

## ALLOY 600 RESISTANCE HEATING

## NICKEL CHROME

**ASTM:** B344 & B267  
**Ω/cir. mil. ft.:** 610  
**Chemical Composition %:** Ni 34-37%, Cr 18-21%, C .15%, Si 1-3%, Mn 1%, S .1%, Fe - Balance  
**Coeff. of Lin. Expansion, X 10<sup>-6</sup>:** 16 (250°C), 17 (500°C), 18 (750°C), 19 (1,000°C)  
**Conductivity:** 13 w/mK  
**Temp. Coeff. of Resistance:** .0004  
**Melting Point:** ~1,390°C (~2,535°F)  
**Max Operating Temp:** ~1,000°C (~2,012°F)  
**Soft Tensile:** 80,000-120,000 PSI

**UNS:**  
**Weight/Density:** .287 lbs/in<sup>2</sup> (7.9 g/cm<sup>3</sup>)  
**Specific Heat:** .119 cal./gm @ 20°C  
**Specific Gravity:** 7.95  
**Elongation:** 20-40%  
**Yield Point:** 30,000-50,000 PSI

Diameter			Resistance @ 68° F/20° C Ω/ft	Sq. in./Ω 68°F	Weight Lb./1000 ft	Ω/lb.	Ft/Lb.	Cross sectional area (in <sup>2</sup> )
B&S	Inches	Mm						
13	0.072	1.83	0.117	23.46	14.0	8.36	71.28	0.00407
14	0.064	1.63	0.149	16.50	11.0	13.4	90.17	0.00322
15	0.057	1.45	0.191	11.66	8.76	21.7	113.7	0.00256
16	0.051	1.29	0.235	8.301	6.94	33.3	142.0	0.00203
17	0.045	1.15	0.305	5.764	5.51	55.6	182.4	0.00161
18	0.04	1.02	0.381	4.051	4.29	88.0	230.9	0.00126
19	0.036	0.912	0.469	2.922	3.48	133.8	285.1	0.00102
20	0.032	0.812	0.610	2.058	2.76	220.1	360.8	0.000804
21	0.0285	0.723	0.753	1.454	2.19	342.5	454.8	0.000638
22	0.0253	0.644	0.953	1.017	1.73	549.9	577.0	0.000507
23	0.0226	0.573	1.196	0.725	1.37	864.8	723.1	0.000401
24	0.0201	0.51	1.525	0.510	1.07	1,394	914.1	0.000314
25	0.0179	0.455	1.906	0.360	0.870	2,198	1,153	0.000254
26	0.0159	0.405	2.440	0.253	0.679	3,565	1,461	0.000199
27	0.0142	0.361	3.050	0.180	0.542	5,600	1,836	0.000158
28	0.0126	0.321	3.836	0.126	0.427	8,934	2,329	0.000125
29	0.0113	0.286	4.766	0.091	0.343	13,800	2,895	0.000100
30	0.01	0.255	6.100	0.063	0.269	22,530	3,694	0.0000785
31	0.0089	0.227	7.721	0.044	0.214	36,010	4,664	0.0000626
32	0.008	0.202	9.531	0.032	0.170	55,030	5,774	0.0000496
33	0.0071	0.18	12.20	0.023	0.135	89,450	7,332	0.0000394
34	0.0063	0.16	15.25	0.016	0.106	142,000	9,311	0.0000312
35	0.0056	0.143	19.67	0.011	0.0846	231,500	11,770	0.0000247
36	0.005	0.127	24.40	0.0079	0.0672	360,600	14,780	0.0000196
37	0.0045	0.113	30.50	0.0057	0.0520	556,600	18,250	0.0000152
38	0.004	0.101	38.12	0.0040	0.0429	880,200	23,090	0.0000126
39	0.0035	0.09	50.83	0.0027	0.0334	1,684,000	30,160	0.00000979
40	0.0031	0.08	63.48	0.0019	0.0267	2,441,000	38,450	0.00000779
41	0.00275	0.07	81.33	0.0013	0.0211	3,973,000	48,850	0.00000616
42	0.0025	0.063	97.60	0.00096	0.0166	5,769,000	59,110	0.00000487
43	0.00225	0.057	119.60	0.00071	0.0130	8,728,000	72,980	0.00000380
44	0.0020	0.051	152.50	0.00049	0.0107	14,080,000	92,360	0.00000314
45	0.00175	0.044	199.20	0.00033	0.0083	24,020,000	120,600	0.00000243
46	0.0015	0.038	271.10	0.00021	0.0069	44,510,000	164,200	0.00000201
47	0.0014	0.036	311.20	0.00018	0.0053	58,660,000	188,500	0.00000154
48	0.0013	0.033	360.90	0.00014	0.0041	78,890,000	218,600	0.00000121

