



Designation: B138/B138M – 11

## Standard Specification for Manganese Bronze Rod, Bar, and Shapes<sup>1</sup>

This standard is issued under the fixed designation B138/B138M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification establishes the requirements for manganese bronze rod, bar and shapes produced in Copper Alloy UNS Nos. C67000, C67500, or C67600.

1.2 *Units*—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 shown in brackets. The values stated in each system of units may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 **Warning**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/faq.htm>) for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.

NOTE 1—Product suitable for hot forging applications is available under Specification B124/B124M.

1.4 The following safety hazard caveat pertains only to the Performance Requirements section of 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.*

<sup>1</sup> 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. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

B124/B124M Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

B154 Test Method for Mercurous Nitrate Test for Copper Alloys

B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

B858 Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in 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)<sup>3</sup>

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)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

E478 Test Methods for Chemical Analysis of Copper Alloys

### 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 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,

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

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



- 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 above, appears in this specification, it contains additional requirements which supplement those appearing in Specification B249/B249M.

#### 4. Ordering Information

4.1 Include the following when placing orders for product under this specification, as applicable:

- 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, width, thickness),
- 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),
- 4.2 The following options are available and should be specified at the time of placing the order when required:
  - 4.2.1 Piston finish (Performance Requirements section),
  - 4.2.2 Residual stress test (Performance Requirements section),
    - 4.2.2.1 Ammonia Vapor Test or Mercurous Nitrate Test,
    - 4.2.2.2 For Ammonia Vapor Test, pH value other than 10.
  - 4.2.3 Certification (Specification B249/B249M),
  - 4.2.4 Mill Test Report (Specification B249/B249M), and
  - 4.2.5 If product is purchased for agencies of the U.S. Government (see Other Requirements section).

#### 5. Material and Manufacture

5.1 *Material*—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 purity and soundness as to be suitable for hot working.

##### 5.2 *Manufacture:*

- 5.2.1 The product shall be manufactured by hot working (extrusion, forging, or rolling) to produce a uniform wrought structure in the finished product.
- 5.2.2 The product shall be finished by such cold working, annealing, and straightening as may be necessary to achieve the temper properties specified.

#### 6. Chemical Composition

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

6.1.1 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.

TABLE 1 Chemical Requirements

Element, %	Copper Alloy UNS No.		
	C67000	C67500	C67600
Copper <sup>A</sup>	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

<sup>A</sup> Includes silver.

6.2 For copper alloys in which zinc is specified as the “remainder,” either copper or zinc may be taken as the difference between the sum of results for all other elements determined 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 in Table 1 are determined, the sum of results shall be 99.5 % min.

#### 7. Temper

7.1 The standard tempers for products described in this specification are given in Tables 2 and 3.

- 7.1.1 Soft Anneal Temper (O60),
- 7.1.2 As Hot Rolled Temper (M20),
- 7.1.3 As Hot Extruded Temper (M30),
- 7.1.4 Half-Hard Temper (H02), and
- 7.1.5 Hard Temper (H04).

#### 8. Mechanical Property Requirements

##### 8.1 *Tensile Requirements:*

8.1.1 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 E8/E8M.

#### 9. Performance Requirements

##### 9.1 *Residual Stress Test:*

9.1.1 When specified in the contract or purchase order, the product shall be tested for residual stress according to the requirements of Test Method B154 or Test Method B858 and show no signs of cracking. (**Warning**—Mercury is a definite health hazard. With the mercurous nitrate test, 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 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.

NOTE 2—A residual stress test provides information about the adequacy of the stress relief of the material. Bar straightening is a method of mechanical stress relief. Stress relief annealing is a method of thermal stress relief.

#### 10. Other Requirements

##### 10.1 *Purchases for U.S. Government:*

10.1.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. government shall