



Standard Specification for Copper-Zinc-Lead (Red Brass or Hardware Bronze) Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B 140/B 140M; 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 copper-zinc-lead (leaded red brass or hardware bronze) rod, bar, and shapes of UNS Alloy Nos. C31400, C31600, and C32000 available for screw machine applications.

1.2 *Units*—The values stated in inch-pound units or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values in each system are not exact equivalents; therefore, each system 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

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

B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

B 846 Terminology for Copper and Copper Alloys

E 8 Test Methods for Tension Testing of Metallic Materials

E 8M Test Methods for Tension Testing of Metallic Materials [Metric]

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

E 478 Test Methods for Chemical Analysis of Copper Alloys

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. General Requirements

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

- 3.1.1 Terminology (**B 846**),
- 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 Reports (Mill),
- 3.1.13 Packaging and Package Marking, and
- 3.1.14 Supplemental 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 that supplement those which appear in Specification **B 249/B 249M**.

4. Ordering Information

4.1 Include the following information when placing orders for products under this specification:

- 4.1.1 ASTM designation and year of issue,
- 4.1.2 Copper Alloy UNS No. designation (Scope),
- 4.1.3 Temper designation (Temper Section),
- 4.1.4 Quantity; total weight or length, or number of pieces of each temper, form, and alloy.
- 4.1.5 Dimensions—diameter, distance between parallel surfaces,
- 4.1.6 How furnished; specific lengths with or without ends, and
- 4.1.7 If product is purchased for agencies of the U.S. government. (**B 249/B 249M**).

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

4.2 The following options are available to this specification and should be specified in the contract or purchase order when required:

- 4.2.1 Heat identification or traceability details,
- 4.2.2 Certification (Specification **B 249/B 249M**), and
- 4.2.3 Mill Test Reports (Specification **B 249/B 249M**).

5. Material and Manufacture

5.1 Material:

5.1.1 The material of manufacture shall be a form (cast billets, logs, or rods) of Copper Alloy UNS Nos. C31400, C31600, or C32000 of such purity and soundness as to be suitable for processing into the products prescribed herein.

5.2 Manufacture:

5.2.1 The product shall be manufactured by such hot working, cold working, straightening, and annealing processes as to produce a uniform wrought structure in the finished product.

6. Chemical Composition

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

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.

6.2 For alloys in which zinc is listed as the “remainder,” either copper or zinc may be taken as the difference between the sum of results of all other elements determined and 100 %. When copper is so determined, that difference value shall conform to the requirements given in **Table 1**.

TABLE 1 Chemical Requirements

Element	Composition, %		
	Copper Alloy UNS No.		
	C31400	C31600	C32000
Copper	87.5 to 90.5	87.5 to 90.5	83.5 to 86.5
Lead	1.3 to 2.5	1.3 to 2.5	1.5 to 2.2
Iron, max	0.10	0.10	0.10
Nickel	0.7 max	0.7 to 1.2	0.25 max
Zinc	remainder	remainder	remainder
Phosphorus	...	0.04 to 0.10	...

6.3 When all elements in **Table 1** are determined, the sum of the results shall be 99.6 % minimum.

7. Temper

7.1 Tempers, as defined in Classification **B 601**, available to this specification are O60 (soft anneal), H02 (half-hard), and H04 (hard).

8. Mechanical Property Requirements

8.1 Tensile Requirements:

8.1.1 Product furnished under this specification shall conform to the tensile requirements specified in **Table 2** (inch-pound units) or **Table 3** (SI units) when tested in accordance with Test Methods **E 8** or **E 8M**.

9. Dimensions, Mass and Permissible Variations

9.1 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:

9.2 Diameter or Distance Between Parallel Surfaces:

9.2.1 Rod—Refer to Table 1 for round, hexagonal and octagonal rod.

9.2.2 Bar—Refer to Table 8 for thickness and Table 10 for width.

9.3 Lengths—Refer to Tables 13 and 14.

9.4 Straightness—Refer to Table 16.

9.5 Shapes—The dimensional tolerances for shapes shall be agreed upon between the manufacturer or supplier and the purchaser and shall be specified in the order or purchase contract.

10. Test Methods

10.1 Chemical Analysis:

10.1.1 The material composition shall, in case of dispute, be determined as follows:

Element	ASTM Test Method
Copper	E 478
Lead	E 478 , atomic absorption
Iron	E 478
Nickel	E 478 , photometric
Phosphorus	E 62
Zinc	E 478 , Titrimetric

TABLE 2 Tensile Requirements (Inch-Pound Units)

Copper Alloy UNS No.	Temper Designation		Diameter or Distance Between Parallel Surfaces, in.	Width, in.	Tensile Strength, min, ksi	Yield Strength at 0.5 % Extension Under Load, min, ksi	Elongation in 4 × Diameter or Thickness of Specimen min, % ^A	
	Code	Name						
C31400, C31600, C32000	O60	soft anneal	all forms	all sizes	...	35	10	25
C31400, C31600, C32000	HO2	half hard	rod:	½ and under	...	50	30	7
				over ½ to 1	...	45	27	10
			bar:	over 1	...	40	25	12
				1 and under	2 and under	40	25	12
				over 1	over 2	40 ^B	25 ^B	12 ^B
C31400	H04	hard	rod	2 and under	...	53	40	6
C31600, C32000	H04	hard	rod	2 and under	...	60	50	6
			bar	1 and under	2 and under	60	50	6

^AIn any case, a minimum gage length of 1 in. shall be used.

^BIn the case of bars either over 1 in. in thickness or over 2 in. in width, or both, these values shall apply.

TABLE 3 Tensile Requirements (SI Units)

Copper Alloy UNS No.	Temper Designation		Diameter or Distance Between Parallel Surfaces, mm	Width, mm	Tensile Strength, min MPa	Yield Strength at 0.5 % Extension Under Load, min, MPa	Elongation ^A min, %	
	Code	Name						
C31400, C 31600, C32000	O60	Soft anneal	all forms	all sizes	...	240	70	25
C31400, C31600, C32000	HO2	half hard	rod:	12 and under	...	345	205	7
				over 12 to 25	...	310	185	10
			bar:	over 25	...	275	170	12
				25 and under	50 and under	275	170	12
				over 25	over 50	275 ^B	170 ^B	12 ^B
C31400	H04	hard	rod	50 and under	...	365	275	6
C31600, C32000	H04	hard	rod	50 and under	...	415	345	6
			bar	25 and under	50 and under	415	345	6

^AElongation values are based on a gage length of 5.65 times the square root of the area for dimensions greater than 2.5 mm.

^BIn the case of bars either over 25 mm in thickness or over 50 mm in width, or both, these values shall apply.

11. Keywords

11.1 C31400; C31600; C32000; hardware bronze; hardware bronze rod; hardware bronze shapes; leaded brass shapes; leaded red brass bar; leaded red brass rod

SUMMARY OF CHANGES

Committee B05 has identified the principle changes to this specification that have been incorporated since the 2001 issue as follows:

(1) Changes made to conform to the *ASTM and B05 Form and Style* guidelines.

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