



Standard Specification for Copper-Silicon Alloy Wire for General Applications¹

This standard is issued under the fixed designation B 99/B99M; 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 wire for general applications other than for electrical transmission cable. The alloys involved are UNS No. C65100 and UNS No. C65500.

1.2 The values stated in inch-pound units or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values 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.

2. Referenced Documents

2.1 ASTM Standards:

B 250 Specification for General Requirements for Wrought Copper-Alloy Wire²

B 250M Specification for General Requirements for Wrought Copper-Alloy Wire [Metric]²

B 601 Practice for Temper Designations for Copper and Copper-Alloys—Wrought and Cast²

B 846 Terminology for Copper and Copper Alloys²

E 62 Test Methods for Chemical Analysis of Copper and Copper-Alloys (Photometric Methods)³

E 478 Test Methods for Chemical Analysis of Copper Alloys³

3. Terminology

3.1 For the definition of general terms related to copper and copper alloys refer to Terminology B 846.

3.2 Definition of Term Specific to This Standard:

3.2.1 *unaided eye*—permits the use of corrective optical lenses necessary to obtain normal vision.

4. Ordering Information

4.1 Contracts or purchase orders for product to this specification should include the following information:

4.1.1 ASTM designation and year of issue,

4.1.2 Copper Alloy UNS No.,

4.1.3 Temper designation (Section 6),

4.1.4 Dimensions (diameter, distance between parallel faces),

4.1.5 How furnished (coil, reel, specific lengths, etc.), and

4.1.6 When product is purchased for agencies of the U.S. Government.

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

4.2.1 Heat identification or traceability details,

4.2.2 Certification,

4.2.3 Mill test reports, and

4.2.4 Special packaging and package markings.

5. Chemical Composition

5.1 The material composition shall conform to the requirements of Table 1 for the Copper Alloy UNS No. specified in the ordering information.

5.1.1 These compositional limits do not preclude the presence of other elements. When required, limits may be established and analysis required for unnamed elements by agreement between the supplier and the purchaser.

5.2 Copper listed as the remainder is the difference between the sum of results for all elements determined and 100 %.

5.3 When all elements listed in Table 1 for the Copper Alloy UNS No. prescribed in the ordering information are determined, the sum of results shall be 99.5 % min.

6. Temper

6.1 Tempers, as defined in Practice B 601, available under this specification are O61 (annealed), H00 ($\frac{1}{8}$ hard), H01 ($\frac{1}{4}$ hard), H02 ($\frac{1}{2}$ hard), H04 (full hard) and H08 (spring).

6.1.1 Product made to H04 (full hard) temper is generally not available in sizes larger than $\frac{1}{2}$ in. (12 mm) in diameter or distance between parallel faces.

6.1.2 Product made to H08 (spring) temper is generally not available in sizes larger than $\frac{1}{4}$ in. (6 mm) in diameter or distance between parallel faces.

7. Mechanical Property Requirements

7.1 Tensile Requirements:

7.1.1 The product of the Copper Alloy UNS No. specified in the ordering information shall conform to the requirements of Table 2 for the prescribed temper.

7.2 Grain Size Requirements:

¹ This specification is under the jurisdiction of ASTM Committee B-5 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.02 on Wire and Wire Rod.

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² Annual Book of ASTM Standards, Vol 02.01.

³ Annual Book of ASTM Standards, Vol 03.05.

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

TABLE 1 Chemical Requirements

	Composition, % max	
	Copper Alloy UNS No.	
	C65100	C65500
Copper (incl silver)	remainder	remainder
Lead	0.05	0.05
Iron	0.8	0.8
Zinc	1.5	1.5
Manganese	0.7	0.50–1.3
Silicon	0.8–2.0	2.8–3.8
Nickel	...	0.6

7.2.1 The average grain size of O61 (annealed) temper wire shall not exceed 0.040 mm but the wire must be completely recrystallized.

