	0.026	0.026	0.030	0.036	0.044

^A When tolerances are specified as all plus or all minus, double the values given.

TABLE 2 Thickness Tolerances

(Applicable to Specifications B96/B96M, B122/B122M, B169/B169M, B194, B422/B422M, B534, B740, and B768)

Thickness, in.	Thickness Tolerances, Plus and Minus, ^A in.								
	Strip					Sheet			
	8 in. and Under in Width	Over 8 to 12 in., incl, in Width	Over 12 to 14 in., incl, in Width	Over 14 to 20 in., incl, in Width	Over 20 to 24 in., incl, in Width	Over 24 to 28 in., incl, in Width	Over 28 to 36 in., incl, in Width	Over 36 to 48 in., incl, in Width	Over 48 to 60 in., incl, in Width
0.004 and under	0.0004	0.0008	0.0008	...	...	...	...	...	...
Over 0.004 to 0.006, incl	0.0006	0.0010	0.0010	0.0015	...	...	...	...	...
Over 0.006 to 0.009, incl	0.0008	0.0013	0.0013	0.002	...	...	...	...	...
Over 0.009 to 0.013, incl	0.0010	0.0015	0.0015	0.0025	...	...	...	...	...
Over 0.013 to 0.017, incl	0.0013	0.002	0.002	0.0025	...	...	...	...	...
Over 0.017 to 0.021, incl	0.0015	0.0025	0.0025	0.003	...	...	...	...	...
Over 0.021 to 0.026, incl	0.002	0.0025	0.0025	0.003	0.004	0.004	0.005	0.006	0.007
Over 0.026 to 0.037, incl	0.0025	0.003	0.003	0.0035	0.005	0.005	0.006	0.007	0.008
Over 0.037 to 0.050, incl	0.003	0.0035	0.0035	0.004	0.006	0.006	0.007	0.008	0.010
Over 0.050 to 0.073, incl	0.0035	0.004	0.004	0.0045	0.007	0.007	0.008	0.010	0.012
Over 0.073 to 0.130, incl	0.004	0.0045	0.0045	0.005	0.008	0.008	0.010	0.012	0.014
Over 0.130 to 0.188, incl	0.0045	0.005	0.005	0.006	0.010	0.010	0.012	0.014	0.016
	Rolled Bar					Plate			
Over 0.188 to 0.205, incl	0.0045	0.005	0.005	0.006	0.010	0.010	0.012	0.014	0.016
Over 0.205 to 0.300, incl	0.005	0.006	0.006	0.007	0.012	0.012	0.014	0.016	0.018
Over 0.300 to 0.500, incl	0.006	0.007	0.007	0.008	0.015	0.015	0.017	0.019	0.023
Over 0.500 to 0.750, incl	0.008	0.010	0.010	0.012	0.019	0.019	0.021	0.024	0.029
Over 0.750 to 1.00, incl	0.010	0.012	0.012	0.015	0.023	0.023	0.026	0.030	0.037
Over 1.00 to 1.50, incl	0.028	0.028	0.028	0.028	0.028	0.028	0.032	0.037	0.045
Over 1.50 to 2.00, incl	0.033	0.033	0.033	0.033	0.033	0.033	0.038	0.045	0.055

^A When tolerances are specified as all plus or all minus, double the values given.

TABLE 3 Special Thickness Tolerances

Thickness, in.	Tolerances Applicable to Copper Alloy UNS No. C72500, Specification B122/B122M	Tolerances Applicable to Specifications B194, B534, B740, and B768
	Tolerances, Plus and Minus, ^A in., for Strip 8 in. and Under in Width	Tolerances, Plus and Minus, ^A in., for Strip 4 in. and Under in Width
0.004 and under	0.0002	0.0002
Over 0.004 to 0.006, incl	0.0003	0.0003
Over 0.006 to 0.009, incl	0.0004	0.0005
Over 0.009 to 0.013, incl	0.0005	0.0006
Over 0.013 to 0.017, incl	0.0007	0.0007
Over 0.017 to 0.021, incl	0.0008	0.0008
Over 0.021 to 0.026, incl	0.0010	0.0010
Over 0.026 to 0.032, incl	0.0013	0.0010
Over 0.032 to 0.050, incl	0.0015	...

