



Designation: B98/B98M – 13 (Reapproved 2019)

Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes¹

This standard is issued under the fixed designation B98/B98M; 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 requirements for copper-silicon rod, bar, and shapes for UNS Copper Alloys C65100, C65500, and C66100.

NOTE 1—Material for hot forging is covered by Specification B124/B124M.

NOTE 2—For ASME Boiler and Pressure Vessel Code applications, see Specification SB-98 in Section II of that code.

1.2 *Units*—The values stated in either SI units or inch-pound 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*:²

B124/B124M Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

B950 Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys

B601 Classification for Temper Designations for Copper and

Copper Alloys—Wrought and Cast

E8/E8M Test Methods for Tension Testing of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)³

E478 Test Methods for Chemical Analysis of Copper Alloys 2.2 *ASME Standard*:⁴

ASME Boiler and Pressure Vessel Code

3. General Requirements

3.1 The following sections of Specification B249/B249M constitute a part of this specification:

3.1.1 Terminology;

3.1.2 Materials and Manufacture;

3.1.3 Workmanship, Finish, and Appearance;

3.1.4 Sampling;

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 Reports;

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 one of those referenced in 3.1 appears in this specification, it contains additional requirements that supplement those which appear in Specification B249/B249M.

4. Ordering Information

4.1 Include the following specified choices when placing orders for product under this specification, as applicable:

4.1.1 ASTM Designation and year of issue;

¹ This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.02 on Rod, Bar, Wire, Shapes and Forgings.

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² 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.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

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

- 4.1.2 Copper Alloy UNS No. designation;
- 4.1.3 Temper designation (see Temper Section 7);
- 4.1.4 Quantity; total weight or length, or number of pieces of each temper, form, or alloy;
- 4.1.5 Dimensions; diameter or distance between parallel surfaces;
- 4.1.6 Type of edge; edge contours;
- 4.1.7 How furnished; specific lengths with or without ends; and
- 4.1.8 Intended application.

4.2 The following options are available but may not be included unless specified at the time of placing of the order when required:

- 4.2.1 Certification (Specification B249/B249M), and
- 4.2.2 Mill Test Report (Specification B249/B249M).
- 4.2.3 Tensile test required for alloys in Table 4 or Table 5 (see 8.1.1.1),
- 4.2.4 If product is purchased for agencies of the U.S. Government (see Supplementary Requirements in Specification B249/B249M).

5. Material and Manufacture

5.1 *Materials*—The starting material shall be cast billets or rods of Copper Alloy UNS Nos. C65100, C65500, or C66100, and shall be of such soundness and structure as to enable them to be processed into the product specified in the contract or purchase order.

5.2 *Manufacture*—The product shall be manufactured by such hot-working, cold-working, straightening, and annealing processing as to produce a uniform wrought structure and obtain the required finish properties.

6. Chemical Composition

6.1 The material shall conform to the chemical requirements specified in Table 1 for the Copper Alloy UNS No. designated in the ordering information.

6.1.1 For alloys in which copper is listed as “remainder,” copper is the difference between the sum of the results of all elements determined and 100 %.

6.1.2 When all elements listed in Table 1 are determined for the designated alloy, the sum of results shall be 99.5 % min.

TABLE 1 Chemical Requirements

| | Composition, % Maximum (Unless Shown as a Range or Minimum) | | |
|-----------------------------|--|-----------|-----------|
| | Copper Alloy UNS No. | | |
| | C65100 | C65500 | C66100 |
| Copper (Includes silver) | remainder | remainder | remainder |
| Lead | 0.05 | 0.05 | 0.20–0.8 |
| Iron | 0.8 | 0.8 | 0.25 |
| Zinc | 1.5 | 1.5 | 1.5 |
| Manganese | 0.7 | 0.50–1.3 | 1.5 |
| Silicon | 0.8–2.0 | 2.8–3.8 | 2.8–3.5 |
| Nickel (includes cobalt) | ... | 0.6 | ... |

6.2 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer and the purchaser.

7. Temper

7.1 The standard tempers, as defined in Classification B601, for products described in this specification are given in Tables 2-5.

- 7.1.1 Soft annealed O60,
- 7.1.2 ¼-hard H01,
- 7.1.3 ½-hard H02,
- 7.1.4 Hard H04,
- 7.1.5 Extra-hard H06,
- 7.1.6 As hot rolled M20, and
- 7.1.7 As hot extruded M30.

7.2 Product of bars and shapes in the temper H06 is normally not produced.

8. Mechanical Property Requirements

8.1 Product furnished under this specification shall conform to the tensile and hardness requirements prescribed in Tables 2-5 for the Copper Alloy UNS No. designation specified in the ordering information.

8.1.1 *Rockwell Hardness Requirement*—For the alloys and tempers listed, product 0.5 in. [12 mm] and over in diameter or in the distance between parallel surfaces shall conform with the requirements given in Table 4 and Table 5, when tested in accordance with Test Methods E18.

8.1.1.1 For the alloys and tempers listed in Table 4 and Table 5, Rockwell hardness shall be the basis of acceptance or rejection for mechanical properties except when the tensile test is specified in the contract or purchase order.

8.1.2 *Tensile Strength Requirements*—The product shall conform with the requirements of Table 2 and Table 3 when tested in accordance with Test Methods E8/E8M.

8.1.2.1 The tensile requirements for all alloys and forms of M20 and M30 tempers shall be as agreed upon between the manufacturer and purchaser at the time of order.

9. Dimensions, Mass and Permissible Variations

9.1 Refer to the appropriate paragraphs in Specification B249/B249M with particular reference to the following tables:

9.2 *Diameter or Distance Between Parallel Surfaces:*

9.2.1 *Rod: Round, Hexagonal, Octagonal*—Refer to Table 1 for Alloy C65100 and to Table 2 for Alloys C65500 and C66100.

9.2.2 *Rod: Round M20 Temper*—Refer to Table 6.

9.2.3 *Rod: Round, Hexagonal, Octagonal, M30 Temper*—Refer to Table 5.

9.2.4 *Bar: Rectangular and Square*—Refer to Tables 8 and 10 for Alloy C65100, and Tables 9 and 11 for Alloys C65500 and C66100.

9.2.5 *Bar: M30 Temper*—Refer to Table 5 for thickness and width tolerances.

9.3 *Shapes*—The dimensional tolerance for shapes shall be as agreed upon between the manufacturer and the purchaser, and shall be specified in the order.