Designation: B569 – 14

Standard Specification for Brass Strip in Narrow Widths and Light Gage for Heat-Exchanger Tubing[1]

This standard is issued under the fixed designation B569; 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 the requirements for brass strip in narrow widths and light gages produced from Copper Alloys Nos. C23000, C26000, and C26130.[2]

NOTE 1—This product is commonly used for the manufacture of thin-wall tubes for water passages in heat exchangers for internal combustion engines and other closed system heat sources.

1.2 *Units*—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 are provided for information only and are not considered standard.

1.2.1 *Exception*—Grain size and chemical analysis sampling are stated in SI units.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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

B846 Terminology for Copper and Copper Alloys

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

E3 Guide for Preparation of Metallographic Specimens

E8/E8M Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[4]

E112 Test Methods for Determining Average Grain Size

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.

4. Ordering Information

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

4.1.1 ASTM designation and year of issue (for example, B569–XX),

4.1.2 Copper [Alloy] UNS No. designation (for example, C26000),

4.1.3 Temper (Section 7),

4.1.4 Dimensions: thickness, width, length (Section 10), and

4.1.5 Quantity: total weight each form, temper, and size.

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 Heat identification or traceability details,

4.2.2 Certification, and

4.2.3 Mill test report.

5. Materials and Manufacture

5.1 *Material:*

5.1.1 The material of manufacture shall be a form (cast bar, cake, or slab) of Copper Alloy UNS No. C23000, C26000, or C26130 of such purity and soundness as to be suitable for processing into the products prescribed herein.

5.1.2 When specified in the contract or purchase order, that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 2—Due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify a specific casting analysis with a specific quantity of finished material.

5.2 *Manufacture:*

[1] This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

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[2] The UNS system for copper and copper alloys (see Practice E527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix "C" and a suffix "00." The suffix can be used to accommodate composition variations of the base alloy.

[3] 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.

[4] 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**

5.2.1 The product width shall be no greater than 3 in. (76.2 mm), and thickness shall be less than 0.0181 in. (0.460 mm).

5.2.2 The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure in the finished product.

5.2.2.1 The product shall be hot- or cold-worked to the finished size, and subsequently annealed, when required, to meet the temper properties specified.

5.2.3 *Edges:*

5.2.3.1 Slit edges shall be furnished.

6. Chemical Composition

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

6.1.1 These composition limits do not preclude the presence of other elements. By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements.

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

6.3 When all elements listed in Table 1 are determined for C26000 and C26130 the sum of results shall be 99.7 % min and for C23000 the sum of results shall be 99.8 % min.

7. Temper

7.1 The standard tempers for products described in this specification are given in Table 2 and Table 3 as defined in Classification B601.

7.1.1 Cold rolled tempers H01 or H02.

7.1.2 Annealed-to-temper O81 or O82.

NOTE 3—The purchaser should confer with the manufacturer or supplier for the availability of product in a specific temper.

8. Grain Size of Annealed Tempers

8.1 Annealed-to-Temper (O81 and O82) strip shall have an average grain size of 0.015 mm maximum as determined by Test Methods E112.

9. Mechanical Property Requirement

9.1 *Tensile Strength Requirement:*

9.1.1 Product furnished to this specification shall conform to the tensile strength requirements prescribed in Tables 2 and 3 for the temper and alloy specified in the ordering information when tested in accordance with Test Methods E8/E8M.

9.2 *Yield Strength Requirement:*

TABLE 1 Chemical Requirements

Copper Alloy UNS No.	Composition, %				
	Copper	Lead, max	Iron, max	Arsenic	Zinc
C23000	84.0–86.0[A]	0.05	0.05	. . .	Remainder
C26000	68.5–71.5[B]	0.07	0.05	. . .	Remainder
C26130	68.5–71.5[B]	0.05	0.05	0.02–0.08	Remainder

[A] Cu + Sum of Named Elements = 99.8 %.
[B] Cu + Sum of Named Elements = 99.7 %.

9.2.1 Product furnished to this specification shall be capable of conforming to the yield strength requirements prescribed in Tables 2 and 3 for the temper and alloy specified in the ordering information when tested in accordance with Test Methods E8/E8M. The purchaser must specify at the time of ordering which yield strength method shall be used.

9.3 *Elongation Test Requirement:*

9.3.1 Product furnished to this specification shall conform to the elongation requirements prescribed in Tables 2 and 3 for the temper and alloy specified in the ordering information when tested in accordance with Test Methods E8/E8M.

9.4 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength and elongation.

10. Dimensions, Mass, and Permissible Variations

10.1 Unless closer tolerances are specified in the contract or purchase order, the product furnished shall conform to the following thickness and width tolerances:

10.1.1 *Thickness Tolerances*—Table 4.

10.1.2 *Width Tolerances*—Table 5.

10.2 *Straightness Tolerances*—The maximum edgewise curvature (depth of arc) in any 72-in. (1829-mm) continuous length shall not exceed ⅛ in. (3.175 mm).

