



Designation: B 21/B 21M – 01

Standard Specification for Naval Brass Rod, Bar, and Shapes ¹

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.

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 124MB 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).

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 249B 249/B 249M/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 249MB 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),

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),

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.

Current edition approved April 10, 2001. Published August 2001. Originally published as B 21 – 18T. Last previous edition B 21 – 00.

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.

4.1.8 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 249MB 249/B 249M), and

4.2.5 Mill test report (Specification B 249/B 249MB 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.

5.2 These composition limits do not preclude the presence of other elements. Limits may be established and analysis

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.

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 601B 601, available under this specification are shown in Tables 2 and 3.

TABLE 2 Tensile Requirements, in./lb

Code	Temper Designation Name	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
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
		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

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 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		
		over 2.000 to 3.000, incl	54	25	25		
H04	hard	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	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		
H04	hard	over 0.500 to 1.000, incl	56	30	20		
		over 1.000 to 2.000, incl	54	25	22		
		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	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		
H04	hard	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	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		
O50	light anneal	over 4.000	54	22	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		
		over 4.000	54	22	25		
		rods and bars:					
1.000 and under	60	27	18				
O60	soft anneal	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		
O50	light 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		
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				