Designation: B 422 – 99

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 Strip[1]

This standard is issued under the fixed designation B 422; 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[2] Copper Alloy UNS Nos. C19025, C63800, C70250, and C70260 (Note 1) Sheet and Strip.

NOTE 1—This document contains some patented alloys. Alternatives such as beryllium coppers and spinodal alloys are available for similar applications.

1.2 The values stated in inch-pound units are to be regarded as the standard.

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 248 Specification for General Requirements for Wrought Copper and Copper–Alloy Plate, Sheet, Strip, and Rolled Bar[3]

E 527 Practice for Numbering Metals and Alloys (UNS)[4]

3. Ordering Information

3.1 Orders for material under this specification should include the following information:

3.1.1 Quantity (of each size),

3.1.2 Alloy: Copper Alloy UNS No. (Section 1),

3.1.3 Form of material (sheet or strip),

3.1.4 Temper (see 6.1),

3.1.5 Dimensions (thickness, width, length (if applicable),

3.1.6 How furnished (rolls, specific lengths with or without ends, stock lengths with or without ends),

3.1.7 Type of edge, if required (slit, sheared, sawed, square corners, rounded corners, rounded edges, or full-rounded edges (see 9.6),

3.1.8 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 9), and

3.1.9 ASTM specification number and year of issue.

3.2 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.

4. General Requirements

4.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification B 248.

5. Chemical Composition

5.1 The materials shall conform to the compositions prescribed in Table 1.

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

5.3 Copper may be taken as the difference between the sum of all the elements analyzed and 100 %. When all the elements in Table 1 for Alloys C63800, C70250, and C70260 are analyzed, their sum shall be 99.5 % min. When all the elements in Table 1 for Alloy C19025 are analyzed, their sum shall be 99.7 % min.

6. Temper

6.1 Tempers available under this specification are as designated in Tables 2, 3, 4, and 5.

7. Mechanical Properties

7.1 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

[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] *Annual Book of ASTM Standards*, Vol 02.01.

[4] *Annual Book of ASTM Standards*, Vol 01.01.

***A Summary of Changes section appears at the end of this standard.**

TABLE 1 Chemical Requirements Composition %

Element	C19025	C63800	C70250	C70260
Nickel	0.80–1.20	0.20 max.	2.2–4.2[A]	1.0–3.0[A]
Silicon	. . .	1.5–2.1	0.25–1.2	0.2–0.7
Lead, max.	. . .	0.05	0.05	. . .
Iron, max.	. . .	0.20	0.20	. . .
Zinc, max.	. . .	0.8	1.0	. . .
Aluminum	. . .	2.5–3.1	. . .	. . .
Copper	remainder	remainder	remainder	remainder
Cobalt	. . .	0.25–0.55	. . .	. . .
Manganese, max.	. . .	0.10	0.10	. . .
Magnesium	. . .	. . .	0.05–0.30	. . .
Tin	0.70–1.10	. . .	. . .	. . .
Phosphorus	0.03–0.07	. . .	. . .	0.010 max.

[A] Including cobalt.

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

Temper		Tensile Strength		Elongation in 2 in. (50.8 mm), %	Approximate Rockwell Hardness[A]	
Designation	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	¼hard	90–102	620–705	. . .	92–96	76–80
H02	½hard	100–112	690–775	. . .	95–98	79–81
H03	¾hard	105–117	720–810	. . .	97–99	80–82
H04	hard	114–126	785–870	. . .	98–100	81–83
H06	extra hard	118–130	815–900	. . .	99–101	81–83
H08	spring	123–134	845–925	. . .	99–101	82–84
H10	extra spring	130 min	900 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 Tensile Property Requirements for Copper Alloy UNS No. C70250

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

[A] ksi = 1000 psi.
[B] See Appendix X1.

TABLE 4 Tensile Requirements for Copper Alloy UNS No. C70260

Temper	Yield Strength at 0.2 % Offset	
Designation	ksi[A]	MPa[B]
TM00	65–85	450–585
TM02	85–105	585–725

[A] ksi = 1000 psi.
[B] See Appendix X1.

property requirements prescribed in Table 2.

