

Resistance Heating Wire Iron-Chrome-Aluminum (Fe-Cr-Al) Alloy - 1JR®

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

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

Common Names: No. 1JR® Alloy (Types 1, 2 and 4); Alkrothal® 720

Uses: Oxidation-resistant steel offering an excellent combination of electrical resistance and scale resistance. Resistivity of the three types in ohms - cir mil/ft at 68° F is: Type 1, 720; Type 2, 680; Type 4, 656. Electric wire wound and edge wound resistors and braking resistors. Also, magnetic core material where resistance to oxidation and corrosion are required.

Composition

Ni	Cr	Fe	Al	Si	Mn	Cu	C	Ti	Mo	W
None/Trace	12 - 14%	Balance	3 - 4%	None/Trace	None/Trace	None/Trace	0.15% max.	0.70% max.	None/Trace	None/Trace

Technical Data

Resistivity (Ω/cm²)	720	Resistivity (Ω/sqmf)	565
Resistivity (μΩ/cm)	120	Nom. Temp. Coeff. of Resistance (TCR)	0.000068
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)	7.335	Density (lb/in³)	0.265
Thermal Conductivity	0.173 W/cm/°C	Coeff. of Linear Expansion (X 10⁻⁶)	11.50 in/in/°C
Approx. Melting Point	1500 °C	Max. Continuous Operating Temp.	1000°C
UTS – Hard (KPSI)		YTS Tensile – Hard (KPSI)	
UTS – Stress Relieved (KPSI)		YTS Tensile – Stress Relieved (KPSI)	
UTS – Annealed (KPSI)	86	YTS Tensile – Annealed (KPSI)	
Magnetic Attraction	Strong	Emissivity – fully oxidized	
Designations/Specifications	ASTM-A341	Forms Available	Wire, Ribbon, Square

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	0.0043	0.0102	419.1095	15.4432	3599.2700
00	0.3648	0.0054	0.0163	332.3685	13.7525	2541.8674
0	0.3249	0.0068	0.0259	263.5798	12.2470	1795.1112
1	0.2893	0.0086	0.0412	209.0280	10.9062	1267.7389
2	0.2576	0.0108	0.0654	165.7665	9.7123	895.2994
3	0.2294	0.0137	0.1041	131.4586	8.6490	632.2761
4	0.2043	0.0172	0.1655	104.2513	7.7022	446.5244
5	0.1819	0.0218	0.2631	82.6749	6.8590	315.3434
6	0.1620	0.0274	0.4183	65.5641	6.1081	222.7010
7	0.1443	0.0346	0.6652	51.9946	5.4394	157.2753
8	0.1285	0.0436	1.0577	41.2335	4.8439	111.0706
9	0.1144	0.0550	1.6818	32.6996	4.3136	78.4400
10	0.1019	0.0693	2.6741	25.9320	3.8414	55.3957
11	0.0907	0.0874	4.2520	20.5649	3.4209	39.1214
12	0.0808	0.1103	6.7610	16.3087	3.0464	27.6282
13	0.0720	0.1390	10.7504	12.9334	2.7129	19.5115
13.5	0.0679	0.1561	13.5560	11.5175	2.5601	16.3969
14	0.0641	0.1753	17.0939	10.2566	2.4159	13.7794
14.5	0.0605	0.1969	21.5550	9.1338	2.2798	11.5797
15	0.0571	0.2211	27.1804	8.1339	2.1514	9.7312
15.5	0.0539	0.2483	34.2739	7.2434	2.0302	8.1778
16	0.0508	0.2788	43.2187	6.4504	1.9159	6.8724
16.5	0.0480	0.3131	54.4978	5.7443	1.8080	5.7753
17	0.0453	0.3515	68.7206	5.1154	1.7061	4.8534
17.5	0.0427	0.3947	86.6551	4.5554	1.6100	4.0786
18	0.0403	0.4433	109.2703	4.0567	1.5194	3.4275
18.5	0.0380	0.4978	137.7875	3.6126	1.4338	2.8804
19	0.0359	0.5590	173.7470	3.2171	1.3530	2.4206
19.5	0.0339	0.6277	219.0913	2.8649	1.2768	2.0342
20	0.0320	0.7048	276.2694	2.5513	1.2049	1.7095

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
20.5	0.0302	0.7915	348.3698	2.2720	1.1370	1.4366
21	0.0285	0.8888	439.2868	2.0233	1.0730	1.2073
21.5	0.0269	0.9981	553.9312	1.8018	1.0126	1.0145
22	0.0253	1.1207	698.4954	1.6045	0.9555	0.8526
22.5	0.0239	1.2585	880.7877	1.4289	0.9017	0.7165
23	0.0226	1.4132	1110.6543	1.2724	0.8509	0.6021
23.5	0.0213	1.5870	1400.5112	1.1331	0.8030	0.5060
24	0.0201	1.7821	1766.0146	1.0091	0.7578	0.4252
24.5	0.0190	2.0011	2226.9065	0.8986	0.7151	0.3573
25	0.0179	2.2471	2808.0812	0.8002	0.6748	0.3003
25.5	0.0169	2.5234	3540.9301	0.7126	0.6368	0.2524
26	0.0159	2.8336	4465.0368	0.6346	0.6009	0.2121
26.5	0.0150	3.1819	5630.3155	0.5651	0.5671	0.1782
27	0.0142	3.5731	7099.7070	0.5033	0.5351	0.1498
27.5	0.0134	4.0123	8952.5780	0.4482	0.5050	0.1259
28	0.0126	4.5056	11289.0086	0.3991	0.4766	0.1058
29	0.0113	5.6815	17950.2781	0.3165	0.4244	0.0747
30	0.0100	7.1642	28542.1419	0.2510	0.3779	0.0528
31	0.0089	9.0339	45383.9132	0.1991	0.3366	0.0373
32	0.0080	11.3916	72163.4552	0.1579	0.2997	0.0263
33	0.0071	14.3645	114744.7167	0.1252	0.2669	0.0186
34	0.0063	18.1134	182451.7685	0.0993	0.2377	0.0131
35	0.0056	22.8405	290110.5059	0.0787	0.2117	0.0093
36	0.0050	28.8014	461295.0936	0.0624	0.1885	0.0065
37	0.0045	36.3180	733490.0292	0.0495	0.1679	0.0046
38	0.0040	45.7962	1166298.1686	0.0393	0.1495	0.0033
39	0.0035	57.7480	1854492.0366	0.0311	0.1331	0.0023
40	0.0031	72.8190	2948766.2817	0.0247	0.1185	0.0016
41	0.0028	91.8232	4688735.4662	0.0196	0.1056	0.0011
42	0.0025	115.7871	7455402.7591	0.0155	0.0940	0.0008
43	0.0022	146.0051	11854588.6627	0.0123	0.0837	0.0006
44	0.0020	184.1093	18849588.2654	0.0098	0.0746	0.0004
45	0.0018	232.1578	29972105.1387	0.0077	0.0664	0.0003
46	0.0016	292.7461	47657650.3316	0.0061	0.0591	0.0002
47	0.0014	369.1465	75778849.1871	0.0049	0.0526	0.0001
48	0.0012	465.4858	120493434.8247	0.0039	0.0469	0.0001
49	0.0011	586.9676	191592614.4510	0.0031	0.0418	0.0001
50	0.0010	740.1535	304645061.9121	0.0024	0.0372	0.0001

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