



Designation: B 122/B122M – 95

Standard Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar¹

This standard is issued under the fixed designation B 122/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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers 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:²

| Copper Alloy UNS No. ² | Previously Used Designation | Nominal Composition, % | | | | Chro- mium |
|--------------------------------------|-----------------------------------|---------------------------|--------|------|-----|---------------|
| | | Copper | Nickel | Zinc | Tin | |
| C70600 | ... | 90 | 10 | ... | ... | ... |
| C71000 | 6 | 80 | 20 | ... | ... | ... |
| C71500 | 5 | 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 | 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, C71500, and C72200 for use as tube plates in surface condensers and heat exchangers are covered by Specification B 171.

1.2 The values stated in either inch-pound units or 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 millimeters.

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

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.

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 171 Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers³
- B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar³
- B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast³
- 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 Alloy number (Section 1),

3.1.1.1 Whether the alloy ordered will be used in applications requiring it to be welded (see Table 1, Footnote B),

3.1.2 Temper (Section 5),

3.1.3 Dimensions: thickness and width (see 9.2 and 9.3),

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

3.1.5 How furnished: flat or rolls,

3.1.6 Length (see 9.4), and

3.1.7 Weight: total for each size.

3.1.8 ASTM Specification B 122/B 122M, 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. Chemical Composition

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

4.2 These specification limits do not preclude the presence of other elements. Limits may be established for unnamed

³ Annual Book of ASTM Standards, Vol 02.01.

⁴ Annual Book of ASTM Standards, Vol 01.01.

TABLE 1 Chemical Requirements

| Copper Alloy UNS No. | Composition, % | | | | | | | | |
|----------------------|---------------------|------------------------|-------------------|-----------|----------------|----------------------|---------|-----------|----------------------|
| | Copper, incl Silver | Nickel, incl Cobalt | Lead, max | Iron, max | Manganese, max | Zinc | Tin | Chromium | Other Named Elements |
| C70600 | remainder | 9.0–11.0 ^A | 0.05 ^B | 1.0–1.8 | 1.0 | 1.0 ^B max | ... | ... | <i>B</i> |
| C71000 | remainder | 19.0–23.0 | 0.05 ^B | 1.0 max | 1.0 | 1.0 ^B max | ... | ... | <i>B</i> |
| C71500 | remainder | 29.0–33.0 ^A | 0.05 ^B | 0.40–1.0 | 1.0 | 1.0 ^B max | ... | ... | <i>B</i> |
| C72200 | remainder | 15.0–18.0 | 0.05 ^B | 0.50–1.0 | 1.0 | 1.0 ^B | ... | 0.30–0.70 | <i>B</i> |
| C72500 | remainder | 8.5–10.5 | 0.05 | 0.6 | 0.2 | 0.5 max | 1.8–2.8 | ... | ... |
| C73500 | 70.5–73.5 | 16.5–19.5 | 0.10 | 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 | ... | ... | ... |
| 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 | ... | ... | ... |
| C77000 | 53.5–56.5 | 16.5–19.5 | 0.05 | 0.25 max | 0.50 | remainder | ... | ... | ... |

^ACopper plus elements with specific limits, 99.5 % min.

^BWhen 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.

elements by agreement between manufacturer or supplier and purchaser.

4.2.1 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 |
| C71000 | 99.5 |
| C71500 | 99.5 |
| C72200 | 99.5 |
| C72500 | 99.8 |

4.2.2 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 |

5. Temper

5.1 *As Hot-Rolled (M20) Material*—The standard temper of

sheet and plate produced by hot rolling and is as designated in Table 2.

5.2 *Rolled (H) Material*—The standard tempers of rolled material are as designated in Table 2 with the prefix “H.” Former designations and the standard designations as defined in Practice B 601 are shown. Special or nonstandard tempers are subject to negotiation between manufacturer and purchaser (See 3.1.2).

