Designation: B 248M – 96
METRIC

Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar [Metric][1]

This standard is issued under the fixed designation B 248M; 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 covers a group of 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: B 36/B 36M, B 96M, B 103/B 103M, B 121/B 121M, B 122/B 122M, B 152M, B 169M, B 194, B 291, B 422, B 465, B 534, B 591, B 592, B 694, B 740, B 747, and B 768.[2]

NOTE 1—This specification is the metric companion of Specification B 248.

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:*

B 36/B 36M Specification for Brass Plate, Sheet, Strip, and Rolled Bar[3]

B 96M Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels [Metric][3]

B 103/B 103M Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar[3]

B 121/B 121M Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar[3]

B 122/B 122M Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar [Metric][3]

B 169M Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar [Metric][3]

B 193 Test Method for Resistivity of Electrical Conductor Materials[4]

B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 291 Specification for Copper-Zinc-Manganese Alloy (Manganese Brass) Sheet and Strip[3]

B 422 Specification for Copper-Aluminum-Silicon-Cobalt Alloy, Copper-Nickel-Silicon-Magnesium Alloy, and Copper-Nickel-Aluminum-Magnesium Alloy Sheet and Strip[3]

B 465 Specification for Copper-Iron Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 534 Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar[3]

B 591 Specification for Copper-Zinc-Tin Alloys Plate, Sheet, Strip, and Rolled Bar[3]

B 592 Specification for Copper-Zinc-Aluminum-Cobalt Plate, Sheet, Strip, and Rolled Bar[3]

B 694 Specification for Copper, Copper-Alloy, and Copper-Clad Stainless Steel (CCS), and Copper-Clad Alloy Steel (CAS) Sheet and Strip for Electrical Cable Shielding[3]

B 740 Specification for Copper-Nickel-Tin Spinodal Alloy Strip[3]

B 747 Specification for Copper-Zirconium Alloy Sheet and Strip[3]

B 768 Specification for Copper-Cobalt-Beryllium Alloy Strip and Sheet[3]

E 8M Test Methods for Tension Testing of Metallic Materials [Metric][5]

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials[5]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[6]

[1] This specification is under the jurisdiction of ASTM Committee B-5 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 E 527) 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] *Annual Book of ASTM Standards*, Vol 02.01.

[4] *Annual Book of ASTM Standards*, Vol 02.03.

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

[6] *Annual Book of ASTM Standards*, Vol 14.02.

E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals[7]
E 53 Test Methods for Chemical Analysis of Copper[7]
E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes[7]
E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[7]
E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)[7]
E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys[7]
E 106 Test Methods for Chemical Analysis of Copper-Beryllium Alloys[7]
E 112 Test Methods for Determining the Average Grain Size[5]
E 118 Test Methods for Chemical Analysis of Copper-Chromium Alloys[7]
E 121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys[7]
E 478 Test Methods for Chemical Analysis of Copper Alloys[7]
E 527 Practice for Numbering Metals and Alloys (UNS)[8]

3. Terminology

3.1 *Definitions:*

3.1.1 *blank*—a piece of flat product intended for subsequent fabrication by forming, bending, cupping, drawing, or hot pressing, etc.

3.1.2 *coil*—a length of the product wound into a series of connected turns. The unqualified term "coil" as applied to "flat product" usually refers to a coil in which the product is spirally wound, with the successive layers on top of one another. (Sometimes called a "roll".)

3.1.2.1 *level or traverse wound*—a coil in which the turns are positioned into layers parallel to the axis of the coil such that successive turns in a given layer are next to one another.

3.1.2.2 *level or traverse wound on a reel or spool*—a coil in which the turns are positioned into layers on a reel or spool parallel to the axis of the reel or spool such that successive turns in a given layer are next to one another.

3.1.3 *lengths*—straight pieces of the product.

3.1.3.1 *ends*—straight pieces, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specific lengths. They are subject to minimum length and maximum weight requirements.

3.1.3.2 *mill*—straight lengths, including ends, that can be conveniently manufactured in the mills. Full length pieces are usually 2400, 3000, or 3600 mm and subject to established length tolerances.

3.1.3.3 *multiple*—straight lengths of integral multiples of a base length, with suitable allowance for cutting if and as specified.

3.1.3.4 *specific*—straight lengths that are uniform in length, as specified, and subject to established length tolerances.

3.1.3.5 *specific with ends*—specific lengths, including ends.

3.1.3.6 *stock*—straight lengths that are mill cut and stored in advance of orders. They are usually 2400, 3000, or 3600 mm and subject to established length tolerances.