## ALLOY 650 RESISTANCE HEATING

## NICKEL CHROME

<b>ASTM:</b> B344	<b>DIN:</b> 17470/17471	<b>UNS:</b> N06003
<b>Ω/cir. mil. ft.:</b> 650	<b>Weight/Density:</b> .301 lbs/in <sup>2</sup> (8.3 g/cm <sup>3</sup> )	
<b>Chemical Composition %:</b> Cr 19-21%, Mn 2.5% max, Ni - Balance		
<b>Coeff. of Lin. Expansion, X 10<sup>-6</sup>:</b> 14.0(200°C), 15.0(400°C), 15.5(600°C), 16.0(800°C), 17.0(1,000°C)		
<b>Conductivity:</b> 14.6 w/mK	<b>Specific Heat:</b> .110 cal./gm @ 20°C	
<b>Temp. Coeff. of Resistance:</b> 0.00009	<b>Specific Gravity:</b> 8.41	
<b>Melting Point:</b> ~1,400°C (~2,552°F)	<b>Elongation:</b> 20-40%	
<b>Max Operating Temp:</b> ~1,230°C (~2,246°F)	<b>Yield Point:</b> 45,000-65,000 PSI	
<b>Soft Tensile:</b> 95,000-125,000 PSI		

Diameter			Resistance @ 68° F/20° C Ω/ft	Sq. in./Ω 68°F	Weight Lb./1000 ft	Ω/lb.	Ft/Lb.	Cross sectional area (in <sup>2</sup> )
B&S	Inches	Mm						
13	0.072	1.83	0.126	21.63	14.7	8.45	67.34	0.00407
14	0.064	1.63	0.159	15.22	11.6	13.5	85.25	0.00322
15	0.057	1.45	0.200	10.77	9.22	21.5	107.5	0.00256
16	0.051	1.29	0.250	7.663	7.30	33.5	134.2	0.00203
17	0.045	1.15	0.321	5.323	5.80	55.3	172.4	0.00161
18	0.04	1.02	0.406	3.740	4.52	88.6	218.2	0.00126
19	0.036	0.912	0.502	2.698	3.66	135.1	269.4	0.00102
20	0.032	0.812	0.635	1.900	2.90	216.4	340.9	0.000804
21	0.0285	0.723	0.800	1.342	2.30	344.0	429.9	0.000638
22	0.0253	0.644	1.017	0.938	1.82	554.9	545.6	0.000507
23	0.0226	0.573	1.272	0.670	1.44	869.4	683.5	0.000401
24	0.0201	0.51	1.609	0.471	1.13	1,391	864.5	0.000314
25	0.0179	0.455	2.029	0.333	0.916	2,212	1,090	0.000254
26	0.0159	0.405	2.571	0.233	0.715	3,551	1,381	0.000199
27	0.0142	0.361	3.228	0.166	0.570	5,591	1,732	0.000158
28	0.0126	0.321	4.090	0.116	0.449	8,994	2,199	0.000125
29	0.0113	0.286	5.090	0.084	0.361	13,920	2,734	0.000100
30	0.01	0.255	6.500	0.059	0.283	22,700	3,492	0.0000785
31	0.0089	0.227	8.206	0.041	0.225	36,160	4,407	0.0000626
32	0.008	0.202	10.16	0.030	0.179	55,430	5,456	0.0000496
33	0.0071	0.18	12.90	0.021	0.142	89,330	6,925	0.0000394
34	0.0063	0.16	16.37	0.015	0.112	144,000	8,795	0.0000312
35	0.0056	0.143	20.72	0.010	0.0890	230,600	11,130	0.0000247
36	0.005	0.127	26.00	0.0073	0.0707	363,200	13,970	0.0000196
37	0.0045	0.113	32.09	0.0053	0.0547	553,200	17,240	0.0000152
38	0.004	0.101	40.62	0.0037	0.0452	886,300	21,820	0.0000126
39	0.0035	0.09	53.06	0.0025	0.0352	1,512,000	28,500	0.00000979
40	0.0031	0.08	67.63	0.0017	0.0281	2,458,000	36,340	0.00000779
41	0.00275	0.07	85.98	0.0012	0.0222	3,970,000	46,170	0.00000616
42	0.0025	0.063	104.00	0.00091	0.0175	5,810,000	55,870	0.00000487
43	0.00225	0.057	128.50	0.00066	0.0137	8,863,000	68,970	0.00000380
44	0.0020	0.051	162.50	0.00046	0.0113	14,180,000	87,260	0.00000314
45	0.00175	0.044	212.40	0.00031	0.0088	24,210,000	114,000	0.00000243
46	0.0015	0.038	288.90	0.00020	0.0072	44,840,000	155,200	0.00000201
47	0.0014	0.036	331.60	0.00016	0.0055	59,060,000	178,100	0.00000154
48	0.0013	0.033	384.60	0.00013	0.0044	79,230,000	206,600	0.00000121