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

6. Mechanical Properties of Rolled Tempers

6.1 Tensile Strength:

6.1.1 Products ordered to this specification in inch-pound units shall conform to the tensile strength requirements prescribed in ksi units in Table 2.

6.1.2 Products ordered to this specification in SI units shall conform to the tensile strength requirements prescribed in MPa units [bracketed] in Table 2.

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

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

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† | | | | | | |
| 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 | | | | | | |
| 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 |

TABLE 2 Continued

| 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. 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 [700] | ... | 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 [720] | ... | 90–95 | 76–79 |
| H06 | extra hard | 99 [685] | 114 [790] | ... | 94–98 | 79–81 |
| H08 | spring | 107 [740] | 122 [840] | ... | 97–100 | 80 and over |
| Copper Alloy UNS No. C77000 | | | | | | |
| M20 | as hot-rolled | 60 [415] | 80 [550] | ... | ... | ... |
| H01 | quarter hard | 69 [475] | 87 [600] | 23–62 | 70–88 | 63–75 |
| H02 | half hard | 78 [540] | 95 [655] | 51–69 | 81–92 | 71–78 |
| H04 | hard | 92 [635] | 109 [750] | 67–76 | 90–96 | 76–80 |
| H06 | extra hard | 102 [700] | 117 [810] | 73–80 | 95–99 | 79–82 |
| H08 | spring | 108 [740] | 123 [850] | 77–83 | 97–100 | 80 and over |

^Aksi = 1000 psi.

^BSee Appendix.

^CRockwell hardness values apply as follows: The B and G scale hardness values apply to metal 0.020 in. (0.508 mm) and over in thickness, and the 30-T scale hardness values apply to metal 0.012 in. (0.305 mm) and over in thickness.

^DStandard designation defined in Practice B 601.

7. Grain Size Requirements of Annealed Tempers

7.1 Grain size shall be the standard test for material of all thicknesses in annealed tempers, and acceptance or rejection shall depend on the grain sizes. The average grain size of each of two samples of annealed material as determined on a plane parallel to the surface of the material shall be within the limits prescribed in Table 3.

8. Rockwell Hardness

8.1 Rockwell hardness tests offer a quick and convenient method of checking copper-nickel-zinc and copper-nickel alloys of any temper for general conformity to the requirements for tensile strength or grain size. The approximate Rockwell hardness values for the rolled tempers are given in Table 2 and those for the annealed tempers of material 0.015 in. and over in thickness are given in Table 4, for general information and assistance in testing.

TABLE 3 Grain Size Requirements for Annealed Material

| Copper Alloy UNS No. | Standard Temper Designation ^A | Grain Size, mm | | |
|---|--|----------------|--------------|-------|
| | | Nomi- nal | Min | Max |
| C70600, C71000, C71500, C72200, C72500, C73500, and C76200 | OS035 | 0.035 | 0.025 | 0.050 |
| | OS015 | 0.015 | ^B | 0.025 |
| C74000, C74500, C75200, and C77000 | OS070 | 0.070 | 0.050 | 0.100 |
| | OS035 | 0.035 | 0.025 | 0.050 |
| | OS015 | 0.015 | ^B | 0.025 |

^AStandard designation defined in Practice B 601.

^BAlthough no minimum grain size is required, this material shall be fully recrystallized.

9. Dimensions and Permissible Variations

9.1 The inch-pound dimensions and tolerances for products covered by this specification shall be as prescribed in the current edition of Specification B 248, and the SI dimensions and tolerances covered by this specification shall be as prescribed in the current edition of Specification B 248M, with particular reference to Section 5 and the following tables of that specification:

9.2 *Thickness*—See 4.2, Table 1 and Table 2. when special thickness tolerances for Copper Alloy UNS No. C72500 are required see 5.2.3 and Table 3.

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 Section 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-Sheared 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.

