



Designation: B967/B967M – 12

Standard Specification for Copper-Zinc-Tin-Bismuth Alloy Rod, Bar and Wire¹

This standard is issued under the fixed designation B967/B967M; 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 copper-zinc-tin-bismuth alloy rod, bar and wire of alloy UNS Nos. C49255, C49260, C49300, C49340, C49350, C49355, and C49360 intended for use in plumbing applications and drinking water systems.

1.2 Typically, rod and bar product made to this specification is furnished as straight lengths. Wire (H04) 0.08-0.3 in. [2-8 mm inclusive] is furnished in coil form, and H50 shapes.

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 The following safety hazard caveat pertains only to the test method(s) described in this specification.

1.4.1 *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/E8M Test Methods for Tension Testing of Metallic Materials

E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes (Withdrawn 2002)³

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)³

E92 Test Method for Vickers Hardness of Metallic Materials (Withdrawn 2010)³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:*

ISO No. 3110 (AA) Copper Alloys – Determination of Aluminum as an Alloying Element – Volumetric⁴ (International Organization of Standardization)

JIS H 1068:2005 Method for Determination of Bismuth in Copper and Copper Alloys⁵ (Japanese Industrial Standards)

3. General Requirements

3.1 The following sections of Specifications **B249/B249M** or **B250/B250M** 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 Certification, and

3.1.7 Test Reports.

3.2 In addition, when a section with a title identical to that referenced in X.1, above, appears in this specification, it contains additional requirements which supplement those appearing in Specifications **B249/B249M** or **B250/B250M**.

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 when placing orders for product under this specification, as applicable:

5.1.1 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 International Organization of Standards, <http://www.ISO.org/ISO/store.htm>

⁵ Japanese Industrial Standard, available through <http://www.JIS.or.jp/>

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

- 5.1.2 Copper Alloy UNS designation,
- 5.1.3 Temper (Section 8),
- 5.1.4 Dimensions, diameter, or distance between parallel surfaces,
- 5.1.5 How furnished: straight lengths or coils,
- 5.1.6 Quantity: total weight or total length or number of pieces of each size,
- 5.1.7 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements section of Specifications **B249/B249M** or **B250/B250M** for additional requirements, if specified).
- 5.1.8 *Shapes*—When product is shapes, the dimensional tolerances shall be as agreed upon between the manufacturer or supplier and purchaser and shall be specified (see **11.1.7**).

5.2 The following options are available and should be specified at the time of placing of the order when required:

- 5.2.1 Heat identification or traceability details,
- 5.2.2 Certification, and
- 5.2.3 Mill Test Report.

6. Materials and Manufacture

6.1 Materials:

6.1.1 The material of manufacture shall be a form of Copper Alloy UNS Nos. C49255, C49260, C49300, C49340, C49350, C49355, and C49360 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 copper alloy UNS Numbers specified in the ordering information.

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

7.3 For alloys in which zinc is listed as “remainder,” either copper or zinc may be taken as the difference between the sum of results of all elements determined and 100 %. When all elements in **Table 1** are determined, the sum of results shall be 99.5 % min.

7.4 For alloys in which copper is listed as “remainder”, copper 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 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 Hot Extruded and Annealed: O30
- 8.1.2 Annealed: 061 for rod and bar
- 8.1.3 As Hot Extruded: M30 for rod and bar
- 8.1.4 Cold drawn half hard temper: H02 for rod and bar
- 8.1.5 Cold drawn hard temper: H04 for wire
- 8.1.6 Hot extruded and drawn: H50 for Shapes in all sizes.

9. Mechanical Property Requirements

9.1 Tensile Strength Requirements:

9.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in **Table 2**, when tested in accordance with Test Methods **E8/E8M**.

9.1.2 Acceptance or rejection shall be based upon the tensile properties prescribed in **Table 2**, **Table 3**, **Table 4**, or **Table 5**, depending on alloy and product form.

10. Other Requirements

10.1 Purchases for the U.S. Government – Product purchased for agencies of the U.S. Government shall conform to the additional requirements prescribed in the Supplementary Requirements section of Specifications **B249/B249M** or **B250/B250M**.

11. Dimensions, Mass, and Permissible Variation

11.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification

TABLE 1 Chemical Composition, %

Copper Alloy UNS No.	Copper	Lead max	Iron max	Tin	Zinc	Phosphorus max	Aluminum max	Antimony max	Bismuth max	Manganese max	Nickel max, incl Co	Selenium max	Silicon max
C49255	58.0-60.0 ^A	0.01	0.10	0.50 max	Rem	0.10	...	...	1.7-2.9	...	0.10-0.30	0.02-0.07	0.10
C49260 ^B	58.0–63.0	0.09	0.50	0.50	Rem	0.05–0.15	...	...	0.50–1.8	...	...	...	0.10
C49300	58.0–62.0	0.01	0.10	1.0–1.8	Rem	0.20	0.50	0.50	.50–2.0	0.03	1.5	0.20	0.10
C49340 ^B	60.0-63.0	0.09	0.12	0.50-1.5	Rem	0.05–0.15	...	...	0.50–2.2	...	...	...	0.10
C49350	61.0–63.0	0.09	0.12	1.5–3.0	Rem	0.04–0.15	...	0.02-0.10	0.50–2.5	...	...	...	0.30
C49355 ^C	63.0–69.0	0.09	0.10	0.50–2.0	27.0–35.0	...	...	...	0.50–1.5	0.10	...	...	1.0–2.0
C49360	Rem	0.09	...	1.0-2.0	19.0-22.0	...	...	...	0.50-1.5	...	...	...	2.0-3.5

^A Includes cadmium 0.01 max.

