Designation: B927/B927M – 17

Standard Specification for Brass Rod, Bar, and Shapes[1]

This standard is issued under the fixed designation B927/B927M; 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.

1. Scope*

1.1 This specification establishes requirements for brass rod (round, hexagonal, and octagonal), bar (rectangular and square), and shapes of UNS Alloys C21000, C22000, C23000, C24000, C26000, C26800, C27000, C27400, C27450, C27451, C27453, and C28500.

1.2 *Units*—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.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B16/B16M Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines

B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar

B121/B121M Specification for Leaded Brass Plate, Sheet, Strip, and Rolled Bar

B124/B124M Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

B134/B134M Specification for Brass Wire

B135 Specification for Seamless Brass Tube

B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

B587 Specification for Welded Brass Tube

E8/E8M Test Methods for Tension Testing of Metallic Materials

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[3]

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,
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 Reports,
3.1.13 Product Marking,
3.1.14 Packaging and Package Marking, and
3.1.15 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 that supplement those that appear in Specification B249/B249M.

4. Ordering Information

4.1 Include the following information 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,
4.1.3 Temper,
4.1.4 Cross section (round, hexagonal, octagonal, rectangular, or square),
4.1.5 Quantity (total weight, footage, or number of pieces of each temper, cross section, and alloy),

[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] 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

4.1.6 Dimensions (diameter or distance between parallel surfaces, width and thickness, length),

4.1.7 Type of edge (square corners, rounded edge, full-rounded edge),

4.1.8 How furnished (specific lengths with or without ends), and

4.1.9 If product is purchased for agencies of the U.S. Government (Specification B249/B249M).

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

4.2.1 Certification (Specification B249/B249M), and

4.2.2 Mill Test Report (Specification B249/B249M).

5. Materials and Manufacture

5.1 *Materials:*

5.1.1 The material of manufacture shall be cast billets, logs, or rods of Copper Alloy UNS Nos. C21000, C22000, C23000, C24000, C26000, C26800, C27000, C27400, C27450, C27451, C27453, and C28500 of such purity, soundness, and structure as to be suitable for processing into the products prescribed herein.

5.2 *Manufacture:*

5.2.1 The products shall be manufactured by such hot working, cold working, and annealing processing 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.

6.2 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.

6.3 For alloys in which zinc is listed as "remainder," either copper or zinc may be taken as the difference between the sum of results of all other elements determined and 100 %.

6.4 When all elements specified for a given alloy in Table 1 are determined, the sum of the results shall be as shown in the following table:

Alloy UNS Nos.	Sum of Results, Percent, Minimum
C21000, C22000, C23000, C24000	99.8
C26000, C26800, C27000, C27400	99.7
C27450, C27451, C27453	99.5
C28500	99.1

7. Temper

7.1 The standard tempers for rod and bar described in this specification are given in Tables 2 and 3.

7.1.1 O60 (Soft Anneal),

7.1.2 H01 (¼ Hard),

7.1.3 H02 (½ Hard), and

7.1.4 H04 (Hard).

7.2 Other tempers, and temper for shapes, shall be subject to agreement between the manufacturer and the purchaser.

8. Mechanical Property Requirements

8.1 *Tensile Strength Requirements:*

8.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Tables 2 and 3, when tested in accordance with Test Methods E8/E8M.

9. Purchases for U.S. Government

9.1 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 Specification B249/B249M.

10. Dimensions and Permissible Variations

10.1 The dimensions and tolerances for rod, bar, and shapes described by this specification shall be as specified in Specification B249/B249M with particular reference to the following tables and related paragraphs.

10.1.1 *Diameter or Distance Between Parallel Surfaces:*

10.1.1.1 *Rod*—Table 1.

10.1.1.2 *Bar*—Tables 8 and 10.

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

10.1.3 *Length*—Tables 13 and 14.

10.1.4 *Straightness*—Table 16—General Use section.

10.1.5 *Edge contours*—Paragraph 6.5.

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Composition, %						
	Copper	Lead, max	Iron, max	Tin, max	Phosphorous	Arsenic	Zinc
C21000	94.0-96.0	0.05	0.05	...	...	...	remainder
C22000	89.0-91.0	0.05	0.05	...	...	...	remainder
C23000	84.0-86.0	0.05	0.05	...	...	...	remainder
C24000	78.5-81.5	0.05	0.05	...	...	...	remainder
C26000	68.5-71.5	0.07	0.05	...	...	...	remainder
C26800	64.0-68.5	0.09	0.05	...	...	...	remainder
C27000	63.0-68.5	0.09	0.07	...	...	...	remainder
C27400	61.0-64.0	0.09	0.05	...	...	...	remainder
C27450	60.0-65.0	0.25	0.35	...	...	...	remainder
C27451	61.0-65.0	0.25	0.35	...	0.05-0.20	...	remainder
C27453	61.5–63.5	0.25	0.15	0.15	...	0.02–0.15	remainder
C28500	57.0–59.0	0.25	0.35	...	...	...	remainder

