



Standard Specification for General Requirements for Wrought Copper Alloy Wire¹

This standard is issued under the fixed designation B 250/B 250M; 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 requirements common to wrought copper alloy wire and shall apply to Specifications B 16/B 16M, B 99/B 99M, B 134/B 134M, B 159/B 159M, B 197/B 197M, B 206/B 206M, B 272, and B 301/B 301M to the extent referenced therein.

1.2 The chemical composition, physical and mechanical properties, and all other requirements not included in this specification shall be prescribed in the product specification.

1.3 *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.

2. Referenced Documents

2.1 *ASTM Standards:*

- B 16/B 16M Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines²
- B 99/B 99M Specification for Copper-Silicon Alloy Wire for General Applications²
- B 134/B 134M Specification for Brass Wire²
- B 159/B 159M Specification for Phosphor Bronze Wire²
- B 193 Test Method for Resistivity of Electrical Conductor Materials³
- B 194 Copper-Beryllium Alloy Plate, Strip, Sheet, and Rolled Bar²
- B 197/B 197M Specification for Copper-Beryllium Alloy Wire²
- B 206/B 206M Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) Wire and Copper-Nickel Alloy Wire²
- B 272 Specification for Copper Flat Products with Finished (Rolled or Drawn) Edges (Flat Wire and Strip)²
- B 301/B 301M Specification for Free-Cutting Copper Rod and Bar²

B 846 Terminology for Copper and Copper Alloys²

E 3 Practice for Preparation of Metallographic Specimens⁴

E 8 Test Methods for Tension Testing of Metallic Materials⁴

E 8M Test Methods for Tension Testing of Metallic Materials [Metric]⁴

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials⁴

E 18M Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials [Metric]⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes⁶

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)⁶

E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys⁶

E 112 Test Methods for Determining Average Grain Size⁴

E 118 Test Methods for Chemical Analysis of Copper-Chromium Alloys⁶

E 121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys⁶

E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition⁶

E 478 Test Methods for Chemical Analysis of Copper Alloys⁷

E 581 Test Methods for Chemical Analysis of Manganese-Copper Alloys⁷

3. Terminology

3.1 For definitions of terms related to copper and copper alloys, refer to Terminology B 846.

4. Materials and Manufacture

4.1 *Materials:*

4.1.1 The materials shall conform to the published compositional requirements of the Copper Alloy UNS No. designation specified in the ordering information.

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 Nov. 10, 2001. Published February 2002. Originally published as B 250 – 51 T. Last previous edition B 250 – 95.

² *Annual Book of ASTM Standards*, Vol 02.01.

³ *Annual Book of ASTM Standards*, Vol 02.03.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ *Annual Book of ASTM Standards*, Vol 03.05.

⁷ *Annual Book of ASTM Standards*, Vol 03.06.

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

4.1.2 In the event heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 1—Because of the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify specific casting analysis with a specific quantity of finished material.

4.2 Manufacture:

4.2.1 The material shall be produced by either hot- or cold-working operations, or both. It shall be finished, unless otherwise specified, by such cold working and annealing or heat treatment as may be necessary to meet the properties specified.

4.2.2 Edges—The edges shall be drawn, extruded, or rolled: refer to Dimensions and Permissible Variations section.

5. Chemical Composition

5.1 The material of manufacture shall conform to the chemical composition requirements prescribed in the product specification.

5.1.1 When a product (check) sample is analyzed by the purchaser, the material shall conform to the chemical composition requirements within the permitted analytical variance given in the product specification.

5.2 The chemical compositional limits established for the Copper Alloy UNS No. designation specified in the product specification does 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 the purchaser.

5.3 When chemical composition has been determined during the course of manufacture, analysis of the finished product by the manufacturer is not required unless specifically stipulated in the contract or purchase order.

6. Dimensions and Permissible Variations

6.1 General—For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the specified limiting value for any dimension may be cause for rejection.

NOTE 2—Blank spaces in the tolerance tables indicate either that the material is not generally available or that no tolerances have been established.

