



Designation: B974/B974M-10 ~~Designation: B974/B974M - 12~~

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 and C49260 suitable for high-speed screw machine work, or for general applications.*~~

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]

E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes

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

E92 Test Method for Vickers Hardness of Metallic Materials

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 Alloys³

ISO 5959-1984 Copper and copper alloys – determination of bismuth content – Diethylthiocarbamate spectrometric method⁴

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.

Current edition approved Oct. 1, 2010. Published November 2010.

Current edition approved April 1, 2012. Published May 2012. Originally approved in 2010. Last previous edition approved in 2010 as B974/B974M-10. DOI: 10.1520/B0974_B0974M-12.

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 Available from Japanese Industrial Standards through <http://www.JIS.or.jp>, or www.webstore.jsa.or.jp/webstore/JIS/Flowcontrol.JSP.

⁴ 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 ~~C49260~~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.

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.

TABLE 1 Chemical Requirements

Element	Composition, % maximum unless shown as a range or minimum		
	Copper or Copper Alloy UNS No.		
	C49250	C49260	C49340
Copper (incl silver)	58.0 – 61.0%	58.0 – 63.0%	
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%	
Bismuth	1.8 – 2.4	0.50 – 1.8	0.50–2.0
Lead	0.09% max	0.09% max	
Lead	0.09	0.09	0.09
Iron	0.50% max	0.50% max	
Iron	0.50	0.50	0.12
Tin	0.30% max	0.50% max	
Tin	0.30	0.50	0.50–1.5
Cadmium	0.001% max	0.001% max	
Cadmium	0.001	0.001	0.001
Phosphorus	--	0.05 – 0.15%	
Phosphorus	--	0.05 – 0.15	0.05–0.15
Silicon	--	0.10% max	
Silicon	--	0.10	0.10
Cu + sum of named elements,	99.5% min.	99.5% min	

TABLE 2 Tensile Requirements, SI

NOTE—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	310 275	105 105	20 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.

9.2 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.