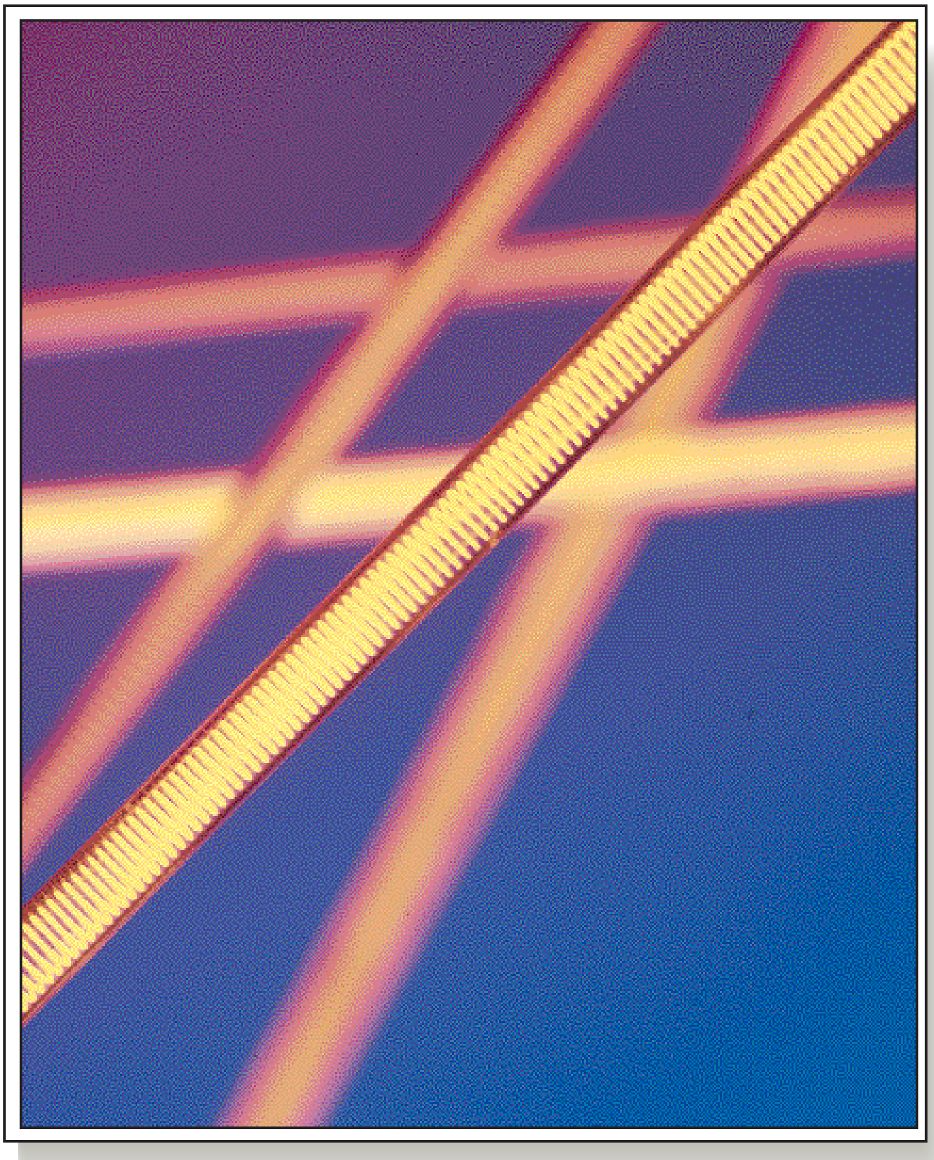
KANTHAL

Appliance Heating Alloys

Handbook



Catalogue 1-A-2-3 02. 97 5000

Set in DTP by Design & Media,
Hallstahammar

Contents

Appliance Heating Alloys from Kanthal

This booklet contains basic technical data for our resistance heating alloys KANTHAL and NIKROTHAL for the appliance industry.

We have also included some design and application guidelines, in order to make it easier for you to select the right alloy.

More detailed information is given by the nearest Kanthal office or in the complete Kanthal Handbook ”Resistance Heating Alloys for Appliances and Heaters”. Kanthal also produces Fine Wire in very small diameters and products for the Furnace industry.

We have substantial technical resources at all our offices around the world and we are glad to help you in different technical questions, or to try out completely new solutions at our central laboratories. Kanthal is never far away! Kanthal produces ferritic alloys under the trade names KANTHAL and ALKROTHAL, austenitic alloys under the trade name NIKROTHAL and two grades of nickel-iron alloys for resistance heating purposes.

Resistance Heating Alloys

Ferritic Alloys (FeCrAl)

Up to 1425°C (*2595°F*). **KANTHAL APM** is a powder metallurgical alloy. It has a very good strength, giving good form stability of the heating elements with less need for element support. It has low tendency to ageing, low resistance change and long element life. KANTHAL APM has an excellent surface oxide, which gives good protection in corrosive atmospheres as well as in atmospheres with high carbon potential, and no scaling.

Up to 1400°C (*2550°F*). **KANTHAL A-1** is usually specified for high temperature furnaces in the heat treating, ceramics, glass, steel and electronics industries.

Up to 1350°C (*2460°F*). **KANTHAL A** is used for applications where its high resistivity and good oxidation resistance are particularly important.

Up to 1300°C (*2370°F*). **KANTHAL AF** is especially recommended where good form stability properties are required. For maximum life above 1300°C *(2370°F)* wire temperature KANTHAL A-1 is recommended since it provides superior oxidation resistance.

Up to 1300°C (*2370°F*). **KANTHAL AE** is developed to meet the extreme demands in fast response elements in glass top hobs and quartz tube heaters. It has exceptional form stability and life in spirals with large coil to wire diameter ratio.

Up to 1300°C (*2370°F*). **KANTHAL D.** Employed chiefly in appliances, its high resistivity and low density, combined with better heat resistance than austenitic alloys, make it suitable for most applications.

Up to 1100°C (*2010°F*). **ALKROTHAL** is typically specified for rheostats, braking resistors, etc. It is also used as a heating wire for low temperatures, such as heating cables.

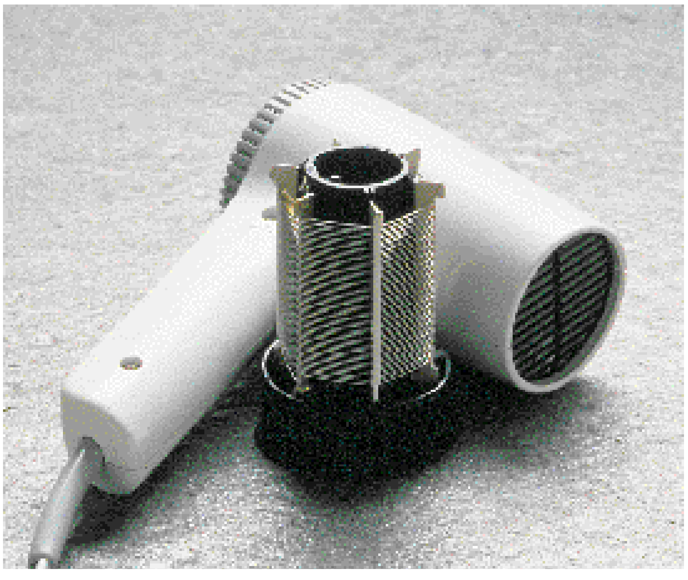


Fig.1 Portable hair dryer with straight KANTHAL AF heating element wound on mica support.

Fig. 2 Coils of KANTHAL AE wire on ceramic fibre base for glass hot plates.