6.2 Diameter or Distance Between Parallel Surfaces—The method of specifying wire diameter or distances between parallel surfaces shall be in decimal fractions of an inch or in millimetres. The tolerances shall be that shown in Table 1 and Table 2 for the product specification indicated.

Table 1—Tolerances for diameter or distances between parallel surfaces of wire applicable to Specifications B 16/B 16M, B 99/B 99M (Alloy C65100) and B 134/B 134M.

Table 2—Tolerances for diameter or distances between parallel surfaces of wire applicable to Specifications B 99/B 99M (Alloy C65500), B 159/B 159M, B 197/B 197M, B 206/B 206M, and B 301/B 301M.

6.3 Thickness—The method of specifying thickness of wire shall be in decimal fractions of an inch or in mm. The

TABLE 1 Tolerances for Diameter or Distance Between Parallel Surfaces of Wire

(Applicable to Specifications B 16/B 16M, B 99/B 99M Copper Alloy UNS No. C65100, B 134/B 134M, and B 301/B 301M.)

Diameter or Distance Between Parallel Surfaces, in. [mm]	Tolerances, Plus and Minus ^A			
	Round, in. [mm]	Hexagonal, in. [mm]	Octagonal, in. [mm]	
Up to 0.010 [0.25], incl	0.0001 [0.003]	...	...
Over 0.010–0.020 [0.25–0.50], incl	0.0002 [0.005]	...	...
Over 0.020–0.030 [0.50–0.75], incl	0.0003 [0.008]	...	...
Over 0.030–0.040 [0.75–1.0], incl	0.0004 [0.010]	0.0008		[0.020]
Over 0.040–0.050 [1.0–1.2], incl	0.0005 [0.013]	0.0010		[0.025]
Over 0.050–0.060 [1.2–1.5], incl	0.0006 [0.015]	0.0012		[0.030]
Over 0.060–0.080 [1.5–2.0], incl	0.0008 [0.020]	0.0016		[0.040]
Over 0.080–0.150 [2.0–3.8], incl	0.0010 [0.025]	0.002		[0.050]
Over 0.150–0.500 [3.8–12], incl	0.0015 [0.040]	0.003		[0.075]
Over 0.500–0.750 [12–20], incl	0.002 [0.050]	0.004		[0.10]

^AIf tolerances are specified as all plus or all minus, double the values given.

TABLE 2 Tolerances for Diameter or Distance Between Parallel Surfaces of Wire

(Applicable to Specifications B 99/B 99M Copper Alloy UNS No. C65500, B 159/B 159M, B 197/B 197M, and B 206/B 206M.)

Diameter or Distance Between Parallel Surfaces, in. [mm]	Tolerances, Plus and Minus ^A			
	Round, in. [mm]	Hexagonal, in. [mm]	Octagonal, in. [mm]	
Up to 0.010 [0.25], incl	0.0002 [0.005]	...	...
Over 0.010–0.020 [0.25–0.50], incl	0.0003 [0.008]	...	...
Over 0.020–0.030 [0.50–0.75], incl	0.0005 [0.013]	...	...
Over 0.030–0.040 [0.75–1.0], incl	0.0007 [0.018]	0.002		[0.020]
Over 0.040–0.050 [1.0–1.2], incl	0.0008 [0.020]	0.003		[0.025]
Over 0.050–0.060 [1.2–1.5], incl	0.0010 [0.025]	0.003		[0.030]
Over 0.060–0.080 [1.5–2.0], incl	0.0015 [0.040]	0.004		[0.040]
Over 0.080–0.150 [2.0–3.8], incl	0.002 [0.050]	0.004		[0.050]
Over 0.150–0.500 [3.8–12], incl	0.002 [0.050]	0.004		[0.075]
Over 0.500–0.750 [12–20], incl	0.003 [0.075]	0.005		[0.10]

tolerances shall be shown in Table 3 and Table 4 for the product specification indicated:

Table 3—Thickness for flat (rectangular and square) wire applicable to Specification B 134/B 134M.

Table 4—Thickness tolerance for flat (rectangular and square) wire applicable to Specifications B 159/B 159M, B 197/B 197M, and B 206/B 206M.