## ALLOY 675 RESISTANCE HEATING

## NICKEL CHROME

<b>ASTM:</b>	<b>DIN:</b> 17470/17471	<b>UNS:</b> N06004
<b>Ω/cir. mil. ft.:</b> 675	<b>Weight/Density:</b> .299 lbs/in <sup>2</sup> (8.2 g/cm <sup>3</sup> )	
<b>Chemical Composition %:</b> Ni 57% min, Cr 14-18%, Mn 1% max, C .02% max, Fe - Balance		
<b>Coeff. of Lin. Expansion, X 10<sup>-6</sup>:</b> 14.0(200°C), 15.0(500°C), 15.5(600°C), 16.0(800°C), 17.0(1,000°C)		
<b>Conductivity:</b> 13 w/mK	<b>Specific Heat:</b> .110 cal./gm @ 20°C	
<b>Temp. Coeff. of Resistance:</b> 0.000014	<b>Specific Gravity:</b> 8.25	
<b>Melting Point:</b> ~1,390°C (~2,535°F)	<b>Elongation:</b> 20-40%	
<b>Max Operating Temp:</b> ~1,150°C (~2,100°F)	<b>Yield Point:</b> 40,000-60,000	
<b>Soft Tensile:</b> 95,000-125,000 PSI		

Diameter			Resistance @ 68° F/20° C Ω/ft	Sq. in./Ω 68°F	Weight Lb./1000 ft	Ω/lb.	Ft/Lb.	Cross sectional area (in <sup>2</sup> )
B&S	Inches	Mm						
13	.072	1.83	0.130	20.84	14.6	8.94	68.68	0.00407
14	.064	1.63	0.165	14.67	11.5	14.3	86.96	0.00322
15	0.057	1.45	0.208	10.36	9.13	22.8	109.6	0.00256
16	0.051	1.29	0.260	7.380	7.23	35.5	136.9	0.00203
17	0.045	1.15	0.333	5.125	5.74	58.6	175.9	0.00161
18	0.04	1.02	0.422	3.600	4.47	93.9	222.6	0.00126
19	0.036	.912	0.521	2.598	3.62	143.1	274.8	0.00102
20	0.032	0.812	0.659	1.829	2.87	229.3	347.8	0.000804
21	0.0285	0.723	0.831	1.292	2.28	364.3	438.4	0.000638
22	0.0253	0.644	1.055	0.904	1.80	587.1	556.5	0.000507
23	0.0226	0.573	1.322	0.645	1.43	921.9	697.4	0.000401
24	0.0201	0.51	1.671	0.454	1.12	1,473	881.8	0.000314
25	0.0179	0.455	2.107	0.320	0.907	2,341	1,111	0.000254
26	0.0159	0.405	2.670	0.225	0.708	3,773	1,413	0.000199
27	0.0142	0.361	3.348	0.160	0.564	5,913	1,766	0.000158
28	0.0126	0.321	4.251	0.112	0.445	9,535	2,243	0.000125
29	0.0113	0.286	5.286	0.081	0.357	17,740	2,789	0.000100
30	0.01	0.255	6.750	0.056	0.280	24,040	3,561	0.0000785
31	0.0089	0.227	8.523	0.039	0.223	38,320	4,496	0.0000626
