Designation: B103/B103M – 15

Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar[1]

This standard is issued under the fixed designation B103/B103M; 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 requirements for copper-tin alloy (phosphor bronze), copper-tin-lead alloy (leaded phosphor bronze), and copper-tin-lead-zinc alloy (bearing bronze), plate, sheet, strip, and rolled bar. The phosphor bronzes commonly are used for deep drawing into bellows and stamping and forming into spring devices and into terminals and connectors for electrical apparatus because they combine high strength with high elongation. The leaded phosphor bronzes are used where strength, corrosion resistance, and machinability are required. The bearing bronze is used in bushings, bearings, and load-bearing thrust washers. The following alloys are covered:

Copper Alloy UNS No.[2]	Nominal Composition, % Copper	Tin	Zinc	Lead	Previously Used Designation
C51000	95	5	. . .	. . .	A1
C51100	96	4	. . .	. . .	A
C51180	96	4	. . .	. . .	. . .
C51900	94	6	. . .	. . .	
C52100[A]	92	8	. . .	. . .	C
C52180	92	8	. . .	. . .	. . .
C52400	90	10	. . .	. . .	D
C53400	94	5	. . .	1	B1
C54400	88	4	3	4	B2

[A] SAE Specification CA 521 conforms to the requirements of UNS No. C52100.

NOTE 1—All of the above alloys contain small amounts of phosphorus, used as a deoxidant in melting, and to enhance the mechanical properties.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 The following safety hazard caveat pertains only to the test method(s) described in this specification.

1.3.1 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

B248 Specification for General Requirements for Wrought Copper and Copper-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)

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

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]

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)

3. General Requirements

3.1 The following sections of Specifications B248 and B248M constitute a part of this specification.

3.1.1 Terminology,

3.1.2 Materials and Manufacturing,

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[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**

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,
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 5.1 appears in this specification, it contains additional requirements, which supplement those appearing in Specifications B248 and B248M

4. Terminology

4.1 *Definitions*—For definitions of terms used in this specification, 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 (for example, B103/B103M – 04);
5.1.2 Copper [Alloy] UNS No. designation (for example, C51000);
5.1.3 Temper;
5.1.4 Dimensions: thickness, width, length, and so forth;
5.1.5 Form: plate, sheet, strip, or rolled bar;
5.1.6 How furnished: coils, specific length or stock lengths, with or without ends;
5.1.7 Quantity: total weight each form, temper, and size; and,
5.1.8 When material is purchased for agencies of the U.S. Government.

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 Type of edge: slit, sheared, sawed, square corners, round corners, rounded edges, or full rounded edges;
5.2.2 Width and straightness tolerances;
5.2.3 Heat identification or traceability details;
5.2.4 Certification, and
5.2.5 Mill Test Report.

6. Materials and Manufacture

6.1 *Materials:*
6.1.1 The material of manufacture shall be a cast bar, cake, slab, of Copper Alloy UNS No. C51000, C51100, C51180, C51900, C52100, C52180, C52400, C53400, or C54400 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 2—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.
6.2.3 *Edges*—Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

7. Chemical Composition

7.1 The materials shall conform to the chemical composition requirements specified in Table 1 for the copper alloy UNS No. designation specified in the ordering information.

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

7.3 Copper, specified as the "remainder," may be taken as the difference between the sum of results of all the elements determined and 100 %. When all the elements in Table 1 are determined, the sum of results for each alloy shall be 99.5 % min.

8. Temper

8.1 The standard tempers for products described in this specification are given in Table 2.
8.1.1 *M20 (as Hot-Rolled Material)*—The standard temper of sheet and plate produced by hot rolling as designated in Table 2.
8.1.2 *H (Rolled Material)*—The standard tempers of rolled material are as designated in Table 2 with prefix "H." Former

TABLE 1 Chemical Requirements

Element	Composition, %								
	Copper Alloy UNS No.								
	C51000	C51100	C51180	C51900	C52100	C52180	C52400	C53400[A]	C54400[A]
Tin	4.2-5.8	3.5-4.9	3.5-4.9	5.0-7.0	7.0-9.0	7.0-9.0	9.0-11.0	3.5-5.8	3.5-4.5
Phosphorus	0.03-0.35	0.03-0.35	0.01-0.35	0.03-0.35	0.03-0.35	0.01-0.35	0.03-0.35	0.03-0.35	0.01-0.50
Iron, max	0.10	0.10	0.05-0.20	0.10	0.10	0.05-0.20	0.10	0.10	0.10
Lead	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max	0.05 max	0.8-1.2	3.0-4.0
Zinc	0.30 max	0.30 max	0.30 max	0.30 max	0.20 max	0.30 max	0.20 max	0.30 max	1.5-4.5
Nickel	. . .	. . .	0.05-0.20	. . .	. . .	0.05-0.20	. . .	. . .	. . .
Copper	remainder	remainder	remainder	remainder	remainder	remainder	remainder	remainder	remainder

[A] When specified for bearings, the phosphorus content shall be maintained from 0.01 to 0.15 %.