6.4 Width—The method of specifying width shall be in decimal fractions of an inch or in mm. The tolerances shall be that shown in Table 5 and Table 6.

TABLE 3 Thickness Tolerances for Flat (Rectangular and Square) Wire

(Applicable to Specification B 134/B 134M.)

Thickness, in. [mm]	Thickness Tolerances, Plus and Minus, ^A in. [mm] for Widths Given in Inches [mm]	
	Up to ½ [12], incl	Over ½ [12] to 1½ [32], incl
Up to 0.013 [0.33], incl	0.0010 [0.025]	0.0013 [0.033]
Over 0.013–0.050 [0.33–1.25], incl	0.0013 [0.033]	0.0015 [0.040]
Over 0.050–0.090 [1.25–2.30], incl	0.0015 [0.040]	0.002 [0.050]
Over 0.090–0.130 [2.30–3.30], incl	0.002 [0.050]	0.0025 [0.065]
Over 0.130–0.188 [3.30–4.80], incl	0.003 [0.075]	0.0035 [0.090]

^AIf tolerances are specified as all plus or all minus, double the values given.



TABLE 4 Thickness Tolerances for Flat (Rectangular and Square) Wire (Applicable to Specifications B 159/B 159M, B 197/B 197M, and B 206/B 206M.)

Table with 3 columns: Thickness, in. [mm], Thickness Tolerances, Plus and Minus, in. [mm] for Widths Given in Inches [mm], and sub-columns for Up to 1/2 [12], incl and Over 1/2 to 1 1/4 [12 to 32], incl.

^If tolerances are specified as all plus or all minus, double the values given.

TABLE 5 Width Tolerances for Flat (Rectangular) Wire (Applicable to Specification B 134/B 134M.) (For Square Wire Use Thickness Tolerances in Table 3.)

Table with 2 columns: Width, in. [mm] and Tolerances, Plus and Minus, in. [mm].

^If tolerances are specified as all plus or all minus, double the values given.

TABLE 6 Width Tolerances for Flat (Rectangular) Wire (Applicable to Specifications B 159/B 159M, B 197/B 197M, and B 206/B 206M.) (For Square Wire Use Thickness Tolerances in Table 4.)

Table with 2 columns: Width, in. [mm] and Tolerances, Plus and Minus, in. [mm].

^If tolerances are specified as all plus or all minus, double the values given.

Table 5—Width tolerances for flat (rectangular and square) wire applicable to Specification B 134/B 134M.

Table 6—Width tolerances for flat (rectangular and square) wire applicable to Specifications B 159/B 159M, B 197/B 197M, and B 206/B 206M.

6.5 Length:

6.5.1 Round, hexagonal, and octagonal wire shall be furnished in coils or reels, consisting of a single length as may be agreed upon between the manufacturer and the purchaser.

6.5.2 Flat (rectangular and square) wire when furnished in straight, specific, or stock lengths shall not exceed the tolerances in Table 7.

Table 7—Length tolerances for straight lengths, specific or stock, of flat (rectangular or square) wire applicable to Specifications B 134/B 134M, B 197/B 197M, and B 206/B 206M.

6.5.3 Stock lengths with short lengths included as specified in Table 8 shall be furnished, unless the contract or purchase order specifically states stock or specific lengths are required.

Table 8—Schedule of lengths, specific or stock, with ends, for flat (rectangular or square) wire furnished in straight

TABLE 7 Length Tolerances for Straight Lengths (Specific and Stock) of Flat (Rectangular and Square) Wire (Applicable to Specifications B 134/B 134M, B 159/B 159M, B 197/B 197M, and B 206/B 206M.)

Table with 2 columns: Lengths and Length Tolerances Applicable Only to Full Length Pieces, in. [mm].

^Tolerances are all plus; if all minus tolerances are desired, use the same values; if tolerances plus and minus are desired, halve the values given.

^BAs stock lengths are cut and placed in stock in advance of orders, departure from this tolerance is not practicable.

