



Designation: ~~B3–13~~ B3 – 13 (Reapproved 2018)

Standard Specification for Soft or Annealed Copper Wire¹

This standard is issued under the fixed designation B3; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

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

1. Scope

1.1 This specification covers drawn and annealed or soft round bare copper wire for electrical purposes (see Explanatory **Note 1**).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.2.1 *Exception*—For density, resistivity and temperature, the values stated in SI units are to be regarded as standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents of the issue in effect at the time of reference form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:²

B49 Specification for Copper Rod for Electrical Purposes

B193 Test Method for Resistivity of Electrical Conductor Materials

B258 Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors

2.3 *Other Standards*:

NBS Handbook 100 **Copper—Copper Wire Tables**³

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

3.1.1 Quantity of each size,

3.1.2 Wire size: diameter in inches (see **5.3** and **Table 1**),

3.1.3 Type of copper, if special (Section **4**),

3.1.4 Package size (see **10.1**),

3.1.5 Special package marking, if required, and

3.1.6 Place of inspection (see **7.1**).

4. Materials

4.1 The material shall be copper of such quality and purity that the finished product shall have the properties and characteristics prescribed in this specification.

¹ This specification is under the jurisdiction of ASTM Committee **B01** on Electrical Conductors and is the direct responsibility of Subcommittee **B01.04** on Conductors of Copper and Copper Alloys.

Current edition approved Oct. 1, 2018. Published October 2018. Originally approved in 1912. Last previous edition approved in 2012 as **B3–12**:**B3–13**. DOI: 10.1520/B0003-13.10.1520/B0003-13R18.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

TABLE 1 Tensile Requirements

| Diameter | | | Area at 20°C | | Elongation in 10 in. (254 mm), % min |
|----------|--------|---------|------------------|-----------------|---|
| in. | mm | cmils | in. ² | mm ² | |
| Diameter | | | Area at 20°C | | Elongation in 10 in. (254 mm), % min |
| in. | mm | cmils | in. ² | mm ² | |
| 0.4600 | 11.684 | 211 600 | 0.1662 | 107.0 | 35 |
| 0.4096 | 10.404 | 167 800 | 0.1318 | 85.0 | 35 |
| 0.3648 | 9.266 | 133 100 | 0.1045 | 67.4 | 35 |
| 0.3249 | 8.252 | 105 600 | 0.08291 | 53.5 | 35 |
| 0.2893 | 7.348 | 83 690 | 0.06573 | 42.4 | 30 |
| 0.2576 | 6.543 | 66 360 | 0.05212 | 33.6 | 30 |
| 0.2294 | 5.827 | 52 620 | 0.04133 | 26.7 | 30 |
| 0.2043 | 5.189 | 41 740 | 0.03278 | 21.2 | 30 |
| 0.1819 | 4.620 | 33 090 | 0.02599 | 16.8 | 30 |
| 0.1620 | 4.115 | 26 240 | 0.02061 | 13.3 | 30 |
| 0.1443 | 3.665 | 20 820 | 0.01635 | 10.5 | 30 |
| 0.1285 | 3.264 | 16 510 | 0.01297 | 8.37 | 30 |
| 0.1144 | 2.906 | 13 090 | 0.01028 | 6.63 | 30 |
| 0.1019 | 2.588 | 10 380 | 0.008155 | 5.26 | 25 |
| 0.0907 | 2.304 | 8 230 | 0.00646 | 4.17 | 25 |
| 0.0808 | 2.052 | 6 530 | 0.00513 | 3.31 | 25 |
| 0.0720 | 1.829 | 5 180 | 0.00407 | 2.63 | 25 |
| 0.0641 | 1.628 | 4 110 | 0.00323 | 2.08 | 25 |
| 0.0571 | 1.450 | 3 260 | 0.00256 | 1.65 | 25 |
| 0.0508 | 1.290 | 2 580 | 0.00203 | 1.31 | 25 |
| 0.0453 | 1.151 | 2 050 | 0.00161 | 1.04 | 25 |
| 0.0403 | 1.024 | 1 620 | 0.00128 | 0.823 | 25 |
| 0.0359 | 0.912 | 1 290 | 0.00101 | 0.654 | 25 |
| 0.0320 | 0.813 | 1 020 | 0.000804 | 0.517 | 25 |
| 0.0285 | 0.724 | 812 | 0.000638 | 0.411 | 25 |
| 0.0253 | 0.643 | 640 | 0.000503 | 0.324 | 25 |
| 0.0226 | 0.574 | 511 | 0.000401 | 0.259 | 25 |
| 0.0201 | 0.511 | 404 | 0.000317 | 0.205 | 20 |
| 0.0179 | 0.455 | 320 | 0.000252 | 0.162 | 20 |
| 0.0159 | 0.404 | 253 | 0.000199 | 0.128 | 20 |
| 0.0142 | 0.361 | 202 | 0.000158 | 0.102 | 20 |
| 0.0126 | 0.320 | 159 | 0.000125 | 0.081 | 20 |
| 0.0113 | 0.287 | 128 | 0.000100 | 0.065 | 20 |
| 0.0100 | 0.254 | 100 | 0.0000785 | 0.051 | 15 |
| 0.0089 | 0.226 | 79.2 | 0.0000622 | 0.040 | 15 |
| 0.0080 | 0.203 | 64.0 | 0.0000503 | 0.032 | 15 |
| 0.0071 | 0.180 | 50.4 | 0.0000396 | 0.026 | 15 |
| 0.0063 | 0.160 | 39.7 | 0.0000312 | 0.020 | 15 |
| 0.0056 | 0.142 | 31.4 | 0.0000246 | 0.016 | 15 |
| 0.0050 | 0.127 | 25.0 | 0.0000196 | 0.013 | 15 |
| 0.0045 | 0.114 | 20.2 | 0.0000159 | 0.010 | 15 |
| 0.0040 | 0.102 | 16.0 | 0.0000126 | 0.0081 | 15 |
| 0.0035 | 0.089 | 12.2 | 0.00000962 | 0.0062 | 15 |
| 0.0031 | 0.079 | 9.61 | 0.00000755 | 0.0049 | 15 |

NOTE 1—Specification B49 defines copper suitable for use.

4.2 Copper bars of special qualities, forms, or types, as may be agreed upon between the manufacturer and the purchaser, and which will conform to the requirements prescribed in this specification may also be used.

5. General Requirements (see Section 8)

5.1 *Tensile Strength and Elongation*—The wire shall conform to the requirements for elongation prescribed in Table 1 (see Explanatory Note 2). No requirements for tensile strength are specified. For wire whose nominal diameter is more than 0.001 in. (0.025 mm) greater than a size listed in Table 1, but less than that of the next larger size, the requirements of the next larger size shall apply.

5.2 *Resistivity*—The electrical resistivity at 20°C shall not exceed 875.20 Ω·lb/mile² (0.15328 Ω·g/m²) (see Explanatory Note 5).

5.3 *Dimensions and Permissible Variations*—The wire sizes shall be expressed as the diameter of the wire in decimal fractions of an inch to the nearest 0.0001 in. (or 0.001 mm) (see Explanatory Note 3). For diameters under 0.0100 in. (0.254 mm), the wire shall not vary from the specified diameter by more than plus and minus 0.0001 in. (0.0025 mm), and for diameters of 0.0100 in. (0.254 mm) and over the wire shall not vary from the specified diameter by more than plus and minus 1 %, expressed to the nearest 0.0001 in. (or 0.001 mm).