TABLE 2 Tensile Requirements (Inch-Pound Units)

Temper		Diameter or Distance Between Parallel Surfaces, in.	Tensile Strength, min	Yield Strength at 0.5 % Extension Under Load, min	Elongation[A] in 4× diameter or 4× thickness, min
Code	Name		ksi	ksi	%
		Copper Alloy UNS No. C21000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	30	10	25
H01	¼ Hard	Under ½	36	16	15
		½ to 1, incl	34	14	17
		over 1	32	12	19
H02	½ Hard	Under ½	42	25	8
		½ to 1, incl	40	23	9
		over 1	37	20	11
H04	Hard	Under ½	52	40	5
		½ to 1, incl	48	37	7
		over 1 to 2 incl	45	35	9
		Copper Alloy UNS No. C21000 Bar[B]			
O60	Soft Anneal	All sizes	30	10	25
H01	¼ Hard	Under ½	34	14	17
		½ to 2, incl	32	12	19
		Copper Alloy UNS No. C22000 Rod (round, hexagonal, octagonal)			
060	Soft Anneal	All sizes	32	10	25
H01	¼ Hard	Under ½	39	20	15
		½ to 1, incl	37	17	17
		over 1	34	15	19
H02	½ Hard	Under ½	50	30	7
		½ to 1, incl	45	27	10
		over 1	40	25	12
H04	Hard	Under ½	57	40	5
		½ to 1, incl	55	37	7
		over 1 to 2 incl	50	35	9
		Copper Alloy UNS No. C22000 Bar[B]			
O60	Soft Anneal	All sizes	32	10	25
H01	¼ Hard	Under ½	35	16	17
		½ to 2, incl	34	15	19
		Copper Alloy UNS No. C23000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	35	10	25
H01	¼ Hard	Under ½	44	20	15
		½ to 1, incl	42	17	17
		over 1	40	15	19
H02	½ Hard	Under ½	50	30	7
		½ to 1, incl	45	27	10
		over 1	40	25	12
H04	Hard	Under ½	63	40	5
		½ to 1, incl	60	37	7
		over 1 to 2 incl	58	35	9
		Copper Alloy UNS No. C23000 Bar[B]			
O60	Soft Anneal	All sizes	35	10	25
H01	¼ Hard	Under ½	40	15	19
		½ to 1, incl	38	13	22
		over 1 to 2 incl	36	11	25
H02	½ Hard	Under ½	44	20	15
		½ to 1, incl	42	17	17
		over 1 to 2 incl	40	15	19
		Copper Alloy UNS No. C24000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	40	10	30
H01	¼ Hard	Under ½	47	25	18
		½ to 1, incl	45	20	20
		over 1	43	18	22
H02	½ Hard	Under ½	53	33	10
		½ to 1, incl	48	30	13
		over 1	43	28	15
H04	Hard	Under ½	68	45	8
		½ to 1, incl	65	40	10
		over 1 to 2 incl	60	35	12
		Copper Alloy UNS No. C24000 Bar[B]			
O60	Soft Anneal	All sizes	40	10	30
H01	¼ Hard	Under ½	45	20	20
		½ to 1, incl	43	18	22
		over 1 to 2 incl	41	16	25
		Copper Alloy UNS No. C26000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	40	12	30
H01	¼ Hard	Under ½	50	30	20
		½ to 1, incl	48	25	24
		over 1	46	20	28

TABLE 2 *Continued*

Temper		Diameter or Distance Between Parallel Surfaces, in.	Tensile Strength, min	Yield Strength at 0.5 % Extension Under Load, min	Elongation[A] in 4× diameter or 4× thickness, min
Code	Name		ksi	ksi	%
H02	½ Hard	Under ½	57	35	15
		½ to 1, incl	54	32	20
		over 1	50	30	25
H04	Hard	Under ½	70	50	10
		½ to 1, incl	65	45	15
		over 1 to 2 incl	60	40	20
Copper Alloy UNS No. C26000 Bar[B]					
O60	Soft Anneal	All sizes	40	12	30
H02	½ Hard	Under ½	50	25	10
		½ to 1, incl	45	17	20
		over 1 to 2 incl	40	15	20
Copper Alloy UNS No. C26800, C27000, C27400, C27450, C27451, C27453 Rod (round, hexagonal, octagonal)					
O60	Soft Anneal	All sizes	40	12	30
H01	¼ Hard	Under ½	47	25	18
		½ to 1, incl	45	20	20
		over 1	43	18	22
H02	½ Hard	Under ½	53	33	10
		½ to 1, incl	48	30	13
		over 1	43	28	15
H04	Hard	Under ½	68	45	8
		½ to 1, incl	65	40	10
		over 1 to 2 incl	60	35	12
Copper Alloy UNS No. C26800, C27000, C27400, C27450, C27451, C27453 Bar[B]					
O60	Soft Anneal	All sizes	40	12	30
H02	½ Hard	Under ½	50	25	10
		½ to 1, incl	45	17	20
		over 1 to 2 incl	40	15	20
Copper Alloy UNS No. C28500 Rod (round, hexagonal, octagonal)					
O60	Soft Anneal	All sizes	43	14	20
H01	¼ Hard	Under ½	58	24	13
		½ to 1, incl	55	21	15
		over 1	52	17	20
H02	½ Hard	Under ½	69	43	8
		½ to 1, incl	65	36	12
		over 1	59	26	18
H04	Hard	Under ½	79	58	5
		½ to 1, incl	75	49	10
		over 1 to 2, incl	71	40	15
Copper Alloy UNS No. C28500 Bar[B]					
O60	Soft Anneal	All sizes	43	14	20
H02	½ Hard	Under ½	69	43	8
		½ to 1, incl	65	36	12
		over 1 to 2, incl	59	26	18

