



Designation: **B587—12 B587—19**

Standard Specification for Welded Brass Tube¹

This standard is issued under the fixed designation B587; 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 (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification establishes the requirements for round, rectangular, and square copper alloy welded tube for general engineering applications.

1.2 ~~Units—Values~~—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units, which units that are provided for information only and are not considered standard.

1.3 ~~The following hazard statement pertains only to the test method described in 18.2.3, 18.2.4, 18.2.6, and 18.2.7 of this specification: 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.~~

1.3 The following safety hazard caveat pertains only to the test method(s) described in this specification:

1.3.1 ~~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, health, and environmental practices and to determine the applicability of regulatory limitations prior to use.~~

1.4 ~~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

[B153 Test Method for Expansion \(Pin Test\) of Copper and Copper-Alloy Pipe and Tubing](#)

[B154 Test Method for Mercurous Nitrate Test for Copper Alloys](#)

[B428 Test Method for Angle of Twist in Rectangular and Square Copper and Copper Alloy Tube](#)

~~[B601](#)~~[B846 Classification for Temper Designations for Terminology for Copper and Copper Alloys—Wrought and Cast Alloys](#)

[B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube](#)

[E3 Guide for Preparation of Metallographic Specimens](#)

~~[E8/E8M](#)~~

~~[E18](#)~~[E8/E8M Test Methods for Rockwell Hardness Tension Testing of Metallic Materials](#)

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)

[E112 Test Methods for Determining Average Grain Size](#)

[E243 Practice for Electromagnetic \(Eddy Current\) Examination of Copper and Copper-Alloy Tubes](#)

[E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition](#)

[E478 Test Methods for Chemical Analysis of Copper Alloys](#)

[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

3. Terminology

3.1 For definitions of terms related to copper and copper alloys, refer to Terminology [B846](#).

3.2 ~~Definitions:~~ *Definitions of Terms Specific to This Standard:*

¹ This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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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.

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

3.2.1 average diameter (for round tubes only), as-welded—*n*—the average of the maximum and minimum outside diameters, or the maximum and minimum inside diameters, whichever is applicable, as determined at any one cross section of the tube; a condition created as a result of shaping sheet, strip, or plate into a tubular form and welding without subsequent heat treatment or cold work, or both.

3.1.2 coil—a length of the product wound into a series of connected turns. The unqualified term “coil” as applied to tube is normally understood as referring to a bunched coil.

3.1.2.1 mill length—lengths that can be conveniently manufactured in the mills.

3.1.2.2 mill lengths with ends—lengths, including ends, that can be conveniently manufactured in the mills.

3.1.3 flash or bead—weld metal that protrudes beyond the normal wall, both inside or outside.

3.2.2 lengths—ends—straight pieces of the product, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specified lengths. They are subject to minimum length and maximum weight requirements.

3.1.4.1 ends—straight pieces, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specified lengths. They are subject to minimum length and maximum weight requirements.

3.1.4.2 specific—straight lengths that are uniform in length, as specified, and subject to established tolerances.

3.1.4.3 stock—straight lengths that are mill cut and stored in advance of orders. They are usually subject to established tolerances.

3.2.3 scarfing—fully finished—the removing of flash or bead by a cutting operation; welded tube with internal and processed to conform to the specified temper.

3.2.4 mill length—lengths that can be conveniently manufactured in the mills.

3.2.5 mill lengths with ends—lengths, including ends, that can be conveniently manufactured in the mills.

3.2.6 specific—straight lengths that are uniform in length, as specified, and subject to established tolerances.

3.2.7 stock—straight lengths that are mill cut and stored in advance of orders. They are usually subject to established tolerances.

3.2.8 tube—welded and annealed—a hollow product of round or any other cross section, having a continuous periphery; welded tube that has been annealed to produce a uniformed grain size appropriate to the specified annealed temper.

3.1.6.1 welded—product made from sheet, strip, or plate with a seam made by welding.

3.1.6.2 as-welded—a condition created as a result of shaping sheet, strip, or plate into a tubular form and welding without subsequent heat treatment or cold work, or both.

3.1.6.3 welded and annealed—welded tube that has been annealed to produce a uniformed grain size appropriate to the specified annealed temper.

3.1.6.4 welded and cold-drawn—welded tube with internal flash removed by scarfing and subsequently cold-drawn to conform to the specified temper.

3.1.6.5 fully finished—welded tube with internal and processed to conform to the specified temper.

