



Designation: B 258 – 01

Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors¹

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

1. Scope

1.1 This specification prescribes standard nominal diameters and cross-sectional areas of American Wire Gage (AWG) sizes of solid round wires, used as electrical conductors, and gives equations and rules for the calculation of standard nominal mass and lengths, resistances, and breaking strengths of such wires (Explanatory Note 1).

1.2 The values stated in inch-pound or SI units are to be regarded separately as standard. Each system shall be used independently of the other. Combining values of the two systems may result in nonconformance with the specification. For conductor sizes designated by AWG or kcmil sizes, the requirements in SI units have been numerically converted from the corresponding values stated or derived, in inch-pound units. For conductor sizes designated by SI units only, the requirements are stated or derived in SI units.

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

2. Referenced Documents

2.1 ASTM Standards:

- A 111 Specification for Zinc-Coated (Galvanized) "Iron" Telephone and Telegraph Line Wire²
- A 326 Specification for Zinc-Coated (Galvanized) High Tensile Steel Telephone and Telegraph Line Wire³
- B 1 Specification for Hard-Drawn Copper Wire⁴
- B 2 Specification for Medium-Hard-Drawn Copper Wire⁴
- B 3 Specification for Soft or Annealed Copper Wire⁴
- B 9 Specification for Bronze Trolley Wire⁴
- B 33 Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes⁴
- B 47 Specification for Copper Trolley Wire⁴
- B 105 Specification for Hard-Drawn Copper Alloy Wires

- for Electrical Conductors⁴
- B 189 Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes⁴
- B 227 Specification for Hard-Drawn Copper-Clad Steel Wire⁴
- B 230/B 230M Specification for Aluminum 1350-H19 Wire for Electrical Purposes⁴
- B 314 Specification for Aluminum 1350 Wire for Communication Cable⁵
- B 396 Specification for Aluminum-Alloy 5005-H19 Wire for Electrical Purposes⁴
- B 398/B 398M Specification for Aluminum-Alloy 6201-T81 Wire for Electrical Purposes⁴
- B 415 Specification for Hard-Drawn Aluminum-Clad Steel Wire⁴
- B 609/B 609M Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes⁴
- B 800 Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes—Annealed and Intermediate Tempers⁴
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁶
- F 205 Test Method for Measuring Diameter of Fine Wire by Weighing⁷

3. Standard Reference Temperature

3.1 For the purpose of this specification, all wire dimensions and properties shall be considered as occurring at the internationally standardized reference temperature of 20°C (68°F).

4. Standard Rules for Rounding

4.1 All calculations for the standard nominal dimensions and properties of solid round wires shall be rounded in the *final* value only, in accordance with rounding method of Practice E 29.

¹ This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.02 on Methods of Test and Sampling Procedure.

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² Annual Book of ASTM Standards, Vol 01.06.

³ Discontinued, see 1990 Annual Book of ASTM Standards, Vol 01.06.

⁴ Annual Book of ASTM Standards, Vol 02.03.

⁵ Discontinued, see 1994 Annual Book of ASTM Standards, Vol 02.03.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ Annual Book of ASTM Standards, Vol 10.04.

5. Standard Nominal Diameters

5.1 Standard nominal diameters of AWG sizes of solid round wires shall be calculated in accordance with the conventional mathematical law of the American Wire Gage (see Explanatory Note 1) and in accordance with Section 4.

5.2 For wire sizes 4/0 to 44 AWG, inclusive, nominal diameters shall be expressed in no more than four significant figures but in no case closer than the nearest 0.1 mil (0.0001 in.).

5.3 For wire sizes 45 to 56 AWG, inclusive, nominal diameters shall be expressed to the nearest 0.01 mil (0.00001 in.).

5.4 The standard nominal diameters expressed in mils have been calculated in accordance with these rules and are given in Table 1 for convenient reference (Explanatory Note 2).

6. Standard Nominal Cross-Sectional Areas

6.1 Standard nominal cross-sectional areas in circular mils and square inches shall be calculated in accordance with the following equations and shall be rounded in accordance with Section 4 to the same number of significant figures as used in expressing the standard diameters, but in no case to less than three significant figures:

$$\text{Area, cmil} = d^2$$

$$\text{Area, in.}^2 = d^2 \times 0.7854 \times 10^{-6}$$

where:

d = diameter of the wire in mils as given in Table 1.

Standard nominal cross-sectional areas in circular mils and square inches have been calculated in accordance with the foregoing rules and are given in Table 1 for convenient reference.

7. Rules for Calculations Involving Mass and Length

7.1 Standard nominal mass and lengths shall be calculated from the standard wire diameters specified in Table 1, in accordance with the following equations. They shall be rounded in the *final* value only, in accordance with Section 4, to the same number of significant figures as used in expressing the standard diameters, but in no case to less than three significant figures:

$$W = d^2 \times \delta \times 0.34049 \times 10^{-3}$$

$$L = (1/d^2) \times (1/\delta) \times 2.9369 \times 10^6$$

where:

W = mass, lb/1000 ft,

d = diameter of the wire in mils as given in Table 1,

δ = density of the wire material at 20°C in g/cm³ as given in Table 2, and

L = length, ft/lb.

