



Standard Specification for Manganese Bronze Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B 138/B 138M; 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 manganese bronze rod, bar and shapes produced in Copper Alloy UNS No. C67000, C67500, or C67600.

1.2 The values stated in inch-pound units or SI units are to be regarded separately in the standard. Within the text, the SI values are given in brackets. The values stated in each system of units are not exact equivalents; each system is independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.3 The following safety hazard caveat pertains only to the Performance Requirements section of this specification. *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.*

1.4 **Warning**—Mercury is a definite health hazard in use and disposal.

NOTE 1—Product suitable for hot forging applications is available under Specification B 124/B 124M.

2. Referenced Documents

2.1 ASTM Standards:

B 124/B 124M Specification for Copper and Copper-Alloy Forging Rod, Bar, and Shapes²

B 154 Test Method for Mercurous Nitrate Test for Copper and Copper Alloys²

B 249/B 249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings²

B 858 Test Method for Determination of Susceptibility to Stress Corrosion Cracking in Copper Alloys Using an Ammonia Vapor Test²

E 8 Test Methods for Tension Testing of Metallic Materials³

E 8M Test Methods for Tension Testing of Metallic Materials (Metric)³

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes⁴

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric)⁴

E 478 Test Methods for Chemical Analysis of Copper Alloys⁵

3. General Requirements

3.1 The following sections of Specification B 249/B 249M constitute a part of this specification:

3.1.1 Terminology,

3.1.2 Materials and Manufacture,

3.1.3 Workmanship, Finish and Appearance,

3.1.4 Sampling,

3.1.5 Number of Tests and Retests,

3.1.6 Specimen Preparation,

3.1.7 Test Methods,

3.1.8 Significance of Numerical Limits,

3.1.9 Inspection,

3.1.10 Rejection and Rehearing,

3.1.11 Certification,

3.1.12 Test Report,

3.1.13 Packaging and Package Marking, and

3.1.14 Supplementary Requirements.

3.2 In addition, when a section with a title identical to one of those referenced in 3.1 appears in this specification, it contains additional requirements which supplement those appearing in Specification B 249/B 249M.

4. Ordering Information

4.1 Include the following when ordering:

4.1.1 ASTM designation and year of issue,

4.1.2 Copper Alloy UNS No. designation (for example, C67000),

4.1.3 Temper,

4.1.4 Form of product (for example, round, hexagonal),

4.1.5 Dimensions (for example, diameter, distance between parallel surfaces),

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² Annual Book of ASTM Standards, Vol 02.01.

³ Annual Book of ASTM Standards, Vol 03.01.

⁴ Annual Book of ASTM Standards, Vol 03.05.

⁵ Annual Book of ASTM Standards, Vol 03.06.

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

- 4.1.6 Tolerances for shapes,
- 4.1.7 Edge contours,
- 4.1.8 Length,
- 4.1.9 Quantity (total weight, footage or number of pieces),
- 4.1.10 When product is purchased for agencies of the U.S. Government.

4.2 The following options are available under this specification and shall be included in the contract or purchase order when required:

- 4.2.1 Heat identification or traceability details (Specification B 249/B 249M),
- 4.2.2 Piston finish,
- 4.2.3 Residual stress test,
- 4.2.4 Certification (Specification B 249/B 249M), and
- 4.2.5 Mill Test Report (Specification B 249/B 249M).

5. Material and Manufacture

5.1 Material:

5.1.1 The material of manufacture shall be cast billets of Copper Alloy UNS No. C67000, C67500, or C67600 as specified in the ordering information, and shall be of such soundness as to be suitable for hot extrusion.

5.2 Manufacture:

5.2.1 The product shall be manufactured by hot working (extrusion, forging, or rolling) and finished by such cold working, annealing, and straightening as may be necessary to achieve the required properties.

6. Chemical Composition

6.1 The material shall conform to the composition requirements specified in Table 1 for the Copper Alloy UNS No. named in the ordering information.

6.1.1 These compositional 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.

6.2 For copper alloys in which zinc is specified as the remainder, either copper or zinc is permitted to be taken as the difference between the sum of results for all elements analyzed and 100 %. When copper is so determined, that difference value shall conform to the requirements given in Table 1.

