



Designation: B740 – 09

# Standard Specification for Copper-Nickel-Tin Spinodal Alloy Strip<sup>1</sup>

This standard is issued under the fixed designation B740; 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 ( $\epsilon$ ) 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 for copper-nickel-tin alloy strip in the following alloys:

Copper Alloy UNS No.	Nominal Composition Weight %		
	Copper	Nickel	Tin
C72700	85	9	6
C72900	77	15	8
C72650	87.5	7.5	5

1.2 *Units*—The values stated in inch-pound units and the values stated in SI units in Table 5 are to be regarded as standard, except for grain size which is stated in metric units only. The values given in parentheses are mathematical conversions to SI units and are provided for information only and are not considered standard.

1.3 The following safety hazard caveat pertains only to the test method(s) described in this specification.

1.3.1 *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 of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:<sup>2</sup>

[B248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar](#)

[B598 Practice for Determining Offset Yield Strength in Tension for Copper Alloys](#)

[B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast](#)

[B820 Test Method for Bend Test for Determining the Formability of Copper and Copper Alloy Strip](#)

[B846 Terminology for Copper and Copper Alloys](#)

[E3 Guide for Preparation of Metallographic Specimens](#)

[E8 Test Methods for Tension Testing of Metallic Materials](#)

[E75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys](#)

[E290 Test Methods for Bend Testing of Material for Ductility](#)

[E478 Test Methods for Chemical Analysis of Copper Alloys](#)

## 3. General Requirements

3.1 The following sections of Specification [B248](#) constitute a part of this specification:

3.1.1 Terminology,

3.1.2 Materials and Manufacture,

3.1.3 Dimensions and Permissible Variations,

3.1.4 Workmanship, Finish, and Appearance,

3.1.5 Sampling,

3.1.6 Significance of Numerical Limits,

3.1.7 Inspection,

3.1.8 Rejection and Reheating,

3.1.9 Certification,

3.1.10 Test Reports, and

3.1.11 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 that supplement those appearing in Specification [B248](#).

## 4. Terminology

4.1 For definitions of terms related to copper and copper alloys, refer to Terminology [B846](#).

## 5. Ordering Information

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

5.1.1 ASTM designation and year of issue,

5.1.2 Quantity,

5.1.3 Copper Alloy UNS No. (see [1.1](#)),

<sup>1</sup> This specification is under the 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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<sup>2</sup> 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

- 5.1.4 Form of material: strip,
- 5.1.5 Temper (see 8.1),
- 5.1.6 Dimensions: thickness and width, and length if applicable,

5.1.7 How furnished: rolls or coils, stock lengths with or without ends, specific lengths with or without ends,

5.1.8 Type of edge other than slit, for example, rounded corners, rounded edges, or full-rounded edges.

5.1.9 When material is purchased for agencies of the U.S. Government, this shall be specified in the contract or purchase order, and the material shall conform to the Supplementary Requirements Section as defined in the current edition of Specification B248.

5.2 The following options are available and should be specified at the time of placing of the order when required:

- 5.2.1 Certification if required,
- 5.2.2 Mill test report if required,

## 6. Chemical Composition

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

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

6.3 Copper may be given as remainder and taken as the difference between the sum of all the elements analyzed and 100%. When all the elements in the table including copper are analyzed, their sum shall be 99.7% min.

## 7. Materials and Manufacture

7.1 *Manufacture*—Spinodal Heat Treatment.

7.1.1 Solution-heat-treatment or solution-heat-treated and cold-worked material is normally spinodal hardened by the purchaser after forming or machining.

7.1.2 Mill-hardened products have been spinodal heat treated by the manufacturer. Further thermal treatment is not normally required.

## 8. Temper

8.1 The standard tempers for products described in this specification are given in Tables 2-4

- 8.1.1 TB00 (Solution Heat Treated)
- 8.1.2 TD01 to TD 12 (Solution Heat Treated with varying degrees of cold working)
- 8.1.3 TX00 ( Spinodal Hardened)

- 8.1.4 TS01 to TS12 (Hard and Spinodal Hardened)
- 8.1.5 TM00 to TS08 (mill hardened)

8.2 Other tempers are available and shall be subject to agreement between supplier or manufacturer and purchaser.

## 9. Grain Size for Annealed Tempers

9.1 Product over 0.010 in. (0.25 mm) in thickness shall have an average grain-size not exceeding the limits prescribed in Table 5. The determinations are made on the separate samples and in a plane perpendicular to the surface.

## 10. Mechanical Property Requirements

10.1 *Tensile Strength Requirements* :

10.1.1 The solution heat-treated or solution heat-treated and cold-worked material shall conform to the tensile property requirements specified in Table 2, when tested in accordance with Test Methods E8.

10.1.2 The spinodal heat-treated material shall conform to the tensile property requirements specified in Table 3.

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

10.1.3 The mill-hardened material shall conform to the tensile property requirements specified in Table 4.

## 11. Performance Requirements

11.1 *Bend Testing*—The bend test is a method for evaluating the ductility of mill-hardened copper-nickel-tin spinodal alloy strip in thicknesses of 0.004 to 0.020 in. (0.102 to 0.508 mm), inclusive.

11.1.1 Material in tempers TM00, TM02, TM04, and TM06 shall conform to the bend test requirements specified in Table 4 when tested in accordance with 15.2.1.

11.1.2 To pass the test, all three specimens tested from a lot must withstand the 90° bend without visible cracks of fracture when observed of the convex surface of the bend at a magnification of ×10.