Austenitic Alloys (NiCr, NiCrFe)

Up to 1200°C (*2190°F*). **NIKROTHAL 80** is the premium-quality austenitic alloy. Because of its good workability and high-temperature strength, NIKROTHAL 80 is widely used for heavy-duty applications in the electric appliance industry.

Up to 1250°C (*2280°F*). **NIKROTHAL 70** is used for electrical heating elements in industrial furnaces. It is particularly well suited for reducing atmospheres, as it is not subject to "green rot".

Up to 1150°C (*2100°F*). **NIKROTHAL 60** has good corrosion resistance, good oxidation properties and very good form stability. The corrosion stability is good except in sulphur containing atmospheres. Typical applications for NIKROTHAL 60 are in tubular heating elements and as suspended coils.

Up to 1100°C (*2010°F*). **NIKROTHAL 40** is used as electric heating element material in domestic appliances and other electric heating equipment.

Up to 1050°C (*1920°F*). **NIKROTHAL 20** is used principally for terminals and for other components exposed to elevated temperature. (Produced on volume based request.)

KANTHAL/NiFe

Up to 600°C (*1110°F*). **KANTHAL 70** and **52** are alloys with low resistivity and high temperature coefficient of resistance. The positive temperature coefficient results in reduced power in the heating elements as temperature increases.

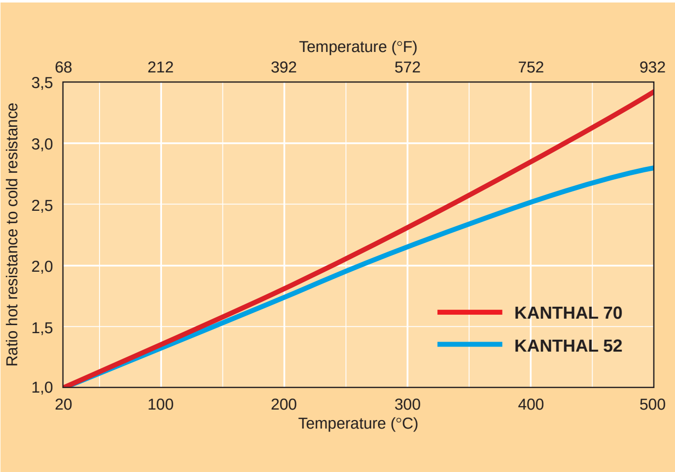


Fig. 3 Ratio of resistance at a given wire temperature to resistance at 20°C/68°F, C_t, vs wire temperature.

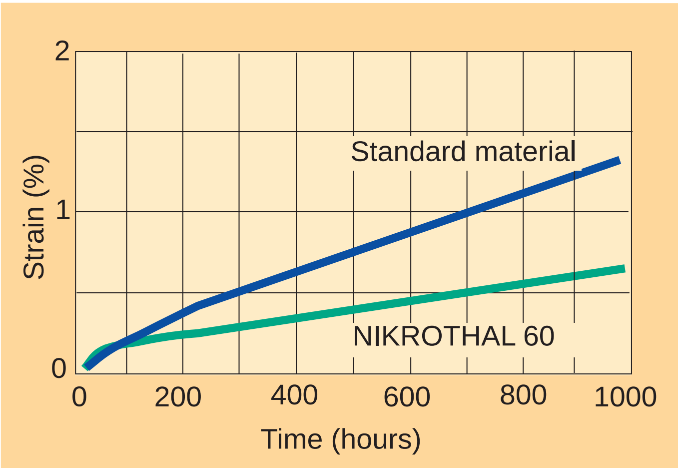


Fig. 4 Deformation vs time for NIKROTHAL 60 compared to standard material. Test performed on Ø 4 mm wire. Stress 1.5 MPa (218 psi).

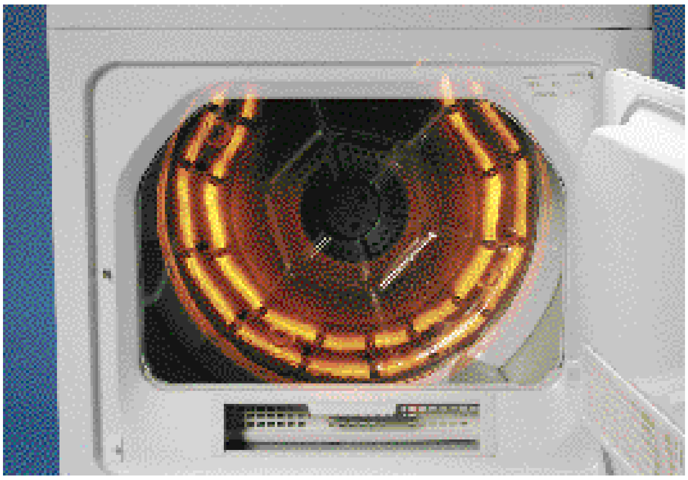


Fig. 5 NIKROTHAL 60 with outstanding combination of oxidation resistance and form stability. An example of typical application: Suspended coils in clothes drier.

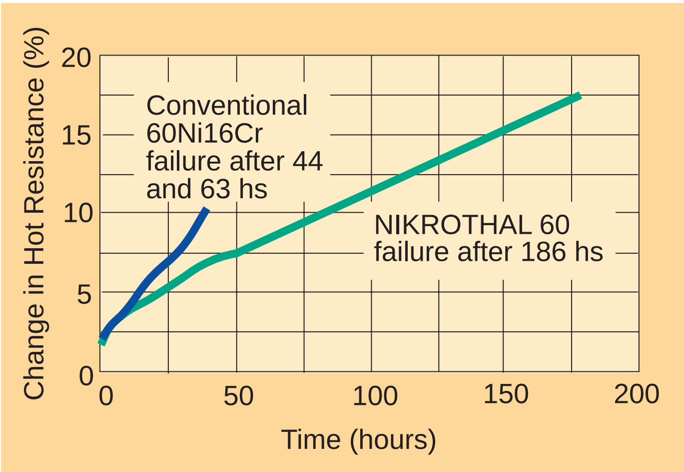


Fig. 6 Life and change in hot resistance for 60Ni, 16 Cr alloys. Constant power 200W. Cycling, 2 minutes on and 2 minutes off.

Physical and Mechanical Properties
KANTHAL Alloys

Heating Alloys	APM	A-1	A	AF	AE
Max continuous operating temperature (element temperature in air), °C *°F*	1425…*2595*	1400…*2550*	1350…*2460*	1300…*2370*	1300…*2370*
Nominal composition, % Cr	22				
Al	5.8		5.3		
Fe	Balance				
Density, g/cm^3 *lb/in^3*	7.10…*0.256*		7.15…*0.258*		
Electrical resistivity at 20 °C, Ω mm^{2}m^{-1} *at 68 °F, Ω/cmf*	1.45…*872*		1.39…*836*		
Temperature factor of the resistivity, C_t					
250 °C *480 °F*	1.00		1.01		
500 °C *930 °F*	1.01		1.03		
800 °C *1470 °F*	1.03		1.05		
1000 °C *1830 °F*	1.04		1.06		
1200 °C *2190 °F*	1.04		1.06		
Coefficient of thermal expansion, K^{-1}					
20-100°C *68-210°F*	–				
20- 250 °C *68- 480 °F*	$11 \cdot 10^{-6}$				
20- 500 °C *68- 930 °F*	$12 \cdot 10^{-6}$				
20- 750 °C *68-1380 °F*	$14 \cdot 10^{-6}$				
20-1000 °C *68-1830 °F*	$15 \cdot 10^{-6}$				
Thermal conductivity at 50 °C, W m^{-1} K^{-1} *122 °F, Btu in ft^{-2}h^{-1}°F^{-1}*	11…*76*				
Specific heat capacity, kJ kg^{-1}K^{-1}, 20 °C *Btu lb^{-1}°F^{-1}, 68 °F*	0.46 *0.110*				
Melting point (approx.), °C *°F*	1500…*2730*				
Mechanical properties *(approx.) Tensile strength, N mm^{-2} *psi*	680…*98600***	760…*110200*	725…*105200*	700…*101500*	720…*104400*
Yield point, N mm^{-2} *psi*	470…*68200***	545…*79000*	550…*798000*	500…*72500*	520…*75400*
Hardness, Hv	230	240	230		
Elongation at rupture, %	20**	20	22	23	20
Tensile strength at 900 °C, N mm^{-2} *at 1650 °F, psi.* Deformation rate 6.2 x 10^{-2}min^{-1}	40 *5800*	34 *4900*		37 *5400*	34 *4900*
Creep strength***					
at 800 °C, N mm^{-2} *at 1470 °F, psi*	8.2….*1190*	1.2….*170*		–	1.2…*170*
at 1000 °C, N mm^{-2} *at 1830 °F, psi*	–	0.5…*70*		–	–
at 1100 °C, N mm^{-2} *at 2010 °F, psi*	–	–		0.7…*100*	–
at 1200 °C, N mm^{-2} *at 2190 °F, psi*	–	–		0.3…*40*	–
Magnetic properties	Magnetic (Curie point approx. 600 °C *1100 °F)*				
Emissivity, fully oxidized condition	0.70				