3.1.3.7 *stock with ends*—stock lengths, including ends.

3.1.4 *plate*—a wrought flat product over 5 mm thick and over 300 mm wide in straight lengths or coils (rolls).

3.1.5 *reel or spool*—a cylindrical device that has a rim at each end and an axial hole for a shaft or spindle, and on which the product is wound to facilitate handling and shipping.

3.1.6 *rolled bar*—a rolled flat product over 5 mm thick and up to and including 300 mm wide, with sheared, sawed, or machined edges, in straight lengths or coils (rolls).

3.1.7 *sheet*—a rolled flat product up to and including 5 mm thick and over 600 mm wide in straight lengths or coils (rolls).

3.1.8 *strip*—a rolled flat product other than flat wire up to and including 5 mm thick in straight lengths, coils (rolls), or traverse wound on reels or spools:

3.1.8.1 with slit or sheared edges in widths up to 600 mm inclusive, and

3.1.8.2 with finished drawn or rolled edges, in widths over 30 mm to 300 mm inclusive.

4. Materials and Manufacture

4.1 *Materials*—The material shall be of such quality and purity that the finished product shall have the properties and characteristics prescribed in the applicable product specification listed in Section 1.

4.2 *Manufacture*—The material shall be produced by either hot- or cold-working operations. It shall be finished, unless otherwise specified, by such hot working, cold working, annealing, or heat treatment as may be necessary to meet the properties specified.

4.3 *Edges*—The edges shall be slit, shared, sawed, or rolled edges, as specified. Slit edges shall be furnished unless otherwise specified or agreed between the purchaser and supplier or manufacturer. See 5.6 for edge descriptions and tolerances.

5. Dimensions, Mass, 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 2—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 a millimetre. For material 0.50 mm and under in thickness, it is recommended that the nominal thicknesses be stated not closer than the nearest 0.01 mm. A list of preferred thicknesses is shown in Appendix X1. The thickness tolerances shall be those shown in Table 1, Table 2, and Table 3 for the product specification indicated:

5.2.1 *Table 1*—Thickness tolerances applicable to Specifications B 36/B 36M, B 121/B 121M, B 152M, B 291, B 465, B 591 (Copper Alloy UNS No. C41100), B 592, and B 747.

5.2.2 *Table 2*—Thickness tolerances applicable to Specifications B 96M, B 103/B 103M, B122/B 122M, B 169M, B 194, B 422, B 534, B 591, B 740 (except Copper Alloy UNS No. C41100), and B 768.

[7] *Annual Book of ASTM Standards*, Vol 03.05.
[8] *Annual Book of ASTM Standards*, Vol 01.01.

TABLE 1 Thickness Tolerances

(Applicable to Specifications B 36/B 36M, B 121/B 121M, B 152M, B 291, B 465, B 591 (Copper Alloy UNS No. C41100), B 592, and B 747)

Thickness, mm		Thickness Tolerances, Plus and Minus, mm						
		Strip			Sheet			
Over	Through	Up to 200 mm, incl, in Width	Over 200 mm to 300 mm, incl, in Width	Over 300 mm to 600 mm, incl, in Width	Over 600 mm to 700 mm, incl, in Width	Over 700 mm to 900 mm, incl, in Width	Over 900 mm to 1200 mm, incl, in Width	Over 1200 mm to 1600 mm, incl, in Width
	0.10	0.007	0.015	...	...	...	...	...
0.10	0.20	0.01	0.02	0.03	...	...	...	...
0.20	0.30	0.015	0.025	0.035	...	...	...	...
0.30	0.40	0.02	0.03	0.045	0.06	0.08	0.09	0.10
0.40	0.50	0.025	0.035	0.05	0.06	0.08	0.09	0.11
0.50	0.60	0.03	0.04	0.05	0.08	0.09	0.10	0.12
0.60	0.70	0.035	0.05	0.06	0.08	0.09	0.10	0.12
0.70	1.0	0.045	0.05	0.06	0.09	0.10	0.12	0.15
1.0	1.3	0.05	0.06	0.07	0.10	0.12	0.15	0.17
1.3	2.0	0.06	0.07	0.08	0.12	0.15	0.17	0.20
2.0	3.5	0.07	0.08	0.10	0.15	0.17	0.20	0.25
3.5	5.0	0.08	0.10	0.11	.17	0.20	0.25	0.30
		Rolled Bar		Plate				
5.0	8.0	0.10	0.11	0.12	0.22	0.25	0.30	0.35
8.0	13.0	0.11	0.12	0.15	0.30	0.35	0.40	0.45
13.0	20.0	0.13	0.17	0.22	0.40	0.45	0.50	0.60
20.0	30.0	0.17	0.22	0.27	0.45	0.55	0.60	0.75
30.0	40.0	0.55	0.55	0.55	0.55	0.65	0.75	0.90
40.0	60.0	0.65	0.65	0.65	0.65	0.75	0.90	1.1