3.2.9 welded and cold-drawn—welded tube with internal flash removed by scarfing and subsequently cold-drawn to conform to the specified temper.

4. Classification (Type)

4.1 The basic types of welded brass tube are:

4.1.1 *Type I*—As-welded tube finished by passing through sizing and straightening rolls at ambient temperature.

4.1.2 *Type II*—As-welded tube finished by sizing, straightening, and annealing.

4.1.3 *Type III*—As-welded tube finished by cold reducing or cold drawing over a plug or mandrel.

4.1.4 *Type IV*—As-welded tube finished by both cold drawing over a plug or mandrel and annealing, and redrawing and annealing when necessary to conform to a specified size and temper.

4.1.4.1 *Type IV* tube may be substituted for Types I, II, and III by agreement between the manufacturer or supplier and the purchaser. The temper of substituted *Type IV* tube shall be stated in the contract or purchase order.

5. Ordering Information

5.1 Include the following specified choices when placing orders for product under this specification, as applicable:

5.1.1 ASTM designation and year of issue (for example, B587 – 12);

5.1.2 Copper Alloy UNS³ No. (for example, C21000) (Section 6);

5.1.3 Classification (type) (Section 4);

5.1.4 Temper (Section 8 and Table 2 and Table 3);

³ Refer to Practice E527 for explanation of the Unified Numbering System (UNS).

- 5.1.5 Dimensions (diameter, distances between parallel surfaces, wall thickness and so forth) (Section 13);
- 5.1.6 How furnished (coils or lengths, specific or stock, with or without ends);
- 5.1.7 Quantity—Number of coils or pieces, each size and type;
- 5.1.8 Total weight, each size and type; and
- 5.1.9 Intended application.

5.2 The following options are available under this specification and shall be specified in the contract or purchase order but may not be included unless specified at the time of placing of the order, when required:

- 5.2.1 Mercurous nitrate test (11.1),
- 5.2.2 Hydrostatic test (12.2),
- 5.2.3 Pneumatic test (12.3),
- 5.2.4 Certification (Section 22),
- 5.2.5 Mill test report (Section 23),
- 5.2.6 Product marking (Section 24), and
- 5.2.7 Package marking of the specification number.

6. Material and Manufacture

6.1 *Material*—The material of manufacture shall be strip, sheet, or plate produced of Copper Alloy UNS No. C21000, C22000, C23000, C26000, C26800, C27000, or C27200 and shall be [or other designation] of such quality and soundness as to be suitable for processing into the products described in this specification.

6.2 *Manufacture:*

- 6.2.1 Tubes shall be welded by any process which produces forged or fusion welds.
 - 6.2.1.1 Tube welded from flat rolled strip can be regularly furnished by welding standard strip tempers and shall have mechanical properties as agreed upon between the manufacturer or supplier and the purchaser.
 - 6.2.2 Forged-welded tube shall be scarfed to remove both internal and external flash.
 - 6.2.2.1 Forged-welded tube to be drawn over a mandrel to produce Types III and IV may have the internal flash completely removed.
 - 6.2.2.2 Forged-welded Types I, II, and III tube may contain a residual thickness at the weld not to exceed 0.006 in. (0.15 mm) or 10 % of the nominal wall thickness, whichever is greater.
 - 6.2.3 Fusion-welded tube shall be mechanically worked to produce a smooth external and internal surface without the application of scarfing or other removal of the weld metal bead.

7. Chemical Composition

- 7.1 The material shall conform to the chemical requirements given in Table 1 for the specified alloy.
 - 7.1.1 These composition limits do not preclude the presence of other elements. Limits By agreement between the manufacturer and purchaser, limit may be established and analysis required for unnamed elements by agreement between the manufacturer and the purchaser.
 - 7.2 Either copper or zinc may be taken as the difference between the sum of results of all elements determined and 100 %; however, when copper is so determined, that difference shall conform to the limits given in Table 1 for copper.
 - 7.2 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 %. When all elements in Table 1 for the specified alloy are determined, the sum of results shall be as follows:

Copper Alloy UNS No.	Copper Plus Sum of Named Elements, min, %
C21000, C22000, C23000	99.8
C26000, C26800, C27000, C27200	99.7

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Composition, %			
	Copper	Lead, max	Iron, max	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
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
C27200	62.0–65.0	0.07	0.07	remainder

8. Temper

8.1 The product furnished shall be one of the tempers indicated in [Table 2](#) or [Table 3](#).

8.1.1 Light-drawn and hard-drawn tempers are normally available in round tube only.

8.1.2 Special temper requirements are subject to agreement between the manufacturer or supplier and the purchaser.

9. Grain Size for Annealed Tempers

9.1 *Grain Size:*

9.1.1 Type II and Type IV tubes with tempers designated as W060 (welded and soft-annealed) and W050 (welded and light-annealed) shall conform to the requirements prescribed in [Table 3](#) for the specified copper alloy UNS No. and temper when tested in accordance with Test Methods [E112](#).