^A If tolerances are specified as all plus or all minus, double the values given.

TABLE 4 Width Tolerances for Slit Metal and Slit Metal with Rolled Edges

(Applicable to all specifications listed in 1.1)

Width, in.	Width Tolerances, ^A Plus and Minus, in.			
	For Thicknesses 0.004 to 0.032 in.	For Thicknesses Over 0.032 to 0.125 in.	For Thicknesses Over 0.125 to 0.188 in.	For Thicknesses Over 0.188 to 0.500 in.
	2 and under	0.005	0.010	0.012	0.015
Over 2 to 8, incl	0.008	0.013	0.015	0.015
Over 8 to 24, incl	1/64	1/64	1/64	1/32
Over 24 to 50, incl	1/32	1/32	1/32	3/64

^A If tolerances are specified as all plus or all minus, double the values given.

5.6.4 *Full-Rounded Edges*—Edges shall be full rounded as shown in Fig. 3 with a radius as prescribed in Table 17.

TABLE 5 Width Tolerances for Square-Sheared Metal

(Applicable to all specifications listed in 1.1)

NOTE 1—All lengths up to 120 in., incl.

Width, in.	Width Tolerances, ^A Plus and Minus, in.		
	1/16 in. and Under in Thickness	Over 1/16 to 1/8 in., incl, in Thickness	Over 1/8 in. in Thickness
20 and under	1/32	3/64	1/16
Over 20 to 36, incl	3/64	3/64	1/16
Over 36 to 120, incl	1/16	1/16	1/16

^A If tolerances are specified as all plus or all minus, double the values given.

TABLE 6 Width Tolerances for Sawed Metal

(Applicable to all specifications listed in 1.1)

Width, in.	Width Tolerances, ^A Plus and Minus, in.		
	For Lengths Up to 10 ft, incl		For Lengths Over 10 ft.
	For Thicknesses Up to 1 1/2 in., incl	For Thicknesses Over 1 1/2 in.	All Thicknesses
Up to 12, incl	1/32	1/16	1/16
Over 12 to 120, incl	1/16	1/16	1/16

^A If tolerances are specified as all plus or all minus, double the values given.

5.7 *Weight Tolerances for Hot-Rolled Material:*

5.7.1 **Table 18**—Lot weight tolerances for hot-rolled sheet and plate applicable to Specifications B36/B36M, B96/B96M (Copper Alloy UNS No. C65500), B103/B103M, B122/B122M, B152/B152M, and B591.

5.7.2 The weight of each lot of five or more plates or sheets of the same type and the same specified dimensions when ordered to thickness, shall not vary from the theoretical by more than the amount prescribed in Table 18 for the product specification indicated. The weight of any individual plate or

TABLE 7 Length Tolerances for Straight Lengths
(Applicable to all specifications listed in 1.1 except B694)

NOTE 1—The following length tolerances are all plus; if all minus tolerances are desired, use the same values; if tolerances are desired plus and minus, halve the values given.

Length ft.	Length Tolerances in.
Specific lengths, mill lengths, multiple lengths, and specific lengths with ends 10 and under	¼
Over 10 to 20, incl	½
Stock lengths and stock lengths with ends	1 ^A

^A As stock lengths are cut and placed in stock in advance of orders, departure from the tolerance is not practicable.

sheet may vary from the nominal by not more than one third in excess of the tolerances prescribed in Table 18 for the product specification indicated. The tolerances for lots of less than five plates or sheets shall be governed by the tolerances for individual plates or sheets.

5.7.3 For the purpose of calculation, the densities of the materials covered by these specifications are listed in Appendix X2.

6. Workmanship, Finish, and Appearance

6.1 The product shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable. A superficial film of residual light lubricant is normally present and is acceptable unless otherwise specified.

7. Sampling

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

7.1.1 *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 and that has been continuously processed and subject to inspection at one time.

7.1.2 *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.