* The values given apply for sizes of approx. 1.0 mm diameter *0.04 in.*
**4.0 mm *0.16 in.* Finer gauges have higher strength and hardness values while the corresponding values are lower for heavier gauges.
***Calculated from observed elongation in a Kanthal standard furnace test. 1 % elongation after 1000 hours.

Heating Alloys	D	ALKROTHAL	K 70	K 52
Max continuous operating temperature (element temperature in air), °C *°F*	1300… *2370*	1100…*2010*	600…*1110*	600…*1110*
Nominal composition, % Cr Al Fe Ni	22 4.8 Bal –	15 4.3 Bal –	– – Bal 70	– – Bal 52
Density, g/cm^3 *lb/in^3*	7.25…*0.262*	7.28…*0.263*	8.45…*0.305*	8.20…*0.296*
Electrical resistivity at 20 °C, Ω mm^{2}m^{-1} *at 68 °F, Ω/cmf*	1.35…*812*	1.25…*755*	0.21…*126*	0.37….*223*
Temperature factor of the resistivity, C_t 250 °C *480 °F* 500 °C *930 °F* 800 °C *1470 °F* 1000 °C *1830 °F* 1200 °C *2190 °F*	 1.01 1.03 1.06 1.07 1.08	 1.03 1.05 1.10 1.11 –	 2.05 3.40 – – –	 1.93 2.77 – – –
Coefficient of thermal expansion, K^{-1} 20-100°C *68-210°F* 20- 250 °C *68- 480 °F* 20- 500 °C *68- 930 °F* 20- 750 °C *68-1380 °F* 20-1000 °C *68-1830 °F*	 – $11 \cdot 10^{-6}$ $12 \cdot 10^{-6}$ $14 \cdot 10^{-6}$ $15 \cdot 10^{-6}$		 $15 \cdot 10^{-6}$ – – – –	 $10 \cdot 10^{-6}$ – – – –
Thermal conductivity at 50 °C, W m^{-1} K^{-1} *122 °F, Btu in ft^{-2}h^{-1}°F*	11…*76*	16…*110*	16…*110*	17…*120*
Specific heat capacity, kJ kg^{-1}K^{-1}, 20 °C *Btu lb^{-1}°F^{-1}, 68 °F*	0.46 *0.110*		0.52 *0.120*	0.50 *0.120*
Melting point (approx.), °C *°F*	1500…*2730*		1430…*2610*	1435…*2620*
Mechanical properties* (approx.) Tensile strength, N mm^{-2} *psi*	670…97200	630…91400	640…92800	610…88500
Yield point, N mm^{-2} *psi*	485…*70300*	455…*66000*	340…*49300*	
Hardness, Hv	230	220	–	–
Elongation at rupture, %	23	22	30	
Tensile strength at 900 °C, N mm^{-2} *at 1650 °F, psi.* Deformation rate 6.2 x 10^{-2} min^{-1}	34 *4900*	30 *4300*	– –	– –
Creep strength*** at 800 °C, N mm^{-2} *at 1470 °F, psi* at 1000 °C, N mm^{-2} *at 1830 °F, psi* at 1100 °C, N mm^{-2} *at 2010 °F, psi* at 1200 °C, N mm^{-2} *at 2190 °F, psi*	 1.2…*170* 0.5…*70* – –	 1…*140* – –	 – – – –	 – – – –
Magnetic properties	Magnetic (Curie point approx. 600 °C *1100 °F)*		Magnetic up to °C/°F (Curie point) 610…*1130*	 530…*990*
Emissivity, fully oxidized condition	0.70		–	

* The values given apply for sizes of approx. 1.0 mm diameter *0.04 in.*
**4.0 mm *0.16 in.* Finer gauges have higher strength and hardness values while the corresponding values are lower for heavier gauges.
***Calculated from observed elongation in a Kanthal standard furnace test. 1 % elongation after 1000 hours.

Physical and Mechanical Properties
NIKROTHAL Alloys

Heating Alloys	N 80	N 70	N 60	N 40	N 20
Max continuous operating temperature (element temperature in air), °C *°F*	1200…*2190*	1250….*2280*	1150…*2100*	1100…*2010*	1050…*1920*
Nominal composition, % Cr Al Fe Ni	20 – – 80	30 – – 70	16 – Bal 60	20 – Bal 35	24 – Bal 20
Density, g/cm^3 *lb/in^3*	8.30…*0.300*	8.10….*0.293*	8.20…*0.296*	7.90…*0.285*	7.80…*0.281*
Electrical resistivity at 20 °C, Ω mm^{2}m^{-1} *at 68 °F, Ω/cmf*	1.09….*655*	1.18…*709*	1.11…*668*	1.04…*626*	0.95…*572*
Temperature factor of the resistivity, C_t 250 °C *480 °F* 500 °C *930 °F* 800 °C *1470 °F* 1000 °C *1830 °F* 1200 °C *2190 °F*	 1.03 1.04 1.04 1.05 1.07	 1.03 1.05 1.04 1.05 1.06	 1.05 1.08 1.10 1.11 –	 1.08 1.15 1.21 1.23 –	 1.12 1.21 1.28 1.32 –
Coefficient of thermal expansion, K^{-1} 20-100°C *68-210°F* 20- 250 °C *68- 480 °F* 20- 500 °C *68- 930 °F* 20- 750 °C *68-1380 °F* 20-1000 °C *68-1830 °F*	 – 15·10^{-6} 16·10^{-6} 17·10^{-6} 18·10^{-6}	 – 14·10^{-6} 15·10^{-6} 16·10^{-6} 17·10^{-6}		 – 16·10^{-6} 17·10^{-6} 18·10^{-6} 19·10^{-6}	
Thermal conductivity at 50 °C, W m^{-1} K^{-1} *122 °F, Btu in ft^{-2}h^{-1}°F^{-1}*	15….*104*	14…*97*	13…*90*		
Specific heat capacity, kJ kg^{-1}K^{-1}, 20 °C *Btu lb^{-1}°F^{-1}, 68 °*	0.46 *0.110*			0.50 *0.119*	
Melting point (approx.), °C *°F*	1400…*2550*	1380…*2515*	1390…*2535*		1380…*2515*
Mechanical properties* (approx.) Tensile strength, N mm^{-2} *psi*	810…*117500*	820…*118900*	730…*105900*	675…*97900*	
Yield point, N mm^{-2} *psi*	420…*60900*	430…*62400*	370…*53700*	340…*49300*	335…*48600*
Hardness, Hv	180	185	180		160
Elongation at rupture, %	30		35		30
Tensile strength at 900 °C, N mm^{-2} *at 1650 °F, psi.* Deformation rate 6.2 x 10^{-2} min $^{-1}$	100 *14500*	120 *17400*	100 *14500*	120 *17400*	
Creep strength*** at 800 °C, N mm^{-2} *at 1470 °F, psi* at 1000 °C, N mm^{-2} *at 1830 °F, psi* at 1100 °C, N mm^{-2} *at 2010 °F, psi* at 1200 °C, N mm^{-2} *at 2190 °F, psi*	 15 4 – –	 – – – –	 15 4 – –	 20 4 – –	
Magnetic properties	Non-magnetic		Slightly magnetic	Non-magnetic	
Emissivity, fully oxidized condition	0.88				

