HYNDMAN

Alloy Datasheet –
HYNDMAN.N4.DATASHEET.MET

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Resistance Heating Wire Nickel-Chromium Alloy 35% Nickel / 18% Chromium - N4

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

I = Current
C_t = Temperature factor
p = Surface load W/in²

Common Names: Chromel® D, Nikrothal® 40, Chromax, HAI-NiCr 40, Tophet® D, Resistohm® 40, Cronifer® III, 35-20 Ni-Cr, Alloy D, MWS-610, Stablohm 610

Uses: Typical applications include night-storage heaters, convection heaters, heavy-duty rheostats and fan heaters. It is also used in heating cables and rope heaters in defrosting and de-icing elements, electric blankets and pads, car seats, baseboard heaters, floor heaters, resistors, etc. This Nickel-Chrome-Iron alloy has been widely used for furnace elements in the critical temperature range between 816º and 982ºC in atmospheres where preferential oxidation of chromium takes place - the "Green Rot" range. N4 is also widely used as electric heating element material in domestic appliances and other electric heating equipment at operating temperatures up to 1100ºC. It has good ductility after use, good corrosion resistance except in sulfur containing atmospheres and certain controlled atmospheres and excellent weldability.

Composition

Ni	Cr	Fe	Al	Si	Mn	Cu	C	Ti	Mo	W
35%	20%	Balance	None/Trace	None/Trace	None/Trace	None/Trace	None/Trace	None/Trace	None/Trace	None/Trace

Technical Data

Resistivity (Ω/cmf)	625	**Resistivity (Ω/sqmf)**	491
Resistivity (μΩ/cm)	104.41	**Nom. Temp. Coeff. of Resistance (TCR)**	0.00040
Std. Res. Tol. <.020"	5%	**Std. Res. Tol. >.020"**	3%
Thermal EMF vs. Cu		**Specific Heat (20°C)**	0.11 cal/g
Density (g/cm³)	7.94	**Density (lb/in³)**	0.287
Thermal Conductivity	0.13 W/cm/°C	**Coeff. of Linear Expansion (X 10^{-6})**	15.60 in/in/°C
Approx. Melting Point	1390°C	**Max. Continuous Operating Temp.**	1050°C
UTS – Hard (KPSI)	175	**YTS Tensile – Hard (KPSI)**	
UTS – Stress Relieved (KPSI)	140	**YTS Tensile – Stress Relieved (KPSI)**	
UTS – Annealed (KPSI)	90	**YTS Tensile – Annealed (KPSI)**	
Magnetic Attraction	Faint	**Emissivity – fully oxidized**	0.88
Designations/Specifications	ASTM = B344	**Forms Available**	Wire, Ribbon

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

°C	20	100	200	300	400	500	600	700	800	900	1000	1100
N4 C_t	1.00	1.03	1.06	1.10	1.12	1.15	1.17	1.19	1.21	1.22	1.23	1.24

Alloy Data

Diameter mm	Resistance at 20° C Ω/m	Resistance at 20° C Ω/kg	Weight kg/1000 m	Surface area cm²/m	cm²/Ω at 20°C
10.4049	0.0119	0.0177	675.4829	326.8804	27408.4525
9.2658	0.0150	0.0281	535.6815	291.0952	19356.3284
8.2515	0.0190	0.0446	424.8141	259.2276	13669.7776
7.3481	0.0239	0.0710	336.8924	230.8486	9653.8359
6.5437	0.0302	0.1129	267.1675	205.5765	6817.7077
5.8273	0.0380	0.1795	211.8731	183.0710	4814.7844
5.1894	0.0479	0.2854	168.0228	163.0293	3400.2849
4.6213	0.0605	0.4537	133.2479	145.1817	2401.3407
4.1154	0.0762	0.7215	105.6703	129.2880	1695.8688
3.6648	0.0961	1.1472	83.8002	115.1342	1197.6522
3.2636	0.1212	1.8241	66.4565	102.5299	845.8029
2.9063	0.1529	2.9004	52.7023	91.3054	597.3208
2.5882	0.1928	4.6118	41.7948	81.3098	421.8384
2.3048	0.2431	7.3331	33.1447	72.4084	297.9096
2.0525	0.3065	11.6602	26.2849	64.4815	210.3890
1.8278	0.3865	18.5405	20.8449	57.4224	148.5804
1.7249	0.4340	23.3791	18.5629	54.1881	124.8621
1.6277	0.4873	29.4806	16.5307	51.1361	104.9301
1.5360	0.5472	37.1744	14.7210	48.2559	88.1798
1.4495	0.6145	46.8761	13.1094	45.5380	74.1035
1.3679	0.6901	59.1098	11.6743	42.9731	62.2741
1.2908	0.7749	74.5361	10.3962	40.5527	52.3332

