



Standard Specification for Copper-Beryllium Alloy Wire¹

This standard is issued under the fixed designation B 197/B 197M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This specification establishes the requirements for copper-beryllium alloy wire in coils, spools, or other than straight lengths, of any uniform cross section. Copper Alloy UNS Nos. C17200 and C17300² are included.

1.2 Unless otherwise required, Copper Alloy UNS No. C17200 shall be the alloy furnished whenever Specification B 197 is specified without any alloy designation.

1.3 The values stated in either inch-pounds or SI units are to be regarded separately as the standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

1.4 *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.*

2. Referenced Documents

2.1 The following documents in the current issue of the Book of Standards form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:

B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar³

B 250 Specification for General Requirements for Wrought Copper-Alloy Wire³

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast³

B 846 Standard Terminology for Copper and Copper Alloys³

E 8 Test Methods for Tension Testing of Metallic Materials⁴

E 112 Test Methods for Determining Average Grain Size⁴
E 527 Practice for Numbering Metals and Alloys (UNS)⁵

3. General Requirements

3.1 The following sections of Specification B 250 constitute a part of this specification:

- 3.1.1 Terminology,
- 3.1.2 Material and Manufacturer,
- 3.1.3 Chemical Composition,
- 3.1.4 Dimensions and Permissible Variations,
- 3.1.5 Workmanship, Finish, and Appearance,
- 3.1.6 Sampling,
- 3.1.7 Number of Tests and Retests,
- 3.1.8 Specimen Preparation,
- 3.1.9 Test Methods,
- 3.1.10 Significance of Numerical Limits,
- 3.1.11 Inspection,
- 3.1.12 Rejection and Reheating,
- 3.1.13 Certification,
- 3.1.14 Mill Test Report, and
- 3.1.15 Packaging and Package Marking.

3.2 In addition, when a section with a title identical to that referenced in 3.1 above, appears in this specification, it contains additional requirements which supplement those appearing in Specification B 250.

4. Terminology

4.1 For terms related to copper and copper alloys, refer to Terminology B 846.

4.2 Definition of Term Specific to This Standard:

4.2.1 *grain count*—the number of grains per stock thickness.

5. Ordering Information

5.1 Orders for products should include the following information:

- 5.1.1 ASTM specification designation and year of issue,
- 5.1.2 Copper (Alloy) UNS No. designation,
- 5.1.3 Temper (Section 7),
- 5.1.4 Dimensions, diameter, or distance between parallel surfaces, and length if applicable,

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² The UNS system for copper and copper alloys (see Practice E 527) 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 *Annual Book of ASTM Standards*, Vol 02.01.

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

⁵ *Annual Book of ASTM Standards*, Vol 01.01.

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

5.1.5 Form of material: cross section such as round, hexagonal, octagonal, oval, trapezoidal, and so forth,

5.1.6 How furnished: coils spools, reels, or bucks, and specific lengths with or without ends or stock lengths with or without ends if applicable, and

5.1.7 When material is ordered for agencies of the U.S. Government (see Section 15).

5.2 The following options are available and should be specified in the contract or purchase order when required:

5.2.1 Type of edge: square corners, round edge, full-rounded edge (see the Edge contours section in the Dimensions and Permissible Variations Section of Specification B 250),

5.2.2 Grain size (Section 9.1),

5.2.3 Grain count (Section 9.2),

5.2.4 Mechanical properties (tensile strength and hardness) (Section 10),

5.2.5 Bend test (after precipitation heat treatment) (11.1),

5.2.6 Heat identification or traceability details,

5.2.7 Special packaging requirements,

5.2.8 Certification, and

5.2.9 Mill test report.

6. Chemical Composition

6.1 The material shall conform to the chemical composition requirements prescribed in Table 1 for copper alloy UNS No. designation specified in the ordering information.

6.2 These composition limits do not preclude the presence of other elements. Limits for unnamed elements may be established and analysis required by agreement between the manufacturer or supplier and purchaser.