[A] In any case, a minimum gage length of 1 in. shall be used.
[B] For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.

11. Test Methods

11.1 *Chemical Analysis:*

11.1.1 In cases of disagreement, determine the composition using the following methods:

Element	Test Method
Copper	E478
Lead	E478 (AA)
Iron	E478
Tin	E478
Arsenic	E62
Zinc	E478 (Titrimetric)

11.1.2 Test methods to be followed for the determination of elements resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

12. Keywords

12.1 brass bar; brass rod; brass shape; copper-alloy rod; C21000; C22000; C23000; C24000; C26000; C26800; C27000; C27400; C27450; C27451; C27453; C28500

TABLE 3 Tensile Requirements (SI Units)

Temper		Diameter or Distance Between Parallel Surfaces, mm	Tensile Strength, min	Yield Strength at 0.5 % Extension Under Load, min	Elongation[A] in 4× diameter or 4× thickness, min
Code	Name		MPa	MPa	%
		Copper Alloy UNS No. C21000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	205	70	25
H01	¼ Hard	Under 12	250	110	15
		12 to 25, incl	235	95	17
		over 25	220	85	19
H02	½ Hard	Under 12	290	170	8
		12 to 25, incl	275	160	9
		over 25	255	140	11
H04	Hard	Under 12	360	275	5
		12 to 25, incl	330	255	7
		over 25 to 50 incl	310	240	9
		Copper Alloy UNS No. C21000 Bar[B]			
O60	Soft Anneal	All sizes	205	70	25
H01	¼ Hard	Under 12	235	95	17
		12 to 50, incl	220	85	19
		Copper Alloy UNS No. C22000 Rod (round, hexagonal, octagonal)			
060	Soft Anneal	All sizes	220	70	25
H01	¼ Hard	Under 12	270	140	15
		12 to 25, incl	255	115	17
		over 25	235	105	19
H02	½ Hard	Under 12	345	205	7
		12 to 25, incl	310	185	10
		over 25	275	170	12
H04	Hard	Under 12	395	275	5
		12 to 25, incl	380	255	7
		over 25 to 50 incl	345	240	9
		Copper Alloy UNS No. C22000 Bar[B]			
O60	Soft Anneal	All sizes	220	70	25
H01	¼ Hard	Under 12	240	110	17
		12 to 50, incl	235	105	19
		Copper Alloy UNS No. C23000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	240	70	25
H01	¼ Hard	Under 12	305	140	15
		12 to 25, incl	290	115	17
		over 25	275	103	19
H02	½ Hard	Under 12	345	205	7
		12 to 25, incl	310	185	10
		over 25	275	170	12
H04	Hard	Under 12	435	275	5
		12 to 25, incl	415	255	7
		over 25 to 50 incl	400	240	9
		Copper Alloy UNS No. C23000 Bar[B]			
O60	Soft Anneal	All sizes	240	70	25
H01	¼ Hard	Under 12	275	105	19
		12 to 25, incl	260	90	22
		over 25 to 50 incl	250	75	25
H02	½ Hard	Under 12	305	140	15
		12 to 25, incl	290	115	17
		over 25 to 50 incl	275	105	19
		Copper Alloy UNS No. C24000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	275	70	30
H01	¼ Hard	Under 12	325	170	18
		12 to 25, incl	310	140	20
		over 25	295	125	22
H02	½ Hard	Under 12	365	230	10
		12 to 25, incl	330	205	13
		over 25	295	195	15
H04	Hard	Under 12	470	310	8
		12 to 25, incl	450	275	10
		over 25 to 50 incl	415	240	12
		Copper Alloy UNS No. C24000 Bar[B]			
O60	Soft Anneal	All sizes	275	70	30
H01	¼ Hard	Under 12	310	140	20
		12 to 25, incl	295	125	22
		over 25 to 50 incl	285	110	25
		Copper Alloy UNS No. C26000 Rod (round, hexagonal, octagonal)			
O60	Soft Anneal	All sizes	275	85	30
H01	¼ Hard	Under 12	345	205	20
		12 to 25, incl	330	170	24
		over 25	315	140	28

