



Designation: B974/B974M – 16 (Reapproved 2021)

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, C49265, C49340, and C49345 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 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.

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

1.5 *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

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

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.

E8/E8M Test Methods for Tension Testing of Metallic Materials

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 Methods for Vickers Hardness and Knoop Hardness of Metallic Materials

E478 Test Methods for Chemical Analysis of Copper Alloys

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

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** for rod and bar, and Specification **B250/B250M** for wire 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,
- 3.1.7 Inspection,
- 3.1.8 Certification, and
- 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

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

⁴ Available from Japanese Standards Association (JSA), Mita MT Bldg., 3-13-12 Mita, Minato-ku, Tokyo 108-0073, Japan, http://www.jsa.or.jp.

⁵ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

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

Specification **B249/B249M** for rod and bar and Specification **B250/B250M** for wire.

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; and
- 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, C49265, C49340, or C49345 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.

7.1.1 Results of analysis on a product (check) sample shall conform to the composition requirements within the permitted analytical variance specified in **Table 1**.

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.

7.4 All chemical composition requirements must be in accordance with the UNS Registered Composition or another internationally recognized system for alloy designation (“other designation”). It is permissible for applications to have tighter (more restrictive) limits, but they must be completely within the registered UNS (or other designation) Composition. When different limits outside the registered limits are desired, a new Registered UNS Composition must be obtained.

NOTE 2—Refer to **E527** Standard Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS) for information on registering a UNS composition.

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	C49265	C49340	C49345
Copper	58.0–61.0	58.0–63.0	58.0–62.0 ^A	60.0–63.0	60.0–64.0 ^A
Zinc	Remainder	Remainder	Remainder	Remainder	Remainder
Bismuth	1.8–2.4	0.50–1.8	0.50–1.3	0.50–2.2	0.50–1.3
Lead	0.09	0.09	0.09–0.25	0.09	0.09–0.25
Iron	0.50	0.50	0.30	0.12	0.30
Tin	0.30	0.50	0.50	0.50–1.5	0.50–1.5
Cadmium	0.001	0.001	0.001	0.001	0.001
Phosphorus	--	0.05–0.15	0.05–0.12	0.05–0.15	0.05–0.12
Silicon	--	0.10	0.10	0.10	0.10

^A Includes Ag.

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
		over 50		275	105	25
H02	half-hard	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 over 100		310	105	20
				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/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/E8M.

TABLE 3 Tensile Requirements, Inch-Pound

NOTE 1—See Table 2 for SI values.

Temper Designation Standard Name		Diameter or Distance Between Parallel Surfaces, in.		Tensile Strength, min, ksi	Yield Strength at 0.5 % Extension under Load, min, ksi	Elongation, ^A min, %
Code	Name	Rod and Wire				
O60	soft anneal	1 and under		48	20	15
		over 1 to 2, incl.		44	18	20
		over 2		40	15	25
H02	half-hard	½ and under		57	25	7 ^B
		over ½ to 1, incl.		55 ^C	25	10
		over 1 to 2, incl.		50	20	15
		over 2 to 4, incl., and over 4		45	15	20
				40	15	20
Bar						
		Thickness, in.	Width, in.			
O60	soft anneal	1 and under	6 and under	44	18	20
		over 1	6 and under	40	15	25
H02	half-hard	½ and under	1 and under	50	25	10
		½ and under	over 1 to 6, incl.	45	17	15
		over ½ to 2, incl.	2 and under	45	17	15
		over ½ to 2, incl.	over 2 to 6, incl.	40	15	20
		over 2	over 2 to 4, incl.	40	15	20

^A In any case, a minimum gage length of 1 in. shall be used.

^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 52 ksi.