



# Standard Specification for Copper Alloy Strip for Use in Manufacture of Electrical Connectors or Spring Contacts<sup>1</sup>

This standard is issued under the fixed designation B 888; 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.

## 1. Scope\*

1.1 This specification establishes the requirements for copper alloy strip for use in the manufacture of electrical connectors or spring contacts produced from one of the following Copper Alloy UNS Nos.<sup>2</sup>: C14530, C15100, C15500, C19010, C19025, C19210, C19400, C19500, C19700, C23000, C26000, C40810, C40850, C40860, C42200, C42500, C42520, C42600, C50580, C50780, C51000, C51080, C51100, C51180, C51980, C52100, C52180, C52480, C63800, C65400, C68800, C70250, C70260, C70265, C75200, and C76200.

1.2 The requirements for the other copper alloys such as beryllium copper UNS C17000, C17200, C17400, C17410, C17500, and C17510 shall be as prescribed in the current edition of Specifications B 194, B 768, and B 534, and copper-nickel-tin spinodal, UNS C72650, C72700, and C72900 shall be as prescribed in the current edition of Specification B 740.

1.3 The values stated in either inch-pound units or SI 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 noncompliance with this specification.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

B 193 Test Method for Resistivity of Electrical Conductor Material

- B 194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
- B 248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar
- B 248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar [Metric]
- B 534 Specification for Copper-Cobalt-Beryllium Alloy and Copper-Nickel-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
- B 601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast
- B 740 Specification for Copper-Nickel-Tin Spinodal Alloy Strip
- B 768 Specification for Copper-Cobalt-Beryllium Alloy Strip and Sheet
- B 820 Test Method for Bend Test for Formability of Copper Alloy Spring Material
- B 846 Terminology for Copper and Copper Alloys
- E 8 Test Methods for Tension Testing of Metallic Materials
- E 8M Test Methods for Tension Testing of Metallic Materials [Metric]
- E 54 Test Methods for Chemical Analysis of Special Brasses and Bronzes<sup>4</sup>
- E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Method)
- E 75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys
- E 478 Test Methods for Chemical Analysis of Copper Alloys
- E 527 Practice for Numbering Metals and Alloys (UNS)

### 2.2 ISO Standards:

ISO 4744 Copper and Copper Alloys—Determination of Chromium Content - Flame Atomic Absorption Spectrometric Method<sup>5</sup>

<sup>1</sup> This specification is under the jurisdiction of Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.01 on Plate, Sheet, and Strip.

Current edition approved May 1, 2004. Published May 2004. Originally approved in 1998. Last previous edition approved in 2003 as B 888 – 03.

<sup>2</sup> 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.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

<sup>4</sup> Withdrawn.

<sup>5</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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

ISO 7602 Copper and Copper Alloys—Determination of Tellurium Content<sup>5</sup>

### 3. Terminology

3.1 *Definitions*—For definition of terms used in this specification, refer to Terminology B 846.

### 4. General Requirements

4.1 For product furnished under this specification in English units, the following sections of Specification B 248 must constitute a part of this specification. For product furnished under this specification in the SI units, the following sections of Specification B 248M must constitute a part of this specification.

- 4.1.1 Terminology,
- 4.1.2 Materials and Manufacture,
- 4.1.3 Dimensions, Weights, and Permissible Variations,
- 4.1.4 Workmanship, Finish, and Appearance,
- 4.1.5 Sampling,
- 4.1.6 Number of Tests and Retests,
- 4.1.7 Specimen Preparation,
- 4.1.8 Test Methods,
- 4.1.9 Significance of Numerical Limits,
- 4.1.10 Certification,
- 4.1.11 Test Reports, and
- 4.1.12 Packaging and Package Marking.

4.2 In the event of a conflict between this specification and Specification B 248 or B 248M, the requirements of this specification shall take precedence.

### 5. Classification

5.1 Product produced to this specification is classified as strip material to be used for spring contact or electrical and electronic connector applications only.

### 6. Ordering Information

6.1 Contract or purchase orders for product under this specification should include the following information:

- 6.1.1 ASTM designation and year of issue,
- 6.1.2 UNS alloy designation,
- 6.1.3 Dimensions, for example, thickness, width,
- 6.1.4 Quantity, and
- 6.1.5 Temper (Section 8).

6.2 The following options are available under this specification and shall be specified in the contract or purchase order when required:

6.2.1 Type of edge: slit, sheared, sawed, square corners, rounded corners, rounded edges, or full-rounded edges (Section 11),

6.2.2 Width and straightness tolerances, slit-metal tolerances, square-sheared metal tolerances, sawed metal tolerances, straightened or edge-rolled metal tolerances (Section 11),

6.2.3 Identification marking (Section 22),

6.2.4 Certification (Section 20),

6.2.5 Mill test report (Section 21), and

6.2.6 How packaged: coil wound in traverse or pancake style (Section 22).

6.2.6.1 Number of strip lengths per coil,

6.2.6.2 Size and weight of each coil, and

6.2.7 The electrical resistivity or any other physical and electrical properties (See Table X1.1).

### 7. Materials and Manufacture

7.1 *Material*—The material of manufacture shall be a cast bar, slab, cake, billet, or other form of the composition given in Table 1 for the specified alloy, suitable for processing into the product prescribed in this specification.

7.2 *Manufacture*—The product shall be produced by either hot- or cold-working operation. It shall be finished, unless otherwise specified, by such hot working, cold working, annealing, or heat treatment as may be necessary to meet the properties specified in Table 2.

7.3 *Edges*—The edges shall be slit or rolled edges as specified by the buyer. Slit edges shall be furnished unless otherwise specified or agreed upon between the purchaser and supplier or manufacturer.

### 8. Chemical Composition

8.1 The materials shall conform to the chemical compositional requirements in Table 1 for the corresponding Copper Alloy UNS Number designation specified in the ordering information.

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

8.3 Copper, when given as the remainder, is determined as the difference between the sum of results for all elements determined and 100 %.

8.4 Zinc, when given as the remainder, is determined as the difference between the sum of results for all elements determined and 100 %.

8.4.1 For those copper alloys in which zinc is given as the remainder, copper may be determined by difference; however, when so determined, the result shall conform to the limits prescribed in Table 1.

8.5 When all elements listed in Table 1 for the Copper Alloy UNS Number specified in the ordering information are determined, the sum of results shall be 99.8 % minimum, except for UNS No. C26000, C42200, and C42500, which shall be



