



Designation: B422/B422M – 22

Standard 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 Strip¹

This standard is issued under the fixed designation B422/B422M; 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 for² Copper Alloy UNS Nos. C19002, C19010, C19015, C19020, C19025, C63800, C64725, C70250, C70260, C70265, C70310, and C70350 sheet and strip.

1.2 The values stated in either inch-pound units or SI units are to be regarded separately as standard. 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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.*

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.

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)

B846 Terminology for Copper and Copper Alloys

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

3. General Requirements

3.1 Material furnished to this specification shall be in accordance with the applicable requirements of the current edition of Specification **B248** or **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 (Section 1),
- 5.1.3 Temper (Section 7),
- 5.1.4 Dimensions (thickness, width, length, if applicable),
- 5.1.5 How furnished (rolls, specific lengths with or without ends, stock lengths with or without ends),

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

5.1.6 Quantity—total weight or total length or number of pieces of each size,

5.1.7 Form of material (sheet or strip),

5.1.8 Type of edge, if required (slit, sheared, sawed, square corners, rounded corners, rounded edges, or full-rounded edges (Subsection 10.6), and

5.1.9 Type of width and straightness tolerances, if required (slit-metal tolerances, square sheared-metal tolerances, sawed-metal tolerances, straightened or edge-rolled-metal tolerances) (Section 10).

5.2 If product is purchased for agencies of the U.S. government (see the Supplementary Requirement section of Specification B248 or B248M for additional requirements, if specified).

6. Chemical Composition

6.1 The material shall conform to the chemical composition requirements in Table 1 for the copper [alloy] UNS No. specified in the ordering information.

6.2 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.

6.3 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 for Alloys C19002, C19010, C63800, C64725, C70250, C70260, C70265, C70310, and C70350 are determined, the sum of the results shall be 99.5 % min. When all elements in Table 1 for Alloy C19025 are determined, the sum of the results shall be 99.7 % min. When all elements in Table 1 for Alloys C19015 and C19020 are determined, the sum of the results shall be 99.8 % min.

7. Temper

7.1 The standard tempers for products described in this specification are given in Tables 2-12.

8. Mechanical Property Requirements

8.1 Copper Alloy UNS No. C63800 is a dispersion-strengthened alloy which does not require heat treatment. The annealed and rolled tempers shall conform to the tensile property requirements prescribed in Table 2.

8.2 Copper Alloy UNS No. C70250 is supplied in a mill-hardened, or cold-worked and precipitation heat-treated, or precipitation heat-treated or spinodal heat-treated, ½ hard and stress-relieved tempers. The 0.2 % offset yield strength shall be the standard tests for these tempers and shall conform to the requirements specified in Table 3.

8.2.1 If ductility or formability requirements are desired, they shall be negotiated and agreed upon between the manufacturer and purchaser.

8.3 Copper Alloys UNS No. C70260 and C70265 are supplied in a mill-hardened temper. The 0.2 % offset yield strength shall be the standard test for the mill-hardened tempers TM00, TM02, TM03, and TM04 and shall conform to the requirements specified in Table 4. The tensile strength shall be the standard test for the mill-hardened temper TM01 and shall conform to the requirements specified in Table 4.

8.3.1 If ductility or formability requirements are desired, they shall be negotiated and agreed upon between the manufacturer and purchaser.

8.4 Copper Alloy UNS Nos. C19020 and C19025 are supplied in cold-worked, stress-relieved temper. These tempers shall conform to the tensile strength and elongation requirements in Table 7 and Table 5, respectively.

8.4.1 If ductility or formability requirements are desired, they shall be negotiated and agreed upon between the manufacturer and purchaser.

8.5 Copper Alloy UNS No. C19010 is supplied in either precipitation heat-treated (TM03 to TM08) tempers, or mill-hardened (H01 to H10) tempers. The 0.2 % offset yield

TABLE 1 Chemical Requirements

Element	Composition % Copper Alloy UNS No.											
	C19002	C19010	C19015	C19020	C19025	C63800	C64725	C70250	C70260	C70265	C70310	C70350
Nickel	1.4–1.7 ^A	0.8–1.8	0.50–2.4	0.50–3.0	0.8–1.2	0.20 max.	1.3–2.7 ^A	2.2–4.2 ^A	1.0–3.0 ^A	1.0–3.0 ^A	1.0–4.0 ^A	1.0–2.5
Silicon	0.20–0.35	0.15–0.35	0.10–0.40	...	...	1.5–2.1	0.20–0.8	0.25–1.2	0.20–0.7	0.20–0.7	0.08–1.0	0.50–1.2
Lead, max	0.05	...	...	...	...	0.05	0.01	0.05	...	0.05	0.05	0.05
Iron, max	0.10	...	...	...	0.10	0.20	0.25	0.20	...	...	0.10	0.20
Zinc	0.04–0.35	...	...	...	0.20 max	0.8 max	0.50–1.5	1.0 max	...	0.30 max	2.0 max	1.0 max
Aluminum	...	...	...	...	...	2.5–3.1	...	...	...	...	...	...
Copper ^B	remainder	remainder	remainder	remainder	remainder	remainder	95.0 min	remainder	remainder	remainder	remainder	remainder
Cobalt	...	...	...	...	...	0.25–0.55	...	...	...	...	...	1.0–2.0
Manganese, max	...	...	...	...	...	0.10	...	0.10	...	...	...	0.20
Magnesium	0.01 max	...	0.02–0.15	...	...	...	0.20 max	0.05–0.30	...	...	0.10 max	0.04 max
Tin	0.02–0.30	...	...	0.30–0.9	0.7–1.1	...	0.20–0.8	...	...	0.05–0.8	1.0 max	...
Phosphorus	0.05 max	0.01–0.05	0.02–0.20	0.01–0.20	0.03–0.07	...	...	...	0.01 max	0.01 max	0.05 max	...
Calcium	...	...	...	...	...	...	0.01 max	...	...	...	...	...
Chromium	...	...	...	...	...	...	0.09 max	...	...	...	...	...
Silver	0.02–0.50	...	...	...	...	...	...	...	...	...	0.02–0.50	...
Zirconium	0.005–0.05	...	...	...	...	...	...	...	...	...	0.005–0.05	...

