Designation: B122/B122M – 20

Standard Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar[1]

This standard is issued under the fixed designation B122/B122M; 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-nickel-tin alloy, copper-nickel-zinc alloy (nickel silver), and copper-nickel alloy plate, sheet, strip, and rolled bar. The following alloys are covered:

		Nominal Composition, %				
Copper Alloy UNS No.[2]	Previously Used Designation	Copper	Nickel	Zinc	Tin	Chro-mium
C70600	...	90	10	...	...	...
C70620	...	90	10	...	...	...
C71000	6	80	20	...	...	...
C71500	5	70	30	...	...	...
C71520	...	70	30	...	...	...
C72200	...	85	15	...	...	0.5
C72500	...	89	9	...	2	...
C73500	1	72	18	10	...	...
C74000	9	70	10	20	...	...
C74500	3	65	10	25	...	...
C75200	2	65	18	17	...	...
C76200	8	59	12	29	...	...
C77000	4	55	18	27	...	...

NOTE 1—Plates of copper-nickel alloy Copper Alloy UNS Nos. C70600, C70620, C71500, C71520, and C72200 for use as tube plates in surface condensers and heat exchangers are covered by Specification B171/B171M.

1.2 *Units*—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 are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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 *ASTM Standards:*[3]

B171/B171M Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers

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

E112 Test Methods for Determining Average Grain Size

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

E478 Test Methods for Chemical Analysis of Copper Alloys

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

3. General Requirements

3.1 The following sections of Specification B248 or Specification B248M constitute a part of this specification:

3.1.1 Terminology

3.1.2 Materials and Manufacture

[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.

***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
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 Report
3.1.13 Packaging and Package Marking
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 that supplement those appearing in Specification B248 or Specification B248M.

4. Terminology

4.1 For definitions of terms related to copper and copper alloys, 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;
5.1.2 Copper [Alloy] UNS No. designation;
5.1.3 Temper (Section 8);
5.1.4 Dimensions, thickness and width (Section 11);
5.1.5 How furnished: straight lengths or coils;
5.1.6 Quantity—Total weight or total length or number of pieces of each size;
5.1.7 Type of edge (slit, sheared, sawed, square corners, round corners, rounded edges, or full rounded edges), if required;
5.1.8 Length (Section 11); and
5.1.9 Intended application.

5.2 The following options are available but may not be included unless specified at the time of placing of the order, when required:
5.2.1 Heat identification or traceability details,
5.2.2 Certification,
5.2.3 Test Report, and
5.2.4 If product is purchased for agencies of the U.S. government (see the Supplementary Requirements of Specification B248 or Specification B248M for additional requirements).

6. Materials and Manufacture

6.1 *Materials:*

6.1.1 The material of manufacture shall be a form (cast bar, cake, slab, et cetera) of Copper Alloy UNS No. C70600, C70620, C71000, C71500, C71520, C72200, C72500, C73500, C74000, C74500, C75200, C76200, or C77000 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.

6.3 *Edges:*

6.3.1 Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Composition, %								
	Copper, incl Silver	Nickel, incl Cobalt	Lead, max	Iron, max	Manganese, max	Zinc	Tin	Chro-mium	Other Named Elements
C70600	remainder	9.0–11.0[A]	0.05[B]	1.0–1.8	1.0	1.0[B] max	...	...	[B]
C70620	86.5 min	9.0–11.0	0.02	1.0–1.8	1.0	0.50 max	...	...	[C]
C71000	remainder	19.0–23.0	0.05[B]	1.0 max	1.0	1.0[B] max	...	...	[B]
C71500	remainder	29.0–33.0[A]	0.05[B]	0.40–1.0	1.0	1.0[B] max	...	...	[B]
C71520	65.0 min	29.0–33.0	0.02	0.40–1.0	1.0	0.50 max	...	...	[C]
C72200	remainder	15.0–18.0	0.05[B]	0.50–1.0	1.0	1.0[B]	...	0.30–0.7	[B, D]
C72500	remainder	8.5–10.5	0.05	0.6	0.20	0.50 max	1.8–2.8	...	...
C73500	70.5–73.5	16.5–19.5	0.09	0.25 max	0.50	remainder	...	...	...
C74000	69.0–73.5	9.0–11.0	0.05	0.25 max	0.50	remainder	...	...	...
C74500	63.5–66.5	9.0–11.0	0.09	0.25 max	0.50	remainder	...	...	...
C75200	63.0–66.5	16.5–19.5	0.05	0.25 max	0.50	remainder	...	...	...
C76200	57.0–61.0	11.0–13.5	0.09	0.25 max	0.50	remainder	...	...	...
C77000	53.5–56.5	16.5–19.5	0.05	0.25 max	0.50	remainder	...	...	...