7.2 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, 1/2 Hd 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.

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

7.3 Copper Alloy UNS No. C70260 is supplied in a mill-hardened temper. The 0.2 % offset yield strength shall be the standard test for the mill-hardened tempers and shall conform to the requirements specified in Table 4.

TABLE 5 Tensile Requirements for Copper Alloy UNS No. C19025

Designation	Tensile Strength		Elongation in 2 in.
	ksi[A]	MPa[B]	(50.8 mm) %
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.

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

7.4 Copper Alloy UNS No. C19025 is supplied in cold-worked, stress-relieved temper. These tempers shall conform to the tensile strength and elongation requirements in Table 5. The 0.2 % offset yield strength shall be the standard test for the mill-hardened tempers and shall conform to the requirements specified in Table 5.

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

8. Electrical Requirement

8.1 The electrical resistivity of Copper Alloys UNS Nos. C63800, C70250, C70260, and C19025 are listed in Table 6 for information only.

9. Dimensions and Permissible Variations

9.1 The dimensions and tolerances shall be as prescribed in

TABLE 6 Electrical Resistivity

Copper Alloy UNS No.	Temper	Electrical Resistivity at 20°C (68°F), $\Omega \cdot g/m^2$	Equivalent Conductivity at 20°C (68°F), % IACS
C63800		1.5328	10
C70250	TR02, TM00, TM02	0.3832	40
C70250	TM03	0.4258	36
C70260	TM00, TM02	0.3832	40
C19025	HR02, HR04, HR06	0.3832	40
C70250	TH03	0.3066	50

the current edition of Specification B 248, with particular reference to Section 5 and the following tables of that specification:

9.2 *Thickness:* See 5.2, Table 2.

9.3 *Width:*

9.3.1 *Slit Metal and Slit Metal with Rolled Edges*—See 5.3, Table 4.

9.3.2 *Square-Sheared Metal*—See 5.3, Table 5.

9.3.3 *Sawed Metal*—See 5.3, Table 6.

9.4 *Length:*

9.4.1 *Specific and Stock Lengths With and Without Ends*—See 5.4, Table 7.

9.4.2 *Schedule of Lengths (Specific and Stock) With Ends*—See 5.4, Table 8.

9.4.3 *Length Tolerances for Square-Metal*—See 5.4, Table 9.

9.4.4 *Length Tolerances for Sawed Metal*—See 5.4, Table 10.

9.5 *Straightness:*

9.5.1 *Slit Metal or Slit Metal Either Straightened or Edge-Rolled*—See 5.5, Table 11.

9.5.2 *Square-Sheared Metal*—See 5.5, Table 12.

9.5.3 *Sawed Metal*—See 5.5, Table 13.

9.6 *Edges*—See 5.6:

9.6.1 *Square Edges*—See 5.6.1, Table 14.

9.6.2 *Rounded Corners*—See 5.6.2, Table 15.

9.6.3 *Rounded Edges*—See 5.6.3, Table 16.

9.6.4 *Full-Rounded Edges*—See 5.6.4, Table 17.

10. Keywords

10.1 copper-aluminum-silicon-cobalt alloy; copper-nickel-aluminum magnesium alloy; copper-nickel-silicon alloy; copper nickel-silicon-magnesium alloy; copper-nickel-tin alloy; sheet; strip

APPENDIX

(Nonmandatory Information)

X1. METRIC EQUIVALENTS

X1.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ($N = kg \cdot m/s^2$). The derived SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since 1 ksi = 6 894 757 Pa, the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2.

SUMMARY OF CHANGES

Committee B05.01 has identified the location of selected changes to this standard since the last issue (B 422–98) that may impact the use of this standard.

(*1*) Removed C72400 from Table 6—Electrical Resistivity.
(*2*) Changed phosphorous content in C70260 to agree with the registered chemical composition.
(*3*)Added TR and TH tempers to 7.2.
(*4*) Changed MPa tensile limits to hard conversion in Table 2, Table 3, and Table 5.