

Resistance Wire for Low Temp Heating or Resistors Nickel-Copper Alloy - A180

$$I = \text{Current}$$

$$C_t = \text{Temperature factor}$$

$$p = \text{Surface load W/in}^2$$

$$I^2/\Omega = \frac{I^2 C_t}{p}$$

Common Names: Alloy 180, CuNi 180, MWS-180, Cuprothal® 180, Midohm, HAI-180, Cu-Ni 23, Alloy 380, Nickel Alloy 180

Uses: Alloy exhibits low resistivity and high temperature coefficient of resistance. Typical applications include voltage regulators, timing devices, temperature sensitive resistors, temperature compensating devices, motor control, heating wires and cables, precision and vitreous resistors, potentiometers, and low temperature heating applications.

Composition

Ni	Cr	Fe	Al	Si	Mn	Cu	C	Ti	Mo	W
22%	None/Trace	None/Trace	None/Trace	None/Trace	None/Trace	Balance	None/Trace	None/Trace	None/Trace	None/Trace

Technical Data

Resistivity (Ω/cm)	180	Resistivity (Ω/sqmf)	141
Resistivity (μΩ/cm)	29.93	Nom. Temp. Coeff. of Resistance (TCR)	0.00018
Std. Res. Tol. <.020"	5%	Std. Res. Tol. >.020"	3%
Thermal EMF vs. Cu	-0.037	Specific Heat (20°C)	0.092 cal/g
Density (g/cm³)	8.89	Density (lb/in³)	0.321
Thermal Conductivity	0.035 W/cm/°C	Coeff. of Linear Expansion (X 10⁻⁶)	15.80 in/in/°C
Approx. Melting Point	1090°C	Max. Continuous Operating Temp.	400°C
UTS – Hard (KPSI)	100	YTS Tensile – Hard (KPSI)	
UTS – Stress Relieved (KPSI)		YTS Tensile – Stress Relieved (KPSI)	
UTS – Annealed (KPSI)	50	YTS Tensile – Annealed (KPSI)	
Magnetic Attraction	None	Emissivity – fully oxidized	
Designations/Specifications	ASTM = B267	Forms Available	Wire, Ribbon

Temperature Factor – To obtain resistance at working temperature multiply by the factor C_t , in the following table:

°F	68	212	392	572	752	932
A180 C_t	1.00	1.018	1.036	1.054	1.072	1.09

Alloy Data

Gage AWG	Diameter Inch	Resistance at 68° F Ω/ft	Resistance at 68° F Ω/lb	Weight lb/1000 ft	Surface area in ² /ft	in ² /Ω at 68°F
000	0.4096	0.0011	0.0021	507.6761	15.4432	14397.0798
00	0.3648	0.0014	0.0034	402.6049	13.7525	10167.4695
0	0.3249	0.0017	0.0053	319.2797	12.2470	7180.4447
1	0.2893	0.0022	0.0085	253.2000	10.9062	5070.9556
2	0.2576	0.0027	0.0135	200.7964	9.7123	3581.1975
3	0.2294	0.0034	0.0215	159.2386	8.6490	2529.1043
4	0.2043	0.0043	0.0341	126.2817	7.7022	1786.0977
5	0.1819	0.0054	0.0543	100.1458	6.8590	1261.3734
6	0.1620	0.0069	0.0863	79.4191	6.1081	890.8040
7	0.1443	0.0086	0.1373	62.9822	5.4394	629.1013
8	0.1285	0.0109	0.2183	49.9470	4.8439	444.2824
9	0.1144	0.0137	0.3471	39.6098	4.3136	313.7600
10	0.1019	0.0173	0.5519	31.4119	3.8414	221.5828
11	0.0907	0.0219	0.8776	24.9107	3.4209	156.4856
12	0.0808	0.0276	1.3954	19.7551	3.0464	110.5129
13	0.0720	0.0348	2.2187	15.6665	2.7129	78.0461
13.5	0.0679	0.0390	2.7978	13.9514	2.5601	65.5874
14	0.0641	0.0438	3.5279	12.4241	2.4159	55.1175
14.5	0.0605	0.0492	4.4487	11.0639	2.2798	46.3190
15	0.0571	0.0553	5.6097	9.8527	2.1514	38.9250
15.5	0.0539	0.0621	7.0737	8.7741	2.0302	32.7113
16	0.0508	0.0697	8.9197	7.8135	1.9159	27.4895
16.5	0.0480	0.0783	11.2476	6.9582	1.8080	23.1013
17	0.0453	0.0879	14.1830	6.1964	1.7061	19.4136
17.5	0.0427	0.0987	17.8844	5.5181	1.6100	16.3145

