



Designation: B 21/B 21M – 01^{e1}

Standard Specification for Naval Brass Rod, Bar, and Shapes¹

This standard is issued under the fixed designation B 21/B 21M; 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.

^{e1} NOTE—Section 1.4 was added editorially in January 2003.

1. Scope *

1.1 This specification establishes the requirements for naval brass rod, bar, and shapes produced from Copper Alloys UNS No. C46200, C46400, C47940, C48200, or C48500.

1.1.1 For piston-finish rod or shafting refer to the Other Requirements Section.

1.1.2 For hot forging material, refer to Specification B 124/B 124M.

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.

1.3 **Warning**—Mercury is a definite health hazard in use and disposal (see Performance Requirements).

1.4 *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.*

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 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast²

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 Method for Tension Testing of Metallic Materials (Metric)³

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials³

E 478 Test Methods for Chemical Analysis of Copper Alloys⁴

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 Mill Test Report,

3.1.13 Packaging and Product Marking, and

3.1.14 Supplementary Requirements.

3.2 In addition, when a section with a title identical to that referenced in 3.1, above, 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 product 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 (Temper Section and related Tables),

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 Annual Book of ASTM Standards, Vol 02.01.

³ Annual Book of ASTM Standards, Vol 03.01.

⁴ Annual Book of ASTM Standards, Vol 03.06.

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

4.1.4 Form: cross-section such as round, hexagonal, square, and so forth,

4.1.5 Diameter or distance between parallel surfaces, width and thickness (Dimensions and Permissible Variations),

4.1.6 Length (Dimensions and Permissible Variations),

4.1.7 Edge contours (Dimensions and Permissible Variations),

4.1.8 Number of pieces or total weight, for each size and form, and

4.1.9 When product is specified for agencies of the U.S. Government (Purchases for U.S. Government).

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

4.2.1 Tensile test for product ½ in. [12 mm] and over, for the alloys and tempers listed in Table 4.

4.2.2 Residual stress test (Performance Requirements section),

4.2.3 Piston finish rod or shafting (Other Requirements section),

4.2.4 Certification (Specification B 249/B 249M), and

4.2.5 Mill test report (Specification B 249/B 249M).

5. Chemical Composition

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

TABLE 1 Chemical Requirements

| Element, % | Copper Alloy UNS No. | | | | |
|---------------------|----------------------|-----------|-----------|-----------|-----------|
| | C46200 | C46400 | C47940 | C48200 | C48500 |
| Copper | 62.0–65.0 | 59.0–62.0 | 63.0–66.0 | 59.0–62.0 | 59.0–62.0 |
| Tin | 0.50–1.0 | 0.50–1.0 | 1.2–2.0 | 0.50–1.0 | 0.50–1.0 |
| Lead | 0.20 max | 0.20 max | 1.0–2.0 | 0.40–1.0 | 1.3–2.2 |
| Zinc | remainder | remainder | remainder | remainder | remainder |
| Iron | 0.10 max | 0.10 max | 0.10–1.0 | 0.10 max | 0.10 max |
| Nickel ^A | ... | ... | 0.10–0.50 | ... | ... |

^AIncluding cobalt.

5.2 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 or supplier, and purchaser.

5.3 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 of all elements determined and 100 %. When copper is so determined, that difference value shall conform to the requirements given in Table 1.

5.4 When all elements listed in Table 1 for the Copper Alloy UNS No. specified in the ordering information are determined, the sum of results shall be 99.6 % minimum.

6. Temper

6.1 Tempers, as defined in Practice B 601, available under this specification are shown in Tables 2 and 3.

TABLE 2 Tensile Requirements, in./lb

| Temper Designation | | Diameter or Distance Between Parallel ^A Surfaces, in. | Tensile Strength, min, ksi | Yield Strength at 0.5 % Extension Under Load, min, ksi | Elongation in 4 × Diameter of Thickness of Specimen, min, % ^B |
|-----------------------------|-----------------------|--|----------------------------|--|--|
| Code | Name | | | | |
| Copper Alloy UNS No. C46200 | | | | | |
| M30 | as-hot extruded | all forms, all sizes | 50 | 20 | 30 |
| O60 | soft anneal | rods and bars, all sizes | 48 | 16 | 30 |
| O50 | light anneal | rods and bars: | | | |
| | | 0.500 and under | 58 | 27 | 22 |
| | | over 0.500 to 1.000, incl | 56 | 27 | 25 |
| | | over 1.000 to 2.000, incl | 54 | 26 | 25 |
| | | over 2.000 to 3.000, incl | 52 | 25 | 27 |
| | | over 3.000 to 4.000, incl | 50 | 22 | 30 |
| | | over 4.000 | 50 | 20 | 30 |
| H60 | cold heading, forming | rods, all sizes | 48 | 18 | 22 |
| H02 | half-hard | rods and bars: | | | |
| | | 0.500 and under | 58 | 27 | 22 |
| | | over 0.500 to 1.000, incl | 56 | 27 | 25 |
| | | over 1.000 to 2.000, incl | 54 | 26 | 25 |
| | | over 2.000 to 3.000, incl | 52 | 25 | 27 |
| | | over 3.000 to 4.000, incl | 50 | 22 | 30 |
| | | over 4.000 | 50 | 20 | 30 |
| H04 | hard | rods and bars: | | | |
| | | 0.500 and under | 64 | 40 | 13 |
| | | over 0.500 to 1.000, incl | 62 | 38 | 13 |
| | | over 1.000 to 2.000, incl | 58 | 34 | 18 |
| Copper Alloy UNS No. C46400 | | | | | |
| M30 | as-hot extruded | all forms, all sizes | 52 | 20 | 30 |
| O60 | soft anneal | rods and bars: | | | |
| | | 1.000 and under | 54 | 20 | 30 |
| | | over 1.000 to 2.000, incl | 52 | 20 | 30 |
| | | over 2.000 | 50 | 20 | 30 |
| | | shapes, all sizes | 52 | 20 | 30 |
| O50 | light anneal | rods and bars: | | | |
| | | 0.500 and under | 60 | 27 | 22 |