7.1.2.1 *Chemical Analysis*—A sample for chemical analysis shall be taken in accordance with Practice E255 for product in its final form. Unless otherwise required by the purchaser, at the time the order is placed, the manufacturer shall have the option of determining conformance to chemical composition by analyzing samples taken at the time the castings are poured or samples taken from the semi-finished product if heat identity can be maintained throughout all operations. If the manufacturer determines the chemical composition during manufacture, he shall not be required to sample and analyze the finished product. The minimum weight of the composite sample in accordance with Practice E255 shall be as follows:

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Weight of Sample, min, g

B36/B36M, B96/B96M, B100, B101, B121/B121M, B122/B122M, B152/B152M, B169/B169M, B194, B370, B422/B422M, B465, B534, B591, B592, B740, B747, B768, B888/B888M, and B936

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7.1.2.2 *Samples for All Other Tests*—Samples for all other tests shall be taken from the sample portion in 7.1.2 and be of a convenient size to accommodate the test and comply with the requirements of the appropriate ASTM standards and test methods.

8. Number of Tests and Retests

8.1 Chemical Requirements:

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

8.1.2 When samples are taken from the semi-finished or finished product, at least one sample representative of the product of each cast bar from a single melt charge continuously processed with heat identity maintained shall be analyzed.

8.1.3 When samples are taken from the semi-finished or finished product and heat identity has not been maintained, a single sample representative of each 10 000 lb lot, or fraction thereof, shall be analyzed. When the product piece is greater than 10 000 lb, one sample to be representative of the product piece shall be analyzed.

8.2 *Mechanical and Electrical Requirements and Grain Size*—Unless otherwise provided in the product specification, test specimens shall be taken from each of the two of the sample pieces selected in accordance with 7.1.2. The required tests shall be made on each of the specimens. In the case of copper alloy Specifications B194, B534, and B740, one specimen shall be tested without further treatment, and the other specimen shall be tested after precipitation hardening. In the case of the requirements in Table 4, Mill Hardened Tempers, in Specifications B194 and B740, the two specimens need to be tested, because the product is in the precipitation hardened temper as supplied. The reported value shall be the arithmetic average of the readings. In the case of hardness, three readings shall be taken and averaged for each sample.

8.3 Retests:

8.3.1 When requested by the manufacturer or supplier, a retest shall be permitted when results of tests obtained by the purchaser fail to conform to the requirements of the product specification.

8.3.2 The retest shall be as directed in the product specification for the initial test, except the number of test specimens shall be twice that normally required for the specified test.

8.3.3 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

8.3.4 If the percentage of elongation of any tension test specimen is less than that specified and any part of the fracture is outside the middle two thirds of the gage length or in a punched or scribed mark within the reduced section, a retest shall be allowed.

TABLE 8 Schedule of Minimum Length and Maximum Weight of Ends for Mill Lengths, Specific Lengths with Ends, and Stock Lengths with Ends
(Applicable to all specifications listed in 1.1 except B694)

Nominal Length, ft	0.050 in. and Under in Thickness		Over 0.050 to 0.125 in., incl, in Thickness		Over 0.125 to 0.250 in., incl, in Thickness	
	Minimum Length of Shortest Piece, ft	Maximum Permissible Weight of Ends, % of Lot Weight	Minimum Length of Shortest Piece, ft	Maximum Permissible Weight of Ends, % of Lot Weight	Minimum Length of Shortest Piece, ft	Maximum Permissible Weight of Ends, % of Lot Weight
6 to 8, incl	4	20	4	25	3	30
8 to 10, incl	6	25	5	30	4	35
10 to 14, incl	7	30	6	35	5	40

TABLE 9 Length Tolerances for Square-Sheared Metal in All Widths 120 in. and Under
(Applicable to all specifications listed in 1.1 except B694)

Length, in.	Length Tolerance, ^A Plus and Minus, in.		
	For Thicknesses Up to 1/16 in., incl	For Thicknesses Over 1/16 to 1/8 in., incl	For Thicknesses Over 1/8 in.
20 and under	1/32	3/64	1/16
Over 20 to 36, incl	3/64	3/64	1/16
Over 36 to 120, incl	1/16	1/16	1/16

^A If tolerances are specified as all plus or all minus, double the values given.