TABLE 1 Chemical Requirements

| Copper Alloy<br>UNS No. | Elements Composition, % |                           |           |                           |          |                        |           |                        |                           |                 |      |           |           |         |            |                              |
|-------------------------|-------------------------|---------------------------|-----------|---------------------------|----------|------------------------|-----------|------------------------|---------------------------|-----------------|------|-----------|-----------|---------|------------|------------------------------|
|                         | Copper                  | Aluminum                  | Cobalt    | Iron                      | Lead     | Magnesium              | Manganese | Nickel                 | Phosphorus                | Tin             | Zinc | Chromium  | Zirconium | Silicon | Silver     | Tellurium                    |
| C14530                  | 99.90 min               |                           |           |                           |          |                        |           |                        | 0.001-<br>0.010           | 0.003-<br>0.023 |      |           |           |         |            | 0.003-<br>0.023 <sup>A</sup> |
| C15100                  | 99.82 min               | 0.005<br>max <sup>B</sup> |           | 0.005<br>max <sup>B</sup> |          | 0.005 max <sup>B</sup> |           |                        |                           |                 |      | 0.05-0.15 |           |         |            |                              |
| C15500                  | 99.75 <sup>C</sup> min  |                           |           |                           |          |                        |           | 0.04-0.08              |                           |                 |      |           |           |         | 0.027-0.10 |                              |
| C19010                  | remainder <sup>D</sup>  |                           |           | 0.10 max                  |          |                        | 0.8-1.8   | 0.01-0.05              |                           |                 |      |           |           |         |            |                              |
| C19025                  | remainder <sup>E</sup>  |                           |           | 0.05-0.15                 |          |                        | 0.8-1.2   | 0.03-0.07              |                           |                 |      |           |           |         |            |                              |
| C19210                  | remainder               |                           |           | 2.1-2.6                   | 0.03 max |                        |           | 0.025-0.04             |                           |                 |      |           |           |         |            |                              |
| C19400                  | 97.0 min                |                           |           | 1.0-2.0                   | 0.02 max |                        |           | 0.015-0.15             |                           |                 |      |           |           |         |            |                              |
| C19500                  | 96.0 min                | 0.02 max                  | 0.30-1.3  | 0.3-1.2                   | 0.05 max | 0.01-0.20              | 0.05 max  | 0.01-0.35              | 0.10-1.0                  | 0.20 max        |      |           |           |         |            |                              |
| C19700                  | remainder               |                           | 0.05 max  | 0.05 max                  | 0.05 max |                        |           | 0.10-0.40              | 0.20 max                  | remainder       |      |           |           |         |            |                              |
| C23000                  | 84.0-86.0               |                           |           | 0.05 max                  | 0.05 max |                        |           |                        |                           | remainder       |      |           |           |         |            |                              |
| C26000                  | 68.5-71.5               |                           |           | 0.07 max                  | 0.07 max |                        |           | 0.028-0.04             | 1.8-2.2                   | remainder       |      |           |           |         |            |                              |
| C40810                  | 94.5-96.5 <sup>F</sup>  |                           |           | 0.08-0.12                 | 0.05 max |                        |           | 0.02-0.04              | 2.6-4                     | remainder       |      |           |           |         |            |                              |
| C40850                  | 94.5-96.5 <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.04              | 1.7-2.3                   | remainder       |      |           |           |         |            |                              |
| C40860                  | 94-96 <sup>F</sup>      |                           |           | 0.01-0.05                 | 0.05 max |                        |           | 0.35 max               | 0.8-1.4                   | remainder       |      |           |           |         |            |                              |
| C42200                  | 86.0-89.0               |                           |           | 0.05 max                  | 0.05 max |                        |           | 0.35 max               | 1.5-3.0                   | remainder       |      |           |           |         |            |                              |
| C42500                  | 87.0-90.0               |                           |           | 0.05 max                  | 0.05 max |                        |           | 0.02-0.04              | 1.5-3                     | remainder       |      |           |           |         |            |                              |
| C42520                  | 88-91 <sup>F</sup>      |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.05              | 2.5-4.0                   | remainder       |      |           |           |         |            |                              |
| C42600                  | 87.0-90.0               |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 1.0-1.7                   | remainder       |      |           |           |         |            |                              |
| C50580                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 1.7-2.3                   | remainder       |      |           |           |         |            |                              |
| C50780                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.03-0.35              | 4.2-5.8                   | remainder       |      |           |           |         |            |                              |
| C51000                  | remainder <sup>F</sup>  |                           |           | 0.10 max                  | 0.05 max |                        |           | 0.02-0.10              | 4.8-5.8                   | remainder       |      |           |           |         |            |                              |
| C51080                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.03-0.35              | 3.5-4.9                   | remainder       |      |           |           |         |            |                              |
| C51100                  | remainder <sup>F</sup>  |                           |           | 0.10 max                  | 0.05 max |                        |           | 0.02-0.10              | 5.7-0                     | remainder       |      |           |           |         |            |                              |
| C51180                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 7.0-9.0                   | remainder       |      |           |           |         |            |                              |
| C51980                  | remainder <sup>F</sup>  |                           |           | 0.10 max                  | 0.05 max |                        |           | 0.03-0.35              | 9.0-11.0                  | remainder       |      |           |           |         |            |                              |
| C52100                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 0.8 max                   | remainder       |      |           |           |         |            |                              |
| C52180                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 0.50 max                  | remainder       |      |           |           |         |            |                              |
| C52480                  | remainder <sup>F</sup>  |                           |           | 0.05-0.20                 | 0.05 max |                        |           | 0.02-0.10              | 21.3-24.1 <sup>C</sup>    | remainder       |      |           |           |         |            |                              |
| C63800                  | remainder               | 2.5-3.1                   | 0.25-0.55 | 0.20 max                  | 0.05 max | 0.10 max               | 0.10 max  | 0.20 max               | 1.2-1.9                   | 0.8 max         |      |           |           |         |            | 1.5-2.1                      |
| C65400                  | remainder <sup>G</sup>  |                           |           | 0.20 max                  | 0.05 max |                        |           | 2.2-4.2 <sup>H</sup>   | 0.20 max                  | 0.50 max        |      |           |           |         |            | 2.7-3.4                      |
| C68800                  | remainder <sup>G</sup>  | 3.0-3.8 <sup>C</sup>      | 0.25-0.55 | 0.20 max                  | 0.05 max | 0.10 max               | 0.10 max  | 1.0-3.0 <sup>D</sup>   | 0.005<br>max <sup>D</sup> | 0.20 max        |      |           |           |         |            | 0.25-1.2                     |
| C70250                  | remainder               |                           |           | 0.20 max                  | 0.05 max |                        |           | 1.0-3.0 <sup>D</sup>   | 0.01 max                  | 0.30 max        |      |           |           |         |            | 0.20-0.70 <sup>D</sup>       |
| C70260                  | remainder <sup>D</sup>  |                           |           | 0.20 max                  | 0.05 max | 0.05-0.30              | 0.10 max  | 1.0-3.0 <sup>D</sup>   | 0.005<br>max <sup>D</sup> | 1.0 max         |      |           |           |         |            | 0.20-0.70 <sup>D</sup>       |
| C70265                  | remainder <sup>D</sup>  |                           |           | 0.05 max                  | 0.05 max |                        |           | 1.0-3.0 <sup>H</sup>   | 0.01 max                  | 0.05-0.8        |      |           |           |         |            | 0.20-0.70                    |
| C75200                  | 63.5-66.5               |                           |           | 0.25 max                  | 0.05 max | 0.50 max               | 0.50 max  | 16.5-19.5 <sup>H</sup> | 0.50 max                  | remainder       |      |           |           |         |            |                              |
| C76200                  | 57.0-61.0               |                           |           | 0.25 max                  | 0.10 max | 0.50 max               | 0.50 max  | 11.0-13.5 <sup>H</sup> | 0.50 max                  | remainder       |      |           |           |         |            |                              |

<sup>A</sup> Includes Te + Se.<sup>B</sup> Aluminum + iron + manganese not to exceed 0.01 %.<sup>C</sup> Aluminum + zinc = 25.1 – 27.1.<sup>D</sup> Copper + nickel + phosphorus + silicon 99.5 min.<sup>E</sup> Copper + other elements 99.7 % min.<sup>F</sup> Copper + other elements 99.5 % min.<sup>G</sup> Including silver.<sup>H</sup> Including cobalt.