[A] Copper plus elements with specific limits, 99.5 % min.
[B] When the product is for subsequent welding applications and so specified by the purchaser, zinc shall be 0.50 % max, lead 0.02 % max, phosphorus 0.02 % max, sulfur 0.02 % max, and carbon 0.05 % max.
[C] Phosphorus at 0.02 % max, sulfur at 0.02 % max, and carbon at 0.05 % max.
[D] Silicon and titanium each at 0.03 % max.

7. Chemical Composition

7.1 The material shall conform to the chemical composition requirements 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 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 results shall be as shown in the following table:

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C70600	99.5
C70620	99.5
C71000	99.5
C71500	99.5
C71520	99.5
C72200	99.8
C72500	99.8

7.4 For alloys in which zinc is listed as "remainder," either copper or zinc may be taken as the difference between the sum of results of all other elements determined and 100 %. When all elements in Table 1 are determined, the sum of the results shall be as shown in the following table:

Copper Alloy UNS No.	Copper Plus Named Elements, % min
C73500	99.5
C74000	99.5
C74500	99.5
C75200	99.5
C76200	99.5
C77000	99.5

8. Temper

8.1 The standard tempers for products described in this specification are given in Tables 2 and 3.

8.1.1 Hot rolled temper M20.

8.1.2 Cold rolled tempers H01 to H14.

8.1.3 Annealed tempers OS015 to OS070.

9. Grain Size for Annealed Tempers

9.1 Grain size shall be the standard requirement for all product in the annealed tempers.

9.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be within the limits prescribed in Table 3 when determined in accordance with Test Methods E112.

9.3 Grain size shall be determined on a plane parallel to the flat surfaces of the product.

10. Mechanical Property Requirements

10.1 *Tensile Strength Requirements:*

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

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

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

10.2 *Rockwell Hardness:*

10.2.1 The approximate Rockwell hardness values given in Tables 2 and 4 are for general information and assistance in testing, and shall not be used as a basis for product rejection.

NOTE 3—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. Dimensions, Mass, and Permissible Variation

11.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 or Specification B248M.

11.2 *Thickness*—When special thickness tolerances for Copper Alloy UNS No. C72500 are required, see appropriate table.

11.3 *Width:*

11.3.1 *Slit Metal and Slit Metal with Rolled Edges.*

11.3.2 *Square Sheared Metal.*

11.3.3 *Sawed Metal.*

11.4 *Length:*

11.4.1 *Specific and Stock Lengths With and Without Ends.*

11.4.2 *Schedule of Lengths (Specific and Stock) with Ends.*

11.4.3 *Length Tolerance for Square Sheared Metal.*

11.4.4 *Length Tolerance for Sawed Metal.*

11.5 *Straightness:*

11.5.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled.*

11.5.2 *Square Sheared Metal.*

11.5.3 *Sawed Metal.*

11.6 *Edges Contours:*

11.6.1 *Square Corners.*

11.6.2 *Rounded Corners.*

11.6.3 *Rounded Edges.*

11.6.4 *Full-Rounded Edges.*

12. Workmanship, Finish, and Appearance

12.1 The product shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

13. Sampling

13.1 Refer to sampling section in Specification B248 or Specification B248M.

13.2 *Chemical Analysis:*

13.2.1 The sample for chemical analysis shall be taken from the pieces selected and combined into one composite sample in accordance with Practice E255 for product in its final form. The minimum weight of the composite sample shall be 150 g.

TABLE 2 Tensile Strength Requirements and Approximate Rockwell Hardness Values for Rolled Temper Product