* The values given apply for sizes of approx. 1.0 mm diameter *0.04 in.*
**4.0 mm *0.16 in.* Finer gauges have higher strength and hardness values while the corresponding values are lower for heavier gauges.
***Calculated from observed elongation in a Kanthal standard furnace test. 1 % elongation after 1000 hours.

KANTHAL or NIKROTHAL?

KANTHAL Advantages

Higher maximum temperature in air. KANTHAL A-1 has a maximum temperature of 1400°C *(2550°F)*; NIKROTHAL 80 has a maximum temperature of 1200°C *(2190°F)*.

Longer life. KANTHAL elements have a life 2-4 times the life of NIKROTHAL when operated in air at the same temperature.

Higher surface load. Higher maximum temperature and longer life allow a higher surface load to be applied on KANTHAL elements.

Better oxidation properties. The aluminium oxide (Al_2O_3) formed on KANTHAL alloys adheres better and is therefore less contaminating. It is also a better diffusion barrier, better electrical insulator and more resistant to carburizing atmospheres than the chromium oxide (Cr_2O_3) formed on NIKROTHAL alloys.

Lower density. The density of the KANTHAL alloys is lower than that of the NIKROTHAL alloys. This means that a greater number of equivalent elements can be made from the same weight material.

Higher resistivity. The higher resistivity of KANTHAL alloys makes it possible to choose a material with larger cross-section, which improves the life of the element. This is particularly important for fine wire. When the same cross-section can be used, considerable weight savings are obtained. Further, the resistivity of KANTHAL alloys is less affected by cold-working and heat treatment than is the case for NIKROTHAL 80.

Higher yield strength. The higher yield strength of KANTHAL alloys means less change in cross-section when coiling wire.

Better resistance to sulphur. In atmospheres containing sulphuric compounds and in the presence of contaminations containing sulphur on the wire surface, KANTHAL alloys have better corrosion resistance in hot state. NiCr alloys are heavily attacked under such conditions.

NIKROTHAL Advantages

Higher hot and creep strength. NIKROTHAL alloys have higher hot and creep strength than KANTHAL alloys. KANTHAL APM, AF and AE are better in this respect than the other KANTHAL grades and have a very good form stability, however, not as good as that of NIKROTHAL.

Better ductility after use. NIKROTHAL alloys remain ductile after long use.

Higher emissivity. Fully oxidized NIKROTHAL alloys have a higher emissivity than KANTHAL alloys. Thus, at the same surface load the element temperature of NIKROTHAL is somewhat lower.

Non-magnetic. In certain low-temperature applications a non-magnetic material is preferred. NIKROTHAL alloys are non-magnetic (except NIKROTHAL 60 at low temperatures). KANTHAL alloys are non-magnetic above 600°C (*1100°F*).

Better wet corrosion resistance. NIKROTHAL alloys generally have better corrosion resistance at room temperature than nonoxidized KANTHAL alloys. (Exceptions: atmospheres containing sulphur and certain controlled atmospheres.)

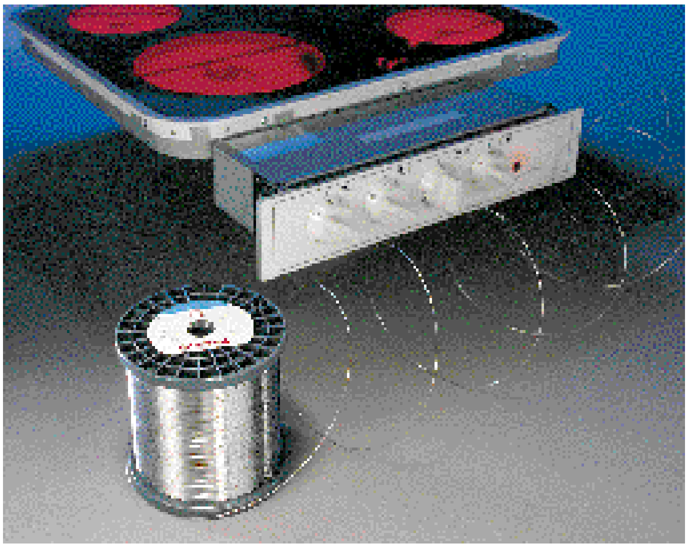


Fig. 7 KANTHAL AE heating wire in fast response elements for ceramic glass top hobs and quartz tube heaters.

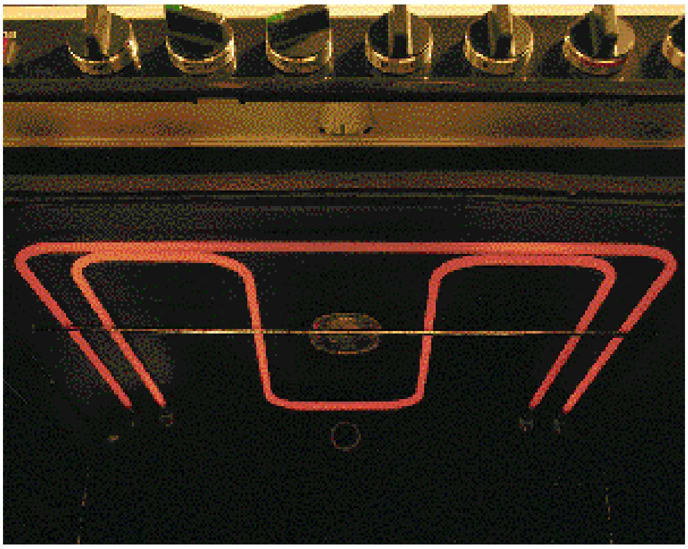


Fig. 8 NIKROTHAL 80 is widely used for heavy-duty applications because of its good workability and high temperature strength.

Weight Savings with KANTHAL alloys

The lower density and higher resistivity of KANTHAL alloys means that for a given power, less material is needed when using KANTHAL instead of NIKROTHAL alloys. The result is that in a great number of applications, substantial savings in weight and element costs can be achieved.

In converting from NiCr to KANTHAL alloys, either the wire diameter can be kept constant while changing the surface load, or the surface load can be held constant while changing the wire diameter. In both cases, the KANTHAL alloy will weigh less than the NiCr alloy.

Conversion			Weight saving (%) Equal wire diameter	Weight saving (%) Equal surface load
NiCr 80/20	→	KANTHAL D	31	6
NiCrFe 60/15	→	KANTHAL D	25	7
NiCrFe 35/20	→	KANTHAL D	20	4

Table 1 Weight savings with KANTHAL alloys at 700 °C (1290 °F)

Example: Aluminium-sheathed tubular element for coffee maker.