11. Workmanship, Finish, and Appearance

11.1 The strip shall be free of defects, but blemishes of a nature that do not interfere with normal commercial operations are acceptable. It shall be well-cleaned and free of dirt. A superficial film of residual light lubricant may be present and is acceptable unless otherwise specified.

11.2 The surface finish and appearance shall be the normal commercial quality for the alloy, thickness, and temper ordered. When application information is provided with the purchase order, the surface shall be that commercially producible for the application. Superficial films of discoloration, or lubricants, or tarnish inhibitors are permissible unless otherwise specified.

12. Sampling

12.1 The lot size, portion size, and selection of sample pieces shall be as follows:

12.1.1 *Lot Size*—An inspection lot shall be 10 000 lb (4536 kg) or less of material of the same mill form, alloy, temper, and nominal dimensions, subject to inspection at one time or shall be the product of one cast bar from a single melt charge, whose weight shall not exceed 25 000 lb (11 340 kg), that has been processed continuously and subject to inspection at one time.

12.1.2 *Portion Size*—A portion shall be two representative samples taken from the product of one cast bar that has been continually processed to the finished temper and dimensions.

12.2 *Chemical Analysis*—The sample for chemical analysis shall be taken in accordance with Practice E255 for product in its final form. Unless otherwise required by the purchaser, at the time the order is placed the manufacturer shall have the option of determining conformance to chemical composition by analyzing samples taken at the time the castings are poured

TABLE 2 Tensile Strength, Yield Strength, and Elongation Requirements for Rolled-to-Temper Material

Copper Alloy UNS No.	Temper Designation Code	Tensile Strength, ksi (MPa[A])			Yield Strength, ksi (MPa[A])				% Elongation
					At 0.5 % Extension Under Load		At 0.2 % Offset		In 2 in. (50 mm)
		Name	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
C23000	H01	¼ Hard	44 (305)	54 (370)	25 (170)	48 (330)	23 (160)	48 (330)	18
C26000 and C26130	H01	¼ Hard	49 (340)	59 (405)	33 (230)	48 (330)	30 (205)	45 (205)	12
C26000 and C26130	H02	½ Hard	58 (400)	68 (470)	43 (295)	58 (400)	40 (275)	55 (380)	10

[A] See Appendix X1.

TABLE 3 Tensile Strength, Yield Strength, and Elongation Requirements for Annealed-to-Temper Material

Copper Alloy UNS No.	Temper Designation Code	Tensile Strength, ksi (MPa[A])		Yield Strength, ksi (MPa[A])				% Elongation
				At 0.5 % Extension Under Load		At 0.2 % Offset		In 2 in. (50 mm)
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
C23000	O81	42 (210)	52 (360)	21 (145)	36 (250)	20 (140)	35 (240)	34
C26000 and C26130	O82	60 (415)	70 (485)	35 (240)	50 (345)	34 (235)	49 (340)	25

[A] See Appendix X1.

TABLE 4 Thickness Tolerances

Thickness, in. (mm)	Thickness Tolerance, ±in. (mm),[A,B] 3 in. (7.62 mm) and Under in Width
0.006 (0.152) and under	0.0003 (0.008)
Over 0.006 to 0.009 (0.152 to 0.229)	0.0004 (0.010)
Over 0.009 to 0.018 (0.229 to 0.457)	0.0005 (0.013)

[A] When tolerances are specified as all plus or minus, double the values shown.
[B] Some applications may require a closer tolerance control within any one coil even though the overall tolerance between coils or shipments can be to the tolerance shown. Such special tolerance requirements shall be negotiated between the manufacturer or supplier and the purchaser at the time the order is placed.

TABLE 5 Width Tolerances for Slit Metal

Width, in. (mm)	Width Tolerances, ±in. (mm),[A,B] for Thicknesses 0.018 in. (0.457 mm) and Under
1.750 (44.45) and under	0.003 (0.08)
Over 1.750 to 3 (44.5 to 76.2)	0.005 (0.13)

[A] When tolerances are specified as all plus or minus, double the values shown.
[B] Some applications may require a closer tolerance control within any one coil even though the overall tolerance between coils or shipments can be to the tolerance shown. Such special tolerance requirements shall be negotiated between the manufacturer or supplier and the purchaser at the time the order is placed.

or samples taken from the semifinished product if heat identity can be maintained throughout all operations. If the manufacturer determines the chemical composition during manufacture, he shall not be required to sample and analyze the finished product. The minimum weight of the composite sample in accordance with Practice E255 shall be 150 g.

12.3 *Samples for All Other Tests*—Samples for all other tests shall be taken from the sample portion in 12.1.2 and be of a convenient size to accommodate the test and comply with the requirements of the appropriate ASTM product standards and test methods.

13. Number of Tests and Retests

13.1 *Tests:*

13.1.1 *Chemical Analysis*—Chemical composition shall be determined as per the element mean of the results from at least two replicate analyses of the sample(s).

13.1.2 *Other Tests:*

13.1.2.1 *Grain Size*—The average grain size of two specimens shall be the arithmetic average of at least three determinations, each in a different field and the test results for each specimen shall be reported.