TABLE 10 Length Tolerances for Sawed Metal
(Applicable to all specifications listed in 1.1 except B694)

NOTE 1—The following tolerances are all plus; if all minus tolerances are desired, use the same values; if tolerances are desired plus and minus, halve the values given.

Width, in.	Length Tolerance, in.
Up to 120, incl	1/4

TABLE 11 Straightness Tolerances for Slit Metal or Slit Metal Either Straightened or Edge-Rolled
(Applicable to all specifications listed in 1.1)

Width, in.	Maximum Edgewise Curvature (Depth of Arc) in any 72-in. Portion of the Total Length		
	Straightness Tolerance, in.		
	As Slit Only	As Slit and Either Straightened or Edge Rolled	
	Shipped in Rolls	Shipped Flat	Shipped Flat, in Rolls, or on Bucks
Over 1/4 to 3/8, incl	2	1 1/2	1/2
Over 3/8 to 1/2, incl	1 1/2	1	1/2
Over 1/2 to 1, incl	1	3/4	1/2
Over 1 to 2, incl	5/8	5/8	3/8
Over 2 to 4, incl	1/2	1/2	3/8
Over 4	3/8	3/8	3/8

8.3.5 If a bend test specimen fails because of conditions of bending more severe than required by the specification, a retest shall be permitted, either on a duplicate specimen or on a remaining portion of the failed specimen.

TABLE 12 Straightness Tolerances for Square-Sheared Metal
(Applicable to all specifications listed in 1.1)
(Not applicable to metal over 120 in. in length)

Thickness, in.	Maximum Edgewise Curvature (Depth of Arc) in any 72-in. Portion of the Total Length	
	Straightness Tolerances, in.	
	Up to 10 in., incl, in Width	Over 10 in., in Width
1/8 and under	1/16	1/32
Over 1/8 to 3/16, incl	1/8	3/64
Over 3/16	1/8	1/16

TABLE 13 Straightness Tolerances for Sawed Metal
(Applicable to all specifications listed in 1.1)
(Not applicable to metal over 144 in. in length)

Width, in.	Maximum Edgewise Curvature (Depth of Arc) in any 72 in. Portion of the Total Length	
	Straightness Tolerances, in.	
3 and under	1/16	
Over 3	3/64	

TABLE 14 Tolerances for Radius of Commercially Square Corners of Rolled or Drawn Edges with Square Corners
(Applicable to all specifications listed in 1.1 except B694)

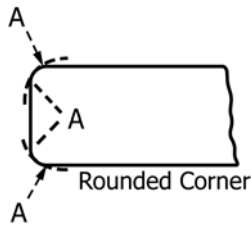
Thickness, in.	Permissible Radius of Corners, max, in.
0.032 to 0.064, incl	0.010
Over 0.064 to 0.188, incl	0.016
Over 0.188 to 1, incl	1/32

8.3.6 After removal of defective specimens and correction of test methods, only one retest cycle is permitted. If after the retest the material fails to meet the requirements of this specification, it shall be rejected.

8.3.7 All test specimens shall conform to the product specification requirement(s) in retest. Failure to conform shall be cause for rejection.

9. Specimen Preparation

9.1 *Chemical Analysis*—A composite sample of the semi-finished or finished product shall be prepared in accordance with Practice E255, or as described in 7.1.2.1.



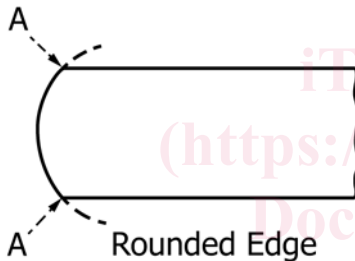
NOTE 1—The arc of the rounded corner shall not necessarily be tangent at points “A,” but the product shall be commercially free from sharp, rough, or projecting edges.

FIG. 1 Rounded Corners

TABLE 15 Tolerances for Radius on Corners of Rolled or Drawn Edges with Rounded Corners
(Applicable to all specifications listed in 1.1 except B694)

Thickness, in.	Radius of Corners, in.	
	Min	Max
Up to 0.125, incl ^A	...	...
Over 0.125 to 0.188, incl	0.016	0.048
Over 0.188 to 1, incl	0.031	0.094
Over 1 to 2, incl	0.063	0.188

^A Not available.



