Chapter 3: Conductor And Insulator Tables

Copper wire gage table

[]{#Gage size, wire} []{#Wire size, gage scale}

Soild copper wire table: below

Soild copper wire table:

Size Diameter Cross-sectional area Weight

AWG inches cir. mils sq. inches lb/1000 ft 4/0 0.4600 211,600 0.1662 640.5 3/0 0.4096 167,800 0.1318 507.9 2/0 0.3648 133,100 0.1045 402.8 1/0 0.3249 105,500 0.08289 319.5 1 0.2893 83,690 0.06573 253.5 2 0.2576 66,370 0.05213 200.9 3 0.2294 52,630 0.04134 159.3 4 0.2043 41,740 0.03278 126.4 5 0.1819 33,100 0.02600 100.2 6 0.1620 26,250 0.02062 79.46 7 0.1443 20,820 0.01635 63.02 8 0.1285 16,510 0.01297 49.97 9 0.1144 13,090 0.01028 39.63 10 0.1019 10,380 0.008155 31.43 11 0.09074 8,234 0.006467 24.92 12 0.08081 6,530 0.005129 19.77 13 0.07196 5,178 0.004067 15.68 14 0.06408 4,107 0.003225 12.43 15 0.05707 3,257 0.002558 9.858 16 0.05082 2,583 0.002028 7.818 17 0.04526 2,048 0.001609 6.200 18 0.04030 1,624 0.001276 4.917 19 0.03589 1,288 0.001012 3.899 20 0.03196 1,022 0.0008023 3.092 21 0.02846 810.1 0.0006363 2.452 22 0.02535 642.5 0.0005046 1.945 23 0.02257 509.5 0.0004001 1.542 24 0.02010 404.0 0.0003173 1.233 25 0.01790 320.4 0.0002517 0.9699 26 0.01594 254.1 0.0001996 0.7692 27 0.01420 201.5 0.0001583 0.6100 28 0.01264 159.8 0.0001255 0.4837 29 0.01126 126.7 0.00009954 0.3836 30 0.01003 100.5 0.00007894 0.3042 31 0.008928 79.70 0.00006260 0.2413 32 0.007950 63.21 0.00004964 0.1913 33 0.007080 50.13 0.00003937 0.1517 34 0.006305 39.75 0.00003122 0.1203 35 0.005615 31.52 0.00002476 0.09542 36 0.005000 25.00 0.00001963 0.07567 37 0.004453 19.83 0.00001557 0.06001 38 0.003965 15.72 0.00001235 0.04759 39 0.003531 12.47 0.000009793 0.03774 40 0.003145 9.888 0.000007766 0.02993 41 0.002800

7.842 0.000006159 0.02374 42 0.002494 6.219 0.000004884 0.01882 43 0.002221 4.932 0.000003873 0.01493 44 0.001978 3.911 0.000003072 0.01184

Copper wire ampacity table

[]{#Conductor ampacity}

Ampacities of copper wire: below

Ampacities of copper wire, in free air at 30^{o} C:

INSULATION TYPE:

RUW, T	THW, THWN	FEP, FEPB
TW	RUH	THHN, XHHW

Size Current Rating Current Rating Current Rating AWG @ 60 degrees C @ 75 degrees C @ 90 degrees C 20 *9 *12.5 18 *13 18 16 *18 24 14 25 30 35 12 30 35 40 10 40 50 55 8 60 70 80 6 80 95 105 4 105 125 140 2 140 170 190 1 165 195 220 1/0 195 230 260 2/0 225 265 300 3/0 260 310 350 4/0 300 360 405

* = estimated values; normally, these small wire sizes are not manufactured with these insulation types, above.

Coefficients of specific resistance

[]{#Resistance, specific} []{#Specific resistance}

Specific resistance table: below

Specific resistance at 20^{o} C:

Material Element/Alloy (ohm-cmil/ft) (ohm-cm·10^{-6})

Nichrome Alloy 675 112.2 Nichrome V Alloy 650 108.1 Manganin Alloy 290 48.21 Constantan Alloy 272.97 45.38 Steel* Alloy 100 16.62 Platinum Element 63.16 10.5 Iron Element 57.81 9.61 Nickel Element 41.69 6.93 Zinc Element 35.49 5.90 Molybdenum Element 32.12 5.34 Tungsten Element 31.76 5.28 Aluminum Element 15.94 2.650 Gold Element 13.32 2.214 Copper Element 10.09 1.678 Silver Element 9.546 1.587

* = Steel alloy at 99.5% iron, 0.5% carbon

Temperature coefficients of resistance

[]{#Temperature coefficient of resistance} []{#Resistance, temperature coefficient of}

Temperature coefficient table: below

Temperature coefficient (α) per degree C:

Material Element/Alloy Temp. coefficient

Nickel Element 0.005866 Iron Element 0.005671 Molybdenum Element 0.004579 Tungsten Element 0.004403 Aluminum Element 0.004308 Copper Element 0.004041 Silver Element 0.003819 Platinum Element 0.003729 Gold Element 0.003715 Zinc Element 0.003847 Steel* Alloy 0.003 Nichrome Alloy 0.00017 Nichrome V Alloy 0.00013 Manganin Alloy 0.000015 Constantan Alloy ±0.000074

* = S teel alloy at 99.5% iron, 0.5% carbon

Critical temperatures for superconductors

[]{#Critical temperature, superconductors} []{#Temperature, critical, for superconductors}

Critical temperature, superconductors below

Critical temperatures given in Kelvins

Material Element or Alloy Critical temperature(K)

Aluminum Element 1.20 Cadmium Element 0.56 Lead Element 7.2 Mercury Element 4.16 Niobium Element 8.70 Thorium Element 1.37 Tin Element 3.72 Titanium Element 0.39 Uranium ELement 1.0 Zinc Element 0.91 Niobium/Tin Alloy 18.1 Cupric sulphide Compound 1.6

[]{#Superconductivity, high temperature} []{#Critical temperature, high temperature superconductors} []{#Temperature, critical, for high temperature superconductors}

Critical temperatures, high temperature superconuctors below

Critical temperatures, high temperature superconuctors in Kelvins

Material Critical temperature(K)

$HgBa_2Ca_2Cu_3O_{8+d}$ 150 (23.5 GPa pressure) $HgBa_2Ca_2Cu_3O_{8+d}$ 133 $Tl_2Ba_2Ca_2Cu_3O_{10}$ 125 $YBa_2Cu_3O_7$ 90 $La_{1.85}Sr_{0.15}CuO_4$ 40 Cs_3C_{60} 40(15 Kbar pressure) $Ba_{0.6}K_{0.4}BiO_3$ 30 $Nd_{1.85}Ce_{0.15}CuO_4$ 22 K_3C_{60} 19 $PbMo_6S_8$ 12.6

Note: all critical temperatures given at zero magnetic field strength, above.

Dielectric strengths for insulators

[]{#Dielectric strength}

Dielectric strength: below

Dielectric strength in kilovolts per inch (kV/in):

Material* Dielectric strength

Vacuum 20 Air 20 to 75 Porcelain 40 to 200 Paraffin Wax 200 to 300 Transformer Oil 400 Bakelite 300 to 550 Rubber 450 to 700 Shellac 900 Paper 1250 Teflon 1500 Glass 2000 to 3000 Mica 5000

* = Materials listed are specially prepared for electrical use, above.

Data

Tables of specific resistance and temperature coefficient of resistance for elemental materials (not alloys) were derived from figures found in the 78th edition of the CRC Handbook of Chemistry and Physics. Superconductivity data from Collier's Encyclopedia (volume 21, 1968, page 640).