8. Rules for Calculations Involving Resistivity

8.1 Standard nominal resistances and other values derived from the resistivity units shall be calculated from the standard wire diameters specified in Table 1 in accordance with the following equations. All values so derived shall be rounded in

TABLE 1 Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires at 20°C

| Size AWG | Diameter | | Cross-Sectional Area | | | Size AWG | Diameter | | Cross-Sectional Area | | |
|-------------|----------|--------|----------------------|-----------------|-----------------|-------------|----------|--------|----------------------|-----------------|-----------------|
| | mils | mm | cmils | in ² | mm ² | | mils | mm | cmils | in ² | mm ² |
| 4/0 | 460.0 | 11.684 | 211 600 | 0.1662 | 107.2 | 29 | 11.3 | 0.287 | 128 | 0.000100 | 0.0647 |
| 3/0 | 409.6 | 10.404 | 167 800 | 0.1318 | 85.0 | 30 | 10.0 | 0.254 | 100 | 0.0000785 | 0.0507 |
| 2/0 | 364.8 | 9.26 | 133 100 | 0.1045 | 67.4 | 31 | 8.9 | 0.226 | 79.2 | 0.0000622 | 0.0401 |
| 1/0 | 324.9 | 8.25 | 105 600 | 0.08291 | 53.5 | 32 | 8.0 | 0.203 | 64.0 | 0.0000503 | 0.0324 |
| 1 | 289.3 | 7.35 | 83 690 | 0.06573 | 42.4 | 33 | 7.1 | 0.180 | 50.4 | 0.0000396 | 0.0255 |
| 2 | 257.6 | 6.54 | 66 360 | 0.05212 | 33.6 | 34 | 6.3 | 0.160 | 39.7 | 0.0000312 | 0.0201 |
| 3 | 229.4 | 5.82 | 52 620 | 0.04133 | 26.7 | 35 | 5.6 | 0.142 | 31.4 | 0.0000246 | 0.0159 |
| 4 | 204.3 | 5.19 | 41 740 | 0.03278 | 21.1 | 36 | 5.0 | 0.127 | 25.0 | 0.0000196 | 0.0127 |
| 5 | 181.9 | 4.62 | 33 090 | 0.02599 | 16.8 | 37 | 4.5 | 0.114 | 20.2 | 0.0000159 | 0.0103 |
| 6 | 162.0 | 4.11 | 26 240 | 0.02061 | 13.3 | 38 | 4.0 | 0.102 | 16.0 | 0.0000126 | 0.00811 |
| 7 | 144.3 | 3.67 | 20 820 | 0.01635 | 10.6 | 39 | 3.5 | 0.0890 | 12.2 | 0.00000962 | 0.00621 |
| 8 | 128.5 | 3.26 | 16 510 | 0.01297 | 8.37 | 40 | 3.1 | 0.0787 | 9.61 | 0.00000755 | 0.00487 |
| 9 | 114.4 | 2.91 | 13 090 | 0.01028 | 6.63 | 41 | 2.8 | 0.0711 | 7.84 | 0.00000616 | 0.00397 |
| 10 | 101.9 | 2.59 | 10 380 | 0.008155 | 5.26 | 42 | 2.5 | 0.0635 | 6.25 | 0.00000491 | 0.00317 |
| 11 | 90.7 | 2.30 | 8 230 | 0.00646 | 4.17 | 43 | 2.2 | 0.0559 | 4.84 | 0.00000380 | 0.00245 |
| 12 | 80.8 | 2.05 | 6 530 | 0.00513 | 3.31 | 44 | 2.0 | 0.0508 | 4.00 | 0.00000314 | 0.00203 |
| 13 | 72.0 | 1.83 | 5 180 | 0.00407 | 2.63 | 45 | 1.76 | 0.0447 | 3.10 | 0.00000243 | 0.00157 |
| 14 | 64.1 | 1.63 | 4 110 | 0.00323 | 2.08 | 46 | 1.57 | 0.0399 | 2.46 | 0.00000194 | 0.00125 |
| 15 | 57.1 | 1.45 | 3 260 | 0.00256 | 1.65 | 47 | 1.40 | 0.0356 | 1.96 | 0.00000154 | 0.000993 |
| 16 | 50.8 | 1.29 | 2 580 | 0.00203 | 1.31 | 48 | 1.24 | 0.0315 | 1.54 | 0.00000121 | 0.000779 |
| 17 | 45.3 | 1.15 | 2 050 | 0.00161 | 1.04 | 49 | 1.11 | 0.0282 | 1.23 | 9.68E-07 | 0.000624 |
| 18 | 40.3 | 1.02 | 1 620 | 0.00128 | 0.823 | 50 | 0.99 | 0.0252 | 0.980 | 7.70 E-07 | 0.000497 |
| 19 | 35.9 | 0.904 | 1 290 | 0.00101 | 0.653 | 51 | 0.88 | 0.0224 | 0.774 | 6.08E-07 | 0.000392 |
| 20 | 32.0 | 0.813 | 1 020 | 0.000804 | 0.519 | 52 | 0.78 | 0.0198 | 0.608 | 4.78E-07 | 0.000308 |
| 21 | 28.5 | 0.724 | 812 | 0.000638 | 0.412 | 53 | 0.70 | 0.0178 | 0.490 | 3.85E-07 | 0.000248 |
| 22 | 25.3 | 0.643 | 640 | 0.000503 | 0.324 | 54 | 0.62 | 0.0158 | 0.384 | 3.02E-07 | 0.000195 |
| 23 | 22.6 | 0.574 | 511 | 0.000401 | 0.259 | 55 | 0.55 | 0.0140 | 0.302 | 2.38E-07 | 0.000153 |
| 24 | 20.1 | 0.511 | 404 | 0.000317 | 0.205 | 56 | 0.49 | 0.0125 | 0.240 | 1.89E-07 | 0.000122 |
| 25 | 17.9 | 0.455 | 320 | 0.000252 | 0.162 | | | | | | |
| 26 | 15.9 | 0.404 | 253 | 0.000199 | 0.128 | | | | | | |
| 27 | 14.2 | 0.361 | 202 | 0.000158 | 0.102 | | | | | | |
| 28 | 12.6 | 0.320 | 159 | 0.000125 | 0.0804 | | | | | | |