NOTE 1—The arc of the rounded edge shall be substantially symmetrical with the axis of the product. The corners “A” will usually be sharp but shall not have rough or projecting edges.

FIG. 2 Rounded Edge

TABLE 16 Tolerances for Radius of Rolled or Drawn Rounded Edges
(Applicable to all specifications listed in 1.1 except B694)

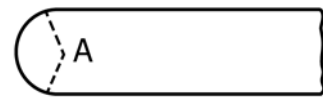
Thickness, in.	Radius of Edges ^A	
	Min	Max
Up to 0.188, incl	$\frac{3}{4} t$	$1\frac{3}{4} t$
Over 0.188	$1 t$	$1\frac{1}{2} t$

^A The t refers to the measured thickness of the test specimen.

9.2 Specimens shall be prepared in accordance with the method prescribed in 10.3 for all other tests. Full cross-section specimens shall be used whenever possible. Samples shall be representative of the condition of the material, and particular specimen preparation techniques shall be stated in the specific product specification.

10. Test Methods

10.1 The test method(s) used for quality control or production control, or both, for determination of conformance with product property requirements are discretionary.



Full Rounded Edge

NOTE 1—The arc of the rounded edge shall not necessarily be tangent at points “A” but shall be substantially symmetrical with the axis of the product, and the product shall be commercially free from sharp, rough, or projecting edges.

FIG. 3 Full Rounded Edge

TABLE 17 Tolerances for Radius of Rolled or Drawn Full-Rounded Edges
(Applicable to all specifications listed in 1.1 except B694)

Thickness, in.	Radius of Edges ^A	
	Min	Max
All thicknesses	$\frac{1}{2} t$	$\frac{3}{4} t$

^A The t refers to the thickness of the test specimen.

TABLE 18 Lot Weight Tolerances for Hot-Rolled Sheet and Plate
(Applicable to Specifications B36/B36M, B96/B96M (Copper Alloy UNS Nos. C65500), B103/B103M, B122/B122M, B152/B152M, and B591)

Thickness, in.	Weight Tolerances, Plus and Minus, Percentage of Theoretical Weight				
	48 in. and Under in Width	Over 48 to 60 in., incl. in Width	Over 60 to 72 in., incl. in Width	Over 72 to 90 in., incl. in Width	Over 90 to 110 in., incl. in Width
	$\frac{1}{8}$ and under	8	9.5	11	12.5	14
Over $\frac{1}{8}$ to $\frac{3}{16}$, incl	6.5	8	9.5	11	12.5
Over $\frac{3}{16}$ to $\frac{1}{4}$, incl	6	7.5	8.5	9	10
Over $\frac{1}{4}$ to $\frac{5}{16}$, incl	5.5	7	8	8.5	9
Over $\frac{5}{16}$ to $\frac{3}{8}$, incl	5	6	7	7.5	8
Over $\frac{3}{8}$ to $\frac{7}{16}$, incl	4.5	5	6	7	7.5
Over $\frac{7}{16}$ to $\frac{1}{2}$, incl	4	4.5	5.5	6	6.5
Over $\frac{1}{2}$ to $\frac{5}{8}$, incl	3.5	4.5	5	5.5	6
Over $\frac{5}{8}$ to $\frac{3}{4}$, incl	3	4	4.5	5	5.5
Over $\frac{3}{4}$ to 1, incl	2.75	3.5	4	4.5	5
Over 1 to $1\frac{1}{2}$, incl	2.5	3	3.5	4	4.5
Over $1\frac{1}{2}$ to 2, incl	2.25	2.75	3.25	3.75	4.25

10.1.1 The test method(s) used to obtain data for preparation of certification or test report, or both, shall be made available to the purchaser upon request.

10.2 Chemical Composition:

10.2.1 In case of disagreement, test method(s) for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser.

10.2.2 The following Test Methods E53, E54, E62, E75, E106, E118, E121, or E478 include published test methods, which may no longer be viable, for reference.

10.2.3 The specific method to be used for each specified element may be prescribed in the product specification.

10.2.4 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 purchaser.