

# 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

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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° 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° C:*

Material Element/Alloy (ohm-cmil/ft) (ohm-cm·10<sup>-6</sup>)

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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

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

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## Temperature coefficients of resistance

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

**Temperature coefficient table:** [below](#)

*Temperature coefficient ( $\alpha$ ) per degree C:*

Material Element/Alloy Temp. coefficient

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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  $\pm 0.000074$

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

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## Critical temperatures for superconductors

$\{\# \text{Critical temperature, superconductors}\}$   $\{\# \text{Temperature, critical, for superconductors}\}$

**Critical temperature, superconductors** [below](#)

*Critical temperatures given in Kelvins*

Material Element or Alloy Critical temperature(K)

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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

$\{\# \text{Superconductivity, high temperature}\}$   $\{\# \text{Critical temperature, high temperature superconductors}\}$   $\{\# \text{Temperature, critical, for high temperature superconductors}\}$

**Critical temperatures, high temperature superconductors** [below](#)

*Critical temperatures, high temperature superconductors in Kelvins*

Material Critical temperature(K)

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HgBa<sub>2</sub>Ca<sub>2</sub>Cu<sub>3</sub>O<sub>8+d</sub> 150 (23.5 GPa pressure) HgBa<sub>2</sub>Ca<sub>2</sub>Cu<sub>3</sub>O<sub>8+d</sub> 133 Tl<sub>2</sub>Ba<sub>2</sub>Ca<sub>2</sub>Cu<sub>3</sub>O<sub>10</sub> 125 YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> 90 La<sub>1.85</sub>Sr<sub>0.15</sub>CuO<sub>4</sub> 40 Cs<sub>3</sub>C<sub>60</sub> 40 (15 Kbar pressure) Ba<sub>0.6</sub>K<sub>0.4</sub>BiO<sub>3</sub> 30 Nd<sub>1.85</sub>Ce<sub>0.15</sub>CuO<sub>4</sub> 22 K<sub>3</sub>C<sub>60</sub> 19 PbMo<sub>6</sub>S<sub>8</sub> 12.6

Note: all critical temperatures given at zero magnetic field strength, [above](#).

## Dielectric strengths for insulators

$\{\# \text{Dielectric strength}\}$

**Dielectric strength:** [below](#)

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

Material\* Dielectric strength

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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).