## 12. Dimensions and Permissible Variations

12.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B248 with particular reference to the following tables and related paragraphs:

**TABLE 1 Chemical Requirements**

Copper Alloy UNS No.	Previous Designation	Copper, incl Silver	Composition, %							
			Lead, <sup>A</sup> max	Iron, <sup>A</sup> max	Zinc, <sup>A</sup> max	Nickel, incl Cobalt	Tin	Manganese, <sup>A</sup> max	Niobium, <sup>A</sup> max	Magnesium, <sup>A</sup> max
C72650	Cu-7.5Ni-5Sn	remainder	0.01	0.10	0.10	7.0-8.0	4.5-5.5	0.10	...	...
C72700	Cu-9Ni-6Sn	remainder	0.02 <sup>B</sup>	0.50	0.50	8.5-9.5	5.5-6.5	0.05-0.30	0.10	0.15
C72900	Cu-15Ni-8Sn	remainder	0.02 <sup>B</sup>	0.50	0.50	14.5-15.5	7.5-8.5	0.30	0.10	0.15

<sup>A</sup> The total of the elements Pb, Fe, Zn, Mn, Nb, and Mg not to exceed 0.7 %.

<sup>B</sup> 0.005 % Pb, max for hot rolling.

**TABLE 2 Tensile Property Requirements**
*Temper:* Solution Heat-Treated  
 Solution Heat-Treated and Cold Worked

Copper Alloy UNS No.	Temper Designations		Tensile Strength, ksi <sup>A</sup> (MPa) <sup>B</sup> min–max <sup>C</sup>	Yield <sup>D</sup> Strength (0.05 % Offset), ksi <sup>A</sup> (MPa) <sup>B</sup> min–max <sup>C</sup>	Elongation in 2 in., %
	Code	Name			
C72650	TB00	Solution HT	55–70 (380–480)	21–32 (145–220)	32
C72650	TD01	Solution HT and Cold Worked ¼ Hard	60–75 (415–515)	45–60 (310–415)	18
C72650	TD02	Solution HT and Cold Worked ½ Hard	75–85 (515–585)	55–75 (380–515)	5
C72650	TD03	Solution HT and Cold Worked ¾ Hard	80–90 (550–620)	68–82 (470–565)	4
C72650	TD04	Solution HT and Cold Worked Hard	85–95 (585–655)	77–90 (530–620)	2
C72700	TB00	Solution HT	60–80 (410–550)	23–33 (160–230)	30
C72700	TD01	Solution HT and Cold Worked ¼ Hard	72–95 (500–660)	48–64 (330–440)	12
C72700	TD02	Solution HT and Cold Worked ½ Hard	82–108 (570–740)	57–80 (390–550)	6
C72700	TD04	Solution HT and Cold Worked Hard	97–125 (670–860)	77–100 (530–690)	3
C72700	TD08	Solution HT and Cold Worked Spring	110–140 (760–970)	95–115 (660–790)	2
C72700	TD12	Solution HT and Cold Worked Special Spring	115–150 (790–1030)	105–125 (720–860)	...
C72900	TB00	Solution HT	64–85 (440–585)	24–40 (165–275)	32
C72900	TD01	Solution HT and Cold Worked ¼ Hard	75–100 (515–690)	50–66 (345–455)	18
C72900	TD02	Solution HT and Cold Worked ½ Hard	85–110 (585–760)	65–84 (450–580)	8
C72900	TD03	Solution HT and Cold Worked ¾ Hard	95–120 (655–825)	80–100 (550–690)	3
C72900	TD04	Solution HT and Cold Worked Hard	100–130 (690–895)	85–108 (585–745)	...
C72900	TD08	Solution HT and Cold Worked Spring	122–145 (840–1000)	100–125 (690–860)	...
C72900	TD12	Solution HT and Cold Worked Special Spring	135–155 (930–1070)	110–130 (760–895)	...

<sup>A</sup> 1 ksi = 1000 psi.

<sup>B</sup> See [Appendix X1](#).

<sup>C</sup> Max for reference.

<sup>D</sup> As per Practice [B598](#).

[ASTM B740-09](#)
<https://standards.itec.org/catalog/standards/sist/3909e850-6429-469a-9309-4602c9c9b01f/astm-b740-09>

### 12.1.1 Thickness—[Table 2](#)

#### 12.1.1.1 Special Thickness—[Table 3](#)

### 12.1.2 Width

### 12.1.3 Length

### 12.1.4 Straightness

#### 12.1.4.1 Slit Metal or Slit Metal Either Straightened or Edge Rolled

## 13. Retests

13.1 If any lot of material fails to conform to the requirements of this specification due to inadequate heat treatment, new samples of material may be resubmitted for test after heat treatment. Only two such reheat treatments shall be permitted.

13.2 If any lot of material fails to conform to the bend test requirements of this specification, one retest is permitted if

only one of the three specimens fails the test. No retest is permitted if two or more specimens fail the test.

## 14. Specimen Preparation

14.1 For the purpose of determining conformance to the mechanical properties of [Table 3](#), a sample of the non-spinodally hardened strip of alloys C72700 and C72900 material shall be heat treated at 662 +/- 9°F (350 +/- 5°C) for 1 ½ h +/- 5 min and a sample of the as-supplied strip of alloy C72650 shall be heat treated at 725 +/- 9° (385 +/- 5°C) for 2 h +/- 5 min. Other heat-treating temperatures and times may be preferred for end products of this material.

14.2 Specimens for the determination of grain size shall be prepared in accordance with [Guide E3](#).