



Designation: **B974/B974M—12 B974/B974M – 12a**

Standard Specification for Free-Cutting Bismuth Brass Rod, Bar and Wire¹

This standard is issued under the fixed designation **B974/B974M**; 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.

1. Scope*

1.1 This specification establishes the requirements for free-cutting bismuth brass rod, bar and wire of UNS Alloy No. C49250, C49260 and C49340 suitable for high-speed screw machine work, or for general applications.

1.2 Typically, product made to this specification is furnished as straight lengths, or coils when requested.

1.3 *Units*—The values stated in either SI units or inch-pound 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.

1.4 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

[B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings](#)

[B250/B250M Specification for General Requirements for Wrought Copper Alloy Wire](#)

[B846 Terminology for Copper and Copper Alloys](#)

[E8 Test Methods for Tension Testing of Metallic Materials](#)

[E8M Test Methods for Tension Testing of Metallic Materials \[Metric\] \(Withdrawn 2008\)³](#)

[E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry](#)

[E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes \(Withdrawn 2002\)³](#)

[E62 Test Methods for Chemical Analysis of Copper and Copper Alloys \(Photometric Methods\) \(Withdrawn 2010\)³](#)

[E92 Test Method for Vickers Hardness of Metallic Materials \(Withdrawn 2010\)³](#)

[E478 Test Methods for Chemical Analysis of Copper Alloys](#)

2.2 Other Standards:

[JIS H 1068:2005 Method for Determination of Bismuth in Copper and Copper Alloys⁴](#)

[ISO 5959-1984 Copper and copper alloys – determination of bismuth content – Diethyldithiocarbamate spectrometric method⁵](#)

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 Sampling,

3.1.4 Number of Tests and Retests,

3.1.5 Specimen Preparation,

3.1.6 Test Methods,

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 Japanese Industrial Standards through [http://www.JIS.or.jp](#), or [www.webstore.jsa.or.jp/webstore/JIS/Flowcontrol.JSP](#).

⁵ Available from International Organization of Standards, [http://www.ISO/ISO/store.htm](#).

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

- 3.1.7 Inspection,
- 3.1.8 Certification,
- 3.1.9 Test Reports.

3.2 In addition, when a section with a title identical to that referenced in 3.1 appears in this specification, it contains additional requirements which supplement those appearing in Specification B249/B249M.

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 information in orders for products:
 - 5.1.1 ASTM designation and year of issue,
 - 5.1.2 Copper UNS No. designation,
 - 5.1.3 How furnished (rod or bar in straight length, or wire in coils)
 - 5.1.4 Temper,
 - 5.1.5 Cross section (round, hexagonal, square, rectangular),
 - 5.1.6 Dimensions; diameter or distance between parallel surfaces, width and thickness,
 - 5.1.7 How furnished: straight lengths or coils,
 - 5.1.8 Quantity: total weight or total length, or number of pieces of each size,
 - 5.1.9 If the product is purchased for agencies of the U.S. Government (see the Supplemental Requirements section of Specifications B249/B249M or B250/B250M for additional requirements, if specified).
- 5.2 The following options are available and should be specified at the time of placing the order when required:
 - 5.2.1 Heat identification or traceability details.
 - 5.2.2 Certification.
 - 5.2.3 Mill Test Report.
 - 5.2.4 Automatic screw machine straightness (see 10.4).
 - 5.2.5 Yield strength test required (see 14.2).
 - 5.2.6 Resistivity test required (see 10.1).
 - 5.2.7 Marking of specification number (see 21.2).

6. Materials and Manufacture

- 6.1 *Materials:*
 - 6.1.1 The material of manufacture shall be a form of Copper Alloy UNS Nos. C49250, C49260 or C49340 of such purity and soundness as to be suitable for processing into the products prescribed herein.
 - 6.1.2 In the event heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 1—Due to 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.

7. Chemical Composition

- 7.1 The material shall conform to the chemical composition requirements in Table 1 for the UNS Number specified in the ordering information.
- 7.2 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.
- 7.3 For alloys in which zinc is listed as “remainder”, zinc is the difference between the sum of results of all elements determined and 100%. When all elements in Table 1 are determined, the sum of the results shall be 99.5% min.

8. Temper

- 8.1 The standard tempers for products described in this specification are given in Table 2.
 - 8.1.1 Rod (round, hexagonal, and octagonal), and bar shall be furnished for general use in O60 temper for maximum formability, and H02 (half-hard) for applications involving moderate cold forming.