8. Performance Requirements

8.1 Bending Requirements:

8.1.1 Wire in sizes up to 0.250 in. [6 mm] inclusive produced to this specification shall be capable of being bent or wrapped one full turn (360°) around its own diameter, or distance between parallel faces, without developing cracks or other flaws visible to the unaided eye on the outside surface of the bend.

NOTE 1—Test specimens that include brazed or welded areas shall not be used for bend test purposes.

9. Dimensions and Permissible Variations

9.1 The tolerances for diameter or distance between parallel surfaces of wire shall be as prescribed in Specification B 250 or B 250M as follows:

9.1.1 Copper Alloy UNS No. C65100—Table 1.

9.1.2 Copper Alloy UNS No. C65500—Table 2.

10. Test Methods

10.1 Chemical Analysis:

10.1.1 Material composition shall, in case of dispute, be determined as follows:

Element	Test Methods
Copper	E 478
Phosphorus	E 62
Lead	E 478 (AA)
Iron	E 478
Zinc	E 478 (Titrametric)
Tin	E 478

10.1.2 Test method(s) to be followed for the determination of elements required by contractual or purchase order agreement shall be as agreed upon between the supplier and the purchaser.

11. General Requirements

11.1 The following sections of Specification B 250 or B 250M constitute a part of this specification.

- 11.1.1 Terminology,
- 11.1.2 Materials and Manufacture,
- 11.1.3 Workmanship, Finish, and Appearance,
- 11.1.4 Sampling,
- 11.1.5 Number of Tests and Retests,
- 11.1.6 Specimen Preparation,
- 11.1.7 Test Methods,
- 11.1.8 Significance of Numerical Limits,
- 11.1.9 Inspection,
- 11.1.10 Rejection and Rehearing,
- 11.1.11 Certification,
- 11.1.12 Test Report (Mill),
- 11.1.13 Packaging and Package Marking, and
- 11.1.14 Supplementary Requirements.

11.2 In addition, when a section with a title identical to that referenced in 11.1 appears in this specification, it contains additional requirements which supplement those that appear in Specification B 250 or B 250M.

12. Keywords

12.1 copper-silicon alloy wire; general purpose wire; non-electrical wire; UNS C65100 wire; UNS C65500 wire

TABLE 2 Mechanical Requirements

Standard	Temper Name	Tensile Strength		Elongation in 2 in. [50 mm] min% , for Wire Over 1/2 in. [12.0 mm] in Diameter
		ksi	[MPa]	
Copper Alloy UNS No. C65100				
O61	annealed	38–55	[260–380]	40
H00	eighth-hard	50–65	[345–450]	20
H01	quarter-hard	60–75	[415–515]	15
H02	half-hard	75–95	[515–655]	10
H04	hard ^A	90–110	[620–760]	8
H08	spring ^B	100 min	[690 min]	6
Copper Alloy UNS No. C65500				
O61	annealed	55–70	[380–485]	47
H00	eighth-hard	62–78	[425–540]	28
H01	quarter-hard	72–90	[495–620]	18
H02	half-hard	90–110	[620–760]	10
H04	hard ^A	115–135	[790–930]	6
H08	spring ^B	130 min	[900 min]	4

^AHard (H04) temper is not generally available in sizes over 1/2 in. [12.0 mm].

^BSpring (H08) temper is not generally available in sizes over 1/4 in. [6.0 mm].

SUPPLEMENTARY REQUIREMENTS

This section identifies the principle changes to this specification that have been incorporated since the 1993 issue as follows:

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| <p>(1) Combined customary inch-lb. and SI unit specifications into a single document.</p> <p>(2) Scope section revised to accommodate the combining of the two documents.</p> <p>(3) Referenced Documents section has been expanded.</p> | <p>(4) Ordering Information section has been added.</p> <p>(5) Terminology section has been added.</p> <p>(6) General Requirements section has been updated.</p> <p>(7) Other changes made to conform to the <i>ASTM Form and Style</i> guidelines.</p> |
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