Voltage:	220 V
Rating:	650 W
Heated tube length:	339 mm *(13.3 in)*
Coil diameter:	2.6 mm *(0.102 in)*

Element Data	NiCrFe 60/15		KANTHAL D	
Cold resistance, R_{20}	85.8		90.0	
Wire diameter, mm *(in)*	0.22	*(0.009)*	0.22	*(0.009)*
Surface load, W/cm² *(W/in²)*	32.0	*(206.4)*	37.1	*(239.3)*
Wire weight, g *(oz)*	0.916	*(0.032)*	0.700	*(0.025)*
No of elements from 1kg	1091		1429	

Weight saving: $\frac{0.916 - 0.700}{0.916} = 23.7\%$ $\quad$ $\frac{0.032 - 0.025}{0.032} = 23.7\%$

Fig. 9 Kanthal AB, Hallstahammar, Sweden

Operating Life

When heated, resistance heating alloys form an oxide layer on their surface, which slows down further oxidation of the material. To accomplish this function the oxide layer must be dense and resist the diffusion of gases as well as metal ions. It must also be thin and adhere to the metal under temperature fluctuations.
The protective oxide layer on KANTHAL alloys formed at temperatures above 1000°C *(1830°F)* consists mainly of alumina (Al_2O_3). The colour is light grey, while at lower temperatures under 1000°C, *(1830°F)* the oxide colour becomes darker. The alumina layer has excellent electrical insulating properties and good chemical resistance to most compounds.
The oxide formed on NIKROTHAL alloys consists mainly of chromium oxide (Cr_2O_3). The colour is dark and the electrical insulating properties inferior to those of alumina.

The oxide layer on NIKROTHAL alloys spalls and evaporates more easily than the tighter oxide layer that is formed on the KANTHAL alloys.
Results of several life tests are given in Table 2 for KANTHAL and NIKROTHAL alloys. In the table, the durability of KANTHAL A-1 wire at 1200°C *(2190°F)* is set at 100%, and the durability of the other alloys is related to that figure.
Numerous practical applications also show a much longer life of KANTHAL elements than of elements equipped with NiCr(Fe) wire.

	1100°C *(2010°F)*	1200°C *(2190°F)*	1300°C *(2370°F)*
KANTHAL A-1	340	**100**	30
KANTHAL AF	465	120	30
KANTHAL AE	550	120	30
KANTHAL D	250	75	25
NIKROTHAL 80	120	25	–
NIKROTHAL 70	150	30	–
NIKROTHAL 60	95	25	–
NIKROTHAL 40	40	15	–

Table 2 Relative Durability Values in %, KANTHAL and NIKROTHAL Alloys (ASTM-test wire 0.7 mm (0.028 in))

Maximum temperature per Wire Size

The maximum permissible temperature depends on both the wire diameter and the atmosphere. Hence, the maximum temperatures given are only valid for heavy gauges of wire and strip. As a rule, elements that operate at the maximum recommended temperatures should have a wire diameter of not less than 3 mm (*0.12 in)* or a strip thickness of at least 2 mm *(0.08 in).*

Diameter, mm *(in)*:	**0.15-0.40 *(0.0059-0.0157)***		**0.41-0.95 *(0.0061-0.0374)***		**1.0-3.0 *(0.039-0.118)***	
	°C	***(°F)***	**°C**	***(°F)***	**°C**	***(°F)***
KANTHAL AF	900-1100	*(1650-2010)*	1100-1225	*(2010-2240)*	1225-1275	*(2240-2330)*
KANTHAL A	925-1050	*(1700-1920)*	1050-1175	*(1920-2150)*	1175-1250	*(2150-2300)*
KANTHAL AE	950-1150	*(1740-2100)*	1150-1225	*(2100-2240)*	1225-1250	*(2240-2300)*
KANTHAL D	925-1025	*(1700-1880)*	1025-1100	*(1880-2010)*	1100-1200	*(2010-2190)*
NIKROTHAL 80	925-1000	*(1700-1830)*	1000-1075	*(1830-1970)*	1075-1150	*(1970-2100)*
NIKROTHAL 60	900-950	*(1650-1740)*	950-1000	*(1740-1830)*	1000-1075	*(1830-1970)*
NIKROTHAL 40	900-950	*(1650-1740)*	950-1000	*(1740-1830)*	1000-1050	*(1830-1920)*

Table 3 Maximum Permissible Temperature as a Function of Wire Size

Corrosion Resistance

Corrosive or potentially corrosive constituents can considerably shorten wire life. Corrosion can be caused by perspiring hands, mounting or supporting materials or other contamination.

Steam. Steam may shorten the wire life.

Halogens. Halogens (fluorine, chlorine, bromine and iodine) severely attack all high-temperature alloys at fairly low temperatures.

Sulphur. In sulphurous atmospheres KANTHAL alloys have considerably better durability than nickel-base alloys. KANTHAL is particularly stable in oxidizing gases containing sulphur, while reducing gases with a sulphur content diminish its service life.
NIKROTHAL alloys are sensitive to sulphur.

Salts and oxides. The salts of alkaline metals, boron compounds, etc. in high concentrations are harmful to heating alloys.

Metals. Some molten metals, such as zinc, brass, aluminium and copper, react with the resistance alloys. The elements should therefore be protected from splashes of molten metals.

Ceramic support material. Special attention must be paid to the ceramic supports that come in direct contact with the heating wire. Firebricks for wire support should have an alumina content of at least 45%. In high-temperature applications, the use of sillimanite and high-alumina firebricks is often recommended. The free silica (uncombined quartz) content should be held low. Iron oxide lowers the melting point of the ceramics.

Water glass as a binder in cements must be avoided.

Embedding compounds. Most embedding compounds including ceramic fibres are suitable for KANTHAL and NIKROTHAL if composed of alumina, alumina-silicate, magnesia or zirconia.

Elements in Electric Appliances

Embedded Elements

The wire in the embedded element type is completely surrounded by solid or granular insulating material.

The Supported Element Type

The wire, normally in spiral form, is placed on the surface, in a groove or a hole of the electrical insulating material.
KANTHAL AE, KANTHAL AF and NIKROTHAL 80 are generally the best materials.
In order to avoid deformation in horizontal coils, the wire temperature should not exceed the values given in Figure 10.

Metal Sheathed Tubular Elements

KANTHAL D is generally the best heating wire for tube temperatures below 700 °C *(1290 °F)* and NIKROTHAL 80 for temperatures above.
Using KANTHAL instead of NiCr gives the following advantages:

- Reduced wire weight by 20-30 % at the same wire dimension
- More even temperature along the element and lower maximum wire temperature. This means that the element can be charged higher for a short time – important at dry boiling
- Closer tolerances of rating. Rating and temperature remains more constant since the resistivity in hot state does not change as much as for NiCr
- Longer life at high surface loads. The element life is also easier predicted
- Elements of wire type KANTHAL is easier to manufacture when high resistance per length is needed, since a heavier wire can be used
- Less sensitive to corrosion attacks

The Suspended Element Type

The wire is suspended freely between insulated points and is subjected to the mechanical stress caused by its own weight, its own spring force and in some cases also from the forces of an external spring.
NIKROTHAL 80, NIKROTHAL 60, KANTHAL D and KANTHAL AF are the best materials.

