

Resistance Heating Wire Iron-Chrome-Aluminum (Fe-Cr-Al) Alloy - KAPM

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

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

Common Names: KAPM, Alloy 875 PM, Kanthal® APM

Uses: Typical applications are in furnaces for firing of high temperature ceramics, heat treatment furnaces, laboratory furnaces, diffusion furnaces, and high temperature kilns. Produced from powder metallurgy technology this alloy has demonstrated significant improvements in both physical and mechanical properties. Its advantages are better form stability, high temperature strength, and the ability to be self-supporting at temperatures above 1300° C. It has an excellent surface oxide, which gives good protection in corrosive atmospheres as well as in atmospheres with high carbon potential, and no scaling.

Composition

Ni	Cr	Fe	Al	Si	Mn	Cu	C	Ti	Mo	W
None/Trace	22%	Balance	5.8%	None/Trace						

Technical Data

Resistivity (Ω/cm ²)	872	Resistivity (Ω/sqmf)	684
Resistivity (μΩ/cm)	145	Nom. Temp. Coeff. of Resistance (TCR)	0.00002
Std. Res. Tol. <.020"	5%	Std. Res. Tol. >.020"	3%
Thermal EMF vs. Cu	-6.4	Specific Heat (20°C)	0.11 cal/g
Density (g/cm ³)	7.10	Density (lb/in ³)	0.256
Thermal Conductivity	0.11 W/cm ² /°C	Coeff. of Linear Expansion (X 10 ⁻⁶)	15.00 in/in/°C
Approx. Melting Point	1500°C	Max. Continuous Operating Temp.	1400°C
UTS – Hard (KPSI)	200	YTS Tensile – Hard (KPSI)	
UTS – Stress Relieved (KPSI)	175	YTS Tensile – Stress Relieved (KPSI)	
UTS – Annealed (KPSI)	115	YTS Tensile – Annealed (KPSI)	
Magnetic Attraction	Strong	Emissivity – fully oxidized	0.70
Designations/Specifications	ASTM = B603	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	1112	1292	1472	1652	1832	2012	2192	2372	2552
KA1 C_t	1.00	1.00	1.00	1.00	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.04	1.04	1.04	1.05

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	0.0052	0.0128	404.8756	15.4432	2971.8743
00	0.3648	0.0066	0.0204	321.0805	13.7525	2098.7896
0	0.3249	0.0083	0.0325	254.6281	12.2470	1482.2019
1	0.2893	0.0104	0.0516	201.9289	10.9062	1046.7569
2	0.2576	0.0131	0.0820	160.1367	9.7123	739.2380
3	0.2294	0.0166	0.1305	126.9940	8.6490	522.0628
4	0.2043	0.0209	0.2074	100.7107	7.7022	368.6899
5	0.1819	0.0263	0.3298	79.8671	6.8590	260.3752
6	0.1620	0.0332	0.5245	63.3374	6.1081	183.8816
7	0.1443	0.0419	0.8339	50.2288	5.4394	129.8604
8	0.1285	0.0528	1.3260	39.8332	4.8439	91.7097
9	0.1144	0.0666	2.1084	31.5891	4.3136	64.7670
10	0.1019	0.0840	3.3525	25.0512	3.8414	45.7396
11	0.0907	0.1059	5.3307	19.8665	3.4209	32.3021
12	0.0808	0.1335	8.4762	15.7548	3.0464	22.8123
13	0.0720	0.1684	13.4777	12.4941	2.7129	16.1104
13.5	0.0679	0.1891	16.9951	11.1263	2.5601	13.5387
14	0.0641	0.2123	21.4304	9.9083	2.4159	11.3775
14.5	0.0605	0.2384	27.0233	8.8236	2.2798	9.5613
15	0.0571	0.2678	34.0758	7.8576	2.1514	8.0350
15.5	0.0539	0.3007	42.9688	6.9974	2.0302	6.7523
16	0.0508	0.3376	54.1828	6.2314	1.9159	5.6744
16.5	0.0480	0.3791	68.3233	5.5492	1.8080	4.7686
17	0.0453	0.4257	86.1542	4.9417	1.7061	4.0074
17.5	0.0427	0.4781	108.6386	4.4007	1.6100	3.3677