**TABLE 2 Mechanical Requirements**

| Temper Designation          |              | Tensile Strength, ksi |     | Tensile Strength, MPa |     | Yield Strength<br>(0.2 % Offset), ksi | Yield Strength<br>(0.2 % Offset),<br>MPa | Elongation, % |
|-----------------------------|--------------|-----------------------|-----|-----------------------|-----|---------------------------------------|--|---------------|
| Standard                    | Former       | min                   | max | min                   | max | min                                   | min                                      | min           |
| Copper Alloy UNS NO. C14530 |              |                       |     |                       |     |                                       |  |               |
| H01                         | ¼ hard       | 35                    | 45  | 240                   | 310 | 26                                    | 180                                      | 7             |
| H02                         | ½ hard       | 40                    | 50  | 275                   | 345 | 33                                    | 230                                      | 5             |
| H03                         | ¾ hard       | 44                    | 54  | 305                   | 370 | 39                                    | 270                                      | 3             |
| H04                         | hard         | 47                    | 57  | 325                   | 395 | 43                                    | 295                                      | 2             |
| H06                         | extra hard   | 50                    | 60  | 345                   | 415 | 47                                    | 325                                      | 1             |
| H08                         | spring       | 54                    | 64  | 370                   | 440 | 51                                    | 350                                      | 1             |
| H10                         | extra spring | 58                    | ... | 400                   | ... | 56                                    | 385                                      | ...           |
| Copper Alloy UNS NO. C15100 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 37                    | 42  | 255                   | 290 | 9                                     | 60                                       | 35            |
| H01                         | ¼ hard       | 40                    | 45  | 275                   | 310 | 26                                    | 180                                      | 11            |
| H02                         | ½ hard       | 43                    | 51  | 295                   | 350 | 35                                    | 240                                      | 3             |
| H03                         | ¾ hard       | 47                    | 56  | 325                   | 385 | 45                                    | 310                                      | 1             |
| H04                         | hard         | 53                    | 62  | 365                   | 425 | 51                                    | 350                                      | 1             |
| H06                         | extra hard   | 59                    | 65  | 405                   | 450 | 57                                    | 395                                      | 1             |
| H08                         | spring       | 64                    | 71  | 440                   | 490 | 62                                    | 425                                      | 1             |
| Copper Alloy UNS NO. C15500 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 34                    | 43  | 235                   | 295 | 15                                    | 105                                      | 30            |
| H02                         | ½ hard       | 45                    | 55  | 310                   | 380 | 38                                    | 260                                      | 13            |
| H04                         | hard         | 56                    | 64  | 385                   | 440 | 50                                    | 345                                      | 6             |
| H06                         | extra hard   | 63                    | 72  | 435                   | 495 | 56                                    | 385                                      | 5             |
| H08                         | spring       | 65                    | 73  | 450                   | 505 | 60                                    | 415                                      | 4             |
| H10                         | extra spring | 68                    | 75  | 470                   | 515 | 63                                    | 435                                      | 3             |
| Copper Alloy UNS NO. C19010 |              |                       |     |                       |     |                                       |  |               |
| TM03                        | ¾ HM         | 67                    | 77  | 460                   | 520 | 50                                    | 340                                      | 12            |
| TM04                        | HM           | 71                    | 81  | 490                   | 560 | 60                                    | 410                                      | 10            |
| TM06                        | XHM          | 75                    | 86  | 520                   | 590 | 64                                    | 440                                      | 8             |
| TM08                        | SHM          | 84                    | ... | 580                   | ... | 74                                    | 510                                      | 6             |
| H01                         | ¼ hard       | 52                    | 64  | 360                   | 430 | 40                                    | 275                                      | 8             |
| H02                         | ½ hard       | 60                    | 70  | 410                   | 470 | 54                                    | 370                                      | 7             |
| H03                         | ¾ hard       | 67                    | 77  | 460                   | 520 | 62                                    | 410                                      | 5             |
| H04                         | hard         | 71                    | 81  | 490                   | 560 | 66                                    | 435                                      | 4             |
| H06                         | extra hard   | 75                    | 86  | 520                   | 590 | 72                                    | 460                                      | 3             |
| H08                         | spring       | 84                    | 95  | 580                   | 655 | 78                                    | 520                                      | 2             |
| H10                         | extra spring | 95                    | ... | 655                   | ... | 85                                    | 585                                      | 1             |
| Copper Alloy UNS NO. C19025 |              |                       |     |                       |     |                                       |  |               |
| HR01                        | ¼ hard       | 49                    | 68  | 340                   | 470 | 42                                    | 290                                      | 15            |
| HR02                        | ½ hard       | 63                    | 76  | 435                   | 525 | 58                                    | 400                                      | 9             |
| HR04                        | hard         | 72                    | 83  | 495                   | 570 | 68                                    | 470                                      | 5             |
| HR06                        | extra hard   | 78                    | 89  | 540                   | 615 | 74                                    | 510                                      | 4             |
| HR08                        | spring       | 84                    | 95  | 580                   | 655 | 81                                    | 560                                      | ...           |
| HR10                        | extra spring | 91                    | 106 | 625                   | 730 | 88                                    | 605                                      | ...           |
| Copper Alloy UNS NO. 19210  |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 27                    | 42  | 190                   | 290 | 16                                    | 110                                      | 30            |
| H01                         | ¼ hard       | 43                    | 53  | 300                   | 365 | 20                                    | 135                                      | 20            |
| H02                         | ½ hard       | 47                    | 60  | 325                   | 410 | 44                                    | 310                                      | 5             |
| H03                         | ¾ hard       | 52                    | 62  | 355                   | 425 | 50                                    | 345                                      | 4             |
| H04                         | full hard    | 56                    | 66  | 385                   | 455 | 54                                    | 355                                      | 3             |
| H06                         | extra hard   | 60                    | 70  | 410                   | 480 | 58                                    | 400                                      | 2             |
| H08                         | spring hard  | 64                    | 74  | 440                   | 510 | 62                                    | 425                                      | 1             |
| H10                         | extra spring | 66                    | ... | 455                   | ... | 64                                    | 440                                      | 1             |
| Copper Alloy UNS NO. C19400 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 40                    | 63  | 275                   | 435 | 16                                    | 110                                      | 10            |
| H02                         | ½ hard       | 53                    | 63  | 365                   | 435 | 36                                    | 250                                      | 6             |
| H04                         | full hard    | 60                    | 70  | 415                   | 485 | 53                                    | 365                                      | 3             |
| H06                         | extra hard   | 67                    | 73  | 460                   | 505 | 64                                    | 440                                      | 2             |
| H08                         | spring hard  | 70                    | 76  | 485                   | 525 | 67                                    | 460                                      | 2             |
| H10                         | extra spring | 73                    | 80  | 505                   | 550 | 70                                    | 485                                      | 1             |
| Copper Alloy UNS NO. C19500 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 50                    | 60  | 345                   | 415 | 21                                    | 145                                      | 22            |
| H01                         | ¼ hard       | 60                    | 72  | 415                   | 495 | 45                                    | 310                                      | 5             |
| H02                         | ½ hard       | 68                    | 78  | 470                   | 540 | 66                                    | 455                                      | 3             |
| H03                         | ¾ hard       | 75                    | 85  | 515                   | 585 | 72                                    | 495                                      | 2             |