9.1.2 Grain size shall be the basis for acceptance or rejection based upon physical properties.

10. Mechanical Properties

10.1 *Tensile Strength Requirements* ~~→ Requirements:~~

10.1.1 Type I, Type III, and Type IV tube in drawn tempers shall conform to the requirements prescribed in [Table 2](#) for the specified copper alloy and temper when tested in accordance with Test Methods [E8/E8M](#).

10.1.2 The tensile test results shall be the basis for acceptance or rejection based upon mechanical properties.

10.2 *Rockwell Hardness Requirement*—The approximate Rockwell hardness value(s) for each copper alloy and temper given in [Table 2](#) and [Table 3](#) are for general information and assistance in testing.

NOTE 1—The Rockwell hardness test offers a quick and convenient method for checking for general conformity to the requirements for tensile strength or grain size.

11. Performance Requirements

11.1 *Mercurous Nitrate Test*—When specified in the contract or purchase order, specimens of annealed tube in all copper alloys and tempers shall ~~show no cracks when tested in accordance with~~ be tested for residual stress according to the requirements in Test Method [B154](#); and show no signs of cracking.

11.2 *Expansion Test:*

11.2.1 Test specimen shall conform to the requirements of the Specimen Preparation section of Test Method [B153](#) and to the below amounts.

Standard Size, in. (mm)	Expansion in Outside Diameter, %
3/4 (19.0) and under	20
Over 3/4 (19.0)	15

11.3 *Flattening Test:*

11.3.1 The flattening test shall be performed in accordance with Test Method [B968/B968M](#).

11.4 *Reverse Bend Test:*

11.4.1 A representative tube sample shall be cut to a length that will accommodate the test. The sample is permitted to be annealed when the temper is other than annealed.

12. Nondestructive Testing Requirements

12.1 *Electromagnetic (Eddy-Current) Examination*—Each tube up to and including ~~3 1/8 in. (79.4 mm)~~ in. (79.4 mm) outside diameter or within the capabilities of the testing unit shall be passed through the testing unit adjusted to provide information on the suitability of the tube for the intended application in accordance with Practice [E243](#). Tube that does not actuate the ~~signaling~~ signaling device shall be considered as conforming with test requirements.

12.2 *Hydrostatic Test:*

12.2.1 When specified in the contract or purchase order, each tube shall withstand an internal hydrostatic pressure sufficient to subject the material to a fiber stress of 6000 psi (41 MPa) without leakage.

12.2.2 The tube need not be tested at a ~~gage~~ gauge pressure over 1000 psi (6.9 MPa) unless so specified in the contract or purchase order.

12.3 *Pneumatic Test*—When specified in the contract or purchase order, each tube shall withstand an internal air pressure of 60 psi (415 kPa) minimum for 5 s without leakage.

13. Dimensions, Mass, and Permissible Variations

13.1 Tube diameter shall be expressed as outside diameter or inside diameter in numerical fractions of an inch. Wall thickness shall be expressed in decimal fractions of an inch.

TABLE 2 Tensile Strength Requirements and Approximate Rockwell Hardness Values for Welded (Type I), Welded and Cold-Worked (Type III), and Fully Finished (Type IV) Tube