13.1.2.2 *Tensile Strength and Elongation* shall be reported from specimens prepared from one of the two pieces selected in 12.1.2. The specimen must meet the requirements of the product specification.

13.2 *Retests:*

13.2.1 When requested by the manufacturer or supplier, a retest shall be permitted when results of tests obtained by the purchaser or supplier fail to conform to the requirements of the product specification.

13.2.2 The retest shall be as directed in the product specification for the initial test except that the number of test specimens shall be twice that normally required for the specified test.

13.2.3 Test results for all specimens shall conform to the product specification requirements in retest. Failure to conform shall be cause for rejection.

14. Specimen Preparation

14.1 *Chemical Analysis*—The analytical specimen preparation shall be the responsibility of the reporting laboratory.

14.2 *Grain Size*—The test specimen shall be prepared in accordance with Practice E3.

14.3 *Tensile Test*—The test specimen shall conform to the requirements prescribed for the specific product described in the Test Specimen section of Test Methods E8/E8M. The test specimen shall be taken so that the longitudinal axis is parallel to the direction of rolling.

15. Test Methods

15.1 *Chemical Analysis:*

15.1.1 In case of disagreement, test methods for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser. The following table is a list

of published test methods, some of which may be no longer viable, that may be considered for use:

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

15.1.2 Test method(s) to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and purchaser.

15.2 *Other Tests:*

15.2.1 The product furnished shall conform to specified requirements when subjected to test in accordance with the following table:

Test	Test Method
Grain Size	E112
Tensile Strength	E8/E8M

15.2.1.1 *Grain Size*—In case of dispute, the intercept method of Test Methods E112 shall be followed.

15.2.1.2 *Yield Strength*—In case of dispute, the yield strength shall be determined by the extension-under-load method of Test Methods E8/E8M. When test results are obtained from both full size and machined specimens and they differ, the test results from the machined specimens shall prevail.

16. Significance of Numerical Limits

16.1 For purposes of determining compliance with the specified limits for requirements of the properties listed in the following table and for dimensional tolerances, an observed value or a calculated value shall be rounded as indicated in accordance with the rounding method of Practice E29.

Property	Rounded Unit for Observed or Calculated Value
Chemical composition	Nearest unit in the last right-hand significant digit used in expressing the limiting value
Tensile strength	nearest ksi (nearest 5 MPa)
Yield strength	nearest ksi (nearest 5 MPa)
Elongation	nearest 1 %
Grain size	nearest multiple of 0.005 mm

17. Inspection

17.1 The manufacturer, or supplier, shall inspect and make tests necessary to verify the product furnished conforms to the specification requirements.

17.2 Source inspection of the product by the purchaser may be agreed upon between the manufacturer, or supplier, and the purchaser as part of the purchase order. In this case, the nature of the facilities needed to satisfy the inspector, representing the purchaser, that the product is being furnished in accordance with the specification, shall be included in the agreement. All tests and the inspection shall be conducted so as not to interfere unnecessarily with the operation of the works.

17.3 When mutually agreed upon, the manufacturer, or supplier, and the purchaser shall conduct the final inspection simultaneously.

18. Rejection and Rehearing

18.1 *Rejection:*

18.1.1 Product that fails to conform to the specification requirements when tested by the purchaser, or purchaser's agent, shall be subjected to rejection.

18.1.2 Rejection shall be reported to the manufacturer, or supplier, promptly. In addition, a written notification of rejection shall follow.

18.1.3 In case of dissatisfaction with results of the test upon which rejection was based, the manufacturer, or supplier, shall have the option to make claim for a rehearing.

18.2 *Rehearing:*

18.2.1 As a result of product rejection, the manufacturer, or supplier, shall have the option to make claim for a retest to be conducted by the manufacturer, or supplier, and the purchaser. Samples of the rejected product shall be taken in accordance with this product specification and subjected to test by both parties using the test method(s) specified in this product specification, or alternately, upon agreement of both parties, an independent laboratory may be selected for the test(s) using the test method(s) specified in this product specification.

19. Certification

19.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met.

20. Test Report

20.1 When specified in the contract or purchase order, a report of the test results shall be furnished.

21. Packaging and Package Marking

21.1 *Packaging:*

21.1.1 The product shall be separated by size, composition, and temper and prepared for shipment by a common carrier, in such a manner to afford protection from the normal hazards of transportation.

21.2 *Package Marking:*

21.2.1 Each shipping unit shall be legibly marked with the purchase order number, metal or alloy designation, temper, size, shape, gross and net weight, and name of supplier. The specification number shall be shown, when specified.

21.2.2 When specified in the contract or purchase order, the product specification number shall be shown.

22. Keywords

22.1 brass strip; heat exchanger tubing; internal combustion engine; strip in light gage; strip in narrow width; UNS No. C23000; UNS No. C26000; UNS No. C26130

APPENDIX

(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 1 kg, gives it an acceleration of 1 m/s^2 ($N = kg \cdot m/s^2$). 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 M/mm^2.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B569 – 09) that may impact the use of this standard. (Approved September 1, 2014.)

(1) The specification was revised in many sections to comply with the selected wording in Guide B950.