Diameter mm	Resistance at 20° C Ω/m	Resistance at 20° C Ω/kg	Weight kg/1000 m	Surface area cm^2/m	cm^2/Ω at 20°C
1.2181	0.8702	93.9885	9.2581	38.2686	43.9791
1.1495	0.9771	118.5174	8.2446	36.1132	36.9586
1.0848	1.0972	149.4479	7.3420	34.0792	31.0588
1.0237	1.2321	188.4506	6.5382	32.1597	26.1008
0.9660	1.3836	237.6322	5.8225	30.3483	21.9343
0.9116	1.5537	299.6491	5.1850	28.6390	18.4328
0.8603	1.7447	377.8511	4.6174	27.0260	15.4904
0.8118	1.9592	476.4621	4.1119	25.5038	13.0176
0.7661	2.2000	600.8085	3.6618	24.0673	10.9396
0.7229	2.4705	757.6066	3.2609	22.7117	9.1933
0.6822	2.7742	955.3256	2.9039	21.4325	7.7257
0.6438	3.1152	1204.6451	2.5860	20.2254	6.4924
0.6075	3.4982	1519.0315	2.3029	19.0862	5.4560
0.5733	3.9282	1915.4662	2.0508	18.0112	4.5851
0.5410	4.4111	2415.3617	1.8263	16.9967	3.8531
0.5106	4.9534	3045.7192	1.6264	16.0394	3.2381
0.4818	5.5623	3840.5865	1.4483	15.1360	2.7212
0.4547	6.2461	4842.8971	1.2898	14.2835	2.2868
0.4291	7.0140	6106.7892	1.1486	13.4790	1.9217
0.4049	7.8763	7700.5300	1.0228	12.7198	1.6150
0.3821	8.8445	9710.2030	0.9108	12.0034	1.3572
0.3606	9.9318	12244.3574	0.8111	11.3273	1.1405
0.3403	11.1527	15439.8717	0.7223	10.6893	0.9584
0.3211	12.5238	19469.3467	0.6433	10.0873	0.8054
0.2859	15.7922	30957.5624	0.5101	8.9830	0.5688
0.2546	19.9136	49224.5932	0.4045	7.9996	0.4017
0.2268	25.1107	78270.3931	0.3208	7.1238	0.2837
0.2019	31.6640	124455.1562	0.2544	6.3439	0.2004
0.1798	39.9276	197892.0162	0.2018	5.6494	0.1415
0.1601	50.3479	314661.5318	0.1600	5.0310	0.0999
0.1426	63.4876	500332.8657	0.1269	4.4802	0.0706
0.1270	80.0565	795562.6957	0.1006	3.9897	0.0498
0.1131	100.9495	1264997.8570	0.0798	3.5529	0.0352
0.1007	127.2952	2011431.1377	0.0633	3.1640	0.0249
0.0897	160.5165	3198309.9413	0.0502	2.8176	0.0176
0.0799	202.4078	5085526.5630	0.0398	2.5092	0.0124
0.0711	255.2319	8086327.1222	0.0316	2.2345	0.0088
0.0633	321.8420	12857800.5673	0.0250	1.9898	0.0062
0.0564	405.8358	20444762.2426	0.0199	1.7720	0.0044
0.0502	511.7502	32508538.3746	0.0157	1.5780	0.0031
0.0447	645.3061	51690748.6971	0.0125	1.4053	0.0022
0.0398	813.7171	82191745.1371	0.0099	1.2514	0.0015
0.0355	1026.0798	130690367.9858	0.0079	1.1144	0.0011
0.0316	1293.8646	207806419.6808	0.0062	0.9924	0.0008
0.0281	1631.5354	330426095.8638	0.0049	0.8838	0.0005
0.0251	2057.3311	525399576.1801	0.0039	0.7870	0.0004