TABLE 2 Tensile Strength Requirements and Approximate Rockwell Hardness Values

NOTE 1—Plate is generally available in only the as hot-rolled (M20) temper. Required properties for other tempers shall be agreed upon between the manufacturer purchaser at the time of placing the order.

Temper Designation[A]		Thickness, in. [mm]	Tensile Strength, ksi[B] [MPa]		Approximate Rockwell Hardness	
Code	Name		Min	Max	B Scale	Superficial 30–T
		Copper Alloy UNS No. C51000				
M20	as hot-rolled	Over 0.188 [4.775]	40 [275]	60 [415]	. . .	. . .
O60	soft	Over 0.039 [0.991]	43 [295]	58 [400]	16-64	. . .
		Over 0.029 [0.737]			. . .	32-59
		Over 0.020 [0.508] to 0.039 [0.991] incl			12-60	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	24-53
		0.003 [0.076] to 0.010 [0.254] incl				
H02	half-hard	Over 0.039 [0.991]	58 [400]	73 [505]	64-85	. . .
		Over 0.029 [0.737]			. . .	59-73
		Over 0.02 [0.508] to 0.039 [0.991] incl			60-82	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	53-69
		0.003 [0.076] to 0.010 [0.254] incl				
H04	hard	Over 0.039 [0.991]	76 [525]	91 [625]	86-93	. . .
		Over 0.029 [0.737]			. . .	73-78
		Over 0.020 [0.508] to 0.039 [0.991] incl			84-91	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	71-75
		0.003 [0.076] to 0.010 [0.254] incl				
H06	extra-hard	Over 0.039 [0.991]	88 [605]	103 [710]	92-96	. . .
		Over 0.029 [0.737]			. . .	77-81
		Over 0.020 [0.508] to 0.039 [0.991] incl			89-95	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	74-78
		0.003 [0.076] to 0.010 [0.254] incl				
H08	spring	Over 0.039 [0.991]	95 [655]	110 [760]	94-98	. . .
		Over 0.029 [0.737]			. . .	79-82
		Over 0.020 [0.508] to 0.039 [0.991] incl			92-97	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	76-80
		0.003 [0.076] to 0.010 [0.254] incl				
H10	extra-spring	Over 0.039 [0.991]	100 [690]	114 [785]	96-99	. . .
		Over 0.029 [0.737]			. . .	80-83
		Over 0.020 [0.508] to 0.039 [0.991] incl			94-98	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	77-81
		0.003 [0.076] to 0.010 [0.254] incl				
		Copper Alloy UNS Nos. C51100, C53400, and C54400				
M20	as hot-rolled	Over 0.188 [4.775]	40 [275]	58 [400]	. . .	. . .
O60	soft	Over 0.039 [0.991]	40 [275]	55 [380]	7-50	. . .
		Over 0.029 [0.737]			. . .	24-50
		Over 0.020 [0.508] to 0.039 [0.991] incl			0-45	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	16-46
H02	half-hard	Over 0.039 [0.991]	55 [380]	70 [485]	60-81	. . .
		Over 0.029 [0.737]			. . .	57-73
		Over 0.020 [0.508] to 0.039 [0.991] incl			53-78	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	52-71
H04	hard	Over 0.039 [0.991]	72 [495]	87 [600]	82-90	. . .
		Over 0.029 [0.737]			. . .	71-77
		Over 0.020 [0.506] to 0.039 [0.991] incl			80-86	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	69-75
H06	extra-hard	Over 0.039 [0.991]	84 [580]	99 [685]	88-94	. . .
		Over 0.029 [0.737]			. . .	75-80
		Over 0.020 [0.506] to 0.039 [0.991] incl			86-92	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	73-78
H08	spring	Over 0.039 [0.991]	91 [625]	106 [730]	90-98	. . .
		Over 0.029 [0.737]			. . .	77-81
		Over 0.020 [0.508] to 0.039 [0.991] incl			86-94	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	75-79
H10	extra-spring	Over 0.039 [0.991]	96 [660]	108 [745]	92-97	. . .
		Over 0.029 [0.737]			. . .	78-82
		Over 0.020 [0.508] to 0.039 [0.991] incl			89-94	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	76-80
		Copper Alloy UNS No. C51180				
H02	half-hard	Over 0.039 [0.991]	69 [475]	84 [580]	80-90	
		Over 0.029 [0.737]				69-75
		Over 0.020 [0.508] to 0.039 [0.991] incl			78-88	
		Over 0.010 [0.254] to 0.029 [0.737] incl				67-73
H03	¾-hard	Over 0.039 [0.991]	80 [550]	92 [635]	84-92	
		Over 0.029 [0.737]				71-77
		Over 0.020 [0.508] to 0.039 [0.991] incl			80-88	
		Over 0.010 [0.254] to 0.029 [0.737] incl				69-75
H04	hard	Over 0.039 [0.991]	85 [585]	100 [690]	88-95	
		Over 0.029 [0.737]				74-80