**TABLE 2** *Continued*

| Temper Designation          |              | Tensile Strength, ksi |     | Tensile Strength, MPa |     | Yield Strength<br>(0.2 % Offset), ksi | Yield Strength<br>(0.2 % Offset),<br>MPa | Elongation, % |
|-----------------------------|--------------|-----------------------|-----|-----------------------|-----|---------------------------------------|--|---------------|
| Standard                    | Former       | min                   | max | min                   | max | min                                   | min                                      | min           |
| H04                         | full hard    | 82                    | 90  | 565                   | 620 | 79                                    | 545                                      | 2             |
| H08                         | spring       | 88                    | 97  | 605                   | 670 | 85                                    | 585                                      | 1             |
| Copper Alloy UNS NO. C19700 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 43                    | 53  | 295                   | 365 | 16                                    | 110                                      | 20            |
| H02                         | ½ hard       | 53                    | 63  | 365                   | 435 | 36                                    | 250                                      | 6             |
| H04                         | full hard    | 60                    | 70  | 415                   | 485 | 53                                    | 365                                      | 2             |
| H06                         | extra hard   | 67                    | 73  | 460                   | 505 | 64                                    | 440                                      | 2             |
| H08                         | spring hard  | 70                    | 76  | 485                   | 525 | 67                                    | 460                                      | 2             |
| H10                         | extra spring | 73                    | 80  | 505                   | 550 | 70                                    | 485                                      | 1             |
| Copper Alloy UNS NO. C23000 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 39                    | 47  | 270                   | 325 | 8                                     | 55                                       | 43            |
| H01                         | ¼ hard       | 44                    | 54  | 305                   | 370 | 23                                    | 160                                      | 15            |
| H02                         | ½ hard       | 51                    | 61  | 350                   | 420 | 43                                    | 295                                      | 8             |
| H03                         | ¾ hard       | 57                    | 67  | 395                   | 460 | 51                                    | 350                                      | 4             |
| H04                         | hard         | 63                    | 72  | 435                   | 495 | 57                                    | 395                                      | 4             |
| H06                         | extra hard   | 72                    | 80  | 495                   | 550 | 65                                    | 450                                      | 3             |
| H08                         | spring       | 78                    | 86  | 540                   | 595 | 69                                    | 475                                      | 3             |
| H10                         | extra spring | 82                    | 90  | 565                   | 620 | 73                                    | 505                                      | 2             |
| Copper Alloy UNS NO. C26000 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 45                    | 61  | 310                   | 420 | 10                                    | 70                                       | 40            |
| H01                         | ¼ hard       | 49                    | 59  | 340                   | 405 | 21                                    | 145                                      | 34            |
| H02                         | ½ hard       | 57                    | 67  | 395                   | 460 | 42                                    | 290                                      | 19            |
| H03                         | ¾ hard       | 64                    | 74  | 440                   | 510 | 55                                    | 380                                      | 8             |
| H04                         | hard         | 71                    | 81  | 490                   | 560 | 67                                    | 460                                      | 6             |
| H06                         | extra hard   | 83                    | 92  | 570                   | 635 | 79                                    | 545                                      | 2             |
| H08                         | spring       | 91                    | 100 | 625                   | 690 | 82                                    | 565                                      | 1             |
| H10                         | extra spring | 95                    | 104 | 655                   | 715 | 86                                    | 595                                      | 1             |
| Copper Alloy UNS NO. C40810 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 57                    | 73  | 395                   | 505 | 41                                    | 285                                      | 20            |
| H04                         | hard         | 75                    | 87  | 515                   | 600 | 68                                    | 470                                      | 8             |
| H06                         | extra hard   | 88                    | 97  | 605                   | 670 | 84                                    | 580                                      | 6             |
| H08                         | spring       | 92                    | 100 | 635                   | 690 | 88                                    | 605                                      | 4             |
| Copper Alloy UNS NO. C40850 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 57                    | 73  | 395                   | 505 | 41                                    | 285                                      | 20            |
| H04                         | hard         | 75                    | 87  | 515                   | 600 | 68                                    | 470                                      | 8             |
| H06                         | extra hard   | 88                    | 97  | 605                   | 670 | 84                                    | 580                                      | 6             |
| H08                         | spring       | 92                    | 104 | 635                   | 715 | 90                                    | 620                                      | 4             |
| Copper Alloy UNS NO. C40860 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 56                    | 72  | 385                   | 495 | 40                                    | 275                                      | 20            |
| H04                         | hard         | 73                    | 86  | 505                   | 595 | 66                                    | 455                                      | 8             |
| H06                         | extra hard   | 86                    | 96  | 595                   | 660 | 84                                    | 580                                      | 6             |
| H08                         | spring       | 90                    | 103 | 620                   | 710 | 88                                    | 605                                      | 4             |
| Copper Alloy UNS NO. C42200 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 41                    | 49  | 285                   | 340 | 12                                    | 85                                       | 43            |
| H01                         | ¼ hard       | 47                    | 57  | 325                   | 395 | 21                                    | 145                                      | 17            |
| H02                         | ½ hard       | 54                    | 65  | 370                   | 450 | 48                                    | 330                                      | 6             |
| H03                         | ¾ hard       | 60                    | 72  | 415                   | 495 | 58                                    | 400                                      | 4             |
| H04                         | hard         | 67                    | 79  | 460                   | 545 | 67                                    | 460                                      | 3             |
| H06                         | extra hard   | 75                    | 85  | 515                   | 585 | 72                                    | 495                                      | 2             |
| H08                         | spring       | 82                    | 92  | 565                   | 635 | 77                                    | 530                                      | 2             |
| H10                         | extra spring | 88                    | ... | 605                   | ... | 82                                    | 565                                      | 1             |
| Copper Alloy UNS NO. C42500 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 41                    | 47  | 285                   | 325 | 13                                    | 90                                       | 47            |
| H01                         | ¼ hard       | 49                    | 59  | 340                   | 405 | 20                                    | 140                                      | 24            |
| H02                         | ½ hard       | 57                    | 69  | 395                   | 475 | 51                                    | 350                                      | 13            |
| H03                         | ¾ hard       | 62                    | 74  | 425                   | 510 | 58                                    | 400                                      | 10            |
| H04                         | hard         | 70                    | 82  | 485                   | 565 | 66                                    | 455                                      | 6             |
| H06                         | extra hard   | 76                    | 88  | 525                   | 605 | 73                                    | 505                                      | 5             |
| H08                         | spring       | 84                    | 94  | 580                   | 650 | 81                                    | 560                                      | 3             |
| H10                         | extra spring | 92                    | ... | 635                   | ... | 87                                    | 600                                      | ...           |
| Copper Alloy UNS NO. C42520 |              |                       |     |                       |     |                                       |  |               |

**TABLE 2** *Continued*

| Temper Designation          |              | Tensile Strength, ksi |     | Tensile Strength, MPa |     | Yield Strength<br>(0.2 % Offset), ksi | Yield Strength<br>(0.2 % Offset),<br>MPa | Elongation, % |
|-----------------------------|--------------|-----------------------|-----|-----------------------|-----|---------------------------------------|--|---------------|
| Standard                    | Former       | min                   | max | min                   | max | min                                   | min                                      | min           |
| H02                         | ½ hard       | 67                    | 82  | 460                   | 565 | 60                                    | 415                                      | 20            |
| H04                         | hard         | 80                    | 95  | 550                   | 655 | 75                                    | 515                                      | 8             |
| H06                         | extra hard   | 90                    | 105 | 620                   | 725 | 85                                    | 585                                      | 6             |
| H08                         | spring       | 95                    | 110 | 655                   | 760 | 90                                    | 620                                      | 4             |
| H10                         | extra spring | 100                   | 115 | 690                   | 795 | 95                                    | 655                                      | 3             |
| Copper Alloy UNS NO. C42600 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 72                    | 87  | 495                   | 600 | 65                                    | 450                                      | 12            |
| H04                         | hard         | 85                    | 100 | 585                   | 690 | 80                                    | 550                                      | 8             |
| H06                         | extra hard   | 97                    | 112 | 670                   | 770 | 92                                    | 635                                      | 6             |
| H08                         | spring       | 108                   | 123 | 745                   | 850 | 103                                   | 710                                      | 3             |
| H10                         | extra spring | 114                   | 128 | 785                   | 885 | 110                                   | 760                                      | 1             |
| Copper Alloy UNS NO. C50580 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 56                    | 71  | 385                   | 490 | 51                                    | 350                                      | 15            |
| H04                         | hard         | 69                    | 84  | 475                   | 580 | 66                                    | 455                                      | 8             |
| H06                         | extra hard   | 74                    | 89  | 510                   | 615 | 71                                    | 490                                      | 6             |
| H08                         | spring       | 79                    | 94  | 545                   | 650 | 77                                    | 530                                      | 5             |
| Copper Alloy UNS NO. C50780 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 58                    | 74  | 400                   | 510 | 43                                    | 295                                      | 15            |
| H04                         | hard         | 75                    | 88  | 515                   | 605 | 65                                    | 450                                      | 8             |
| H06                         | extra hard   | 83                    | 97  | 570                   | 670 | 76                                    | 525                                      | 5             |
| H08                         | spring       | 86                    | 100 | 595                   | 690 | 81                                    | 560                                      | 3             |
| Copper Alloy UNS NO. C51000 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 46                    | 56  | 315                   | 385 | 19                                    | 130                                      | 48            |
| H01                         | ¼ hard       | 49                    | 61  | 340                   | 420 | 22                                    | 150                                      | 32            |
| H02                         | ½ hard       | 58                    | 73  | 400                   | 505 | 47                                    | 325                                      | 10            |
| H03                         | ¾ hard       | 68                    | 79  | 470                   | 545 | 61                                    | 420                                      | 10            |
| H04                         | hard         | 76                    | 91  | 525                   | 625 | 74                                    | 510                                      | 9             |
| H06                         | extra hard   | 88                    | 103 | 605                   | 710 | 85                                    | 585                                      | 2             |
| H08                         | spring       | 95                    | 110 | 655                   | 760 | 92                                    | 635                                      | 1             |
| H10                         | extra spring | 100                   | 114 | 690                   | 785 | 98                                    | 675                                      | 1             |
| Copper Alloy UNS NO. C51080 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 87                    | 102 | 600                   | 705 | 83                                    | 670                                      | 8             |
| H04                         | hard         | 100                   | 115 | 690                   | 795 | 96                                    | 660                                      | 6             |
| H06                         | extra hard   | 105                   | 120 | 725                   | 825 | 101                                   | 695                                      | 4             |
| H08                         | spring       | 110                   | 125 | 760                   | 860 | 107                                   | 740                                      | 1             |
| Copper Alloy UNS NO. C51100 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 46                    | 54  | 315                   | 370 | 16                                    | 110                                      | 45            |
| H01                         | ¼ hard       | 46                    | 58  | 315                   | 400 | 20                                    | 140                                      | 25            |
| H02                         | ½ hard       | 55                    | 70  | 380                   | 485 | 42                                    | 290                                      | 12            |
| H03                         | ¾ hard       | 67                    | 82  | 460                   | 565 | 64                                    | 440                                      | 6             |
| H04                         | hard         | 72                    | 87  | 495                   | 600 | 70                                    | 485                                      | 2             |
| H06                         | extra hard   | 84                    | 99  | 580                   | 685 | 81                                    | 560                                      | 1             |
| H08                         | spring       | 91                    | 105 | 625                   | 725 | 88                                    | 605                                      | 1             |
| H10                         | extra spring | 96                    | 109 | 660                   | 750 | 92                                    | 635                                      | 1             |
| Copper Alloy UNS NO. C51180 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 83                    | 98  | 570                   | 675 | 78                                    | 540                                      | 15            |
| H04                         | hard         | 97                    | 112 | 670                   | 770 | 93                                    | 640                                      | 8             |
| H06                         | extra hard   | 102                   | 117 | 705                   | 805 | 98                                    | 675                                      | 5             |
| H08                         | spring       | 105                   | 120 | 725                   | 825 | 103                                   | 710                                      | 2             |
| Copper Alloy UNS NO. C51980 |              |                       |     |                       |     |                                       |  |               |
| H02                         | ½ hard       | 90                    | 105 | 620                   | 725 | 86                                    | 595                                      | 18            |
| H04                         | hard         | 103                   | 118 | 710                   | 815 | 99                                    | 685                                      | 10            |
| H06                         | extra hard   | 109                   | 124 | 750                   | 855 | 105                                   | 725                                      | 6             |
| H08                         | spring       | 115                   | 130 | 795                   | 895 | 112                                   | 770                                      | 2             |
| Copper Alloy UNS NO. C52100 |              |                       |     |                       |     |                                       |  |               |
| O61                         | annealed     | 56                    | 65  | 385                   | 450 | 23                                    | 160                                      | 60            |
| H01                         | ¼ hard       | 63                    | 75  | 435                   | 515 | 35                                    | 240                                      | 40            |
| H02                         | ½ hard       | 69                    | 84  | 475                   | 580 | 51                                    | 350                                      | 25            |
| H03                         | ¾ hard       | 80                    | 92  | 550                   | 635 | 70                                    | 485                                      | 18            |
| H04                         | hard         | 85                    | 100 | 585                   | 690 | 78                                    | 540                                      | 12            |
| H06                         | extra hard   | 97                    | 112 | 670                   | 770 | 92                                    | 635                                      | 10            |