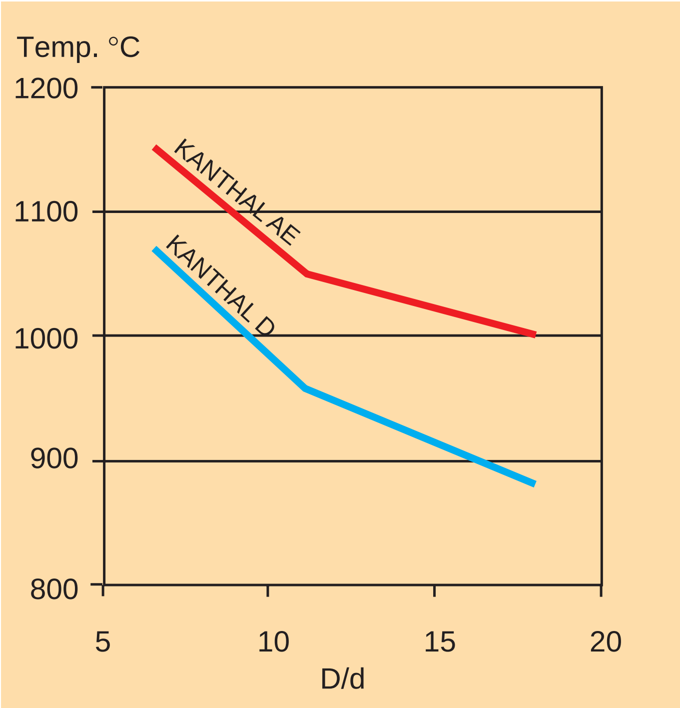


Fig. 10 Permissible D/d ratios as a function of wire temperature.

Embedded Elements

Metal Sheathed Tubular Elements

Characteristics

The heating coil is insulated from the encasing metallic tube by granular material (MgO). The tube is compressed to a round, oval or triangular shape. Terminals may be at either end or at one end of the element.

Recommended Alloy

KANTHAL D in elements with sheath temperature <700°C *(<1290°F)*.
NIKROTHAL 80 in elements with sheath temperature >700°C *(>1290°F)*.

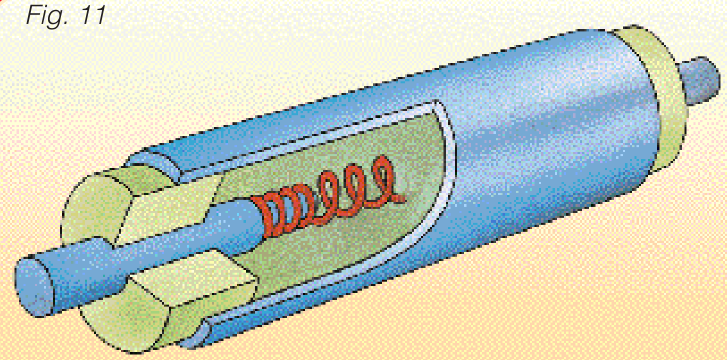
Surface Load

Wire: Normally 2-4 times the element surface load.
Element: 2-25 W/cm² *(13-161 W/in²)*.

Typical Applications

Cooking: Hot plates, domestic ovens, grills, toaster ovens, frying pans, deep fryers, rice cookers.
Water and beverage: Boilers, immersion heaters, teapots, coffee makers, dishwashers, washing machines.
Space heating: Radiators, storage heaters.
Others: Irons, air heaters, oil heaters, glow plugs.

Fig. 11



Elements Embedded in Ceramics

Characteristics

Heating coil is embedded in green ceramics and fired to solidify ceramics or cemented in grooves in ceramic bodies.

Recommended Alloy

KANTHAL A for high temperature firing.
KANTHAL D for other applications.

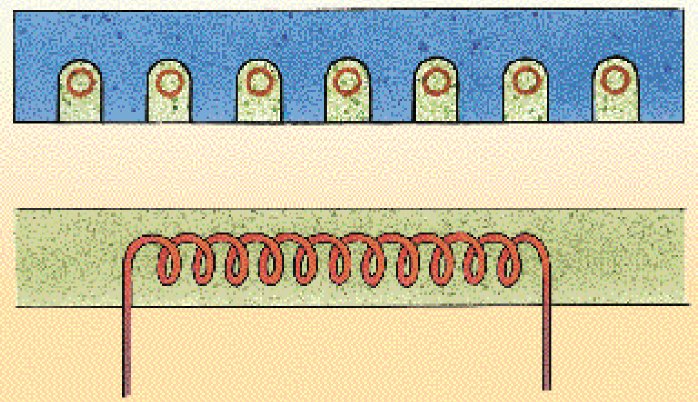
Surface Load

Wire: 5-10 W/cm² *(30-60 W/in²)*.

Typical Applications

Panel heaters, infrared heaters, warming plates, irons, ceramic pots.

Fig. 12



Coils in grooved Metal Plates

Characteristics

Heating coil and insulating powder are pressed into grooves of a metal plate.

Recommended Alloy

KANTHAL D.

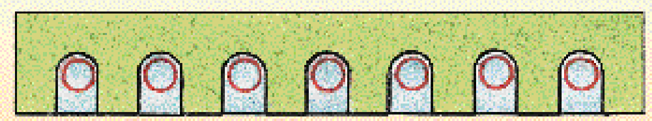
Surface Load

Wire: 4-20 W/cm² *(25-130 W/in²)*.

Typical Applications

Cast iron plates; also, irons, warming plates, kettles, domestic ovens.

Fig. 13



Cartridge Elements, Powder filled

Characteristics
Straight wire or coil is wound on a threaded ceramic body and insulated by granular insulating material (MgO) from enveloping metal tube. Terminals are at one end of the element. Elements are compressed when high-loaded.

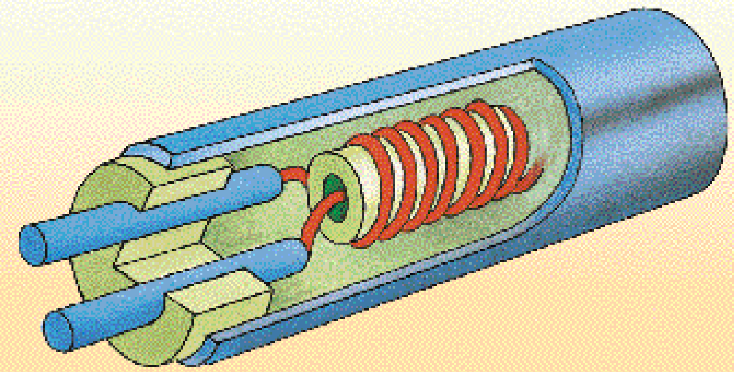
Recommended Alloy
NIKROTHAL 80 in straight wire elements. KANTHAL D in coiled wire elements.

Surface Load
On tube: 10-25 W/cm² *(65-160 W/in²)* for elements with straight wire.

Other types: about 5 W/cm² *(30 W/in²)*.

Typical Applications
Metal dies, plates, etc., refrigerators.

Fig. 14



Heating Cables and Rope Heaters

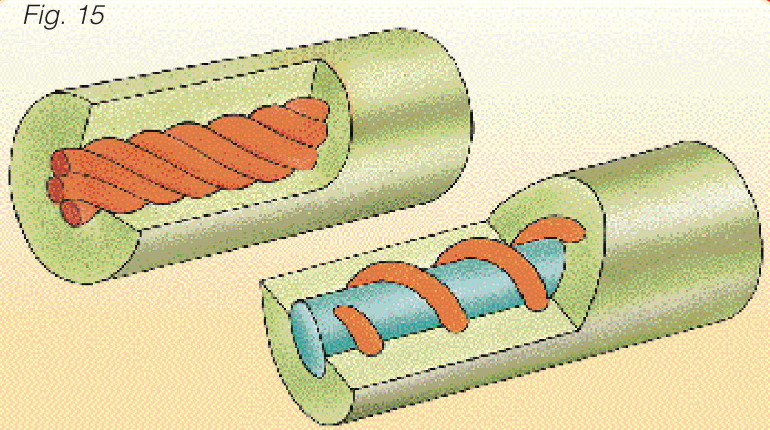
Characteristics
Wire is wound on a fibreglass core and insulated with PVC (max. 105°C *(220°F)* or silicon rubber (max. 150°C *(300°F)*. Fibreglass insulation permits higher temperatures. Heating cable with straight or stranded wire, sometimes enclosed in aluminium tube.