TABLE 2 *Continued*

Temper Designation[A]		Thickness, in. [mm]	Tensile Strength, ksi[B] [MPa]		Approximate Rockwell Hardness	
Code	Name		Min	Max	B Scale	Superficial 30–T
		Over 0.020 [0.508] to 0.039 [0.991] incl			85-93	
		Over 0.010 [0.254] to 0.029 [0.737] incl				71-78
H06	extra-hard	Over 0.039 [0.991]	97 [670]	112 [770]	89-97	
		Over 0.029 [0.737]				76-81
		Over 0.020 [0.508] to 0.039 [0.991] incl			87-95	
		Over 0.010 [0.254] to 0.029 [0.737] incl				74-79
H08	spring	Over 0.039 [0.991]	105 [725]	119 [820]	94-100	
		Over 0.029 [0.737]				77-82
		Over 0.020 [0.508] to 0.039 [0.991] incl			92-98	
		Over 0.010 [0.254] to 0.029 [0.737] incl				74-80
H10	extra-spring	Over 0.039 [0.991]	110 [760]	122 [840]	96-104	
		Over 0.029 [0.737]				78-82
		Over 0.020 [0.508] to 0.039 [0.991] incl			94-102	
		Over 0.010 [0.254] to 0.029 [0.737] incl				76-80
		Copper Alloy UNS No. C51900				
O60	soft	Over 0.039 [0.991]	48 [330]	63 [435]	22-66	. . .
		Over 0.029 [0.737]			. . .	35-64
		Over 0.020 [0.508] to 0.039 [0.991] incl			18-63	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	25-57
H02	half-hard	Over 0.039 [0.991]	64 [440]	79 [545]	70-88	. . .
		Over 0.029 [0.737]			. . .	63-76
		Over 0.020 [0.508] to 0.039 [0.991] incl			65-85	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	58-72
H04	hard	Over 0.039 [0.991]	80 [550]	96 [660]	89-95	. . .
		Over 0.029 [0.737]			. . .	74-80
		Over 0.020 [0.508] to 0.039 [0.991] incl			86-93	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	72-78
		Copper Alloy UNS No. C52100				
M20	as hot-rolled	Over 0.188 [4.775]	50 [345]	78 [540]	. . .	. . .
O60	soft	Over 0.039 [0.991]	53 [365]	67 [460]	29-70	. . .
		Over 0.029 [0.737]			. . .	38-68
		Over 0.020 [0.508] to 0.039 [0.991] incl			20-66	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	27-62
H02	half-hard	Over 0.039 [0.991]	69 [475]	84 [580]	76-91	. . .
		Over 0.029 [0.737]			. . .	67-78
		Over 0.020 [0.508] to 0.039 [0.991] incl			69-88	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	63-75
H04	hard	Over 0.039 [0.991]	85 [585]	100 [690]	91-97	. . .
		Over 0.029 [0.737]			. . .	76-81
		Over 0.020 [0.508] to 0.039 [0.991] incl			89-95	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	73-80
H06	extra-hard	Over 0.039 [0.991]	97 [670]	112 [770]	95-100	. . .
		Over 0.029 [0.737]			. . .	78-83
		Over 0.020 [0.508] to 0.039 [0.991] incl			93-98	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	77-82
H08	spring	Over 0.039 [0.991]	105 [725]	119 [820]	97-102	. . .
		Over 0.029 [0.737]			. . .	79-84
		Over 0.020 [0.508] to 0.039 [0.991] incl			95-100	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	78-83
H10	extra-spring	Over 0.039 [0.991]	110 [760]	122 [840]	98-103	. . .
		Over 0.029 [0.737]			. . .	80-84
		Over 0.020 [0.508] to 0.039 [0.991] incl			96-101	. . .
		Over 0.010 [0.254] to 0.029 [0737] incl			. . .	79-83
		Copper Alloy UNS No. C52180				
H02	half-hard	Over 0.039 [0.991]	90 [620]	105 [725]	90-100	
		Over 0.029 [0.737]				77-83
		Over 0.020 [0.508] to 0.039 [0.991] incl			93-99	
		Over 0.010 [0.254] to 0.029 [0.737] incl				72-81
H03	¾ hard	Over 0.039 [0.991]	97 [670]	112 [770]	...	...
		Over 0.029 [0.737]			...	...
		Over 0.020 [0.508] to 0.039 [0.991] incl			...	...
		Over 0.010 [0.254] to 0.029 [0.737] incl			...	...
H04	hard	Over 0.039 [0.991]	105 [725]	120 [825]	94-102	
		Over 0.029 [0.737]				78-84
		Over 0.020 [0.508] to 0.039 [0.991] incl			92-98	
		Over 0.010 [0.254] to 0.029 [0.737] incl				77-82
H06	extra-hard	Over 0.039 [0.991]	108 [745]	125 [860]	97-103	
		Over 0.029 [0.737]				79-85
		Over 0.020 [0.508] to 0.039 [0.991] incl			96-103	
		Over 0.010 [0.254] to 0.029 [0.737] incl				78-84
H08	spring	Over 0.039 [0.991]	115 [795]	132 [910]	98-105	
		Over 0.029 [0.737]				80-86