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	0.5369	136.9910	3.9189	1.5194	2.8301
18.5	0.0380	0.6029	172.7427	3.4899	1.4338	2.3783
19	0.0359	0.6770	217.8248	3.1079	1.3530	1.9987
19.5	0.0339	0.7602	274.6724	2.7676	1.2768	1.6796
20	0.0320	0.8536	346.3560	2.4646	1.2049	1.4115
20.5	0.0302	0.9586	436.7474	2.1948	1.1370	1.1862
21	0.0285	1.0764	550.7291	1.9545	1.0730	0.9968
21.5	0.0269	1.2088	694.4576	1.7406	1.0126	0.8377
22	0.0253	1.3573	875.6961	1.5500	0.9555	0.7040
22.5	0.0239	1.5242	1104.2340	1.3803	0.9017	0.5916
23	0.0226	1.7116	1392.4154	1.2292	0.8509	0.4972
23.5	0.0213	1.9220	1755.8059	1.0947	0.8030	0.4178
24	0.0201	2.1583	2214.0335	0.9748	0.7578	0.3511
24.5	0.0190	2.4236	2791.8487	0.8681	0.7151	0.2951
25	0.0179	2.7215	3520.4612	0.7731	0.6748	0.2480
25.5	0.0169	3.0561	4439.2260	0.6884	0.6368	0.2084
26	0.0159	3.4318	5597.7686	0.6131	0.6009	0.1751
26.5	0.0150	3.8537	7058.6660	0.5459	0.5671	0.1472
27	0.0142	4.3274	8900.8262	0.4862	0.5351	0.1237
27.5	0.0134	4.8594	11223.7507	0.4330	0.5050	0.1039
28	0.0126	5.4568	14152.9085	0.3856	0.4766	0.0873
29	0.0113	6.8809	22504.0705	0.3058	0.4244	0.0617
30	0.0100	8.6766	35782.9761	0.2425	0.3779	0.0436
31	0.0089	10.9411	56897.3235	0.1923	0.3366	0.0308
32	0.0080	13.7965	90470.5470	0.1525	0.2997	0.0217
33	0.0071	17.3970	143854.2163	0.1209	0.2669	0.0153
34	0.0063	21.9373	228737.8182	0.0959	0.2377	0.0108
35	0.0056	27.6624	363708.4185	0.0761	0.2117	0.0077
36	0.0050	34.8817	578320.6936	0.0603	0.1885	0.0054
37	0.0045	43.9851	919568.5544	0.0478	0.1679	0.0038
38	0.0040	55.4643	1462175.4600	0.0379	0.1495	0.0027
39	0.0035	69.9393	2324956.7048	0.0301	0.1331	0.0019
40	0.0031	88.1919	3696836.5471	0.0239	0.1185	0.0013
41	0.0028	111.2081	5878217.1850	0.0189	0.1056	0.0009
42	0.0025	140.2311	9346758.1900	0.0150	0.0940	0.0007
43	0.0022	176.8284	14861970.2050	0.0119	0.0837	0.0005
44	0.0020	222.9768	23631525.9134	0.0094	0.0746	0.0003
45	0.0018	281.1690	37575705.5960	0.0075	0.0664	0.0002
46	0.0016	354.5480	59747883.2391	0.0059	0.0591	0.0002
47	0.0014	447.0774	95003127.5508	0.0047	0.0526	0.0001
48	0.0012	563.7550	151061322.2618	0.0037	0.0469	0.0001
49	0.0011	710.8830	240197598.4556	0.0030	0.0418	0.0001
50	0.0010	896.4082	381930234.9536	0.0023	0.0372	0.0000

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