TABLE 8 Schedule of Lengths (Specific and Stock) With Ends for Flat (Rectangular and Square) Wire Furnished in Straight Lengths (Applicable to Specifications B 134/B 134M, B 159/B 159M, B 197/B 197M, and B 206/B 206M.)

Table with 3 columns: Nominal Length, ft [mm], Shortest Permissible Length, in. [mm], and Maximum Permissible Weight of Ends, in. [mm].

^Expressed to the nearest 1/2 ft [150 mm].

lengths applicable to Specifications B 134/B 134M, B 197/B 197M, and B 206/B 206M.

6.6 Straightness—For flat (rectangular and square) wire, the deviation from straightness shall not exceed the limitations specified in Table 9. To determine compliance with this tolerance, the lengths shall, in case of disagreement, be checked by placing the lengths on a level table so that the arc or departure from straightness is horizontal. Measure the depth of the arc to the nearest 1/32 in. [1 mm] using a straight-edge.

6.7 Edge Contours—Flat (rectangular and square) wire applicable to Specifications B 134/B 134M, B 197/B 197M, and B 206/B 206M shall, unless otherwise specified in the contract or purchase order, be finished with commercially square corners with a maximum permissible radius of 1/100 in. [0.3 mm] for wire 1/32 to 1/16 in. [1 to 1.5 mm] inclusive in thickness, and of 1/64 in. [0.4 mm] for wire over 1/16 to 3/16 in. [1.5 to 5 mm] inclusive in thickness.

6.7.1 Sharp Corners—When specified in the contract or purchaser order, the corner radius shall be 0.003 in. [0.080

TABLE 9 Straightness Tolerances for Flat (Rectangular and Square) Wires

(Applicable Specifications B 134/B 134M, B 159/B 159M, B 197/B 197M, and B 206/B 206M.)

Applicable to any longitudinal edge of material supplied in nominally flat straight lengths and in rolls or on bucks.

Table with 2 columns: For material having a cross-sectional area of 0.010 in.² [6.5 mm²] and over and a thickness of 0.010 in. [0.25 mm] and over, furnished in straight lengths, in rolls or on bucks and 1/2 in. [12 mm] maximum edgewise curvature (depth of arc) in any 6-ft [2000 mm] portion of the total length.

Table with 2 columns: For material having a cross-sectional area of less than 0.010 in.² [6.5 mm²], or a thickness of less than 0.010 in. [0.25 mm], and all material furnished on reels or on stagger wound rolls and No straightness tolerances established.

mm] maximum on all sizes of wire up to and including 0.188 in. [5 mm] between flats.

6.7.2 *Rounded Corners*—When specified in the contract or purchase order, wire over $\frac{1}{8}$ to $\frac{3}{16}$ in. [3 to 5 mm], inclusive in thickness may be finished with corners rounded as shown in Fig. 1 to a quarter of a radius of $\frac{1}{32}$ in. [1 mm]. The tolerance on the radius shall be $\pm 25\%$. Wire up to $\frac{1}{8}$ in. [3 mm] inclusive in thickness, may be finished with a full rounded edge as described in 6.7.4.

6.7.3 *Round Edge*—When specified in the contract or purchase order, wire may be finished with edges rounded as shown in Fig. 2, the radius of curvature being $1\frac{1}{4}$ times the thickness for flat wire with a thickness up to $\frac{3}{16}$ in. [5 mm] inclusive. The tolerance on the radius is $\pm \frac{1}{2}$ times the wire thickness.

6.7.4 *Full Rounded Edge*—When specified in the contract or purchase order, wire may be finished with a substantially uniform round edge, the radius of curvature being approximately $\frac{1}{2}$ the thickness of the wire, as shown in Fig. 3, but in no case to exceed $\frac{1}{2}$ the thickness by more than 25 % (see also Fig. 4).

7. Workmanship, Finish, and Appearance

7.1 *Workmanship:*

7.1.1 The product shall not have defects of a nature that interfere with the intended applications. The product shall be free of dirt.