TABLE 2 *Continued*

Temper Designation[A]		Thickness, in. [mm]	Tensile Strength, ksi[B] [MPa]		Approximate Rockwell Hardness	
Code	Name		Min	Max	B Scale	Superficial 30–T
		Over 0.020 [0.508] to 0.039 [0.991] incl			98-104	
		Over 0.010 [0.254] to 0.029 [0.737] incl				79-84
H10	extra-spring	Over 0.039 [0.991]	120 [825]	140 [965]	100 min	
		Over 0.029 [0.737]				82 min
		Over 0.020 [0.508] to 0.039 [0.991] incl			98 min	
		Over 0.010 [0.254] to 0.029 [0.737] incl				80 min
Copper Alloy UNS No. C52400						
M20	as hot-rolled	Over 0.188 [4.775]	55 [380]	75 [515]	. . .	. . .
O60	soft	Over 0.039 [0.991]	58 [400]	73 [505]	35-75	. . .
		Over 0.029 [0.737]			. . .	40-78
		Over 0.020 [0.508] to 0.039 [0.991] incl			25-71	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	29-84
H02	half-hard	Over 0.039 [0.991]	76 [525]	91 [625]	78-96	. . .
		Over 0.029 [0.737]			. . .	67-80
		Over 0.020 [0.508] to 0.039 [0.991] incl			74-93	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	63-77
H04	hard	Over 0.039 [0.991]	94 [650]	109 [750]	94-101	. . .
		Over 0.029 [0.737]			. . .	78-82
		Over 0.020 [0.508] to 0.039 [0.991] incl			92-100	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	75-81
H06	extra-hard	Over 0.039 [0.991]	107 [740]	122 [840]	98-103	. . .
		Over 0.029 [0.737]			. . .	80-84
		Over 0.020 [0.508] to 0.039 [0.991] incl			97-102	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	79-83
H08	spring	Over 0.039 [0.991]	115 [795]	129 [890]	99-104	. . .
		Over 0.029 [0.737]			. . .	81-85
		Over 0.020 [0.508] to 0.039 [0.991] incl			98-103	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	80-84
H10	extra-spring	Over 0.039 [0.991]	120 [825]	133 [915]	100-106	. . .
		Over 0.029 [0.737]			. . .	82-86
		Over 0.020 [0.508] to 0.039 [0.991] incl			99-104	. . .
		Over 0.010 [0.254] to 0.029 [0.737] incl			. . .	81-85

[A] Standard designations defined in Classification B601.
[B] ksi = 1000 psi.

designations and the standard designations as defined in Classification B601 are shown.

NOTE 3—The properties of special and nonstandard tempers are subject to agreement between the manufacture and purchaser.