TABLE 2 *Continued*

| Temper Designation | | Diameter or Distance Between Parallel ^A Surfaces, in. | Tensile Strength, min, ksi | Yield Strength at 0.5 % Extension Under Load, min, ksi | Elongation in 4 × Diameter of Thickness of Specimen, min, % ^B | | |
|-----------------------------|--|--|--|--|--|----------------|----|
| Code | Name | | | | | | |
| H50 ^C H02 | extruded and drawn ^C half-hard | over 0.500 to 1.000, incl | 60 | 27 | 25 | | |
| | | over 1.000 to 2.000, incl | 58 | 26 | 25 | | |
| | | over 2.000 to 3.000, incl | 54 | 25 | 25 | | |
| | | over 3.000 to 4.000, incl | 54 | 22 | 27 | | |
| | | over 4.000 | 54 | 22 | 30 | | |
| | | shapes, all sizes | 58 | 25 | 20 | | |
| | | rods and bars: | | | | | |
| | | 0.500 and under | 60 | 27 | 22 | | |
| | | over 0.500 to 1.000, incl | 60 | 27 | 25 | | |
| | | over 1.000 to 2.000, incl | 58 | 26 | 25 | | |
| H04 | hard | over 2.000 to 3.000, incl | 54 | 25 | 25 | | |
| | | over 3.000 to 4.000, incl | 54 | 22 | 27 | | |
| | | over 4.000 | 54 | 22 | 30 | | |
| | | rods and bars: | | | | | |
| | | 1.000 and under | 67 | 45 | 13 | | |
| | | over 1.000 to 2.000, incl | 62 | 37 | 18 | | |
| | | Copper Alloy UNS No. C47940 | | | | | |
| | | M30 | as-hot extruded | all forms, all sizes | 50 | 20 | 30 |
| | | O60 | soft anneal | rods and bars, all sizes | 48 | 20 | 30 |
| | | H50 ^C H02 | extruded and drawn ^C half-hard | O50 | light anneal | rods and bars: | |
| 0.500 and under | 58 | | | 30 | 18 | | |
| over 0.500 to 1.000, incl | 56 | | | 30 | 20 | | |
| over 1.000 to 2.0, incl | 54 | | | 25 | 22 | | |
| over 2.000 | 50 | | | 25 | 25 | | |
| shapes, all sizes | 56 | | | 25 | 20 | | |
| rods and bars: | | | | | | | |
| 0.500 and under | 58 | | | 30 | 18 | | |
| over 0.500 to 1.000, incl | 56 | | | 30 | 20 | | |
| over 1.000 to 2.000, incl | 54 | | | 25 | 22 | | |
| H04 | hard | over 2.000 | 50 | 25 | 25 | | |
| | | rods and bars: | | | | | |
| | | 0.500 and under | 70 | 55 | 10 | | |
| | | over 0.500 to 1.000, incl | 65 | 52 | 13 | | |
| | | over 1.000 to 2.000, incl | 62 | 45 | 15 | | |
| | | Copper Alloy UNS No. C48200 | | | | | |
| | | M30 | as-hot extruded | all forms, all sizes | 52 | 20 | 25 |
| | | H50 ^C H02 | extruded and drawn ^C half-hard | O60 | soft anneal | rods and bars: | |
| | | | | 1.000 and under | 54 | 20 | 25 |
| | | | | over 1.000 to 2.000, incl | 52 | 20 | 25 |
| over 2.000 | 50 | | | 20 | 25 | | |
| shapes, all sizes | 52 | | | 20 | 25 | | |
| rods and bars: | | | | | | | |
| 1.000 and under | 60 | | | 27 | 18 | | |
| over 1.000 to 2.000, incl | 58 | | | 26 | 20 | | |
| over 2.000 to 3.000, incl | 54 | | | 25 | 20 | | |
| over 3.000 to 4.000, incl | 54 | | | 22 | 20 | | |
| H04 | hard | over 4.000 | 54 | 22 | 25 | | |
| | | shapes, all sizes | 58 | 25 | 15 | | |
| | | rods and bars: | | | | | |
| | | 1.000 and under | 60 | 27 | 18 | | |
| | | over 1.000 to 2.000, incl | 58 | 26 | 20 | | |
| | | over 2.000 to 3.000, incl | 54 | 25 | 20 | | |
| | | over 3.000 to 4.000, incl | 54 | 22 | 20 | | |
| | | over 4.000 | 54 | 22 | 25 | | |
| | | rods and bars: | | | | | |
| | | 1.000 and under | 67 | 45 | 11 | | |
| over 1.000 to 2.000, incl | 62 | 37 | 15 | | | | |
| Copper Alloy UNS No. C48500 | | | | | | | |
| M30 | as-hot extruded | all forms, all sizes | 52 | 20 | 20 | | |
| H50 ^C H02 | extruded and drawn ^C half-hard | O60 | soft anneal | rods and bars: | | | |
| | | 1.000 and under | 54 | 20 | 20 | | |
| | | over 1.000 to 2.000, incl | 52 | 20 | 20 | | |
| | | over 2.000 | 50 | 20 | 20 | | |
| | | shapes, all sizes | 52 | 20 | 20 | | |
| | | rods and bars: | | | | | |
| | | 1.000 and under | 60 | 27 | 12 | | |
| | | over 1.000 to 2.000, incl | 58 | 26 | 20 | | |