



Designation: **B139/B139M—07 B139/B139M – 12**

Standard Specification for Phosphor Bronze Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B139/B139M; 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 Department of Defense.

1. Scope*

1.1 This specification establishes the requirements for phosphor bronze rod, bar, and shapes.

1.2 ~~Units—The values~~ Values stated in either inch-pound units or SI units are to be regarded separately ~~in the as~~ standard. Within the text, ~~the SI values~~ units are given shown in brackets. The values stated in each system ~~are~~ may not be exact equivalents; ~~therefore,~~ each system of ~~units is independent~~ shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

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

[E8B601](#) ~~Test Methods for Tension Testing of Metallic Materials~~ Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

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

[B950](#) Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys

[E8ME8/E8M](#) Test Methods for Tension Testing of Metallic Materials ~~[Metric]~~ (Withdrawn 2008)

[E62](#) Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)³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

3. Terminology

3.1 For definitions of terms related to copper and copper alloys refer to Terminology [B846](#).

4. General Requirements

4.1 The following sections of Specification [B249/B249M](#) constitute a part of this specification.

4.1.1 Terminology.

4.1.2 Materials and Manufacture.

4.1.3 Workmanship, Finish and Appearance.

4.1.4 Sampling.

4.1.5 Number of Tests and Retests.

4.1.6 Specimen Preparation.

4.1.7 Test Methods.

4.1.8 Significance of Numerical Limits.

4.1.9 Inspection.

4.1.10 Rejection and Rehearing.

4.1.11 Certification.

4.1.12 Mill Test Report.

4.1.13 Packaging and Package Marking.

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, 2007~~ Oct. 1, 2012. Published ~~October 2007~~ November 2012. Originally approved in 1941. Last previous edition approved in ~~2006~~ 2007 as [B139/B139M—06](#). [B139/B139M – 07](#). DOI: [10.1520/B0139_B0139M-07.10.1520/B0139_B0139M-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 The last approved version of this historical standard is referenced on [www.astm.org](#).

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



4.2 In addition, when a section with a title identical to that referenced in 3.14.1 above appears in this specification, it contains additional information which supplements that appearing in Specification B249/B249M. In case of conflict, this specification shall prevail.

5. Ordering Information

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

- 5.1.1 ASTM designation and year of issue,
5.1.2 Copper Alloy UNS No. designation (for example, C51000),
5.1.3 Temper (for example, H04),
5.1.4 Form of product (rod, bar or shape),
5.1.5 Dimensions and permissible variations,
5.1.6 Edge Contours,
5.1.7 Quantity—total weight of each copper alloy, temper, form, and size, and
5.1.8 If product is purchased for an agency of the U.S. government (see Supplementary Requirements section of Intended application B249/B249M).

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

- 5.2.1 Piston-finish rod or shafting (Other Requirements section),
5.2.2 Certification (Specification B249/B249M), and
5.2.3 Mill test report (Specification B249/B249M).
5.2.4 If product is purchased for agencies of the U.S. Government (see Supplementary Requirements section of B249/B249M).

6. Material and Manufacture

6.1 Material:

6.1.1 The material of manufacture shall be cast rod, bar, or billets of Copper Alloy UNS Nos. C51000, C52100, C52400, C53400, or C54400 and of such soundness as to be suitable for processing in to the products prescribed herein.

NOTE 1—Copper Alloy UNS Nos. C51000, C52100, and C52400 are suitable for structural applications, pump parts, rods, bolts, gears, and similar applications.

NOTE 2—Copper Alloys UNS Nos. C53400 and C54400 are free machining and are suitable for screw-machine products.

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 No. designation specified in the ordering information.

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

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

7.3 When all elements specified in Table 1, for the Copper Alloy UNS No. named in the ordering information are determined, the sum of results shall be 99.5 % min.

8. Temper

8.1 Rod and Bar—The standard tempers—tempers, as defined in Classification B601 for rod and bar produced under this specification are identified in Table 2 or Table 3.

TABLE 1 Chemical Requirements

Table with 7 columns: Element, %, C51000, C52100, C52400, C53400, C54400. Rows include Tin, Phosphorus, Iron, max, Lead, Zinc, and Copper.



TABLE 2 Tensile Requirements for Rod and Bar, inch-pound

NOTE 1—For SI values, see Table 3.

Temper Designation		Diameter or Distance Between Parallel Surfaces, ^A in.	Tensile Strength, ksi		Elongation in 4x Diameter or Thickness of Specimen, min, % ^B
Code	Name		min	max	
Copper Alloy UNS No. C51000					
O60	soft anneal	rod: round under ¼	40	58	...
H04	hard	rod: round under ¼	80	128	...
		round and hexagonal:			
		¼ to ½, incl	70	...	13
		over ½ to 1, incl	60	...	15
		over 1	55	...	18
		bar: square and rectangular:			
		¼ to ¾, incl	60	...	10
		over ¾	55	...	15
H08	spring	rod: round:			
		0.026 to ¼, incl	115
		over ¼ to ½, incl	110
		over ½ to ¾, incl	105	...	3.5
		over ¾ to 1, incl	100	...	5.0
		over 1 to 1½, incl	90	...	9.0
Copper Alloy UNS No. C52100					
O60	soft anneal	rod: round under ¼	53	68	...
H04	hard	rod: round under ¼	105	150	...
		round and hexagonal:			
		¼ to ½, incl	85	...	12
		over ½ to 1, incl	75	...	15
		over 1	60	...	20
		bar: square and rectangular:			
		¼ to ¾, incl	68	...	10
		over ¾	60	...	15
Copper Alloy UNS No. C52400					
O60	soft anneal	rod: round under ¼	60	75	...
H04	hard	rod: round under ¼	105	160	...
		round and hexagonal:			
		¼ to ½, incl	95	...	10
		over ½ to 1, incl	85	...	12
		over 1	70	...	15
		bar: square and rectangular:			
		¼ to ¾, incl	76	...	10
		over ¾	70	...	15
Copper Alloy UNS Nos. C53400 and C54400					
H04	hard	rod: round and hexagonal:			
		¼ to ½, incl	65	...	8
		over ½ to ¾, incl	60	...	10
		over ¾ to 1, incl	55	...	12
		over 1	50	...	15
		bar: square and rectangular:			
		¼ to ¾, incl	55	...	10
		over ¾	50	...	15

^A For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.^B In any case, a minimum gage length of 1 in. shall be used.

8.1.1 Soft anneal temper (O60),

8.1.2 Hard temper (H04), and

8.1.3 Spring temper (H08).

8.2 *Shapes*—The temper for shapes is subject to agreement between the manufacturer and the purchaser and the agreement shall be a part of the contract or purchase order.

9. Mechanical Property Requirements

9.1 Tensile Strength Requirements :

9.1.1 *Rod and Bar*—Rod and bar furnished under this specification shall conform to the tensile requirements prescribed in Table 2 or Table 3 for the specified Copper Alloy UNS No. designation, temper, cross-section, and size when tested in accordance with Test Methods E8E8/E8M or E8M.

9.1.2 *Shapes*—The tensile requirements for shapes shall be subject to agreement between the manufacturer and the purchaser and the agreement shall be a part of the contract or purchase order.