Recommended Alloy
KANTHAL D, NIKROTHAL 40. NIKROTHAL 80 (CuNi alloys).

Surface Load
Wire: <1 W/cm² *(<6 W/in²)* on wire for PVC and silicon rubber.
2-5 W/cm² *(13-30 W/in²)* for fibreglass insulation.

Typical Applications
Defrosting and de-icing elements, electric blankets and pads, car seats, baseboard heaters, floor heating.

Fig. 15



Micanite Elements

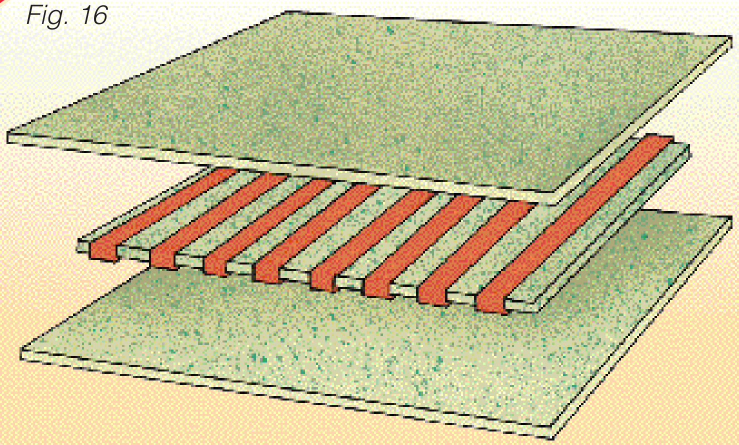
Characteristics
Resistance ribbon or wire is wound on micanite sheet or tube and insulated by mica–micanite. Elements are often encapsulated in steel sheaths.

Recommended Alloy
KANTHAL D.
NIKROTHAL 80.

Surface Load
Wire: 2-10 W/cm² *(13-65 W/in²)*.

Typical Applications
Irons, ironing machines, water heaters, plastic moulding dies, soldering irons.

Fig. 16



Foil Elements

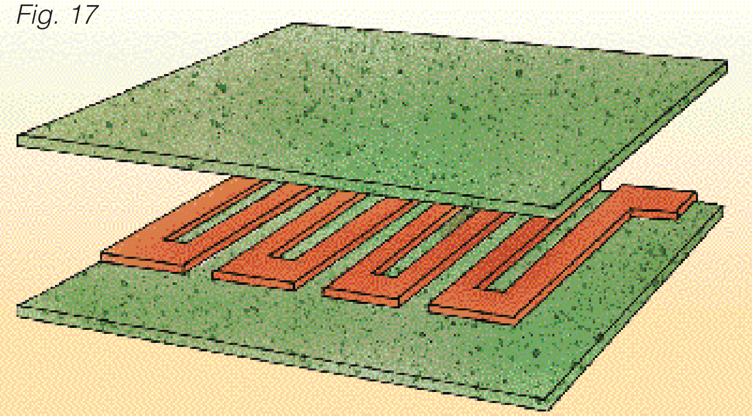
Characteristics
An etched metallic foil is sandwiched between two thin layers of insulating material.

Recommended Alloy
KANTHAL, NIKROTHAL, (Aluminium, stainless brass, PbSn, etc.).

Surface Load
Element: 1-10 W/cm² *(6.5-65 W/in²)*
0.01-40 Ω/cm².

Typical Applications
Waterbed, pickling baths car seats, antennas, operating tables, trouser presses, etc.

Fig. 17



Supported Elements

Cartridge Elements

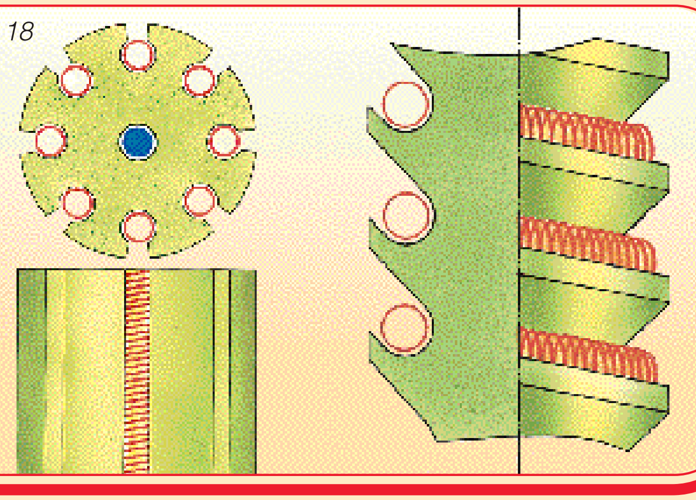
Characteristics
Most common design consists of round ceramic bodies with longitudinal holes or grooves for heating coil. Elements are often in metallic tube with terminals at one end. Often provisions are made to avoid excessive sagging of the coil when the element is operating vertically.

Recommended Alloy
KANTHAL A or D for horizontally operating coils.
NIKROTHAL 80 (usually) for long vertically situated coils when sagging is a problem.

Surface load
Wire: 3-6 W/cm² *(20 - 40 W/in²).*
Element: 2-5 W/cm² *(13 - 32 W/in²).*

Typical Applications
Liquid heating, storage heaters.

Fig. 18



Other ceramic Elements

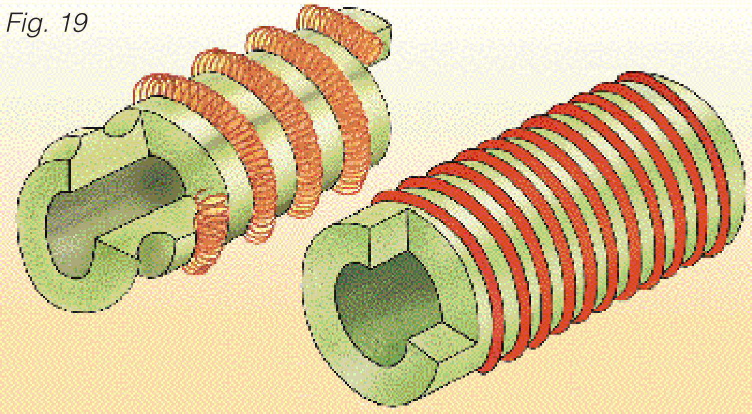
Characteristics
Coiled and straight wire is located on smooth ceramic tube or in grooves or holes of ceramic bodies of various shapes (plates, tubes, rods, cylinders, etc.).

Recommended Alloy
KANTHAL A, AF and D.
NIKROTHAL 80 (for pencil bars).

Surface Load
Wire: 3-9 W/cm² *(20-60 W/in²).*

Typical Applications
Boiling plates, air guns, hobby kilns, radiators.

Fig. 19



Quartz Tube Heaters

Characteristics

Heating coil is placed inside quartz tube. When the element is operating vertically or at an angle, the coil should be tight-wound and pre-oxidized. For horizontal use the relative pitch is 1.2-2.0.

Recommended Alloy

KANTHAL AE, AF, A and D.

Surface Load

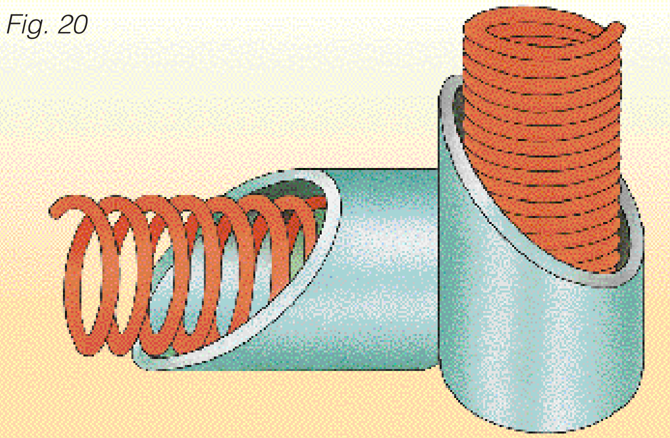
Wire: 2-8 W/cm² *(13-52 W/in²).*

Element: 4-8W/cm² *(26-52 W/in²).*

Typical Applications

Space heating; toasters,toaster ovens, grills, industrial infrared dryers etc.

