Designation: B 99/B 99M – 06

Standard Specification for Copper-Silicon Alloy Wire for General Applications[1]

This standard is issued under the fixed designation B 99/B 99M; 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 round, rectangular, and square wire for general applications other than for electrical transmission cable. The alloys involved are UNS Nos. C65100 and C65500.

1.2 *Units*—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 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 nonconformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

B 250/B 250M Specification for General Requirements for Wrought Copper Alloy Wire

E 8 Test Methods for Tension Testing of Metallic Materials

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

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

E 112 Test Methods for Determining Average Grain Size

E 478 Test Methods for Chemical Analysis of Copper Alloys

3. General Requirements

3.1 The following sections of Specification B 250/B 250M constitute a part of this specification.

3.1.1 Terminology,

3.1.2 Materials and Manufacture,

3.1.3 Workmanship, Finish, and Appearance,

3.1.4 Sampling,

3.1.5 Number of Tests and Retests,

3.1.6 Specimen Preparation,

3.1.7 Test Methods,

3.1.8 Significance of Numerical Limits,

3.1.9 Inspection,

3.1.10 Rejection and Rehearing,

3.1.11 Certification,

3.1.12 Mill Test Report,

3.1.13 Packaging and Package Marking, and

3.1.14 Supplementary Requirements.

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

4. Ordering Information

4.1 Include the following information when placing orders for product under this specification, as applicable:

4.1.1 ASTM designation and year of issue,

4.1.2 Copper Alloy UNS No.,

4.1.3 Temper,

4.1.4 Dimensions (diameter, distance between parallel surfaces, width, and thickness),

4.1.5 How furnished (coil, reel, and so forth),

4.1.6 Total weight of each size, and

4.1.7 If product is purchased for agencies of the U.S. government (see the Supplementary Requirements section of Specification B 250/B 250M).

4.2 The following options are available to this specification and should be specified at the time of placing of the 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 shall conform to the chemical compositional requirements in Table 1 for 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.

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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.**

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 (incl cobalt)	...	0.6

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

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

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

6. Temper

6.1 The standard tempers for products described in this specification are given in Table 2.

6.1.1 Product made to H04 (full hard) temper is generally not available in sizes larger than 0.500 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 0.250 in. [6 mm] in diameter or distance between parallel faces.

7. Grain Size for Annealed Temper

7.1 Grain size shall be the standard requirement for all product in annealed temper.

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

7.3 Acceptance or rejection based upon grain size shall depend only on the average grain size of test specimens taken from each of two sample portions and each specimen shall be within the limits prescribed in 7.2 when determined in accordance with Test Methods E 112.

8. Mechanical Property Requirements

8.1 *Tensile Strength Requirements*:

8.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table 2, when tested in accordance with Test Methods E 8 or E 8M.

9. Performance Requirements

9.1 *Bending Requirements*:

9.1.1 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.

10. Dimensions, Mass, and Permissible Variations

10.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B 250/B 250M with particular reference to the following tables in that specification:

10.1.1 *Diameter or Distance Between Parallel Surfaces*:

10.1.1.1 Copper Alloy UNS No. C65100—Table 1.

10.1.1.2 Copper Alloy UNS No. C65500—Table 2.

10.1.2 *Thickness*:

10.1.2.1 Copper Alloy UNS No. C65100—Table 3.

10.1.2.2 Copper Alloy UNS No. C65500—Table 4.

10.1.3 *Width*:

10.1.3.1 Copper Alloy UNS No. C65100—Table 5.

10.1.3.2 Copper Alloy UNS No. C65500—Table 6.

TABLE 2 Mechanical Requirements

Temper		Tensile Strength		Elongation in 2 in. [50 mm] min % , for Wire Over 0.500 in. [12 mm] in Diameter
Code	Name	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

[A] Hard (H04) temper is not generally available in sizes over 0.500 in. [12 mm].
[B] Spring (H08) temper is not generally available in sizes over 0.250 in. [6 mm].

11. Test Methods

11.1 *Chemical Analysis*:

11.1.1 In cases of disagreement, determine the composition using the following methods:

Element	Methods
Copper	E 478
Silicon	E 62
Lead	E 478 (AA)
Iron	E 478
Zinc	E 478 (titrametric)
Nickel	E 478 (photometric)
Manganese	E 62

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

12. Keywords

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

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B 99/B 99M – 01) that may impact the use of this standard. (Approved Feb. 1, 2006.)

(*1*) Changes were made throughout due to the combination of Specification B 250/B 250M.

(*2*) A small change was made to Table 1, "Nickel (incl cobalt)."

(*3*) Other changes were made in accordance with the ASTM *Form and Style* guidelines.