

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

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

I = Current  
C<sub>t</sub> = Temperature factor  
p = Surface load W/in<sup>2</sup>

**Common Names:** Alloy 835, Kanthal A

**Uses:** Typical applications include elements embedded in ceramics for panel heaters, infrared heaters, warming plates, irons, ceramic pots, in cartridge heaters for liquid heating, storage heaters, in ceramic heaters for cooking plates, air guns, hobby kilns, radiators, in quartz tube heaters for space heating, toasters, toaster ovens, grills, industrial infrared dryers, coils on molded ceramic fiber for cooking plates with ceramic hobs. In addition to industrial furnaces, this alloy is used in appliances where its high resistivity and good oxidation resistance are of particular importance.

### Composition

| Ni         | Cr  | Fe      | Al   | Si         | Mn         | Cu         | C          | Ti         | Mo         | W          |
|------------|-----|---------|------|------------|------------|------------|------------|------------|------------|------------|
| None/Trace | 22% | Balance | 5.3% | None/Trace | None/Trace | None/Trace | None/Trace | None/Trace | None/Trace | None/Trace |

### Technical Data

|                                  |              |  |                |
|----------------------------------|--------------|--|----------------|
| Resistivity (Ω/cm <sup>2</sup> ) | 836          | Resistivity (Ω/sqmf)                             | 656            |
| Resistivity (μΩ/cm)              | 139          | Nom. Temp. Coeff. of Resistance (TCR)            | 0.00002        |
| Std. Res. Tol. <.020"            | 5%           | Std. Res. Tol. >.020"                            | 3%             |
| Thermal EMF vs. Cu               |              | Specific Heat (20°C)                             | 0.1099 cal/g   |
| Density (g/cm <sup>3</sup> )     | 7.15         | Density (lb/in <sup>3</sup> )                    | 0.258          |
| Thermal Conductivity             | 0.11 W/cm/°C | Coeff. of Linear Expansion (X 10 <sup>-6</sup> ) | 11.00 in/in/°C |
| Approx. Melting Point            | 1500°C       | Max. Continuous Operating Temp.                  | 1300°C         |
| UTS – Hard (KPSI)                | 105          | YTS Tensile – Hard (KPSI)                        | 80             |
| UTS – Stress Relieved (KPSI)     |              | YTS Tensile – Stress Relieved (KPSI)             |                |
| UTS – Annealed (KPSI)            |              | 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<sub>t</sub>, in the following table:

| °F                | 68   | 212  | 392  | 572  | 752  | 932  | 1112 | 1292 | 1472 | 1652 | 1832 | 2012 | 2192 | 2372 |
|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| KA C <sub>t</sub> | 1.00 | 1.00 | 1.01 | 1.01 | 1.02 | 1.03 | 1.04 | 1.04 | 1.05 | 1.05 | 1.06 | 1.06 | 1.06 | 1.06 |