7.2 *Finish:*

7.2.1 Necessary joints in the wire shall be made prior to final drawing and in accordance with current practice.

7.3 *Appearance:*

7.3.1 The surface finish and appearance shall be the normal quality for product ordered.

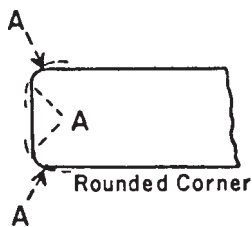
7.3.2 When application information is provided with the contract or purchase order, the surface condition shall be suitable for the application.

7.3.3 Superficial films of discoloration, such as lubricants or tarnish inhibitors, are permissible unless otherwise specified.

8. Sampling

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

8.1.1 *Lot Size*—An inspection lot shall be 10 000 lb [5000 kg] or less, of the same mill form, 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



NOTE 1—The arc of the rounded corner shall not necessarily be tangent at Points A, but the product shall be commercially free from sharp, rough, or projecting edges.

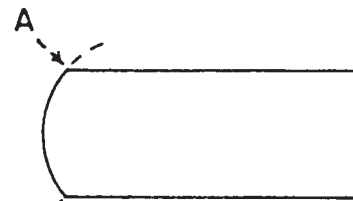
FIG. 1 Rounded Corners



Full Rounded Edge

NOTE 1—The arc of the rounded edge shall not necessarily be tangent at Points A, but shall be substantially symmetrical with the axis of the product, and the product shall be commercially free from sharp, rough, or projecting edges.

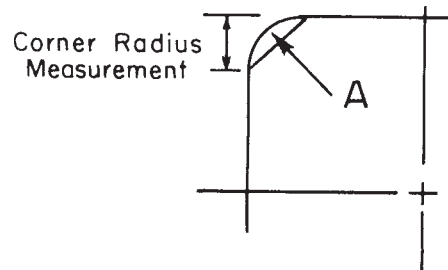
FIG. 2 Full Rounded Edge



Rounded Edge

NOTE 1—The arc of the rounded edge shall be substantially symmetrical with the axis of the product. The Corners A will usually be sharp but shall not have rough or projecting edges.

FIG. 3 Rounded Edge



NOTE 1—Any configuration within A is a corner radius.

FIG. 4 Corner Radius

shall not exceed 20 000 lb [10 000 kg] and that has been continuously processed and subject to inspection at one time.

8.1.2 *Portion Size*—The portion shall be four or more pieces selected so as to be representative of each lot. Should the lot consist of less than five pieces, representative samples shall be taken from each piece.

8.2 *Chemical Analysis:*

8.2.1 The sample for chemical analysis shall be taken in accordance with Practice E 255 for product in the final form from the pieces selected in 8.1.2 and combined into one composite sample. The minimum weight of the composite sample shall be 150 g.

8.2.2 Instead of sampling as directed in 8.2.1, the manufacturer shall have the option of sampling at the time castings are poured or from the semifinished product. When samples are taken during the course of manufacture, sampling of the finished product by the manufacturer is not required. The number of samples taken for the determination of composition shall be as follows:

8.2.2.1 When samples are taken at the time the castings are poured, at least one sample shall be taken for each group of castings poured from the same source of molten metal.

8.2.2.2 When samples are taken from semifinished product, a sample shall be taken to represent each 10 000 lb [5000 kg], or fraction thereof, except that not more than one sample shall be required per piece.

8.2.2.3 Only one sample need be taken from the semifinished product of one cast bar from a single, continuously processed melt charge.

8.3 *Samples for All Other Tests*—Samples for all other tests shall be taken from the sample portions selected in 8.1.2 and be of a convenient size to accommodate the test and comply with the requirements of the appropriate product specification and test method.

9. Number of Tests and Retests

9.1 Tests:

9.1.1 *Chemical Analysis*—Chemical composition shall be determined as the per element mean of results from at least two replicate analysis of the sample(s), and the results of each replication shall meet the requirements of the product specification.

9.1.2 Other Tests:

9.1.2.1 *Tensile, Grain Size, and Electrical Resistivity*—These tests shall be reported as the average of results obtained from specimens prepared from each of two pieces selected in 8.1.2, and each specimen shall meet the requirements of the product specification. In the case of copper-beryllium alloy, two specimens shall be taken for each required test from each of the two sample pieces selected. One specimen from each piece shall be tested without further treatment, and the other two specimens shall be tested after precipitation hardening.