32	0.008	0.202	10.55	0.029	0.177	58,710	5,565	0.0000496
33	0.0071	0.18	13.39	0.020	0.141	94,560	7,062	0.0000394
34	0.0063	0.16	17.00	0.014	0.111	152,600	8,977	0.0000312
35	0.0056	0.143	21.52	0.010	0.0881	244,500	11,360	0.0000247
36	0.005	0.127	27.00	0.0070	0.0700	384,800	14,250	0.0000196
37	0.0045	0.113	33.33	0.0051	0.0542	586,300	17,590	0.0000152
38	0.004	0.101	42.19	0.0036	0.0447	939,100	22,260	0.0000126
39	0.0035	0.09	55.10	0.0024	0.0348	1,602,000	29,070	0.00000979
40	0.0031	0.08	70.24	0.0017	0.0278	2,603,000	37,060	0.00000779
41	0.00275	0.07	89.29	0.0012	0.0220	4,204,000	47,080	0.00000616
42	0.0025	0.063	108.00	0.00087	0.0173	6,154,000	56,980	0.00000487
43	0.00225	0.057	133.40	0.00064	0.0136	9,381,000	70,320	0.00000380
44	0.002	0.051	168.80	0.00045	0.0112	15,030,000	89,050	0.00000314
45	0.00175	0.044	220.60	0.00030	0.0087	25,656,000	116,300	0.00000243
46	0.0015	0.038	300.00	0.00019	0.0072	47,490,000	158,300	0.00000201
47	0.0014	0.036	344.40	0.00015	0.0055	62,580,000	181,700	0.00000154
48	0.0013	0.033	399.50	0.00012	0.0043	84,150,000	210,700	0.00000121

## ALLOY 710 RESISTANCE HEATING

## NICKEL CHROME

<b>ASTM:</b>	<b>UNS:</b> <i>N06008</i>
<b>Ω/cir. mil. ft.:</b> <i>710</i>	<b>Weight/Density:</b> <i>.293 lbs/in<sup>2</sup> (8.1 g/cm<sup>3</sup>)</i>
<b>Chemical Composition %:</b> <i>Ni 70% nom., Cr 30% nom.</i>	
<b>Coeff. of Lin. Expansion, X 10<sup>-6</sup>:</b> <i>13.7 (250°C), 14.6 (500°C), 15.8 (750°C), 17.1 (1,000°C)</i>	
<b>Conductivity:</b> <i>14 w/mK</i>	<b>Specific Heat:</b> <i>.110 cal./gm @ 20°C</i>
<b>Temp. Coeff. of Resistance:</b> <i>.00009</i>	<b>Specific Gravity:</b> <i>8.11</i>
<b>Melting Point:</b> <i>~1,380°C (~2,515°F)</i>	<b>Elongation:</b> <i>15-30%</i>
<b>Max Operating Temp:</b> <i>~1,250°C (~2,280°F)</i>	<b>Yield Point:</b> <i>55,000-75,000 PSI</i>
<b>Soft Tensile:</b> <i>125,000-145,000 PSI</i>	