Gage AWG	Diameter Inch	Resistance at 68° F Ω/ft	Resistance at 68° F Ω/lb	Weight Lb/1000 ft	Surface area in ² /ft	in ² /Ω at 68°F
18	0.0403	0.1108	22.5519	4.9140	1.5194	13.7102
18.5	0.0380	0.1244	28.4374	4.3760	1.4338	11.5216
19	0.0359	0.1397	35.8590	3.8970	1.3530	9.6824
19.5	0.0339	0.1569	45.2174	3.4703	1.2768	8.1368
20	0.0320	0.1762	57.0182	3.0904	1.2049	6.8379
20.5	0.0302	0.1979	71.8987	2.7521	1.1370	5.7463
21	0.0285	0.2222	90.6628	2.4508	1.0730	4.8290
21.5	0.0269	0.2495	114.3238	2.1825	1.0126	4.0582
22	0.0253	0.2802	144.1599	1.9436	0.9555	3.4103
22.5	0.0239	0.3146	181.7825	1.7308	0.9017	2.8659
23	0.0226	0.3533	229.2238	1.5413	0.8509	2.4084
23.5	0.0213	0.3967	289.0463	1.3726	0.8030	2.0240
24	0.0201	0.4455	364.4812	1.2223	0.7578	1.7009
24.5	0.0190	0.5003	459.6030	1.0885	0.7151	1.4294
25	0.0179	0.5618	579.5495	0.9693	0.6748	1.2012
25.5	0.0169	0.6308	730.7994	0.8632	0.6368	1.0094
26	0.0159	0.7084	921.5224	0.7687	0.6009	0.8483
26.5	0.0150	0.7955	1162.0199	0.6846	0.5671	0.7129
27	0.0142	0.8933	1465.2822	0.6096	0.5351	0.5991
27.5	0.0134	1.0031	1847.6894	0.5429	0.5050	0.5035
28	0.0126	1.1264	2329.8966	0.4835	0.4766	0.4231
29	0.0113	1.4204	3704.6914	0.3834	0.4244	0.2988
30	0.0100	1.7911	5890.7069	0.3040	0.3779	0.2110
31	0.0089	2.2585	9366.6176	0.2411	0.3366	0.1490
32	0.0080	2.8479	14893.5480	0.1912	0.2997	0.1052
33	0.0071	3.5911	23681.7367	0.1516	0.2669	0.0743
34	0.0063	4.5283	37655.5441	0.1203	0.2377	0.0525
35	0.0056	5.7101	59874.8318	0.0954	0.2117	0.0371
36	0.0050	7.2004	95204.9843	0.0756	0.1885	0.0262
37	0.0045	9.0795	151382.2880	0.0600	0.1679	0.0185
38	0.0040	11.4491	240707.9554	0.0476	0.1495	0.0131
39	0.0035	14.4370	382741.7365	0.0377	0.1331	0.0092
40	0.0031	18.2048	608584.9413	0.0299	0.1185	0.0065
41	0.0028	22.9558	967690.7310	0.0237	0.1056	0.0046
42	0.0025	28.9468	1538692.9370	0.0188	0.0940	0.0032
43	0.0022	36.5013	2446624.6072	0.0149	0.0837	0.0023
44	0.0020	46.0273	3890296.6436	0.0118	0.0746	0.0016
45	0.0018	58.0395	6185831.6680	0.0094	0.0664	0.0011
46	0.0016	73.1865	9835885.7772	0.0074	0.0591	0.0008
47	0.0014	92.2866	15639715.7590	0.0059	0.0526	0.0006
48	0.0012	116.3715	24868193.3244	0.0047	0.0469	0.0004
49	0.0011	146.7419	39542089.4311	0.0037	0.0418	0.0003
50	0.0010	185.0384	62874564.9585	0.0029	0.0372	0.0002

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