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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 B 122/B 122M; 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 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:

Copper Alloy UNS No.[2]	Previously Used Designation	Nominal Composition, %				
		Copper	Nickel	Zinc	Tin	Chro-mium
C70600	...	90	10	...	...	...
C70620	...	86	10	...	...	...
C71000	6	80	20	...	...	...
C71500	5	70	30	...	...	...
C71520	...	65	31	...	...	...
C72200	...	85	15	...	...	0.5
C72500	...	89	9	...	2	...
C73500	1	72	18	10	...	...
C74000	9	70	10	20	...	...
C74500	3	65	10	24	...	...
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 B 171/B 171M.

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

1.2.1 When the product is ordered in inch-pound units, the inch-pound units are to be regarded as the standard except grain size is always specified in millimetres.

1.2.2 When the product is ordered in SI units, the SI units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

B 171/B 171M Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers

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

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

B 601 Classification for Temper Designations for Copper and Copper AlloysWrought and Cast

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[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 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] 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.**

B 846 Terminology for Copper and Copper Alloys
E 8 Test Methods for Tension Testing of Metallic Materials
E 8M Test Methods for Tension Testing of Metallic Materials [Metric]
E 112 Test Methods for Determining Average Grain Size
E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition
E 478 Test Methods for Chemical Analysis of Copper Alloys
E 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

3. General Requirements

3.1 The following sections of Specification B 248 constitute a part of this specification:
3.1.1 Terminology—Definitions,
3.1.2 Materials and Manufacturing,
3.1.3 Workmanship, Finish, and Appearance,
3.1.4 Sampling—except for chemical analysis,
3.1.5 Number of Tests and Retests,
3.1.6 Specimen Preparation,
3.1.7 Test Methods—except for chemical analysis,
3.1.8 Significance of Numerical Limits,
3.1.9 Inspection,
3.1.10 Rejection and Rehearing,
3.1.11 Certification,
3.1.12 Test Reports (Mill),
3.1.13 Packaging and Package Marking, and
3.1.14 Supplementary Requirements,
3.2 In addition, when a section with a title identical to that referenced in 4.1 appears in this specification, it contains additional requirements, which supplement those appearing in Specification B 248.

4. Terminology

4.1 *Definitions*— For standard terms related to copper and copper alloys, refer to Terminology B 846.

5. Ordering Information

5.1 Orders for products under this specification should include the following information:
5.1.1 ASTM designation and year of issue (B 122/B 122M – XX),
5.1.2 Copper (alloy) UNS number designation,
5.1.3 Temper (Section 8),
5.1.4 Dimensions: thickness and width (see Section 12),
5.1.5 Type of edge, if required: slit, sheared, sawed, square corners, rounded corners, rounded edges, or full rounded edges,
5.1.6 How furnished: flat or rolls,
5.1.7 Length (see Section 12), and
5.1.8 Weight: total for each size.
5.2 In addition, when material is purchased for agencies of the U.S. government, it shall conform to the Supplementary Requirements as defined in Specification B 248 when specified in the contract or purchase order.

6. Materials and Manufacture

6.1 *Material*:
6.1.1 The material of manufacture shall be a cast bar, cake, slab, and so forth of Copper Alloy UNS No. C70600, C70620, C71000, C71500, C71520, C72200, C72500, C73500, C74000, C74500, C75200, C76200, or C77000 as specified in the ordering information.
6.1.2 In the event that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 2—Because of 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 in the ordering information.
6.2.3 *Edges*—Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

7. Chemical Composition

7.1 The material shall conform to the chemical composition prescribed in Table 1.

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	28.0–33.0	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]	...	0.30–0.70	[B]
C72500	remainder	8.5–10.5	0.05	0.6	0.2	0.5 max	1.8–2.8	...	[D]
~~C73500~~	~~70.5–73.5~~	~~16.5–19.5~~	~~0.10~~	~~0.25 max~~	~~0.50~~	~~remainder~~	~~...~~	~~...~~	~~...~~
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	0.10	0.25 max	0.50	remainder	...	...	...
~~C74500~~	~~63.5–66.5~~	~~9.0–11.0~~	~~0.10~~	~~0.25 max~~	~~0.50~~	~~remainder~~	~~...~~	~~...~~	~~...~~
C74500	63.5–66.5	9.0–11.0	0.09	0.25 max	0.50	remainder	...	...	...
C75200	63.5–66.5	16.5–19.5	0.05	0.25 max	0.50	remainder	...	...	...
~~C76200~~	~~57.0–61.0~~	~~11.0–13.5~~	~~0.10~~	~~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.

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

7.2.1 For copper alloys for which copper is specified as a remainder, copper may be taken as the difference between the sum of all the elements analyzed and 100 %. When all the elements in Table 1 are analyzed, their sum shall be as follows:

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

7.2.2 For copper alloys for which zinc is specified as a remainder, either copper or zinc may be taken as the difference between the sum of all elements analyzed and 100 %. When all elements in Table 1 are analyzed, their sum shall be as follows:

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 *As Hot-Rolled (M20) Tempers*—The standard temper of sheet and plate produced by hot rolling and is as designated in Table 2.

8.2 *Cold Rolled (H) Tempers*—The standard tempers of cold rolled tempers are as designated in Table 2 with the prefix "H." Former designations and the standard designations as defined in Classification B 601 are shown. Special or nonstandard tempers are subject to negotiation between manufacturer and purchaser (See 5.1.2).

8.3 *Annealed Tempers*—The standard tempers are indicated in Table 3.

9. Grain Size for Annealed Tempers

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

9.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of test specimens taken from each of two sampling portions and each specimen shall be within the limits prescribed in Table 3 when determined in accordance with Test Methods E 112.

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

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

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

Temper Designation		Tensile Strength, ksi[A] [MPa[B]]		Approximate Rockwell Hardness[C,D]		
Standard	Former	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 [700]	...	90–94	76–79
H08	spring	95 [655]	108 [740]	...	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