Diameter			Resistance @ 68° F/20° C Ω/ft	Sq. in./Ω 68°F	Weight Lb./1000 ft	Ω/lb.	Ft/Lb.	Cross sectional area (in <sup>2</sup> )
B&S	Inches	Mm						
13	0.072	1.83	0.137	19.87	14.3	9.55	69.70	0.00407
14	0.064	1.63	0.173	13.95	11.3	15.3	88.33	0.00322
15	0.057	1.45	0.219	9.887	9.00	24.3	111.1	0.00256
16	0.051	1.29	0.273	6.967	7.12	38.3	140.4	0.00203
17	0.045	1.15	0.351	4.934	5.66	61.9	176.7	0.00161
18	0.04	1.02	0.444	3.474	4.48	99.1	223.2	0.00126
19	0.036	0.912	0.548	2.458	3.55	154.2	281.5	0.00102
20	0.032	0.812	0.693	1.737	2.83	245.0	353.3	0.000804
21	0.0285	0.723	0.874	1.229	2.24	389.4	445.5	0.000638
22	0.0253	0.644	1.109	0.860	1.77	627.9	566.1	0.000507
23	0.0226	0.573	1.390	0.614	1.41	989.1	711.5	0.000401
24	0.0201	0.51	1.757	0.432	1.11	1,579	898.8	0.000314
25	0.0179	0.455	2.216	0.305	0.884	2,506	1,131	0.000254
26	0.0159	0.405	2.808	0.213	0.698	4,024	1,433	0.000199
27	0.0142	0.361	3.521	0.152	0.556	6,329	1,798	0.000158
28	0.0126	0.321	4.472	0.106	0.438	10,205	2,282	0.000125
29	0.0113	0.286	5.560	0.077	0.352	15,781	2,838	0.000100
30	0.01	0.255	7.100	0.053	0.276	25,705	3,620	0.0000785
31	0.0089	0.227	8.964	0.037	0.219	41,000	4,574	0.0000626
32	0.008	0.202	11.09	0.027	0.177	62,799	5,661	0.0000496
33	0.0071	0.18	14.08	0.019	0.140	100,915	7,165	0.0000394
34	0.0063	0.16	17.89	0.013	0.109	163,648	9,148	0.0000312
35	0.0056	0.143	22.64	0.009	0.0866	261,522	11,551	0.0000247
36	0.005	0.127	28.40	0.0066	0.0690	411,575	14,492	0.0000196
37	0.0045	0.113	35.06	0.0048	0.0559	626,944	17,881	0.0000152
38	0.004	0.101	44.38	0.0034	0.0441	1,005,889	22,668	0.0000126
39	0.0035	0.09	57.96	0.0023	0.0338	1,716,312	29,612	0.00000979
40	0.0031	0.08	73.88	0.0016	0.0265	2,783,019	37,669	0.00000779
41	0.00275	0.07	93.88	0.0012	0.0217	4,333,015	46,153	0.00000616
42	0.0025	0.063	113.60	0.00083	0.0173	6,575,901	57,886	0.00000487
43	0.00225	0.057	140.25	0.00057	0.0134	10,488,731	74,788	0.00000380
44	0.0020	0.051	177.50	0.00043	0.0110	16,094,226	90,672	0.00000314
45	0.00175	0.044	231.84	0.00029	0.0085	27,116,169	116,962	0.00000243
46	0.0015	0.038	315.56	0.00022	0.0071	44,656,784	141,518	0.00000201
47	0.0014	0.036	362.24	0.00015	0.0054	66,995,047	184,944	0.00000154
48	0.0013	0.033	420.12	0.00010	0.0042	98,953,821	235,538	0.00000121

## ALLOY 40B IRON

## NICKEL CHROME

<b>ASTM:</b>	<b>UNS:</b> X10NiCrSiLa 38-22
<b><math>\Omega</math>/cir. mil. ft.:</b> 638	<b>Weight/Density:</b> .287 lbs/in <sup>2</sup> (8.2 g/cm <sup>3</sup> )
<b>Chemical Composition %:</b> Fe, Ni, Cr, C, Mn, Si, Al, La, S, P, Cu	
<b>Coeff. of Lin. Expansion, X 10<sup>-6</sup>:</b>	<b>Conductivity:</b> 12.0 w/mK
<b>Specific Heat:</b> .117 cal./gm @ 20°C	<b>Temp. Coeff. of Resistance:</b>
<b>Specific Gravity:</b> 7.95	<b>Melting Point:</b> 1350-1395°C
<b>Elongation:</b> 28% min	<b>Max Operating Temp:</b>
<b>Yield Point:</b> 39,200 psi min	<b>Soft Tensile:</b> 87,000 psi min