TABLE 2 Thickness Tolerances

(Applicable to Specifications B 96M, B 103/B 103M, B 122/B 122M, B 169M, B 194, B 422, B 534, B 591, B 740 (except Copper Alloy UNS No. C41100), and B 768)

Thickness, mm		Thickness Tolerances, Plus and Minus, mm						
		Strip			Sheet			
Over	Through	Up to 200 mm, incl, in Width	Over 200 mm to 300 mm, incl, in Width	Over 300 mm to 600 mm, incl, in Width	Over 600 mm to 700 mm, incl, in Width	Over 700 mm to 900 mm, incl, in Width	Over 900 mm to 1200 mm, incl, in Width	Over 1200 mm to 1600 mm, incl, in Width
	0.10	0.01	0.02	...	...	...	...	...
0.10	0.20	0.015	0.025	0.035	...	...	...	...
0.20	0.30	0.02	0.03	0.05	...	...	...	...
0.30	0.40	0.025	0.035	0.06	...	...	...	...
0.40	0.50	0.03	0.05	0.06	...	...	...	...
0.50	0.60	0.035	0.06	0.07	...	...	...	...
0.60	0.70	0.05	0.06	0.07	0.10	0.13	0.15	0.18
0.70	1.0	0.06	0.07	0.08	0.13	0.15	0.18	0.20
1.0	1.3	0.07	0.08	0.10	0.15	0.18	0.20	0.25
1.3	2.0	0.08	0.10	0.11	0.18	0.20	0.25	0.30
2.0	3.5	0.10	0.11	0.12	0.20	0.25	0.30	0.35
3.5	5.0	0.11	0.13	0.15	0.25	0.30	0.35	0.40
		Rolled Bar		Plate				
5.0	8.0	0.13	0.15	0.18	0.30	0.35	0.40	0.45
8.0	13.0	0.15	0.18	0.20	0.40	0.45	0.50	0.60
13.0	20.0	0.20	0.25	0.30	0.50	0.55	0.60	0.75
20.0	30.0	0.30	0.40	0.50	0.60	0.65	0.75	0.95
30.0	40.0	0.70	0.70	0.70	0.70	0.80	0.95	1.2
40.0	60.0	0.85	0.85	0.85	0.85	0.95	1.1	1.4

5.2.3 *Table 3*—Special thickness tolerances applicable to Copper Alloy UNS No. C72500 when ordered to Specification B 122/B 122M and to Specifications B 194, B 534, B 740, and B 768 as noted in the table.

5.3 *Width*—The width tolerances shall be those shown in Table 4, Table 5, and Table 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 Table 7, Table 8, or Table 9, depending on the method of cutting required (see 5.4.1, 5.4.2, and 5.4.3). When ends are permitted, the length and quantity of the ends shall be in accordance with the schedule in Table 8.

TABLE 3 Special Thickness Tolerances

Thickness, mm	Tolerances Applicable to Copper Alloy UNS No. C72500, Specifications B 122/B 122M and B740 Tolerances, Plus and Minus,[A] mm for Strip 200 mm and Under in Width	Tolerances Applicable to Specifications B 194, B534, and B 768 Tolerances, Plus and Minus,[A] mm for Strip 100 mm and Under in Width
0.10 and under	0.005	0.005
Over 0.10 to 0.16, incl	0.008	0.008
Over 0.016 to 0.22, incl	0.010	0.013
Over 0.22 to 0.35, incl	0.013	0.015
Over 0.35 to 0.45, incl	0.018	0.018
Over 0.45 to 0.55, incl	0.020	0.020
Over 0.55 to 0.60, incl	0.025	0.025
Over 0.65 to 0.80, incl	0.033	0.025
Over 0.80 to 1.2, incl	0.038	...

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

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 lengths with ends.

5.4.3 *Table 9*—Length tolerances for square-sheared metal.

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 1800-mm portion of the total length, shall be those shown in Table 11, Table 12, and Table 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 square corners with a permissible maximum 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.