8.1.3 *O60 (Annealed)*—The standard temper is O60 (soft), as indicated in Table 2.

9. Grain Size of Annealed Tempers

9.1 Other than O60 (soft) temper, as indicated in Table 2, annealed tempers are special, and the material shall conform to grain size requirements agreed upon between manufacturer and purchaser as defined in Classification B601.

10. Mechanical Property Requirements

10.1 *Tensile Strength Requirements:*

10.1.1 Product furnished under this specification in inch-pound units shall conform to tensile requirements prescribed in ksi units in Table 2, when tested in accordance with Test Methods E8/E8M.

10.1.2 Product furnished under this specification in SI units shall conform to tensile requirements prescribed in MPa units in Table 2, when tested in accordance with Test Methods E8/E8M.

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

10.1.4 The tension test specimens shall be taken so the longitudinal axis of the specimens is parallel to direction of rolling.

10.2 *Rockwell Hardness:*

10.2.1 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.

11. Other Requirements

11.1 *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 Specifications B248 and B248M.

12. Dimensions, Mass, and Permissible Variations

12.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 and B248M with particular reference to the following tables and related paragraphs.

12.1.1 *Thickness:*

12.1.1.1 *Tolerances*—See Table 1.

12.1.2 *Width:*

12.1.2.1 *Tolerances for Slit Metal and Slit Metal with Rolled Edges.*

12.1.2.2 *Tolerances for Square-Sheared Metal.*

12.1.2.3 *Tolerances for Sawed Metal.*

12.1.3 *Length:*

12.1.3.1 *Tolerances for Straight Lengths.*

12.1.3.2 *Schedule of Minimum Lengths with Ends.*

12.1.3.3 *Tolerances for Squared-Sheared Metal.*

12.1.3.4 *Tolerances for Sawed Metal.*

12.1.4 *Straightness:*

12.1.4.1 *Tolerances for Slit Metal or Slit Metal Either Straightened or Edge-Rolled.*

12.1.4.2 *Tolerances for Squared Sheared Metal.*

12.1.4.3 *Tolerance for Squared Sheared Metal.*

12.1.5 *Edges:*

12.1.5.1 *Tolerances for Radius of Square Edges.*

12.1.5.2 *Tolerances for Radius of Rounded Corners.*

12.1.5.3 *Tolerances for Radius of Rounded Edges.*

12.1.5.4 *Tolerances for Radius of Full-Rounded Edges.*

13. Sampling

13.1 *Chemical Analysis:*

13.1.1 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.

13.1.2 Instead of sampling in accordance with Practice E255, 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.

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

13.1.3 The number of samples to be taken for determination of chemical composition shall be as follows.

13.1.3.1 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.

13.1.3.2 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.

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

13.1.3.4 When the material is cast in the horizontal continuous casting mode, at least one sample will be taken to represent the composition of the holder per cast coil.

14. Test Methods

14.1 *Chemical Analysis:*

14.1.1 In case of disagreement, test methods for chemical analysis shall be subject to agreement upon between the manufacturer or supplier and 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	Test Method
Copper	E478
Iron	E75 (AA)
Lead	E478 (AA)
Phosphorus	E62
Tin	E478 (Photometric)
Zinc	E478 (AA)

14.1.2 Test methods(s) used for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacturer and the purchaser.

15. Keywords

15.1 copper-tin alloy plate; copper-tin alloy rolled bar; copper-tin alloy sheet; copper-tin alloy strip; copper-tin-lead alloy plate; copper-tin-lead alloy rolled bar; copper-tin-lead alloy sheet; copper-tin-lead alloy strip; copper-tin-lead-zinc alloy plate; copper-tin-lead-zinc alloy rolled bar; copper-tin-lead-zinc alloy sheet; copper-tin-lead-zinc alloy strip; copper-tin-lead-zinc-iron alloy sheet; copper-tin-lead-zinc-iron alloy strip; UNS No. C51000; UNS No. C51100; UNS No. C51180; UNS No. C51900; UNS No. C52100; UNS No. C52180; UNS No. C52400; UNS No. C53400; UNS No. C54400

SUMMARY OF CHANGES

Committee B05 has identified the principal changes to this specification that have been incorporated since the 2010 issue as follows (Approved May 15, 2015):

(1) Rewrote Sections 1, 3, 4, 5, 6, 7, 8, 10, 12, and 15 to incorporate the format of Guide B950.

(2) Changed the nominal zinc value in 1.1 from 4 to 3.