6.2.1 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.

7. Temper

7.1 The standard tempers for products under this specification are identified in Tables 2 and 3.

TABLE 1 Chemical Requirements

Element, %	Copper Alloy UNS No.		
	C67000	C67500	C67600
Copper ^A	63.0–68.0	57.0–60.0	57.0–60.0
Tin	0.50 max	0.50–1.5	0.50–1.5
Lead	0.20 max	0.20 max	0.50–1.0
Zinc	remainder	remainder	remainder
Iron	2.0–4.0	0.8–2.0	0.40–1.3
Aluminum	3.0–6.0	0.25 max	...
Manganese	2.5–5.0	0.05–0.50	0.05–0.50

^A Includes silver.

8. Mechanical Property Requirements

8.1 Tensile Requirements:

8.1.1 The product furnished under this specification shall conform to the tensile requirements prescribed in Table 2 or Table 3 when tested in accordance with Test Methods E 8 or E 8M.

9. Performance Requirements

9.1 Residual Stress Test:

9.1.1 When specified in the contract or purchase order, the product shall pass a test for residual stress according to the requirements of Test Method B 154 or Test Method B 858. (**Warning**—Mercury is a definite health hazard; therefore, equipment for the detection and removal of mercury vapor produced in volatilization is recommended. The use of protective gloves for this test is recommended.)

9.1.2 Unless otherwise agreed upon between the manufacturer, or supplier, and the purchaser, the manufacturer shall have the option of using either the mercurous nitrate test or the ammonia vapor test. When the ammonia vapor test is used, the test pH value appropriate for the intended application shall be 10 unless otherwise specified by the purchaser.

9.2 Piston Finish:

9.2.1 When specified in the contract or purchase order, round rod over 0.500 in. [13 mm] in diameter shall be furnished piston finish.

10. Purchases for U.S. Government

10.1 Product purchased for agencies of the U.S. Government shall conform to the additional requirements prescribed in the Supplementary Requirements section of Specification B 249/B 249M.

11. Dimensions and Permissible Variations

11.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B 249/B 249M with particular reference to the following tables and related paragraphs in that specification:

11.2 Diameter or Distance Between Parallel Surfaces:

11.2.1 *Rod: Round, Hexagonal, Octagonal*, in H02 or H04 tempers—Refer to Table 2.

11.2.2 *Rod, M30 Temper*, in Alloy C67000—Refer to Table 5.

11.2.3 *Rod, M20 Temper*—Refer to Table 6.

11.2.4 *Rod, Piston Finish*—Refer to Table 3.

11.2.5 *Bar, Rectangular and Square*, in tempers H02 and H04—Refer to Tables 9 and Tables 11.

11.2.6 *Rod and Bar in M10 Temper*—Refer to Table 12.

NOTE 2—M10 hot-forged rod and bar are generally produced in sizes over 3/2 in. [88 mm] in diameter and should not be confused with M30 extruded or M20 rolled rod and bar.

11.2.7 *Bar, Rectangular and Square in M30 Temper*—Refer to Table 4 for thickness and width for Alloy C67500 and Alloy C67600, and to Table 5 for Alloy C67000.

11.3 *Shapes*—The dimensional tolerances for shapes shall be agreed upon between the manufacturer and the purchaser.

11.4 *Lengths*:

**B 138/B 138M – 01****TABLE 2 Tensile Requirements, in./lb**

Form	Temper		Diameter or Distance Between Parallel Surface, ^A in.	Tensile Strength, min, ksi	Yield Strength at 0.5 % Extension Under Load, min, ksi	Elongation min, % ^B
	Standard	Name				
Copper Alloy UNS No. C67000						
Rod and bar	<i>c</i>	soft	all sizes	85	45	10
	<i>c</i>	half-hard	all sizes	105	60	7
	<i>c</i>	hard	all sizes	115	68	5
Copper Alloy UNS Nos. C67500 and C67600						
Rod	O60	soft anneal	all sizes	55	22	20
		half-hard	1 and under	72	36	13
	H04	hard	over 1 to 2½ incl	70	35	15
			over 2½	65	32	17
			1 and under	80	56	8
			over 1 to 1½ incl	76	52	10
Bar	O60	soft anneal	all sizes	55	22	20
		half-hard	1 and under	72	36	13
Shapes ^D	O60	soft anneal	over 1 to 2½ incl	70	35	15
			over 2½	65	32	17
	H04	hard	over 1 and under	76	52	8
			over 1 to 2½ incl	72	47	12
			over 2½	68	45	16
			all sizes	55	22	20