### 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 <sup>2</sup> /ft | in <sup>2</sup> /Ω at 68°F |
|----------|---------------|--------------------------|--------------------------|-------------------|----------------------------------|----------------------------|
| 000      | 0.4096        | 0.0050                   | 0.0122                   | 408.0387          | 15.4432                          | 3099.8497                  |
| 00       | 0.3648        | 0.0063                   | 0.0194                   | 323.5889          | 13.7525                          | 2189.1681                  |
| 0        | 0.3249        | 0.0079                   | 0.0309                   | 256.6173          | 12.2470                          | 1546.0288                  |
| 1        | 0.2893        | 0.0100                   | 0.0491                   | 203.5065          | 10.9062                          | 1091.8326                  |
| 2        | 0.2576        | 0.0126                   | 0.0780                   | 161.3878          | 9.7123                           | 771.0712                   |
| 3        | 0.2294        | 0.0159                   | 0.1241                   | 127.9861          | 8.6490                           | 544.5440                   |
| 4        | 0.2043        | 0.0200                   | 0.1973                   | 101.4975          | 7.7022                           | 384.5665                   |
| 5        | 0.1819        | 0.0253                   | 0.3138                   | 80.4910           | 6.8590                           | 271.5876                   |
| 6        | 0.1620        | 0.0318                   | 0.4989                   | 63.8322           | 6.1081                           | 191.7999                   |
| 7        | 0.1443        | 0.0402                   | 0.7933                   | 50.6212           | 5.4394                           | 135.4524                   |
| 8        | 0.1285        | 0.0506                   | 1.2614                   | 40.1444           | 4.8439                           | 95.6589                    |
| 9        | 0.1144        | 0.0639                   | 2.0057                   | 31.8359           | 4.3136                           | 67.5560                    |
| 10       | 0.1019        | 0.0805                   | 3.1892                   | 25.2470           | 3.8414                           | 47.7092                    |
| 11       | 0.0907        | 0.1015                   | 5.0710                   | 20.0217           | 3.4209                           | 33.6931                    |
| 12       | 0.0808        | 0.1280                   | 8.0632                   | 15.8779           | 3.0464                           | 23.7946                    |
| 13       | 0.0720        | 0.1614                   | 12.8211                  | 12.5917           | 2.7129                           | 16.8042                    |
| 13.5     | 0.0679        | 0.1813                   | 16.1671                  | 11.2133           | 2.5601                           | 14.1217                    |
| 14       | 0.0641        | 0.2036                   | 20.3864                  | 9.9857            | 2.4159                           | 11.8674                    |
| 14.5     | 0.0605        | 0.2286                   | 25.7068                  | 8.8925            | 2.2798                           | 9.9730                     |