**TABLE 2** *Continued*

| Temper Designation                             |              | Tensile Strength, ksi |     | Tensile Strength, MPa |      | Yield Strength<br>(0.2 % Offset), ksi | Yield Strength<br>(0.2 % Offset),<br>MPa | Elongation, % |
|--|--------------|-----------------------|-----|-----------------------|------|---------------------------------------|--|---------------|
| Standard                                       | Former       | min                   | max | min                   | max  | min                                   | min                                      | min           |
| H08  | spring       | 105                   | 119 | 725                   | 820  | 100                                   | 690                                      | 3             |
| H10  | extra spring | 110                   | 122 | 760                   | 840  | 105                                   | 725                                      | 2             |
| Copper Alloy UNS NO. C52180                    |              |                       |     |                       |      |                                       |  |               |
| H02  | ½ hard       | 95                    | 110 | 655                   | 760  | 90                                    | 620                                      | 20            |
| H04  | hard         | 107                   | 122 | 740                   | 840  | 105                                   | 725                                      | 10            |
| H06  | extra hard   | 112                   | 128 | 770                   | 885  | 108                                   | 745                                      | 6             |
| H08  | spring       | 120                   | 140 | 825                   | 965  | 118                                   | 815                                      | 2             |
| H10  | extra spring | 125                   | 145 | 860                   | 1000 | 120                                   | 825                                      | 2             |
| Copper Alloy UNS NO. C52480                    |              |                       |     |                       |      |                                       |  |               |
| H02  | ½ hard       | 102                   | 118 | 705                   | 815  | 96                                    | 660                                      | 15            |
| H04  | hard         | 114                   | 128 | 785                   | 885  | 112                                   | 770                                      | 6             |
| H06  | extra hard   | 120                   | 136 | 825                   | 940  | 118                                   | 815                                      | 4             |
| H08  | spring       | 130                   | 150 | 895                   | 1035 | 127                                   | 875                                      | 2             |
| H10  | extra spring | 136                   | 156 | 940                   | 1075 | 135                                   | 930                                      | 1             |
| Copper Alloy UNS NO. C63800                    |              |                       |     |                       |      |                                       |  |               |
| O61  | annealed     | 77                    | 87  | 530                   | 600  | 45                                    | 310                                      | 27            |
| H01  | ¼ hard       | 90                    | 102 | 620                   | 705  | 75                                    | 515                                      | 12            |
| H02  | ½ hard       | 100                   | 112 | 690                   | 770  | 87                                    | 600                                      | 7             |
| H03  | ¾ hard       | 105                   | 117 | 725                   | 805  | 93                                    | 640                                      | 5             |
| H04  | hard         | 114                   | 126 | 785                   | 870  | 102                                   | 705                                      | 3             |
| H06  | extra hard   | 118                   | 130 | 815                   | 895  | 106                                   | 730                                      | 2             |
| H08  | spring       | 123                   | 134 | 850                   | 925  | 111                                   | 765                                      | 2             |
| H10  | extra spring | 130                   | ... | ...                   | ...  | 119                                   | 820                                      | ...           |
| Copper Alloy UNS NO. C65400                    |              |                       |     |                       |      |                                       |  |               |
| H01  | ¼ hard       | 75                    | 90  | 515                   | 620  | 45                                    | 310                                      | 21            |
| H02  | ½ hard       | 86                    | 101 | 595                   | 695  | 66                                    | 455                                      | 11            |
| H03  | ¾ hard       | 97                    | 112 | 670                   | 770  | 82                                    | 565                                      | 6             |
| H04  | hard         | 108                   | 120 | 745                   | 825  | 94                                    | 650                                      | 3             |
| H06  | extra hard   | 116                   | 126 | 800                   | 870  | 102                                   | 705                                      | 2             |
| H08  | spring       | 124                   | 133 | 855                   | 915  | 112                                   | 770                                      | 2             |
| H10  | extra spring | 131                   | 140 | 905                   | 965  | 118                                   | 815                                      | 1             |
| Copper Alloy UNS NO. C68800                    |              |                       |     |                       |      |                                       |  |               |
| O61  | annealed     | 77                    | 87  | 530                   | 600  | 44                                    | 305                                      | 30            |
| H01  | ¼ hard       | 87                    | 101 | 600                   | 695  | 63                                    | 435                                      | 10            |
| H02  | ½ hard       | 97                    | 112 | 670                   | 770  | 82                                    | 565                                      | 3             |
| H04  | hard         | 106                   | 120 | 730                   | 825  | 95                                    | 655                                      | 2             |
| H06  | extra hard   | 113                   | 127 | 780                   | 875  | 102                                   | 705                                      | 2             |
| H08  | spring       | 123                   | 133 | 850                   | 915  | 111                                   | 765                                      | 1             |
| H10  | extra spring | 130                   | ... | 895                   | ...  | 117                                   | 805                                      | 1             |
| Copper Alloy UNS NO. C70250                    |              |                       |     |                       |      |                                       |  |               |
| TM00   | AM           | 90                    | 110 | 620                   | 760  | 65                                    | 450                                      | 10            |
| TM02   | ½ HM         | 95                    | 120 | 655                   | 825  | 83                                    | 585                                      | 7             |
| TM03   | ¾ HM         | 100                   | 125 | 690                   | 860  | 95                                    | 655                                      | 5             |
| Copper Alloy UNS NO. C70260 and UNS NO. C70265 |              |                       |     |                       |      |                                       |  |               |
| TM00   | AM           | 80                    | 100 | 550                   | 690  | 65                                    | 450                                      | 10            |
| TM01   | ¼ HM         | 90                    | 105 | 620                   | 720  | 75                                    | 515                                      | 6             |
| TM02   | ½ HM         | 90                    | 110 | 620                   | 760  | 85                                    | 585                                      | 4             |
| TM03   | ¾ HM         | 105                   | 120 | 720                   | 825  | 95                                    | 655                                      | 2             |
| TM04   | HM           | 110                   | 125 | 760                   | 860  | 100                                   | 685                                      | 1             |
| Copper Alloy UNS NO. C75200                    |              |                       |     |                       |      |                                       |  |               |
| O61  | annealed     | 53                    | 63  | 365                   | 435  | 18                                    | 125                                      | 29            |
| H01  | ¼ hard       | 58                    | 72  | 400                   | 495  | 26                                    | 180                                      | 14            |
| H02  | ½ hard       | 66                    | 80  | 455                   | 550  | 48                                    | 330                                      | 6             |
| H03  | ¾ hard       | 74                    | 86  | 510                   | 595  | 69                                    | 475                                      | 4             |
| H04  | hard         | 78                    | 91  | 540                   | 625  | 75                                    | 515                                      | 3             |
| H06  | extra hard   | 86                    | 98  | 595                   | 675  | 85                                    | 585                                      | 3             |
| H08  | spring       | 90                    | 101 | 620                   | 695  | 88                                    | 605                                      | 1             |
| H10  | extra spring | 96                    | ... | 660                   | ...  | 95                                    | 655                                      | 1             |
| Copper Alloy UNS NO. C76200                    |              |                       |     |                       |      |                                       |  |               |
| O61  | annealed     | 57                    | 75  | 395                   | 515  | 21                                    | 145                                      | 32            |
| H01  | ¼ hard       | 65                    | 81  | 450                   | 560  | 36                                    | 250                                      | 20            |



