



Designation: B453/B453M – 11

# Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Rod, Bar, and Shapes<sup>1</sup>

This standard is issued under the fixed designation B453/B453M; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope\*

1.1 This specification establishes the requirements for copper-zinc-lead alloy (leaded-brass) rod, bar, wire, and shapes produced from Copper Alloys UNS Nos. C33500, C34000, C34500, C35000, C35300, C35330, C35350, and C35600. These alloys have nominal composition given in [Table 1](#).

1.1.1 This product is suitable for applications requiring extensive machining before such cold-forming operations as swaging, flaring, severe knurling, or thread rolling.

NOTE 1—Refer to [Appendix X1](#) for additional applications information.

1.1.2 Typically, product made to this specification is furnished as straight lengths. Sizes  $\frac{1}{2}$  in. [12 mm] and under may be furnished as wire in coils or on reels when requested.

1.2 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.

NOTE 2—Refer to Specifications [B16/B16M](#) and [B140/B140M](#) for copper-zinc-lead (leaded-brass) rod and bar for screw machine applications.

## 2. Referenced Documents

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

[B16/B16M](#) Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines

[B140/B140M](#) Specification for Copper-Zinc-Lead (Red Brass or Hardware Bronze) Rod, Bar, and Shapes

[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

[B601](#) Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

[E8](#) Test Methods for Tension Testing of Metallic Materials

[E8M](#) Test Methods for Tension Testing of Metallic Materials [Metric] (Withdrawn 2008)<sup>3</sup>

[E18](#) Test Methods for Rockwell Hardness of Metallic Materials

[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](#) and [B250/B250M](#) are a part of this specification:

3.1.1 Terminology,

3.1.2 Materials and Manufacture,

3.1.3 Workmanship, Finish, and Appearance, [B453/B453M-11](#)

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 Reheating,

3.1.11 Certification,

3.1.12 Mill 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 Specifications [B249/B249M](#) and [B250/B250M](#).

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

<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.

Current edition approved Oct. 1, 2011. Published November 2011. Originally approved in 1967. Last previous edition approved in 2008 as B453/B453M – 08. DOI: 10.1520/B0453\_B0453M-11.

<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.

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



TABLE 1 Nominal Composition, %

Copper Alloy UNS No.	Copper	Zinc	Lead
C33500	63.5	36.0	0.5
C34000	63.5	35.3	1.2
C34500	63.5	34.5	2.0
C35000	61.5	37.1	1.4
C35300	61.5	36.5	2.0
C35330	61.8	35.7	2.5
C35350	62.0	34.5	3.2
C35600	61.5	36.0	2.5

4. Ordering Information

- 4.1 Include the following information in orders for product:
  - 4.1.1 ASTM designation and year of issue (for example, B453/B453M – 05),
  - 4.1.2 Copper Alloy UNS Number designation,
  - 4.1.3 Product (rod, bar, wire, or shape),
  - 4.1.4 Cross section (round, hexagonal, square, and so forth),
  - 4.1.5 Temper (See Section 6),
  - 4.1.6 Dimensions (diameter or distance between parallel surfaces, width, thickness),
  - 4.1.7 How furnished: straight lengths, coils, or reels,
  - 4.1.8 Length,
  - 4.1.9 Total length or number of pieces of each size,
  - 4.1.10 Weight: total for each form, and size, and
  - 4.1.11 When product is purchased for agencies of the U.S. government.

- 4.2 The following are options and should be specified in the ordering information when required:
  - 4.2.1 Tensile test for product 1/2 in. (12 mm) and over in diameter or distance between parallel surfaces,
  - 4.2.2 Certification,
  - 4.2.3 Mill test report, and
  - 4.2.4 Automatic screw machine use (9.1.4).

5. Chemical Composition

5.1 The material shall conform to the chemical composition requirements in Table 2 for the Copper Alloy UNS No. designation specified in the ordering information.

5.1.1 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. For copper alloys in which zinc is listed as the “remainder,” either copper or zinc may be taken as the difference between the sum of all elements

TABLE 2 Chemical Requirements

Copper Alloy UNS No.	Composition, %			
	Copper	Lead	Iron	Zinc
C33500	62.0–65.0	0.25–0.7	0.15 max	remainder
C34000	62.0–65.0	0.8–1.5	0.15 max	remainder
C34500	62.0–65.0	1.5–2.5	0.15 max	remainder
C35000	61.0–63.0	0.8–2.0	0.15 max	remainder
C35300	61.0–63.0	1.5–2.5	0.15 max	remainder
C35330 <sup>A</sup>	59.5–64.0	1.5–3.5 <sup>B</sup>	–	remainder
C35350 <sup>C</sup>	61.0–63.0	2.0–4.5	0.40	remainder
C35600	60.0–63.0	2.0–3.0	0.15 max	remainder

<sup>A</sup>.02 – .25 As  
<sup>B</sup>Pb may be reduced to 1.0 % by agreement.  
<sup>C</sup>includes nickel 0.05-0.30, phosphorus 0.05-0.20, tin 0.30 max.

determined and 100 %. When copper is so determined, that difference value shall conform to the requirements given in Table 2.