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

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 B 96M (Copper Alloy UNS Nos. C65500 and C65800) and B 152M.

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 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 material shall be free of defects, but blemishes of a nature that do not interfere with normal commercial operations are acceptable. It shall be well cleaned and free of dirt. A superficial film of residual light lubricant is normally present and is acceptable unless otherwise specified.

6.2 The surface finish and appearance shall be the normal commercial quality for the alloy, thickness, and temper ordered. When application information is provided with purchase order, the surface shall be that commercially producible for the application. Superficial films of discoloration, or lubricants, or tarnish inhibitors are permissible 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 5000 kg 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 12 000 kg that has been continuously processed and subject to inspection at one time.

7.1.2 *Portion Size*—A portion shall be four or more pieces selected to be representative of each lot. If the lot consists of less than four pieces, representative samples shall be taken from each piece.

7.1.2.1 *Chemical Analysis*—A sample for chemical analysis shall be taken in accordance with Practice E 55 for product in its final form. Unless required otherwise 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 semifinished product, if heat identity can be maintained throughout all operations. If the manufacturer determined the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product. The minimum weight of the composite sample in accordance with Practice E 55 shall be as follows:

ASTM Designation	Weight of Sample, min, g
B 36/B 36M, B 96M, B 121/B 121M, B 122/B 122M, B 152M, B 169M, B 194, B 291, B 422, B 465, B 534, B 591, B 592, and B 740	150
B 103/B 103M	225

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 standard 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

TABLE 4 Width Tolerances for Slit Metal and Slit Metal with Rolled Edges
(Applicable to all specifications listed in 2.1.1)

Width, mm	Width Tolerances,[A] Plus and Minus, mm			
	For Thicknesses 0.102 to 0.80 mm, incl	For Thicknesses Over 0.80 to 3.2 mm, incl	For Thicknesses Over 3.2 to 5.0 mm, incl	For Thicknesses Over 5.0 to 12.0 mm, incl
50.8 and under	0.13	0.25	0.30	0.38
Over 50.8 to 200, incl	0.20	0.33	0.38	0.38
Over 200 to 600, incl	0.40	0.40	0.40	0.79
Over 600 to 1020, incl	0.79	0.79	0.79	1.19

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

TABLE 5 Width Tolerances for Square-Sheared Metal
(Applicable to all specifications listed in 2.1.1)

NOTE 1—All Lengths up to 3.05 m, inclusive.

Width, mm	Width Tolerances,[A] Plus and Minus, mm		
	1.59 mm and Under in Thickness	Over 1.5 mm to 3.5 mm, incl, in Thickness	Over 3.5 mm in Thickness
500 and under	0.79	1.2	1.6
Over 500 to 900, incl	1.2	1.2	1.6
Over 900 to 3000, incl	1.6	1.6	1.6

[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 2.1.1)

Width, mm	Width Tolerances,[A] Plus and Minus, mm		
	For Lengths Up to 3000 mm, incl		For Length Over 3000 mm
	For Thicknesses Up to 38 mm, incl	For Thicknesses Over 38.1 mm	All Thicknesses
Up to 300, incl	0.79	1.6	1.6
Over 300 to 3000, incl	1.6	1.6	1.6

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

TABLE 7 Length Tolerances for Straight Lengths
(Applicable to all specifications listed in 2.1.1 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, mm	Length Tolerances, mm
Specific lengths, mill lengths, multiple lengths, and specific lengths with ends	
3000 and under	6.4
Over 3000 to 6000, incl	13
Stock lengths and stock lengths with ends	25[A]

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

castings poured simultaneously from the same source of molten metal.

8.1.2 When samples are taken from the semifinished 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 semifinished or finished product and heat identity has not been maintained, a single sample representative of each 5000 kg lot, or fraction thereof, shall be analyzed. When the product piece is greater than 5000 kg, 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 two of the sample pieces selected in accordance with 7.1.2. The required tests shall be made on each of the specimens so selected. In the case of copper alloy Specifications B 194, B 534, and B 740 two specimens shall be taken from each of two sample pieces selected in accordance with 7.1.2. One specimen from each sample piece shall be tested without further treatment, and the other two specimens shall be tested after precipitation hardening. In the case of the requirements in Table 4, Mill Hardened Tempers, in Specifications B 194 and B 740, only two specimens need to be taken and 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 If the chemical analysis of the specimens prepared from samples selected in accordance with 7.1.2 fails to conform to the specified limits, analysis shall be made on a new composite sample prepared from the pieces selected in accordance with 7.1.2.