**TABLE 2** *Continued*

| Temper Designation |              | Tensile Strength, ksi |     | Tensile Strength, MPa |     | Yield Strength<br>(0.2 % Offset), ksi | Yield Strength<br>(0.2 % Offset),<br>MPa | Elongation, % |
|--------------------|--------------|-----------------------|-----|-----------------------|-----|---------------------------------------|--|---------------|
| Standard           | Former       | min                   | max | min                   | max | min                                   | min                                      | min           |
| H02                | ½ hard       | 75                    | 91  | 515                   | 625 | 58                                    | 400                                      | 6             |
| H03                | ¾ hard       | 83                    | 98  | 570                   | 675 | 73                                    | 505                                      | 4             |
| H04                | hard         | 90                    | 105 | 620                   | 725 | 82                                    | 565                                      | 3             |
| H06                | extra hard   | 101                   | 114 | 695                   | 785 | 93                                    | 640                                      | 1             |
| H08                | spring       | 109                   | 122 | 750                   | 840 | 101                                   | 695                                      | 1             |
| H10                | extra spring | 114                   | ... | 785                   | ... | 102                                   | 705                                      | 1             |

99.7 % minimum, and UNS C51000, C51100, C52100, C19010, C70260, C70265, C75200, and C76200, which shall be 99.5 % minimum.

## 9. Temper

9.1 Tempers, as defined in Classification B 601, available under this specification are as follows:

*Temper Designation<sup>6</sup>*

| <i>Standard</i> | <i>Former</i> |
|-----------------|---------------|
| O61             | annealed      |
| H01             | ¼ hard        |
| H02             | ½ hard        |
| H03             | ¾ hard        |
| H04             | hard          |
| H06             | extra hard    |
| H08             | spring        |
| H10             | extra spring  |
| TM00            | AM            |
| TM01            | ¼ HM          |
| TM02            | ½ HM          |
| TM03            | ¾ HM          |
| TM04            | HM            |
| TM06            | XHM           |
| TM08            | SHM           |

9.2 *Rolled (H) Material*—The standard tempers of rolled products are as designated in Table 2 with the prefix “H.” Former designations and the standard designations as defined in Classification B 601 are shown.

9.3 *Mill Hardened (TM) Material*—The standard tempers of mill hardened products are as designated in Table 2 with the prefix “TM.” Former designations and the standard designations as defined in Classification B 601 are shown.

NOTE 1—The properties for product in special or nonstandard tempers are subject to negotiation between the manufacturer and the purchaser.

## 10. Mechanical Property Requirements

10.1 Product ordered to this specification shall conform to the requirements prescribed in Table 2 for the alloy and temper specified in the contract or purchase order.

10.1.1 The ultimate tensile strength, 0.2 % offset minimum yield strength, and the minimum elongation properties shall be the basis for acceptance or rejection when tested in accordance with Test Methods E 8 or E 8M.

10.1.1.1 Product ordered to this specification in inch-pound units shall be tested in accordance with Test Methods E 8 and shall conform to tensile strength, 0.2 % offset minimum yield strength, and minimum elongation requirements prescribed in ksi units in Table 2.

10.1.1.2 Product ordered to this specification in SI units shall be tested in accordance with Test Methods E 8M and shall conform to tensile strength, 0.2 % offset minimum yield strength, and minimum elongation requirements prescribed in MPa units in Table 2.

## 11. Dimensions, Mass, and Permissible Variations

11.1 The dimensions and tolerances for product under this specification shall be as prescribed in Specifications B 248 or B 248M, with particular reference to Section 5 and the following tables of those specifications:

11.1.1 *Thickness*—see Paragraph 5.2 and Table 1.

11.1.2 *Width*:

11.1.2.1 *Slit Metal and Slit Metal with Rolled Edges*—see Paragraph 5.3 and Table 4.

11.1.2.2 *Square Sheared Metal*—see Paragraph 5.3 and Table 5.

11.1.2.3 *Sawed Metal*—see Paragraph 5.3 and Table 6.

11.1.3 *Length*:

11.1.3.1 *Specific and Stock Lengths with and without Ends*—see Paragraph 5.4 and Table 7.

11.1.3.2 *Schedule of Lengths (Specific and Stock) with Ends*—see Paragraph 5.4 and Table 8.

11.1.3.3 *Length Tolerances for Squared Sheared Metal*—see Paragraph 5.4 and Table 9.

11.1.3.4 *Length Tolerances for Sawed Metal*—see Paragraph 5.4 and Table 10.

11.1.4 *Straightness*:

11.1.4.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled*—see Paragraph 5.5 and Table 11.

11.1.4.2 *Square Sheared Metal*—see Paragraph 5.5 and Table 12.

11.1.4.3 *Sawed Metal*—see Paragraph 5.5 and Table 13.

## 12. Workmanship, Finish and Appearance

12.1 The product shall be free of defects, well cleaned, and free of dirt. A superficial film of residual light lubricant is normally present and is acceptable unless otherwise specified. The surface finish and appearance of the material shall be as prescribed in Specification B 248 unless otherwise specified.

<sup>6</sup> All tempers are subject to product limitations, and the manufacturer should be consulted.



### 13. Sampling

13.1 The lot size, portion size, and selection of sample pieces shall be as prescribed in the sampling section of Specification B 248 or B 248M.

### 14. Specimen Preparation

14.1 The specimen preparation procedure to be used for the products covered by this specification shall be as prescribed in the specimen preparation section of Specification B 248 or B 248M.

### 15. Test Methods

15.1 Test methods used for quality control or production control, or both, for determining conformance to product property requirements are discretionary.