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

Temper Designation		Tensile Strength, ksi[A] [MPa[B]]		Approximate Rockwell Hardness[C, D]		
Code	Name	Min	Max	G Scale	B Scale	Superficial 30-T
		Copper Alloy UNS No. C70600 and C70620				
M20	as hot-rolled	40 [275]	62 [425]	...	...	...
H01	quarter hard	51 [350]	67 [460]	...	51–78	52–70
H02	half hard	58 [400]	72 [495]	...	66–81	61–72
H04	hard	71 [490]	83 [570]	...	76–86	67–74
H06	extra hard	73 [505]	85 [585]	...	80–88	71–77
H08	spring	78 [540]	88 [605]	...	83–91	72–78
		Copper Alloy UNS No. C71000				
M20	as hot-rolled	38 [260]	56 [385]	...	...	...
H01	quarter hard	47 [325]	63 [435]	...	45–72	46–65
H02	half hard	56 [385]	70 [485]	...	64–78	59–69
H04	hard	67 [460]	79 [545]	...	76–84	67–73
H06	extra hard	72 [495]	84 [580]	...	79–87	69–75
H08	spring	76 [525]	87 [600]	...	82–88	71–75
		Copper Alloy UNS No. C71500 and C71520				
M20	as hot-rolled	45 [310]	65 [450]	...	...	...
H01	quarter hard	58 [400]	72 [495]	...	67–81	61–71
H02	half hard	66 [455]	80 [550]	...	76–85	67–74
H04	hard	75 [515]	88 [605]	...	83–89	72–76
H06	extra hard	80 [550]	92 [635]	...	85–91	73–77
H08	spring	84 [580]	94 [650]	...	87–91	74–77
		Copper Alloy UNS No. C72200				
M20	as hot-rolled	42 [290]	62 [425]	...	...	...
H01	quarter hard	55 [380]	67 [460]	...	63–78	58–70
H02	half hard	58 [400]	72 [495]	...	66–85	61–73
H04	hard	71 [490]	85 [585]	...	76–88	67–78
H06	extra hard	73 [505]	90 [620]	...	79–90	69–78
H08	spring	78 [540]	91 [625]	...	81–91	71–79
		Copper Alloy UNS No. C72500				
M20	as hot-rolled	50 [345]	70 [485]	...	...	...
H01	quarter hard	55 [380]	75 [515]	...	Up to 85	Up to 72
H02	half hard	65 [450]	80 [550]	...	70–90	62–75
H04	hard	75 [515]	90 [620]	...	75–90	66–75
H06	extra hard	80 [550]	95 [655]	...	80–95	70–80
H08	spring	85 [585]	100 [690]	...	85–95	72–80
H10	extra spring	90 [620]	105 [725]	...	87–95	76–80
H14	super spring	100 [690]	125 [860]	...	92 and over	78 and over
		Copper Alloy UNS No. C73500				
M20	as hot-rolled	48 [330]	63 [435]	...	...	...
H01	quarter hard	56 [385]	69 [475]	20–47	66–80	60–70
H02	half hard	63 [435]	75 [515]	38–53	75–84	67–73
H04	hard	73 [505]	84 [580]	51–61	83–88	72–75
H06	extra hard	79 [545]	90 [620]	57–65	86–90	74–76
		Copper Alloy UNS No. C74000				
M20	as hot-rolled	48 [330]	63 [435]	...	...	...
H01	quarter hard	55 [380]	70 [485]	...	60–80	...
H02	half hard	63 [435]	77 [530]	...	70–85	...
H04	hard	73 [505]	87 [600]	...	79–91	...
H06	extra hard	79 [545]	91 [625]	...	83–93	...
		Copper Alloy UNS No. C74500				
M20	as hot-rolled	48 [330]	65 [450]	...	...	...
H01	hard	56 [385]	73 [505]	...	51–80	50–70
H02	half hard	67 [460]	82 [565]	...	72–87	65–75
H04	hard	80 [550]	94 [650]	...	85–92	73–78
H06	extra hard	89 [615]	102 [705]	...	90–94	76–79
H08	spring	95 [655]	108 [745]	...	92–96	77–80
		Copper Alloy UNS No. C75200				
M20	as hot-rolled	52 [355]	65 [450]	...	...	...
H01	quarter hard	58 [400]	72 [495]	...	50–75	49–67
H02	half hard	66 [455]	80 [550]	...	68–82	62–72
H04	hard	78 [540]	91 [625]	...	80–90	70–76
H06	extra hard	86 [595]	98 [675]	...	87–94	74–79
H08	spring	90 [620]	101 [695]	...	89–96	75–80
		Copper Alloy UNS No. C76200				
M20	as hot-rolled	55 [380]	75 [515]	...	...	...
H01	quarter hard	65 [450]	81 [560]	...	61–85	57–74
H02	half hard	75 [515]	91 [625]	...	78–91	69–77
H04	hard	90 [620]	105 [750]	...	90–95	76–79
H06	extra hard	99 [685]	114 [785]	...	94–98	79–81