Diameter			Resistance @ 68° F/20° C $\Omega$ /ft	Sq. in./ $\Omega$ 68°F	Weight Lb./1000 ft	$\Omega$ /lb.	Ft/Lb.	Cross sectional area (in <sup>2</sup> )
B&S	Inches	Mm						
13	0.072	1.83	0.1231	22.1	14.017	8.78	71.34	0.00407
14	0.064	1.63	0.1558	15.5	11.090	14.05	90.17	0.00322
15	0.057	1.45	0.1964	10.94	8.817	22.27	113.42	0.00256
16	0.051	1.29	0.2453	7.84	6.991	35.08	143.03	0.00203
17	0.045	1.15	0.3151	5.38	5.545	56.82	180.35	0.00161
18	0.04	1.02	0.3988	3.78	4.339	91.9	230.44	0.00126
19	0.036	0.912	0.4923	2.76	3.513	140.1	284.67	0.00102
20	0.032	0.812	0.6230	1.94	2.769	225.0	361.14	0.000804
21	0.0285	0.723	0.7855	1.37	2.197	357.5	455.11	0.000638
22	0.0253	0.644	0.9967	0.957	1.746	570.8	572.70	0.000507
23	0.0226	0.573	1.2491	0.682	1.381	904.5	724.09	0.000401
24	0.0201	0.51	1.5792	0.480	1.081	1,460.3	924.71	0.000314
25	0.0179	0.455	1.9912	0.339	0.875	2,276.2	1,143.15	0.000254
26	0.0159	0.405	2.5236	0.238	0.685	3,682.2	1,459.10	0.000199
27	0.0142	0.361	3.1641	0.169	0.544	5,814.7	1,837.72	0.000158
28	0.0126	0.321	4.0186	0.118	0.431	9,335	2,322.88	0.000125
29	0.0113	0.286	4.9965	0.085	0.344	14,508	2,903.60	0.000100
30	0.01	0.255	6.3800	0.059	0.270	23,599	3,698.85	0.0000785
31	0.0089	0.227	8.0545	0.042	0.216	37,360	4,638.34	0.0000626
32	0.008	0.202	9.9688	0.030	0.171	58,357	5,854.03	0.0000496
33	0.0071	0.18	12.6562	0.021	0.136	93,271	7,369.54	0.0000394
34	0.0063	0.16	16.0746	0.015	0.107	149,597	9,306.41	0.0000312
35	0.0056	0.143	20.3444	0.010	0.085	239,158	11,755.47	0.0000247
36	0.005	0.127	25.5200	0.0074	0.068	378,061	14,814.29	0.0000196
37	0.0045	0.113	31.5062	0.0054	0.052	601,851	19,102.63	0.0000152
38	0.004	0.101	39.8750	0.0038	0.043	918,897	23,044.45	0.0000126
39	0.0035	0.09	52.0816	0.0025	0.034	1,544,681	29,658.84	0.00000979
40	0.0031	0.08	66.3892	0.0018	0.027	2,474,553	37,273.43	0.00000779
41	0.00275	0.07	84.3636	0.0012	0.021	3,976,596	47,136.37	0.00000616
42	0.0025	0.063	102.0800	0.00092	0.017	6,086,233	59,622.19	0.00000487
43	0.00225	0.057	126.0247	0.00067	0.013	9,629,615	76,410.54	0.00000380
44	0.0020	0.051	159.5000	0.00047	0.011	14,749,181	92,471.35	0.00000314
45	0.00175	0.044	208.3265	0.00032	0.008	24,892,881	119,489.73	0.00000243
46	0.0015	0.038	283.5556	0.00020	0.007	40,961,793	144,457.73	0.00000201
47	0.0014	0.036	325.5102	0.00016	0.005	61,373,479	188,545.48	0.00000154
48	0.0013	0.033	377.5148	0.00013	0.004	90,591,085	239,966.98	0.00000121