15.1.1 Test methods used to obtain data for the preparation of certification or test report shall be made available to the purchaser on request.

15.2 *Chemical Analysis*—In case of disagreement, the test method to be followed for a specific element and range or maximum concentration shall be as indicated in Table 3 for alloys listed in Table 1.

15.2.1 The determination of magnesium and zirconium, for which no recognized test method is known to be published, shall be subject to agreement between the manufacturer or supplier and the purchaser.

15.3 *Tensile Strength*—The tensile strength must be determined in accordance with Test Methods E 8.

15.4 *Yield Strength*—The yield strength shall be determined in accordance with Test Methods E 8.

15.5 *Elongation*—The elongation shall be determined in accordance with Test Methods E 8.

### 16. Number of Tests and Retests

16.1 The number of tests and retests procedure to be used for the products covered by this specification shall be as prescribed in the Number of Tests and Retests section of Specification B 248 or B 248M.

### 17. Significance of Numerical Limits

17.1 For significance of numerical limits, refer to Specification B 248 or B 248M.

**TABLE 3 Chemical Test Methods**

| Element        | Range or max % | Test Method                         |
|----------------|----------------|-------------------------------------|
| Aluminum (Al)  | 0.0-12.0       | E 54                                |
|                | 2.0-12.0       | E 478                               |
| Chromium (Cr)  | 0.003-2.0      | ISO 4744                            |
| Cobalt (Co)    | 0.5            | E 75                                |
| Copper (Cu)    | 50-99.99       | E 478                               |
| Iron (Fe)      | 0.003-1.25     | E 478                               |
| Lead (Pb)      | 0.002-15.0     | E 478 Atomic Absorption             |
| Magnesium (Mg) | 0.01-2.0       | ...                                 |
| Manganese (Mn) | 6.0            | E 62                                |
| Nickel (Ni)    | 50.0           | E 478                               |
| Phosphorus (P) | 1.2            | E 62                                |
| Silicon (Si)   | 5.0            | E 54                                |
| Silver (Ag)    | 0.01-0.12      | E 478                               |
| Tellurium (Te) | 0.003-0.05     | ISO 7602 Part I E/F (ISO/TC26 N692) |
| Tin (Sn)       | 0.01-1.0       | E 478 Photometric                   |
|                | 0.5-20.0       | E 478 Titrimetric                   |
| Zinc (Zn)      | 2-40           | E 478 Titrimetric                   |
| Zirconium (Zr) | 0.01-0.30      | ...                                 |

### 18. Inspection

18.1 The manufacturer or supplier shall inspect and make tests necessary to verify that the product furnished conforms to the requirements specified for the product.

### 19. Rejection and Rehearing

#### 19.1 *Rejection:*

19.1.1 Product that fails to conform to the requirements of the product specification may be rejected.

19.1.2 The rejection shall be reported to the manufacturer or the supplier, promptly and in writing.

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

#### 19.2 *Rehearing:*

19.2.1 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 specification.

### 20. Certification

20.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

### 21. Mill Test Report

21.1 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.

### 22. Packaging and Package Marking

22.1 *Packaging*—The material shall be separated by size, composition, and temper and prepared for shipment in such manner as to ensure acceptance by common carrier for transportation and afford protection from normal hazards of transportation.

22.2 *Package Marking*—Each shipping unit shall be legibly marked with the purchase order number, specification number, alloy designation, temper, gross and net weight, and name of supplier.

22.3 Product shall be supplied in coils wound in traverse or pancake style as specified in the purchase order or contract.

22.3.1 Product supplied in coils wound in pancake style shall be with or without interleaf paper as required by the purchaser.

### 23. Keywords

23.1 coefficient of thermal expansion; density; electrical conductivity; electrical connectors; electrical resistivity; elongation; modulus of elasticity; spring contacts; thermal conductivity; yield strength; UNS No. C14530; UNS No. C15100;

UNS No. C15500; UNS No. C17000; UNS No. C17200; UNS No. C17400; UNS No. C17410; UNS No. C17500; UNS No. C17510; UNS No. C19010; UNS No. C19025; UNS No. C19210; UNS No. C19400; UNS No. C19500; UNS No. C19700; UNS No. C23000; UNS No. C26000; UNS No. C40810; UNS No. C40850; UNS No. C40860; UNS No. C42200; UNS No. C42500; UNS No. C42520; UNS No. C42600; UNS No. C50580; UNS No. C50780; UNS No. C51000; UNS No. C51080; UNS No. C51100; UNS No. C51180; UNS No. C51980; UNS No. C52100; UNS No. C52180; UNS No. C52480; UNS No. C63800; UNS No. C65400; UNS No. C68800; UNS No. C70250; UNS No. C70260; UNS No. C70265; UNS No. C72650; UNS No. C72700; UNS No. C72900; UNS No. C75200; UNS No. C76200

## APPENDIX

### (Nonmandatory Information)

#### X1. Preferred Physical and Electrical Properties

##### X1.1 Physical Properties:

X1.1.1 Unless specified in the purchase order or contract, the modulus of elasticity, density, electrical conductivity,

thermal conductivity, coefficient of thermal expansion, and the electrical resistivity data in Table X1.1 do not constitute a part

