



Designation: **B21/B21M—12** **B21/B21M – 14**

## Standard Specification for Naval Brass Rod, Bar, and Shapes<sup>1</sup>

This standard is issued under the fixed designation B21/B21M; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

### 1. Scope\*

1.1 This specification establishes the requirements for naval brass rod, bar, and shapes produced from Copper Alloy UNS Nos. C46200, C46400, C46750, 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 **B124/B124M**.

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 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 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:*<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

**B601** Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

**B858** Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys

**B950** ~~Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys~~

**E8E8/E8M** Test Methods for Tension Testing of Metallic Materials

**E8ME18** Test Methods for ~~Tension Testing~~ Rockwell Hardness of Metallic Materials—~~[Metric]~~ (Withdrawn 2008)

**E18E62** Test Methods for ~~Rockwell Hardness of Metallic Materials~~ 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,

<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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<sup>2</sup> 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.

<sup>3</sup> The last approved version of this historical standard is referenced on www.astm.org.

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

- 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 B249/B249M.

#### 4. Ordering Information

4.1 Include the following specified choices 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 (Scope),
- 4.1.3 Temper (Temper Section and related Tables),
- 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 Quantity—number of pieces or total weight, for each size and form, and
- 4.1.9 Intended application.

4.2 The following options are available, but may not be included, unless specified at the time of placing of the 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 B249/B249M),
- 4.2.5 Mill test report (Specification B249/B249M),
- 4.2.6 Heat identification or traceability details (Specification B249/B249M), and
- 4.2.7 If product is purchased for agencies of the U.S. government (Other Requirements—Purchases for U.S. Government).

#### 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.

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.

**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 <sup>A</sup>	...	...	0.10–0.50	...	...

**TABLE 1 Chemical Requirements**

Element, %	Copper Alloy UNS No.					
	C46200	C46400	C46750	C47940	C48200	C48500
Copper	62.0–65.0	59.0–62.0	59.2–62.5	63.0–66.0	59.0–62.0	59.0–62.0
Tin	0.50–1.0	0.50–1.0	1.00–1.80	1.2–2.0	0.50–1.0	0.50–1.0
Lead	0.20 max	0.20 max	0.25 max	1.0–2.0	0.40–1.0	1.3–2.2
Zinc	remainder	remainder	remainder	remainder	remainder	remainder
Iron	0.10 max	0.10 max	0.10 max	0.10–1.0	0.10 max	0.10 max
Nickel <sup>A</sup>	...	...	0.50 max	0.10–0.50	...	...
Antimony	...	...	0.05–0.15	...	...	...
Phosphorus	...	...	0.05–0.15	...	...	...

<sup>A</sup> Including cobalt.

**TABLE 2 Tensile Requirements, inch-pound/inch-pound**

colwidth="1.25in"/COLSPEC

Temper Designation		Diameter or Distance Between Parallel Surfaces, in.	Tensile Strength, min, ksi	Yield Strength at 0.5% Extension Under Load, min, ksi	Elongation in 4 x Diameter or Diameter or Thickness of Specimen, % <sup>B</sup>	
Code	Name				2	5
<b>Copper Alloy UNS No. C46200</b>						
M30	as-hot extruded	all forms, all sizes			50	2030
O60	soft anneal	rods and bars, all sizes			48	1630
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	1822
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
<b>Copper Alloy UNS No. C46400</b>						
M30	as-hot extruded	all forms, all sizes			52	2030
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
O50	light anneal	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
			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
H50 <sup>C</sup>	extruded and drawn <sup>C</sup>	shapes, all sizes			58	2520
H02	half-hard	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
			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
H04	hard	rods and bars:				
			1.000 and under	67	45	13
			over 1.000 to 2.000, incl	62	37	18
<b>Copper Alloy UNS No. C46750</b>						
M30	as hot extruded	all forms, all sizes			48	20
O60	soft annealed	rod and bar, all sizes			49	20
O61	annealed	rod and bar, all sizes			49	20
H50	hot extruded and drawn	rod and bar:				
			over 0.300 to .500	48	20	5
			over 0.500 to 1.000	48	20	10
			over 1.000	48	20	15
<b>Copper Alloy UNS No. C47940</b>						
M30	as-hot extruded	all forms, all sizes			50	2030
O60	soft anneal	rods and bars, all sizes			48	2030
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
H50 <sup>C</sup>	extruded and drawn <sup>C</sup>	shapes, all sizes			56	2520
H02	half-hard	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

**TABLE 2** *Continued*

Temper Designation			Diameter or Distance Between Parallel Surfaces, in.	Yield Strength, min, ksi	Elongation in 4 × Diameter or Thickness of Specimen, min, % <sup>B</sup>	Elongation in 4 × Diameter or Thickness of Specimen, % <sup>B</sup>
Code	Name	Shapes, all sizes				
H04	hard	rods and bars:	over 2.000	50	25	25
			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	2025
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
O50	light anneal	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
H50 <sup>C</sup>	extruded and drawn <sup>C</sup>	shapes, all sizes			58	2515
H02	half-hard	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
H04	hard	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	2020
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
O50	light anneal	rods and bars:	1.000 and under	60	27	12
			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	20
H50 <sup>C</sup>	extruded and drawn <sup>C</sup>	shapes, all sizes			58	2515
H02	half-hard	rods and bars:	1.000 and under	60	27	12
			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	20
H04	hard	rods and bars:	1.000 and under	67	45	10
			over 1.000 to 2.000, incl	62	37	13

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

<sup>B</sup> In any case, a minimum gage length of 1 in. shall be used.

<sup>C</sup> This temper does not apply to hollow shapes.

5.3 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**.

5.4 When all the elements listed in **Table 1** for the Copper Alloy UNS No. specified in the ordering information No. are determined, the sum of the results shall be 99.6 % minimum except for C46750, which shall be 99.5 % minimum.

## 6. Temper

6.1 The standard tempers for products described in this specification, as defined in Classification **B601**, are shown in **Tables 2 and 3**.