9.1.2.2 *Rockwell Hardness*—The value of the hardness number of each specimen shall be established as the arithmetical average of at least three readings, and each specimen shall meet the requirements of the product specification.

9.1.2.3 *Bend and Hydrogen Embrittlement Tests*—At least two individual specimens shall be subjected to test for each requirement and each specimen shall conform to the test requirement.

9.2 Retests:

9.2.1 When requested by the manufacturer or supplier, a retest shall be permitted when test results obtained by the purchaser fail to conform with the product specification requirement(s).

9.2.2 Retesting shall be as directed in the product specification for the initial test except for the number of test specimens which shall be twice that normally required for the test. Test results for all specimens shall conform to the product specification requirement(s) in retest, and failure to comply shall be cause for lot rejection.

9.2.3 *Chemical Analysis*—If one, or more, of the elements with specified limits fail to meet the compositional requirement of the product specification when determined from the sample prepared in accordance with Practice E 255, one retest cycle shall be permitted with a second composite sample prepared in accordance with Practice E 255.

9.2.4 *Other Tests*—If a test specimen fails to conform to a test requirement of the product specification, one recycle test shall be permitted with specimens prepared from two of the remaining pieces of the finished product selected in 8.1.2.

9.2.4.1 If the percent elongation of any tensile test-specimen is less than that specified and any part of the fracture is outside of the middle two thirds of the gage length or in a punched or scribed mark within the reduced section, a retest shall be allowed.

9.3 All test specimens shall conform to the product specification requirements in retest. Failure to comply shall be cause for rejection.

10. Specimen Preparation

10.1 *Chemical Analysis*—Sample preparation shall be in accordance with Practice E 255.

10.1.1 Analytical specimen preparation shall be the responsibility of the reporting laboratory.

10.2 *Tensile Test*—The test specimen shall conform to the requirements prescribed for the product in the Test Specimen Section of Test Methods E 8 or E 8M. (Round specimens: specimens for wire, rod, and bar).

10.3 *Grain Size*—The test specimen shall be prepared in accordance with Practice E 3.

10.4 *Rockwell Hardness*—The test specimen shall be of a size and shape to permit testing by the available test equipment and shall be taken to permit testing in a plane parallel or perpendicular to the direction of deformation given to the product.

10.4.1 The surface of the test specimen shall be sufficiently smooth and even to permit the accurate determination of hardness.

10.4.2 The specimen shall be free of scale and foreign matter and care shall be taken to avoid any change in condition, that is, heating or cold working.

10.5 *Electrical Resistivity*—Test specimens are to be full size where practical and shall be the full cross section of the material it represents.

10.5.1 When the test specimen is cut from material in bulk, care should be taken that the properties are not appreciably altered in the preparation. Plastic deformation may work harden a material and tend to raise the resistivity, while heating tends to anneal the material with a consequent reduction in resistivity.

10.5.2 When necessary, products are to be rolled or cold drawn to a wire approximately 0.080 in. [2 mm] (12 gage AWG) and at least 180 in. [4 500 mm] in length. The specimen shall be annealed at approximately 935°F [500°C] for 30 min in an inert atmosphere and cooled to ambient temperature in the same inert atmosphere.

10.5.3 For heat-treatable material, diameter and heat treatment shall be agreed upon between the manufacturer and purchaser.

10.6 Should any test specimen show defective machining or develop flaws, it may be discarded and another specimen substituted.

10.7 *Bend Test*:

10.7.1 The specimen shall be of a length sufficient for the test. The preparation of copper-beryllium test specimens shall be as prescribed in the product specification to which the item is being produced.

11. Test Methods

11.1 The test methods used for quality control or production control, or both, for the determination of conformance with product property requirements are discretionary.

11.1.1 The test method(s) used to obtain data for the preparation of certification or test report, or both, shall be made available to the purchaser on request.