**TABLE X1.1 Preferred Physical Properties**

| Copper Alloy<br>UNS No. | Density                         |                              | Modulus of Elasticity |     | Electrical<br>Conductivity        | Electrical Resistivity $\zeta$<br>(max) <sup>A</sup> |                               | Thermal Conductivity   |                  | Coefficient of Thermal<br>Expansion               |  |
|-------------------------|---------------------------------|------------------------------|-----------------------|-----|-----------------------------------|--|-------------------------------|------------------------|------------------|---|--|
|                         | lbs/in. <sup>3</sup><br>at 68°F | g/cm <sup>3</sup><br>at 20°C | 10 <sup>6</sup> psi   | GPa | % IACS (min)<br>at 68°F<br>(20°C) | Ω·lb/mile <sup>2</sup> at<br>68°F                    | Ω·g/m <sup>2</sup> at<br>20°C | BTU/ft·h° F at<br>68°F | W/m·k at<br>20°C | in./in./°F ×<br>10 <sup>-6</sup> from<br>68-572°F | m/m°C ×<br>10 <sup>-6</sup> from<br>20-300°C |
| C14530                  | 0.323                           | 8.94                         | 17                    | 115 | 94                                | 931.06   | 0.163 06                      | 210                    | 363              | 9.8   | 17.6   |
| C15100                  | 0.323                           | 8.94                         | 17                    | 115 | 95                                | 921.26   | 0.161 35                      | 208                    | 360              | 9.8   | 17.6   |
| C15500                  | 0.322                           | 8.91                         | 17                    | 115 | 86                                | 1 017.67   | 0.178 23                      | 200                    | 346              | 9.9   | 17.8   |
| C19010                  | 0.322                           | 8.91                         | 19                    | 130 | 60                                | 1 458.67   | 0.255 47                      | 150                    | 260              | 9.8   | 17.6   |
| C19025                  | 0.322                           | 8.91                         | 17                    | 115 | 40                                | 2 188.00   | 0.383 20                      | 93                     | 161              | 9.4   | 16.9   |
| C19210                  | 0.322                           | 8.91                         | 17                    | 115 | 80                                | 1 094.00   | 0.191 60                      | 185                    | 320              | 9.8   | 17.6   |
| C19400                  | 0.322                           | 8.91                         | 17                    | 115 | 60                                | 1 458.67   | 0.255 47                      | 150                    | 260              | 9.8   | 17.6   |
| C19500                  | 0.322                           | 8.91                         | 17                    | 115 | 50                                | 1 750.40   | 0.306 56                      | 115                    | 199              | 9.4   | 16.9   |
| C19700                  | 0.319                           | 8.83                         | 17                    | 115 | 80                                | 1 094.00   | 0.191 60                      | 185                    | 320              | 9.6   | 17.3   |
| C23000                  | 0.316                           | 8.75                         | 17                    | 115 | 37                                | 2 365.41   | 0.414 27                      | 92                     | 159              | 10.4  | 18.7   |
| C26000                  | 0.308                           | 8.53                         | 16                    | 110 | 28                                | 3 125.71   | 0.547 43                      | 70                     | 121              | 11.1  | 20.0   |
| C40810                  | 0.320                           | 8.86                         | 17                    | 115 | 33                                | 2 652.12   | 0.464 48                      | 82                     | 142              | 10.1  | 18.2   |
| C40850                  | 0.320                           | 8.86                         | 17                    | 115 | 30                                | 2 917.33   | 0.510 93                      | 75                     | 130              | 10.1  | 18.2   |
| C40860                  | 0.320                           | 8.86                         | 17                    | 115 | 32                                | 2 735.00   | 0.479 00                      | 80                     | 138              | 10.1  | 18.2   |
| C42200                  | 0.318                           | 8.80                         | 16                    | 110 | 31                                | 2 823.23   | 0.494 45                      | 75                     | 130              | 10.2  | 18.4   |
| C42500                  | 0.317                           | 8.77                         | 16                    | 110 | 28                                | 3 125.71   | 0.547 43                      | 69                     | 119              | 10.2  | 18.4   |
| C42520                  | 0.318                           | 8.80                         | 16                    | 110 | 30                                | 2 917.33   | 0.510 93                      | 75                     | 130              | 10.2  | 18.4   |
| C42600                  | 0.318                           | 8.80                         | 17                    | 115 | 25                                | 3 500.80   | 0.613 12                      | 63                     | 113              | 10.2  | 18.4   |
| C50580                  | 0.321                           | 8.89                         | 17                    | 115 | 41                                | 2 134.63   | 0.372 85                      | 103                    | 178              | 9.9   | 17.8   |
| C50780                  | 0.320                           | 8.86                         | 17                    | 115 | 35                                | 2 500.57   | 0.437 94                      | 87                     | 151              | 9.9   | 17.8   |
| C51000                  | 0.320                           | 8.86                         | 16                    | 110 | 15                                | 5 834.67   | 1.021 87                      | 40                     | 69               | 9.9   | 17.8   |
| C51080                  | 0.320                           | 8.86                         | 16                    | 110 | 15                                | 5 834.67   | 1.021 87                      | 40                     | 69               | 9.9   | 17.8   |
| C51100                  | 0.320                           | 8.86                         | 16                    | 110 | 20                                | 4 376.00   | 0.766 40                      | 48                     | 83               | 9.9   | 17.8   |
| C51180                  | 0.321                           | 8.89                         | 16                    | 110 | 20                                | 4 376.00   | 0.766 40                      | 52                     | 90               | 9.9   | 17.8   |
| C51980                  | 0.319                           | 8.83                         | 16                    | 110 | 14                                | 6 251.42   | 1.094 87                      | 38                     | 66               | 10.0  | 18.0   |
| C52100                  | 0.318                           | 8.80                         | 16                    | 110 | 13                                | 6 732.31   | 1.179 08                      | 36                     | 62               | 10.1  | 18.2   |
| C52180                  | 0.318                           | 8.80                         | 16                    | 110 | 13                                | 6 732.31   | 1.179 08                      | 36                     | 62               | 10.1  | 18.2   |
| C52480                  | 0.317                           | 8.77                         | 16                    | 110 | 11                                | 7 683.63   | 1.393 45                      | 29                     | 50               | 10.2  | 18.4   |
| C63800                  | 0.299                           | 8.28                         | 17                    | 115 | 10                                | 8 752.00   | 1.532 80                      | 22                     | 38               | 9.5   | 17.1   |
| C65400                  | 0.309                           | 8.55                         | 17                    | 115 | 7                                 | 12 502.86  | 2.189 71                      | 21                     | 36               | 9.7   | 17.5   |
| C68800                  | 0.296                           | 8.19                         | 17                    | 115 | 18                                | 4 862.22   | 0.851 56                      | 47                     | 81               | 10.1  | 18.2   |
| C70250                  | 0.318                           | 8.80                         | 19                    | 130 | 40                                | 2 188.00   | 0.383 20                      | 98                     | 170              | 9.8   | 17.6   |
| C70260                  | 0.320                           | 8.86                         | 19                    | 130 | 40                                | 2 188.00   | 0.383 20                      | 90                     | 156              | 10.0  | 18.0   |
| C70265                  | 0.320                           | 8.86                         | 19                    | 130 | 35                                | 2 500.57   | 0.437 94                      | 87                     | 151              | 10.0  | 18.0   |
| C75200                  | 0.316                           | 8.75                         | 18                    | 125 | 6                                 | 14 586.67  | 2.554 67                      | 19                     | 33               | 9.0   | 16.2   |
| C76200                  | 0.310                           | 8.58                         | 18                    | 125 | 9                                 | 9 724.44   | 1.703 11                      | 24                     | 42               | 9.0   | 16.2   |

<sup>A</sup> The weight resistivity values in the table are calculated from the corresponding electrical conductivity per Test Method B 193 as follows:  
 $R = 1/N (15.328)$ , where  $R =$  wt. resistivity at 20°C in ohms × grams per square metre ( $\Omega$ -g/m<sup>2</sup>) and  $N =$  electrical conductivity in % IACS.

of this specification. They will indicate to the purchaser the mechanical and physical properties that may be expected.

X1.1.2 Formability property of material usually determines if a spring material is capable of forming to a given radius. Bend test per Test Method B 820 will provide useful information as to the formability or the ability of copper alloy spring material to resist cracking when formed. This test method may be used in selecting a spring material that will safely form to the geometry of a given part.

#### X1.2 *Electrical Properties:*

X1.2.1 The value of  $0.153\ 28\ \Omega\cdot\text{g}/\text{m}^2$  at  $20^\circ\text{C}$  ( $68^\circ\text{F}$ ) is the international standard for the resistivity of annealed copper equal to 100 % conductivity. The term means that a wire 1 m in length and weighing 1 g would have a resistance of  $0.153\ 28\ \Omega$ . This is equivalent to a resistivity value of  $875.20\ \Omega\cdot\text{lb}/\text{mile}^2$ , which signifies the resistance of a wire 1 mile in length weighing 1 lb. The electrical resistivity (weight) values in Table X1.1 are calculated from the corresponding electrical conductivity per Specification B 193 as follows:

$$R = 1/N (15.328)\ \Omega\cdot\text{g}/\text{m}^2 = 1/N (875\ 20)\ \Omega\cdot\text{lb}/\text{mile}^2 \quad (\text{X1.1})$$

where:

$R$  = wt. resistivity at  $20^\circ\text{C}$  in Ohms  $\times$  grams per square metre or wt. resistivity at  $68^\circ\text{F}$  in Ohms  $\times$  pounds per square mile and

$N$  = electrical conductivity in % IACS.

#### X1.3 *Metric Equivalent:*

X1.3.1 The SI unit for strength properties now shown is in accordance with the International Systems of Units (SI). The derived SI unit for force is the Newton (N), which is defined as that force which when applied to a body having a mass of 1 kg gives it an acceleration of  $1\ \text{m}/\text{s}^2$  ( $\text{N} = \text{kg} \times \text{m}/\text{s}^2$ ). The derived SI unit for pressure or stress is the Newton per square meter ( $\text{N}/\text{m}^2$ ), which has been named the Pascal (Pa) by the General Conference on Weights and Measures. Since  $1\ \text{ksi} = 6\ 894\ 757\ \text{Pa}$ , the metric equivalents are expressed as megapascal (MPa), which is the same as  $\text{MN}/\text{m}^2$  and  $\text{N}/\text{mm}^2$ .

## SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B 888 – 03) that may impact the use of this standard (approved May 1, 2004.)

(I) Added new alloys UNS Nos. C19010, C19210, C70265, and tempers of C70260.

Committee B05 has identified the location of selected changes to this standard since the last issue (B 888 – 98) that may impact the use of this standard (approved Apr. 10, 2003).

(I) Added new alloys UNS No. C19025, C40810, C40850, C42600, C50580, C50780, C51080, C51180, C51980, C52180, and C52480.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*