^B Includes Cadmium 0.001 max.

^C Boron 0.001 max.

TABLE 2 Mechanical Property Requirements – Round and Hexagonal Rod, Bar^A and Wire

Temper	Diameter or Distance Between Parallel Surfaces, in. (mm)	Tensile Strength, ksi (MPa) min	Yield Strength 0.2 offset ksi (MPa) min	Elongation in 4 × dia. % min	Vickers Hardness 5000 gms Typ.
Code	Name				
Copper Alloys UNS No. C49260, C49300, and C49340					
M30	As Hot Extruded	1 to 4.375 incl. (25 – 110) incl.	50 (345)	20 (140)	18
O61	Annealed	.3 – 1 incl. (8 – 25) incl.	50 (345)	20 (140)	15
		1 – 2.5 incl. (26 – 65) incl.	48 (330)	16 (110)	15
H02	½ Hard	.3 – 1 incl. (8 – 25) incl.	55 (380)	25 (170)	15
		1 – 2.5 incl. (26 – 65) incl.	50 (345)	20 (140)	15
H04	Hard Wire	.08 – .3 incl. (2 – 8) incl.	67 (460)	45 (310)	3
H50	Hot extruded and Drawn	All Sizes	50 (345)	20 (140)	
Copper Alloy UNS No C49350					
M30	As Hot extruded	1 – 4.375 incl. (25-110 incl.)	50 (345)	20 (140)	15
O61	Annealed	.3 – 2.5 incl. (8-25 incl.)	48 (330)	16 (110)	12

^A For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.

TABLE 3 Mechanical Property Requirements UNS Alloy No. C49255 Rod

Code	Temper Name	Diameter or Distance Between Parallel Surfaces, in. (mm)	Tensile Strength, ksi (MPa) min	Yield Strength 0.2 offset ksi (MPa) min	Elongation in 4 × dia. % min	Vickers Hardness 5000 gms Typ.
M30	As Hot Extruded	1 to 4.375 incl. (25 – 110) incl.	46 (315)	...	15	...
O30	Hot Extruded and Annealed	0.3 – 3 incl. (8 – 75) incl.	49 (335)	...	...	80

TABLE 4 Mechanical Property Requirements UNS Alloy No. C49355 Round and Hexagonal Rod and Bar^A

Code	Temper Name	Diameter or Distance Between Parallel Surfaces, in. (mm)	Tensile Strength, ksi (MPa) min	Yield Strength 0.2 offset ksi (MPa) min	Elongation in 4 × dia. % min
M30	As Hot extruded	0.3–2.5 incl. (8–65 incl.)	50 (345)	20 (140)	15
O60	Soft Annealed	0.3–2.5 incl. (8–65 incl.)	50 (345)	20 (140)	15

TABLE 5 Mechanical Property Requirements UNS Alloy No. C49360 Round and Hexagonal Rod and Bar^A

Code	Temper Name	Diameter or Distance Between Parallel Surfaces, in. (mm)	Tensile Strength, ksi (MPa) min	Yield Strength 0.2 offset ksi (MPa) min	Elongation in 4 × dia. % min	Vickers Hardness 5000 gms Typ.
M30	As Hot Extruded	1 to 3.15 incl. (26 – 80) incl.	50 (345)	22 (150)	15	...
O61	Annealed	0.4 – 1 incl. (10 – 25) incl.	50 (345)	22 (150)	12	...

^A For rectangular bar, the distance between parallel surfaces refers to thickness.

B249/B249M or **B250/B250M** for wire as noted, with particular reference to the following Tables and related paragraphs:

11.1.1 Diameter or Distance Between Parallel Surfaces

11.1.1.1 Rod, Cold-Drawn, H02, H04 Table 1, **B249/B249M**.

11.1.1.2 Hot Extruded and Annealed, O30 Table 4, **B249/B249M**.

11.1.1.3 Rod and Bar, As Extruded, O61 Table 4, **B249/B249M**.

11.1.1.4 Wire Cold Drawn Hard, H04 Table 1, **B250/B250M**.

11.1.2 Thickness Tolerance for Rectangular and Square Bar, Table 8, **B249/B249M**.

11.1.3 Width Tolerance for Rectangular Bar, Table 10, **B249/B249M**.

11.1.4 Length: Table 13, Full Length Tolerances for Rod, Bar, and Table 15, Schedule of Lengths with Ends for Rod and Bar, **B249/B249M**.