11.2 Chemical Composition:

11.2.1 In case of disagreement, an applicable test method may be found in the following documents: E 54, E 62, E 75, E 118, E 121, E 478, and E 581.

11.2.1.1 The specific test method to be used for each specified element shall be referenced, or given, in the product specification.

11.2.1.2 The test methods for the determination of composition for copper-beryllium alloys shall be as described in Annex A1 of Specification B 194.

11.2.2 The test method(s) used for the determination of element(s) required by contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and the purchaser.

11.3 Other Tests:

11.3.1 The product in final form shall conform with physical, mechanical, and other requirements specified in the product specification when subjected to test in accordance with the appropriate method in the following table:

Test	Test Methods
Tensile	E 8 or E 8M
Rockwell hardness	E 18 or E 18M
Grain size	E 112
Electrical resistivity	B 193
Bend	Section 11.3.5
Corner radius	Section 11.3.6

11.3.2 Tensile:

11.3.2.1 The test method to be used for determining yield strength shall be specified in the product specification.

11.3.2.2 Elongation shall be determined in accordance with the first two paragraphs of the subsection titled "Elongation" of the Procedure section of Test Methods E 8 or E 8M.

11.3.2.3 Whenever test results are obtained from both full-size and machined specimens and they differ, the test results from the full-size specimens shall prevail.

11.3.2.4 Test results are not seriously affected by variations in speed of testing. A considerable range of testing speed is permitted; however, the rate of stressing to the yield strength should not exceed 100 ksi/min [690 MPa/min]. Above the yield strength the movement per minute of the testing machine head under load should not exceed 0.5 in./in. [0.5 mm/mm] of gage length or distance between grips for full-section specimens.

11.3.3 *Grain Size*—In case of dispute, the intercept procedure shall be used.

11.3.4 *Electrical Resistivity*—The limit of measurement uncertainty for Test Method B 193 shall be $\pm 0.15\%$ as an umpire method and $\pm 0.30\%$ as a routine method.

11.3.5 *Bend Test*—The specimens shall be bent cold over a mandrel radius and to the bend requirements prescribed in the product specification.

11.3.6 *Corner Radius*—Square or rectangular wire shall be measured by transverse sectioning and optically measuring the radius at 40 \times magnification; refer to Fig. 4.

12. Significance of Numerical Limits

12.1 For the purpose of determining compliance with the specified limits for requirements of the properties listed in the following table, an observed value or calculated value shall be rounded as indicated in accordance with the rounding method of Practice E 29.

Property	Rounded Unit for Observed or Calculated Value
Dimensions	nearest unit in the last righthand significant digit used in expressing the limiting value
Chemical composition	
Hardness	
Electrical resistivity	
Tensile strength	nearest ksi [5 MPa]
Yield strength	nearest ksi
Elongation	
Below 5 %	nearest multiple of 0.5 %
5 % and over	nearest 1 %
Grain size	
Under 0.060 mm	nearest multiple of 0.005 mm
0.060 mm and over	nearest 0.01 mm

13. Inspection

13.1 The manufacturer shall inspect and make tests necessary to verify that the product furnished conforms to the requirements prescribed in the product specification.

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

13.3 The manufacturer, or supplier, and the purchaser may accomplish the final inspection simultaneously by mutual agreement.

14. Rejection and Rehearing

14.1 Rejection:

14.1.1 Material that fails to conform to the specified requirement is subject to rejection.

14.1.2 Rejection shall be reported to the manufacturer, or supplier, promptly and in writing.

14.1.3 In case of disagreement or dissatisfaction with results of the test on which rejection was based, the manufacturer or supplier may make claim for a rehearing.

14.2 Rehearing:

14.2.1 As a result of product rejection, the manufacturer or supplier may make claim for retest to be conducted by the manufacturer or supplier and the purchaser. Samples of the rejected product shall be taken in accordance with the product

specification and tested by both parties as directed in the product specification, or, alternatively, upon agreement by both parties, an independent laboratory may be selected for the tests using the test methods prescribed in the product specification.