Copper Alloy UNS/UNS No.	Temper	Type	Outside Diameter, in. (mm)	Wall Thickness, in. (mm)	Rockwell 30T Hardness, ^A min	Tensile Strength, min, ksi ^B (MPa) ^C
C21000	welded from annealed strip	I	all	all	7	34 (235)
C21000	welded from cold-rolled strip	I	all	all	<i>D</i>	<i>D</i>
C21000	cold reduced or light drawn	III, IV	all	all	34	37 (255)
C21000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020–0.119 (0.508–3.02)	52	46 (315)
C21000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	52	46 (315)
			over 1 to 2 (25.4 to 50.8) —incl	0.035–0.119 (0.889–3.02)		
			over 1 to 2 (25.4 to 50.8) incl	0.035 to 0.119 (0.889 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) —incl	0.060–0.119 (1.52–3.02)		
			over 2 to 3½ (50.8 to 88.9) incl	0.060 to 0.119 (1.52 to 3.02)		
C22000	welded from annealed strip	I	all	all	10	37 (255)
C22000	welded from cold-rolled strip	I	all	all	<i>D</i>	<i>D</i>
C22000	cold reduced or light drawn	III, IV	all	all	38	40 (275)
C22000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	55	52 (360)
C22000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	55	52 (360)
			over 1 to 2 (25.4 to 50.8) —incl	0.035 to 0.119 (0.889 to 3.02)		
			over 1 to 2 (25.4 to 50.8) incl	0.035 to 0.119 (0.889 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) —incl	0.060 to 0.119 (1.52 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) incl	0.060 to 0.119 (1.52 to 3.02)		
C23000	welded from annealed strip	I	all	all	24	40 (275)
C23000	welded from cold-rolled strip	I	all	all	<i>D</i>	<i>D</i>
C23000	cold reduced or light drawn	III, IV	all	all	43	44 (305)
C23000	cold reduced or drawn (general purpose)	III, IV	all	all	43	44 (305)
C23000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	65	57 (395)
C23000	cold reduced or hard drawn	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	65	57 (395)
			over 1 to 2 (25.4 to 50.8) —incl	0.035 to 0.119 (0.889 to 3.02)		
			over 1 to 2 (25.4 to 50.8) incl	0.035 to 0.119 (0.889 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) —incl	0.060 to 0.119 (1.52 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) incl	0.060 to 0.119 (1.52 to 3.02)		
C26000, C26800, C27000, C27200	welded from annealed strip	I	all	all	25	48 (330)
C26000, C26800, C27000, C27200	welded from cold-rolled strip	I	all	all	<i>D</i>	<i>D</i>
C26000, C26800, C27000, C27200	cold reduced or drawn (general purpose)	III, IV	all	all	53	54 (370)
C26000, C26800, C27000, C27200	cold reduced or hard drawn ^E	III, IV	up to 1 (25.4) incl	0.020 to 0.119 (0.508 to 3.02)	70	66 (455)
			over 1 to 2 (25.4 to 50.8) incl	0.035 to 0.119 (0.889 to 3.02)		
			over 2 to 3½ (50.8 to 88.9) incl	0.060 to 0.119 (1.52 to 3.02)		

^A Rockwell hardness values shall only apply to: (a) tubes having a wall thickness of 0.012 in. (0.305 mm) or greater; (b) round tube having an inside diameter of 5/16 in. (7.94 mm) or greater; and (c) rectangular and square tube having an inside major distance between parallel surfaces of 3/4 in. (4.76 mm) or greater. Rockwell hardness tests shall be made on the inside surface of the tube, and the value of the Rockwell hardness number of each specimen shall be established by taking the arithmetical average of at least three readings. When suitable equipment is not available for determining the specified Rockwell hardness, other Rockwell scales and values may be specified subject to agreement between the manufacturer and the purchaser.

^B ksi = 1000 psi.

^C See Appendix X1.

^D Tube welded from cold-rolled strip can be regularly supplied by welding standard strip tempers and shall have mechanical properties as agreed upon between the purchaser and the supplier.

^E Light-drawn and hard-drawn tempers are normally available in round tube only.

TABLE 3 Grain Size Requirements and Approximate Rockwell Hardness Values for Welded Tube and Fully Finished Tube When Furnished in the Annealed Temper