8.3.2 If one of the two tests made to determine any of the mechanical or physical properties fails to meet a specified limit, this test shall be repeated on the remaining pieces, maximum of two, selected in accordance with 7.1.2 and the results of both of these tests shall comply with the specified requirements.

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 percent 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.

8.3.5 If a bend test specimen fails, due to 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.

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

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 2.1.1 except B694)

Nominal Length, mm	1.3 mm and Under in Thickness		Over 1.3 to 3.2 mm, incl, in Thickness		Over 3.2 to 6.5 mm, incl, in Thickness	
	Minimum Length of Shortest Piece, mm	Maximum Permissible Weight of Ends, % of Lot Weight	Minimum Length of Shortest Piece, mm	Maximum Permissible Weight of Ends, % of Lot Weight	Minimum Length of Shortest Piece, mm	Maximum Permissible Weight of Ends, % of Lot Weight
1800 to 2400, incl	1200	20	1200	25	900	30
2400 to 3000, incl	1800	25	1500	30	1200	35
3000 to 4300, incl	2000	30	1800	35	1500	40

TABLE 9 Length Tolerances for Square-Sheared Metal in All Widths 3000 mm and Under
(Applicable to all specifications listed in 2.1.1 except B 694)

Length, mm	Length Tolerance,[A] Plus and Minus, mm		
	For Thicknesses Up to 1.6 mm, incl	For Thicknesses Over 1.6 to 3.2 mm, incl	For Thicknesses Over 3.2mm
508 and under	0.8	1.2	1.6
Over 508 to 914, incl	1.2	1.2	1.6
Over 914 to 3048, incl	1.6	1.6	1.6

[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 2.1.1 except B 694)

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, mm	Length Tolerance, mm
Up to 3000, incl	64

TABLE 11 Straightness Tolerances for Slit Metal or Slit Metal Either Straightened or Edge-Rolled
(Applicable to all specifications listed in 2.1.1)

Width, mm	Maximum Edgewise Curvature (Depth of Arc) in any 1800-mm Portion of the Total Length, Straightness Tolerance, mm		
	As Slit Only		As Slit and Either Straightened or Edge Rolled
	Shipped in Rolls	Shipped Flat	Shipped Flat, in Rolls, or on Bucks
Over 6 to 10, incl	51	38	13
Over 10 to 12, incl	38	25	13
Over 12 to 25, incl	25	19	13
Over 25 to 50, incl	16	16	9.5
Over 50 to 100, incl	13	13	9.5
Over 100	9.5	9.5	9.5

specification, it shall be rejected.

9. Specimen Preparation

9.1 *Chemical Analysis*—A composite sample of the semi-finished or finished product shall be prepared in accordance with Practice E 55, or as described in 7.1.2.1.

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.

TABLE 12 Straightness Tolerances for Square-Sheared Metal
(Applicable to all specifications listed in 2.1.1)
(Not applicable to metal over 3000 mm in length)

Thickness, mm	Maximum Edgewise Curvature (Depth of Arc) in any 1800-mm Portion of the Total Length, Straightness Tolerances, mm	
	Up to 250 mm, incl, in Width	Over 250 mm in Width
3.2 and under	1.6	0.79
Over 3.2 to 5.0, incl	3.2	1.2
Over 5.0	3.2	1.6

TABLE 13 Straightness Tolerances for Sawed Metal
(Applicable to all specifications listed in 2.1.1)
(Not applicable to metal over 3600 mm in length)

Width, mm	Maximum Edgewise Curvature (Depth of Arc) in any 2000-mm Portion of the Total Length, Straightness Tolerances, mm
80 and under	1.6
Over 80	1.2

TABLE 14 Tolerances for Radius of Commercially Square Corners of Rolled or Drawn Edges with Square Corners
(Applicable to all specifications listed in 2.1.1 except B 694)

Thickness, mm	Permissible Radius of Corners, max, mm
0.8 to 1.6, incl	0.25
Over 1.6 to 4.8, incl	0.40
Over 4.8 to 25, incl	0.8

10. Test Methods

10.1 The test method used for routine chemical analysis for specification compliance and preparation of certifications and test reports, when required, shall be at the discretion of the reporting laboratory.

10.1.1 Commonly accepted technique for routine chemical analysis of copper and copper alloys include, but are not limited to, X-ray fluorescence spectroscopy, atomic absorption spectrophotometry, argon plasma spectroscopy, and emission spectroscopy.

10.2 In case of disagreement concerning chemical composition, an applicable test method for chemical analysis may be