TABLE 4 Approximate Rockwell Hardness of Annealed Material

| Standard Designation | Temper Nominal Grain Size, mm | Approximate Rockwell Hardness ^A | | |
|-----------------------------|----------------------------------|--|---------|------------------|
| | | B Scale | F Scale | Superficial 30-T |
| Copper Alloy UNS No. C70600 | | | | |
| OS035 | 0.035 | 10–27 | 55–72 | 15–34 |
| OS015 | 0.015 | 16–48 | 65–83 | 25–45 |
| Copper Alloy UNS No. C71000 | | | | |
| OS035 | 0.035 | 18–35 | 67–76 | 28–40 |
| OS015 | 0.015 | 35–58 | 76–90 | 40–55 |
| Copper Alloy UNS No. C71500 | | | | |
| OS035 | 0.035 | 23–45 | 70–85 | 31–46 |
| OS015 | 0.015 | 37–63 | 74–93 | 40–58 |
| Copper Alloy UNS No. C72200 | | | | |
| OS035 | 0.035 | 14–31 | ... | 24–36 |
| OS015 | 0.015 | 18–42 | ... | 26–41 |
| Copper Alloy UNS No. C72500 | | | | |
| OS035 | 0.035 | 24–39 | 70–81 | 32–42 |
| OS015 | 0.015 | 37–61 | 78–92 | 41–58 |
| Copper Alloy UNS No. C73500 | | | | |
| OS035 | 0.035 | 20–35 | 70–80 | 29–40 |
| OS015 | 0.015 | 28–55 | 76–90 | 34–53 |
| Copper Alloy UNS No. C74000 | | | | |
| OS070 | 0.070 | 5–20 | ... | ... |
| OS035 | 0.035 | 20–40 | ... | ... |
| OS015 | 0.015 | 35–55 | ... | ... |
| Copper Alloy UNS No. C74500 | | | | |
| OS070 | 0.070 | 15–30 | 63–73 | 26–36 |
| OS035 | 0.035 | 23–41 | 70–80 | 31–44 |
| OS015 | 0.015 | 41–59 | 80–90 | 44–56 |
| Copper Alloy UNS No. C75200 | | | | |
| OS070 | 0.070 | 25–40 | 70–80 | 32–43 |
| OS035 | 0.035 | 35–55 | 75–88 | 40–53 |
| OS015 | 0.015 | 45–70 | 83–93 | 46–64 |
| Copper Alloy UNS No. C76200 | | | | |
| OS035 | 0.035 | 20–35 | 70–80 | ... |
| OS015 | 0.015 | 28–55 | 76–90 | ... |
| Copper Alloy UNS No. C77000 | | | | |
| OS070 | 0.070 | 29–45 | 72–83 | 35–46 |
| OS035 | 0.035 | 37–60 | 76–91 | 41–57 |
| OS015 | 0.015 | 47–73 | 84–98 | 47–65 |

^ARockwell hardness values apply as follows: The B and F scale hardness values apply to metal 0.020 in. (0.508 mm) and over in thickness and the 30-T scale hardness values apply to metal 0.015 in. (0.381 mm) and over in thickness.

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. General Requirements

10.1 Products furnished under this specification in inch-pound units shall conform to the applicable requirements of the current edition of Specification B 248.

10.2 Products furnished under this specification in SI Units shall conform to the applicable requirements of the current edition of Specification B 248M.

11. Keywords

11.1 copper-nickel plate; copper-nickel rolled bar; copper-nickel sheet; copper-nickel strip; copper-nickel-tin plate; copper-nickel-tin rolled bar; copper-nickel-tin sheet; copper-nickel-tin strip; copper-nickel-zinc plate; copper-nickel-zinc rolled bar; copper-nickel-zinc sheet; copper-nickel-zinc 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 ($N = \text{kg} \cdot \text{m}/\text{s}^2$). 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 $1 \text{ ksi} = 6\,894\,757 \text{ Pa}$ the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2 .

 **B 122/B122M**

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