| Gage AWG | Diameter Inch | Resistance at 68° F Ω/ft | Resistance at 68° F Ω/lb | Weight Lb/1000 ft | Surface area in <sup>2</sup> /ft | in <sup>2</sup> /Ω at 68°F |
|----------|---------------|--------------------------|--------------------------|-------------------|----------------------------------|----------------------------|
| 15       | 0.0571        | 0.2567                   | 32.4157                  | 7.9190            | 2.1514                           | 8.3810                     |
| 15.5     | 0.0539        | 0.2883                   | 40.8755                  | 7.0521            | 2.0302                           | 7.0431                     |
| 16       | 0.0508        | 0.3237                   | 51.5432                  | 6.2800            | 1.9159                           | 5.9188                     |
| 16.5     | 0.0480        | 0.3635                   | 64.9948                  | 5.5925            | 1.8080                           | 4.9740                     |
| 17       | 0.0453        | 0.4082                   | 81.9571                  | 4.9803            | 1.7061                           | 4.1800                     |
| 17.5     | 0.0427        | 0.4583                   | 103.3461                 | 4.4351            | 1.6100                           | 3.5127                     |
| 18       | 0.0403        | 0.5147                   | 130.3173                 | 3.9495            | 1.5194                           | 2.9520                     |
| 18.5     | 0.0380        | 0.5780                   | 164.3273                 | 3.5172            | 1.4338                           | 2.4807                     |
| 19       | 0.0359        | 0.6490                   | 207.2132                 | 3.1321            | 1.3530                           | 2.0847                     |
| 19.5     | 0.0339        | 0.7288                   | 261.2913                 | 2.7892            | 1.2768                           | 1.7519                     |
| 20       | 0.0320        | 0.8184                   | 329.4828                 | 2.4839            | 1.2049                           | 1.4723                     |
| 20.5     | 0.0302        | 0.9190                   | 415.4707                 | 2.2120            | 1.1370                           | 1.2372                     |
| 21       | 0.0285        | 1.0320                   | 523.8996                 | 1.9698            | 1.0730                           | 1.0397                     |
| 21.5     | 0.0269        | 1.1588                   | 660.6262                 | 1.7542            | 1.0126                           | 0.8738                     |
| 22       | 0.0253        | 1.3013                   | 833.0354                 | 1.5621            | 0.9555                           | 0.7343                     |
| 22.5     | 0.0239        | 1.4613                   | 1050.4398                | 1.3911            | 0.9017                           | 0.6171                     |
| 23       | 0.0226        | 1.6409                   | 1324.5820                | 1.2388            | 0.8509                           | 0.5186                     |
| 23.5     | 0.0213        | 1.8426                   | 1670.2695                | 1.1032            | 0.8030                           | 0.4358                     |
| 24       | 0.0201        | 2.0692                   | 2106.1739                | 0.9824            | 0.7578                           | 0.3662                     |
| 24.5     | 0.0190        | 2.3235                   | 2655.8401                | 0.8749            | 0.7151                           | 0.3078                     |
| 25       | 0.0179        | 2.6092                   | 3348.9573                | 0.7791            | 0.6748                           | 0.2586                     |
| 25.5     | 0.0169        | 2.9299                   | 4222.9633                | 0.6938            | 0.6368                           | 0.2173                     |
| 26       | 0.0159        | 3.2901                   | 5325.0660                | 0.6179            | 0.6009                           | 0.1826                     |
| 26.5     | 0.0150        | 3.6946                   | 6714.7938                | 0.5502            | 0.5671                           | 0.1535                     |
| 27       | 0.0142        | 4.1488                   | 8467.2108                | 0.4900            | 0.5351                           | 0.1290                     |
| 27.5     | 0.0134        | 4.6588                   | 10676.9710               | 0.4363            | 0.5050                           | 0.1084                     |
| 28       | 0.0126        | 5.2315                   | 13463.4311               | 0.3886            | 0.4766                           | 0.0911                     |
| 29       | 0.0113        | 6.5968                   | 21407.7552               | 0.3082            | 0.4244                           | 0.0643                     |
| 30       | 0.0100        | 8.3184                   | 34039.7616               | 0.2444            | 0.3779                           | 0.0454                     |
| 31       | 0.0089        | 10.4894                  | 54125.4960               | 0.1938            | 0.3366                           | 0.0321                     |
| 32       | 0.0080        | 13.2269                  | 86063.1560               | 0.1537            | 0.2997                           | 0.0227                     |
| 33       | 0.0071        | 16.6788                  | 136846.1700              | 0.1219            | 0.2669                           | 0.0160                     |
| 34       | 0.0063        | 21.0316                  | 217594.5563              | 0.0967            | 0.2377                           | 0.0113                     |
| 35       | 0.0056        | 26.5204                  | 345989.8873              | 0.0767            | 0.2117                           | 0.0080                     |
| 36       | 0.0050        | 33.4417                  | 550147.0448              | 0.0608            | 0.1885                           | 0.0056                     |
| 37       | 0.0045        | 42.1692                  | 874770.5699              | 0.0482            | 0.1679                           | 0.0040                     |
| 38       | 0.0040        | 53.1745                  | 1390943.6707             | 0.0382            | 0.1495                           | 0.0028                     |
| 39       | 0.0035        | 67.0519                  | 2211693.3990             | 0.0303            | 0.1331                           | 0.0020                     |
| 40       | 0.0031        | 84.5510                  | 3516740.3211             | 0.0240            | 0.1185                           | 0.0014                     |
| 41       | 0.0028        | 106.6170                 | 5591852.1490             | 0.0191            | 0.1056                           | 0.0010                     |
| 42       | 0.0025        | 134.4417                 | 8891418.6437             | 0.0151            | 0.0940                           | 0.0007                     |
| 43       | 0.0022        | 169.5281                 | 14137949.8941            | 0.0120            | 0.0837                           | 0.0005                     |
| 44       | 0.0020        | 213.7713                 | 22480285.2299            | 0.0095            | 0.0746                           | 0.0003                     |
| 45       | 0.0018        | 269.5611                 | 35745155.9670            | 0.0075            | 0.0664                           | 0.0002                     |
| 46       | 0.0016        | 339.9107                 | 56837186.9857            | 0.0060            | 0.0591                           | 0.0002                     |
| 47       | 0.0014        | 428.6201                 | 90374925.9739            | 0.0047            | 0.0526                           | 0.0001                     |
| 48       | 0.0012        | 540.4807                 | 143702172.4325           | 0.0038            | 0.0469                           | 0.0001                     |
| 49       | 0.0011        | 681.5346                 | 228496058.3843           | 0.0030            | 0.0418                           | 0.0001                     |
| 50       | 0.0010        | 859.4005                 | 363324004.1775           | 0.0024            | 0.0372                           | 0.0000                     |

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