^A Including cobalt.

^B Including silver.

TABLE 2 Tensile Strength Requirements and Approximate Hardness Values for Copper Alloy UNS No. C63800

Temper Designation		Tensile Strength		Elongation in 2 in. [50.8 mm], %	Approximate Rockwell Hardness ^A	
Code	Name	ksi ^B	MPa ^C		Rockwell B	Superficial 30T
O60	soft anneal	78 max	540 max	37 min	...	...
O61	annealed	77–87	530–600	27–40	...	70–78
H01	¼ hard	90–102	620–705	...	92–96	76–80
H02	½ hard	100–112	690–770	...	95–98	79–81
H03	¾ hard	105–117	725–805	...	97–99	80–82
H04	hard	114–126	785–870	...	98–100	81–83
H06	extra hard	118–130	815–895	...	99–101	81–83
H08	spring	123–134	850–925	...	99–101	82–84
H10	extra spring	130 min	895 min	...	100 min	83 min

^A Hardness values shown apply only to direct determination, not converted values. They are for information only.

^B ksi = 1000 psi.

^C See Appendix X1.

TABLE 3 Yield Strength Requirements for Copper Alloy UNS No. C70250

Temper Designation Code	Yield Strength at 0.2 % Offset	
	ksi ^A	MPa ^B
TM00	65–90	450–620
TM02	83–110	570–760
TM03	95–120	655–825
TR02	80 min	550 min
TH03	65–85	450–585

^A ksi = 1000 psi.

^B See Appendix X1.

TABLE 6 Yield Strength Requirements for Copper Alloy UNS No. C19010

Temper Designation Code	Yield Strength at 0.2 % Offset	
	ksi ^A	MPa ^B
TM03	50–65	345–450
TM04	60–75	415–515
TM06	64–79	440–545
TM08	74–89	510–615
H01	40–55	275–380
H02	54–69	370–475
H03	62–77	430–530
H04	66–81	455–560
H06	72–87	495–600
H08	78–93	540–640
H10	85–100	585–690

^A ksi = 1000 psi.

^B See Appendix X1.

TABLE 4 Tensile and Yield Strength Requirements for Copper Alloy UNS No. C70260 and C70265

Temper Designation Code	Yield Strength at 0.2 % Offset	
	ksi ^A	MPa ^B
TM00	65–85	450–585
TM02	90–100	620–690
TM03	95–115	655–795
TM04	100–120	690–825

Temper Designation Code	Tensile Strength	
	ksi ^A	MPa ^B
TM01	90–105	620–725

^A ksi = 1000 psi.

^B See Appendix X1.

TABLE 7 Tensile Strength Requirements for Copper Alloy UNS No. C19020

Temper Designation Code	Tensile Strength		Elongation in 2 in. [50.8 mm], %
	ksi ^A	MPa ^B	
HR02	58–70	400–485	5 min
HR04	65–74	450–510	3 min
HR06	71–80	490–550	3 min
HR08	77 min	530 min	2 min

^A ksi = 1000 psi.

^B See Appendix X1.

TABLE 5 Tensile Strength Requirements for Copper Alloy UNS No. C19025

Temper Designation Code	Tensile Strength		Elongation in 2 in. [50.8 mm], %
	ksi ^A	MPa ^B	
HR02	63–76	435–525	9–25
HR04	72–83	495–570	5–14
HR06	78 min	540 min	4–12

^A ksi = 1000 psi.

^B See Appendix X1.

TABLE 8 Yield Strength Requirements for Copper Alloy UNS No. C64725

Temper Designation Code	Yield Strength	
	ksi ^A	MPa ^B
TM02	70–90	485–620
TM04	85–105	585–725
TM06	95–115	655–795
TM08	100–120	690–825
HR04	80–105	550–725

^A ksi = 1000 psi.

^B See Appendix X1.

strength shall be the standard test for the precipitation heat-treated and mill-hardened tempers and shall conform to the requirements specified in Table 6.

8.5.1 If ductility or formability requirements are desired, they shall be negotiated and agreed upon between the manufacturer and purchaser.

8.6 Copper alloy C64725 is supplied in either mill-hardened temper (TM02–TM08) temper, or cold-worked, stress relieved

(HR04) temper. Tempers shall conform to the 0.2 % offset yield requirements specified in Table 8.

8.6.1 If ductility or formability requirements are desired, they shall be negotiated and agreed upon between the manufacturer and purchaser.