6.3 Copper is customarily given as remainder, but may be taken as the difference between the sum of all elements analyzed and 100 %.

6.4 When all the elements in Table 1 are determined, the sum of results shall be 99.5 % min.

7. Temper

7.1 The standard tempers available under this specification and as specified in Practice B 601 are TB00 (solution heat treated), or with varying degrees of cold work TD00 to TD04 to be precipitation heat treated by the user. Also available are products already precipitation heat-treated by the manufacturer, tempers TF00 (AT), TH00 to TH04. These products meet property requirements in Tables 2 and 3 and generally do not require further heat treatment by the user.

7.2 The pretempered product TL08 shown in Table 4 is prepared by the manufacturer for special applications.

TABLE 2 Tensile Strength Requirements for Round, Hexagonal, Octagonal, and Square Wire After Precipitation Heat Treatment (See 11.2)

Temper Designation		Tensile Strength, ^A	
Standard	Former	ksi ^B	MPa
TF00	Precipitation hardened (AT)	160–200 ^C	[1105–1380]
TH01	¼ hard and precipitation heat treated (¼HT)	175–210 ^C	[1205–1450]
TH02	½ hard and precipitation heat treated (½HT)	185–215	[1275–1480]
TH03	¾ hard and precipitation heat treated (¾HT) ^D	190–230	[1310–1585]
TH04	Hard and precipitation heat treated (HT)	195–230	[1345–1585]

^A These values apply to mill products (see 11.2). See 11.3 for exceptions in mill products.

^B ksi = 1000 psi.

^C Corrected editorially.

^D TH03 (¾HT) condition is generally available up to 0.080 in. [2.0 mm], inclusive, in diameter or distance between parallel surfaces.

NOTE 1—Special or nonstandard tempers are subject to negotiation between the supplier and the purchaser.

8. Precipitation Heat Treatment

8.1 The precipitation heat treatment is normally performed by the purchaser after forming. The heat treatment specified herein is applicable to mill products. Other treatment times and temperatures may be preferable for end products made from this material.

8.2 Conformance to the TF00 (AT) through TH04 (HT) specification limits shown in Tables 2 and 3 for products supplied in the TB00 (A) through TD04 (H) tempers, shall be determined by testing test specimens heat-treated at a uniform temperature of 600 to 625°F [316 to 329°C] for the times shown in Table 5.

8.3 Special combinations of properties such as increased ductility, electrical conductivity, dimensional accuracy, endurance life, and resistance to elastic drift and hysteresis in springs may be obtained by special precipitation-hardening heat treatments. The mechanical requirements of Tables 2 and 3 do not apply to such special heat treatments.

9. Physical Property Requirements

9.1 *Grain Size*—The average grain size of each of two samples of rectangular other than square wire, in thicknesses over 0.010 in. [0.25 mm] taken after precipitation heat treatment (see 8.2), shall not exceed the limits specified in Table 6 when determined in accordance with Test Methods E 112 and taken on a plane perpendicular to the direction of rolling or drawing.

9.2 *Grain Count*:

9.2.1 The grain count of each of two samples of rectangular other than square wire, in thicknesses over 0.004 to 0.010 in. [0.10 to 0.25 mm] inclusive, taken after precipitation heat treatment (see 8.2), shall not be less than the limits specified in Table 7 when tested in accordance with 9.2.2.

9.2.2 Grain count is the number of grains per stock thickness, averaged for five locations one stock thickness apart.

TABLE 1 Chemical Requirements

Element	Composition, %	
	Copper Alloy UNS No. C17200	Copper Alloy UNS No. C17300
Beryllium	1.80–2.00	1.80–2.00
Additive elements:		
Nickel + cobalt, min	0.20	0.20
Nickel + cobalt + iron, max	0.6	0.6
Lead	...	0.20–0.60
Aluminum, max	0.20	0.20
Silicon, max	0.20	0.20
Copper	remainder	remainder