TABLE 3 *Continued*

Temper		Diameter or Distance Between Parallel Surfaces, mm	Tensile Strength, min	Yield Strength at 0.5 % Extension Under Load, min	Elongation[A] in 4× diameter or 4× thickness, min
Code	Name		MPa	MPa	%
H02	½ Hard	Under 12	395	240	15
		12 to 25, incl	370	220	20
		over 25	345	205	25
H04	Hard	Under 12	485	345	10
		12 to 25, incl	450	310	15
		over 25 to 50 incl	415	275	20
Copper Alloy UNS No. C26000 Bar[B]					
O60	Soft Anneal	All sizes	275	85	30
H02	½ Hard	Under 12	345	170	10
		12 to 25, incl	310	115	20
		over 25 to 50 incl	275	105	20
Copper Alloy UNS No. C26800, C27000, C27400, C27450, C27451, C27453 Rod (round, hexagonal, octagonal)					
O60	Soft Anneal	All sizes	275	85	30
H01	¼ Hard	Under 12	325	170	18
		12 to 25, incl	310	140	20
		over 25	295	125	22
H02	½ Hard	Under 12	365	230	10
		12 to 25, incl	330	205	13
		over 25	295	195	15
H04	Hard	Under 12	470	310	8
		12 to 25, incl	450	275	10
		over 25 to 50 incl	415	240	12
Copper Alloy UNS No. C26800, C27000, C27400, C27450, C27451, C27453 Bar[B]					
O60	Soft Anneal	All sizes	275	85	30
H02	½ Hard	Under 12	345	170	10
		12 to 25, incl	310	115	20
		over 25 to 50 incl	275	105	20
Copper Alloy UNS No. C28500 Rod (round, hexagonal, octagonal)					
O60	Soft Anneal	All sizes	300	100	20
H01	¼ Hard	Under 12	400	170	13
		12 to 25, incl	380	150	15
		over 25	360	120	20
H02	½ Hard	Under 12	480	300	8
		12 to 25, incl	450	250	12
		over 25	410	180	18
H04	Hard	Under 12	550	400	5
		12 to 25, incl	520	340	10
		over 25 to 50, incl	490	280	15
Copper Alloy UNS No. C28500 Bar[B]					
O60	Soft Anneal	All sizes	300	100	20
H02	½ Hard	Under 12	480	300	8
		12 to 25, incl	450	250	12
		over 25 to 50, incl	410	180	18

[A] In any case, a minimum gage length of 25 mm shall be used.
[B] For rectangular bar, the Distance Between Parallel Surfaces refers to thickness.

APPENDIXES

(Nonmandatory Information)

X1. METRIC EQUIVALENTS

X1.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ($N = kg \cdot m/s^2$). The derived SI unit for pressure or stress is the newton per square metre (N/m^2), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since 1 ksi = 6 894 757 Pa the metric equivalents are expressed as megapascal (MPa), which is the same as MN/m^2 and N/mm^2.

X2. RATIONALE (COMMENTARY)

X2.1 This specification is a new Standard Specification for Brass Rod, Bar, and Shapes. Federal Specification QQ-B-626, which covered a number of binary brass and leaded brass alloys in rods, shapes, forgings, and flat products, was cancelled by Rev D, Notice 2, February 28, 1991. ASTM Specifications B36/B36M, B16/B16M, B121/B121M, and B124/B124M were referenced replacements for future procurement.

X2.2 The above listed ASTM standards do not cover, in particular, UNS alloys C26000 and C26800 in rod and bar. As there continues to be significant commerce in these and other binary brass products, this specification for Brass Rod, Bar, and Shapes has been written by Subcommittee B05.02.

X2.3 Alloys included are C21000, C22000, C23000, C24000, C26000, C26800, C27000, C27400, C27450, and C27451 in rod and bar sizes up to 4.250 in. in diameter, and shapes.

X2.4 This specification completes the general product coverage for binary brass: Specification B36/B36M for flat products; Specification B134/B134M for wire; Specification B135 for seamless tube; Specification B587 for welded tube; and this specification for rod, bar, and shapes.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B927/B927M – 13) that may impact the use of this standard. (Approved April 1, 2017.)

(1) Added UNS Alloy Nos. C27453 and C28500 to 1.1, 5.1, 6.4, Table 1, Table 2, Table 3, 11.1.1, and Section 12.