5.2 When all the named elements in Table 2 for the specified alloy are determined, the sum of results shall be as follows:

Copper Alloy UNS No.	Percent, min
C33500, C34000, C34500, C35000	99.6
C35300, C35330, C35350, C35600	99.5

5.3 In the event that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 3—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. Temper

- 6.1 The standard tempers, as defined in Classification B601, for products described in this specification are given in Tables 3-6.
  - 6.1.1 O60 (soft anneal),
  - 6.1.2 H01 (1/4 hard),
  - 6.1.3 HR01 (1/4 hard and Stress Relieved), and
  - 6.1.4 H02 (1/2 hard) (UNS Alloy No. C35350 is available only in this temper).

6.2 Other tempers, and temper for other products including shapes, shall be subject to agreement between the manufacturer and the purchaser.

7. Mechanical Property Requirement

7.1 Rockwell Hardness Requirements :

- 7.1.1 Product with a diameter or distance between parallel surfaces of 1/2 in. (12 mm) and over shall conform to the requirements of Table 3 and Table 4 when tested in accordance with Test Methods E18.
  - 7.1.1.1 Rockwell hardness test results shall be the basis for product acceptance for mechanical properties except when tensile test is so specified in the ordering information (4.2.1).
  - 7.1.1.2 Product that fails to conform to the hardness requirements shall be acceptable if tensile strength requirements are in conformance.

7.2 Tensile Strength Requirements :

- 7.2.1 Product with diameter or distance between parallel surfaces under 1/2 in. (12 mm) shall conform to the requirements of Tables 3-6 when tested in accordance with Test Methods E8 or E8M.
- 7.2.2 When specified in the contract or purchase order, product with diameter or distance between parallel surfaces of 1/2 in. (12 mm) and over shall conform to the tensile requirements prescribed in Tables 3-6 for the specified temper and size when tested in accordance with Test Methods E8 or E8M.

8. Purchases for U.S. Government

8.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. government shall conform to the special government requirements stipulated in the Supplementary Requirements section of Specifications B249/B249M and B250/B250M.

**TABLE 3 Rockwell Hardness Requirements, Inch-Pound<sup>A</sup>**

NOTE 1—SI values are stated in Table 4.

Temper Designation		Diameter or Distance Between Parallel Surfaces, in.	Rockwell B Hardness Determined on the Cross Section Midway Between Surface and Center (All Alloys ex- cept C35350)	Rockwell Hardness Determined on the Cross Section Midway Between Surface and Center (Alloy C35350)
Code	Name			
<b>Rod and Wire</b>				
O60	soft anneal	½ and over	45 max	
H01	¼ hard	½ to 1, both incl over 1 to 2, incl over 2	50–75 40–70 35–65	... ... ...
HR01	¼ hard and Stress Relieved	½ to 1, both incl over 1 to 2, incl over 2	50–75 40–70 35–65	... ... ...
H02	½ hard	½ to 1, both incl over 1 to 2, incl over 2	60–80 50–75 40–70	68–85 62–80 53–70
<b>Bar<sup>B</sup></b>				
O60	soft anneal	½ and over	35 max	...
H01	¼ hard	½ to 1, both incl over 1 to 2, incl over 2	45–75 35–70 35–65	... ...
H02	½ hard	½ to 1, both incl over 1 to 2, incl over 2	45–85 40–80 35–70	68–85 62–80 53–70

<sup>A</sup> Rockwell hardness requirements are not established for diameters less than ½ in.

<sup>B</sup> For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.

**9. Dimensions and Permissible Variations**

9.1 The dimensions and tolerances for rod, bar, and shapes in accordance with this specification shall be as specified in Specification B249/B249M with particular reference to the following tables in that specification:

9.1.1 *Diameter or Distance Between Parallel Surfaces:*

9.1.1.1 *Rod*—Table 1.

9.1.1.2 *Bar*—Tables 8 and 10.

9.1.2 *Shapes*—Dimensional tolerances shall be subject to agreement between the manufacturer and the purchaser.

9.1.3 *Length*—Tables 13 and 14.

9.1.4 *Straightness*—Table 16.

9.1.4.1 General use straightness tolerances will apply unless rod is specified for automatic screw machine use at the time of placing an order.

9.1.5 *Angles*—All regular polygonal sections shall have substantially exact angles and, unless otherwise specified, sharp corners.

9.2 The dimensions and tolerances for wire product described by this specification shall be as specified in Table 1 of Specification B250/B250M.

**10. Test Methods**

10.1 *Chemical Analysis:*

10.1.1 Composition shall be determined, in case of disagreement, as follows:

Element	Method
Arsenic	E62
Copper	E478
Iron	E478
Lead	E478 (AA)
Nickel	E478
Phosphorus	E62
Tin	E478
Zinc	E478 (titrimetric)

10.1.2 Test method(s) to be used for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

**11. Keywords**

11.1 copper-zinc-lead alloy bar; copper-zinc-lead alloy rod; copper-zinc-lead alloy wire; leaded-brass bar; leaded-brass rod; leaded-brass wire; UNS No. C33500; UNS No. C34000; UNS No. C34500; UNS No. C35000; UNS No. C35300; UNS No. C35330; UNS No. C35350; UNS No. C35600