^A For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.^B Elongation in 4× diameter or thickness of specimen. In any case, a minimum gage length of 1 in. shall be used.^C See Note 2. The tensile properties of hot-forged (M10), as-hot-rolled (M20), and as-hot-extruded (M30) are essentially the same as those shown for rod and bar, but have not been finalized for publication.^D Tensile requirements for drawn shapes shall be as agreed upon between the manufacturer and the purchaser at the time of the order.**TABLE 3 Tensile Requirements, SI**

Form	Temper		Diameter or Distance Between Parallel Surface, ^A mm	Tensile Strength, min, [MPa]	Yield Strength at 0.5 % Extension Under Load, min, MPa	Elongation min, % ^B
	Standard	Name				
Copper Alloy UNS No. C67000						
Rod and bar	<i>c</i>	soft	all sizes	585	310	10
	<i>c</i>	half-hard	all sizes	720	415	7
	<i>c</i>	hard	all sizes	790	470	5
Copper Alloy UNS Nos. C67500 and C67600						
Rod	O60	soft anneal	all sizes	380	150	20
		half-hard	25 and under	500	250	13
	H04	hard	over 25 to 65 incl	450	240	15
			over 65	450	220	17
			25 and under	550	385	8
			over 25 to 38 incl	525	360	10
Bar	O60	soft anneal	all sizes	380	150	20
		half-hard	25 and under	500	250	13
Shapes ^D	O60	soft anneal	over 25 to 65 incl	450	240	15
			over 65	450	220	17
	H04	hard	25 and under	525	360	8
			over 25 to 65 incl	500	325	12
			over 65	470	310	16
			all sizes	380	150	20

^A For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.^B Elongation in 4× diameter or thickness of specimen. In any case, a minimum gage length of 25 mm shall be used.^C See Note 2. The tensile properties of hot-forged (M10), as-hot-rolled (M20), and as-hot-extruded (M30) are essentially the same as those shown for rod and bar, but have not been finalized for publication.^D Tensile requirements for drawn shapes shall be as agreed upon between the manufacturer and the purchaser at the time of the order.11.4.1 *Rod, Bar, and Shapes*—Refer to Table 13 for tolerances.11.4.2 *Schedule of Lengths*—Refer to Table 14 for specific and stock with ends for Alloy C67500 and Alloy C67600 and to Table 15 for Alloy C67000.11.5 *Straightness*:11.5.1 *Rod and Bar in H02 or H04 Tempers*—Refer to Table 16.11.5.2 *Shafting Rod*—Refer to Table 17.

11.5.3 *Rod, Bar and Shapes in M20, M30 or M10*—Tempers shall have straightness requirements as agreed upon between the manufacturer and the purchaser.

11.6 *Edge Contours*:

11.6.1 For a description of edge contours, refer to the section entitled, “Edge Contours” and Figs. 1, 2, and 3 in Specification B 249/B 249M.

Aluminum	E 54
Copper	E 478
Iron	E 478
Lead	E 478 (atomic absorption)
Manganese	E 62
Tin	E 478 (titrimetric)
Zinc	E 478 (titrimetric)

12.1.2 Test method(s) to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the supplier and the purchaser.

12. Test Methods

12.1 *Chemical Analysis*:

12.1.1 Chemical composition, in case of disagreement, shall be determined by the following test methods:

Element	Test Methods
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13. Keywords

13.1 C67000; C67500; C67600; manganese bronze bar; manganese bronze rod; manganese bronze shape

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (1996) that may impact the use of this standard.

- (1) Scope—Section revised to state purpose more clearly.
- (2) All sections—editorially changed to clarify intent.
- (3) The Ordering Information section revised to identify purchaser options.
- (4) The addition of Alloy UNS No. C67600.
- (5) The addition of Test Method B 858 as an optional test for residual stress.

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