TABLE 1 Chemical Requirements

| Element | Composition, % maximum unless shown as a range or minimum Copper or Copper Alloy UNS No. | | |
|------------|---------------------------------------------------------------------------------------------|-------------|-----------|
| | C49250 | C49260 | C49340 |
| Copper | 58.0 - 61.0 | 58.0 - 63.0 | 60.0-63.0 |
| Zinc | Remainder | Remainder | Remainder |
| Bismuth | 1.8-2.4 | 0.50-1.8 | 0.50-2.0 |
| Bismuth | 1.8 - 2.4 | 0.50 - 1.8 | 0.50-2.2 |
| Lead | 0.09 | 0.09 | 0.09 |
| Iron | 0.50 | 0.50 | 0.12 |
| Tin | 0.30 | 0.50 | 0.50-1.5 |
| Cadmium | 0.001 | 0.001 | 0.001 |
| Phosphorus | -- | 0.05 - 0.15 | 0.05-0.15 |
| Silicon | -- | 0.10 | 0.10 |

TABLE 2 Tensile Requirements, SI

NOTE 1—See Table 3 for inch-pound values.

| Temper Designation Standard Name | | Diameter or Distance Between Parallel Surfaces, mm | | Tensile Strength, Min, MPa | Yield Strength at 0.5 % Extension under Load, min, MPa | Elongation, ^A min, % |
|-------------------------------------|-------------|----------------------------------------------------------|-----------------------|-------------------------------|-----------------------------------------------------------------|------------------------------------|
| Code | Name | Rod and Wire | | | | |
| O60 | soft anneal | 25 and under | | 330 | 140 | 15 |
| | | over 25 to 50, incl. | | 305 | 125 | 20 |
| H02 | half-hard | over 50 | | 275 | 105 | 25 |
| | | 12 and under | | 395 | 170 | 7 ^B |
| | | over 12 to 25, incl. | | 380 ^C | 170 | 10 |
| | | over 25 to 50, incl. | | 345 | 140 | 15 |
| | | over 50 to 100, incl., and | | 310 | 105 | 20 |
| | | over 100 | | 275 | 105 | 20 |
| | | Bar | | | | |
| | | Thickness, mm | Width, mm | | | |
| O60 | soft anneal | 25 and under | 150 and under | 305 | 125 | 20 |
| | | over 25 | 150 and under | 275 | 105 | 25 |
| H02 | half-hard | 12 and under | 25 and under | 345 | 170 | 10 |
| | | 12 and under | over 25 to 150, incl. | 310 | 115 | 15 |
| | | over 12 to 50, incl. | 50 and under | 310 | 115 | 15 |
| | | over 12 to 50, incl. | over 50 to 150, incl. | 275 | 105 | 20 |
| | | over 50 | over 50 to 100, incl. | 275 | 105 | 20 |

^A In any case, a minimum gage length of 25 mm shall be used. SI elongation values are based on a gage length of 5.65 times the square root of the area for dimensions greater than 2.5 mm.

^B For product furnished in coils the elongation shall be 4% min.

^C If product is specified for thread rolling applications, the minimum tensile strength shall be 350 MPa.

9. Mechanical Property Requirements

9.1 The product shall conform to the tensile strength and elongation requirements of Tables 2 and 3 when tested in accordance with Test Methods E8 and E8M.

9.2 When specified in the contract or purchase order, the yield strength shall be determined and conform with the yield strength requirements of Table 2 when tested in accordance with Test Methods E8 and E8M.

10. Dimensions, Mass, and Permissible Variations

10.1 The dimensions and tolerances for rod and material described by this specification shall be as specified in Specifications B249/B249M or B250/B250M with particular reference to the following tables and related paragraphs in those specifications.

10.2 *Diameter or Distance Between Parallel Surfaces:*

10.2.1 *Rod (Round, Hexagonal, and Octagonal)*—See 6.2 and Table 1 of Specification B249/B249M.

10.2.2 *Bar (Rectangular and Square)*—See 6.2 and Tables 7 and 10 of Specification B249/B249M.

10.2.3 *Wire*—See 6.2 and Table 1 of Specification B250/B250M.

10.3 *Lengths*—O60 (soft anneal) and H02 (half hard) temper rod and bar, See 6.3 and Tables 13 and 14 of Specification B249/B249M.