15. Certification

15.1 When specified in the contract or purchase order, a manufacturer's certificate of compliance shall be furnished to the purchaser stating that each lot purchased has been sampled, tested, and inspected in accordance with the product specification and the requirements have been met.

16. Mill Test Report

16.1 When specified in the purchase order or contract, the manufacturer or supplier shall furnish to the purchaser a manufacturer's test report showing the results of the required tests.

17. Packaging and Package Marking

17.1 Packaging:

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

17.2 Package Marking:

17.2.1 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 or manufacturer. The specification number shall be shown when specified.

18. Keywords

18.1 copper-alloy wire; wire; wrought copper-alloy wire

SUPPLEMENTARY REQUIREMENTS

S1. Scope

S1.1 The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract or order for agencies of the U.S. government.

S2. Referenced Documents

S2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S2.1.1 ASTM Standard:

B 900, Practice for Packaging of Copper and Copper Alloy Mill Products for U.S. Government Agencies

S2.1.2 Federal Standards:⁸

Fed. Std. No. 102 Preservation, Packaging and Packing Levels

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

Fed. Std. No. 185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S2.1.3 Military Standard:⁸

MIL-STD-129 Marking for Shipment and Storage

S3. Quality Assurance

S3.1 Responsibility for Inspection:

S3.1.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the

manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

S4. Identification Marking

S4.1 All material shall be properly marked for identification in accordance with Fed. Std. No. 185 except that the ASTM specification number and the alloy number shall be used.

S5. Preparation for Delivery

S5.1 Preservation, Packaging, Packing:

S5.1.1 *Military Agencies*—The material shall be separated by size, composition, grade or class and shall be preserved and packaged, Level A or C, packed Level A, B, or C as specified in the contract or purchase order, in accordance with the requirements of Practice B 900.

S5.1.2 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S5.2 Marking:

S5.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S5.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

⁸ Available from Standardization Documents Order Desk, Bldg 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

APPENDIX
(Nonmandatory Information)
X1. STANDARD DENSITIES

X1.1 The densities of the materials covered by the specifications listed in Section 1 are as shown in Table X1.1.

TABLE X1.1 Densities

ASTM Designation	Material	Copper Alloy UNS No.	Density (lb/in. ³)	Density [g(sol)cm ³]
B 16/B 16M	free cutting brass	C36000	0.307	[8.50]
B 99/B 99M	copper-silicon alloy	C65100	0.316	[8.75]
B 134/B 134M	brass	C65500	0.308	[8.53]
		C21000	0.320	[8.86]
		C22000	0.318	[8.80]
		C23000	0.316	[8.75]
		C24000	0.313	[8.67]
		C26000	0.308	[8.53]
		C27000	0.306	[8.47]
		C27400	0.305	[8.44]
B 159/B 159M	phosphor bronze	C51000	0.320	[8.86]
		C52100	0.318	[8.80]
		C52400	0.317	[8.77]
B 197/B 197M	copper-beryllium alloy	C17200	0.297	[8.22]
B 197/B 197M	leaded copper-beryllium alloy	C17300	0.297	[8.22]
B 206/B 206M	copper-nickel-zinc alloy (nickel silver)	C71000	0.323	[8.94]
		C74500	0.313	[8.66]
		C75200	0.316	[8.75]
		C75700	0.314	[8.69]
		C76400	0.315	[8.72]
		C77000	0.314	[8.69]
		C79200	0.316	[8.72]
B 301/B 301M	free-cutting copper	C14500	0.323	[8.94]
		C14510	0.323	[8.94]
		C14520	0.323	[8.94]
		C14700	0.323	[8.94]
		C18700	0.323	[8.94]

SUMMARY OF CHANGES

Committee B05 has identified the location of specific changes to this standard since the publication of B 250-95 and B 250M-95 that may impact the use of this standard.

(1) A comprehensive five-year review was conducted. The two companion standards B 250 and B 250M were combined.
 (2) References to Specification B 412 were removed, since this standard has been withdrawn.

(3) References to B 301/B 301M were added.
 (4) Terminology was withdrawn and reference made to Terminology B 846.

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