Copper Alloy UNS No.	Temper		Types	Outside Diameter, in. (mm)	Wall Thickness, in. (mm)	Approximate Rockwell Hardness ^A		Avg Grain Size, mm										
	Designation	Name				Scale	Max	min	max									
C21000	WO60	soft anneal	II, IV	all	up to 0.045 (1.14) incl over 0.045 (1.14)	30T F	17 61	0.025 0.025	0.060 0.060									
C21000	WO50	light anneal	II, IV	all	up to 0.045 (1.14) over 0.045 (1.14)	30T F	27 68	^B ^B	0.035 0.035									
C22000	WO60	soft anneal	II, IV	all	up to 0.045 (1.14) incl over 0.045, (1.14)	30T F	30 70	0.025 0.025	0.060 0.060									
C22000	WO50	light anneal	II, IV	all	up to 0.045 (1.14) incl over 0.045, (1.14)	30T F	37 78	^B ^B	0.035 0.035									
C23000	WO60	soft anneal	II, IV	all	up to 0.045 (1.14) incl over 0.045, (1.14)	30T F	36 75	0.025 0.025	0.060 0.060									
C23000	WO50	light anneal	II, IV	all	up to 0.045 (1.14) incl over 0.045 (1.14)	30T F	39 85	^B ^B	0.035 0.035									
C26000 C26800 C27000 C27200	} WO60	soft anneal	II, IV	all	up to 0.30 (0.762) incl over 0.030 (0.762)	30T F	40 80	0.025 0.025	0.060 0.060									
C26000 C26800 C27000 C27200										} WO50	light anneal	II, IV	all	up to 0.30 (0.762) incl over 0.030 (0.762)	30T F	60 90	^B ^B	0.035 0.035

^A Rockwell hardness values only apply to: (a) tube having a wall thickness of 0.015 in. (0.38 mm) or greater; (b) round tube having an inside diameter of 5/16 in. (7.94 mm) or greater; and (c) rectangular and square tube having an inside major distance between parallel surfaces of 3/16 in. (4.76 mm) or greater. Rockwell hardness values do not apply for other tube. Rockwell hardness tests shall be made on the inside surface of the tube and the value of the Rockwell hardness number of each specimen shall be established by taking the arithmetical average of at least three readings. When suitable equipment is not available for determining the specified Rockwell hardness, other Rockwell scales and values may be specified subject to agreement between the manufacturer and the purchaser.

^B Although no minimum grain size is specified, the product must, nevertheless, have a fully recrystallized grain structure.

13.2 Tolerances on a given tube may be specified with respect to any two, but not all three, of the following: outside diameter, inside diameter, and wall thickness.

13.3 For purposes of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting values for any dimension shall be cause for rejection.

13.4 *Wall Thickness Tolerances*—Wall thickness tolerances for round tube shall conform to the tolerances listed in Table 4. Wall thickness tolerances for rectangular including square tube shall be in accordance with Table 5.

13.5 Diameter tolerances for round tubes furnished in straight lengths only shall be in accordance with Table 6. Tolerances have not been established for tube furnished in coils.

TABLE 4 Wall Thickness Tolerances^A for Welded Brass Tube

NOTE 1—*Maximum Deviation at any Point*—The following tolerances are plus and minus. If tolerances all plus or all minus are desired, double the values given.

Wall Thickness, ^B in. (mm)	Outside Diameters, ^C in. (mm)				
	1/32 (0.794) to 1/8 (3.18), incl	Over 1/8 (3.18) to 5/16 (15.9), incl	Over 5/16 (15.9) to 1 (25.4), incl	Over 1 (25.4) to 2 (50.8), incl	Over 2 (50.8) to 3 1/2 (88.9), incl
Up to 0.017 (0.432), incl	0.002 (0.051)	0.001 (0.025)	0.0015 (0.038)	0.002 (0.051)	...
Over 0.017 (0.432) to 0.024 (0.610), incl	0.003 (0.076)	0.002 (0.051)	0.002 (0.051)	0.0025 (0.064)	...
Over 0.024 (0.610) to 0.034 (0.864), incl	0.003 (0.076)	0.0025 (0.064)	0.0025 (0.064)	0.003 (0.076)	0.004 (0.10)
Over 0.034 (0.864) to 0.057 (1.48), incl	0.003 (0.076)	0.003 (0.076)	0.0035 (0.089)	0.0035 (0.089)	0.005 (0.13)
Over 0.057 (1.48) to 0.082 (2.08), incl	...	0.0035 (0.089)	0.004 (0.10)	0.004 (0.10)	0.006 (0.15)
Over 0.082 (2.08) to 0.119 (3.02), incl	...	0.004 (0.10)	0.005 (0.13)	0.005 (0.13)	0.007 (0.18)

^A The thickness tolerance is the maximum deviation at any point from the specified thickness.

^B The wall thickness at the weld in Types I, II, and III tube may exceed the nominal wall thickness by an amount double the value shown in the tolerance table.

^C When round tube is ordered by outside and inside diameters, the maximum plus and minus deviation of the wall thickness from the nominal at any point shall not exceed the values given in the table by more than 50 %.