Fig. 20



Coils on moulded ceramic fibre

Characteristics

Heating coil rests on moulded ceramic fibre plate, which may incorporate grooves in which coil is cemented at intervals. Coils may also be stapled to a flat surface or pressed into ribs on this surface. Corrugated strip and coiled ribbon are also used.

Recommended Alloy

KANTHAL AE or AF.

Surface Load

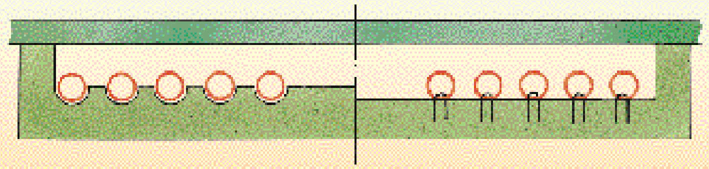
Wire: <10 W/cm² *(< 65 W/in²)* .

Ribbon: 4-6 W/cm² *(25-40 W/in²).*

Typical Applications

Boiling plates with ceramic hobs.

Fig. 21



Bead insulated coils

Characteristics

Heating coil is insulated by ceramic beads. With beads having two holes heating mats are made. Stranded wires are sometimes used. This element type is becoming less common.

Recommended Alloy

KANTHAL D, NIKROTHAL 80 (for panel heaters).

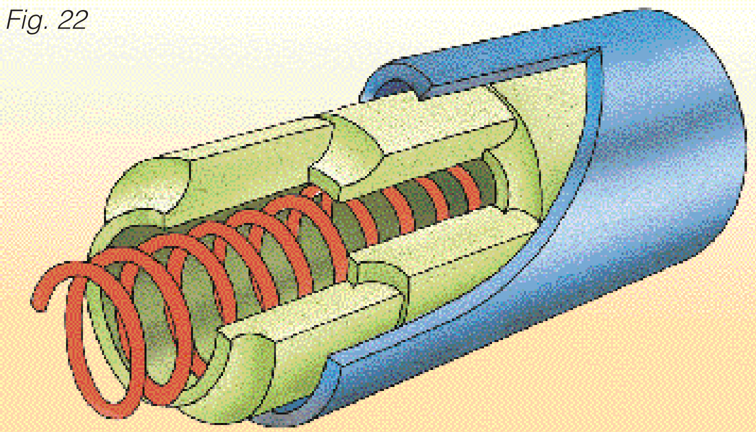
Surface Load

Wire: 1-8 W/cm² *(6.5-52 W/in²).*

Typical Applications

Panel heaters, waffle irons, domestic ovens, water heater, stress relief annealing of welded parts (mats).

Fig. 22



String Elements

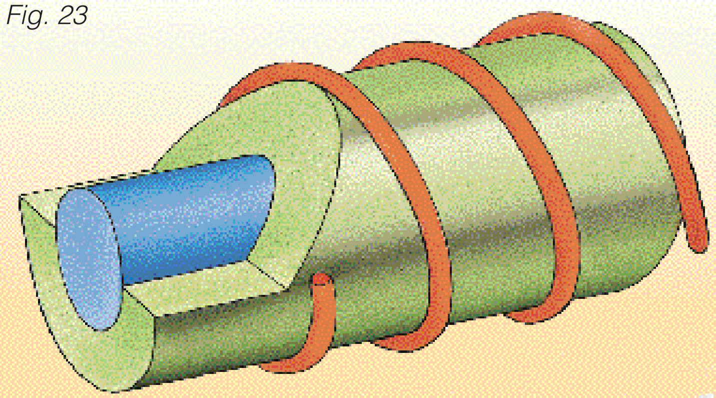
Characteristics
Insulated steel wire (approx. 2 mm *0.008 in)* is wound with a heating conductor.

Recommended Alloy
KANTHAL D.

Surface Load
Wire: <10 W/cm^2 *(<65 W/in^2).*

Typical Applications
Stationary hair dryers.

Fig. 23



Suspended Elements

Suspended coils

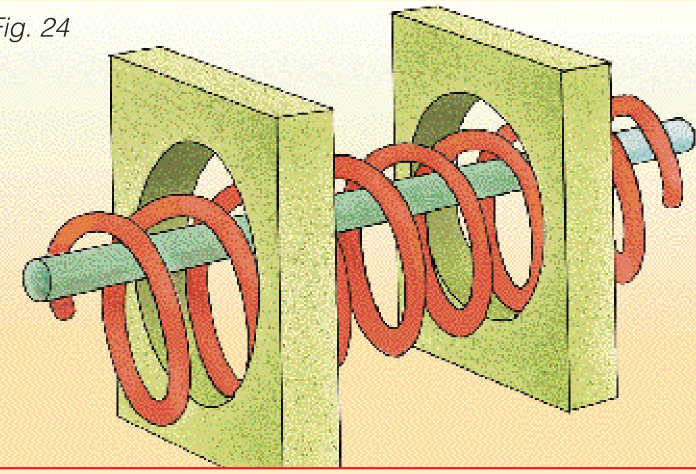
Characteristics
Wire coil is supported at intervals. Fibreglass cord is often placed inside coil to prevent the coil from falling in case of element failure.

Recommended Alloy
NIKROTHAL 80, NIKROTHAL 60, KANTHAL D and AF (mainly for wire temperatures below 600°C *(1110°F).*

Surface Load
Wire: 7-8 W/cm^2 *(45-50 W/in^2)* forced air; 3-4 W/cm^2 *(20-25 W/in^2)* natural convection.

Typical Applications
Air heaters such as:
laundry dryers, fan heaters, land dryers.

Fig. 24



Suspended straight wires and ribbons

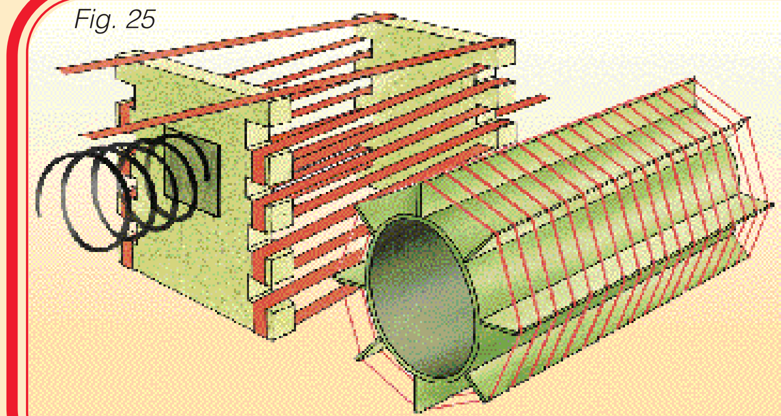
Characteristics
Wire or ribbon may have elastic or fixed suspension.
Elastic: Wire kept straight by springs when heated.
Fixed: Operating temperature is lower and low thermal expansion is advantageous.

Recommended Alloy
KANTHAL A and AF (low thermal expansion).
NIKROTHAL 80 (high hot strength).

Surface Load
Wire: 4-12 W/cm^2 *(25-77 W/in^2).*

Typical Applications
Radiators, toasters, convection heaters.

Fig. 25



Open Micanite Elements

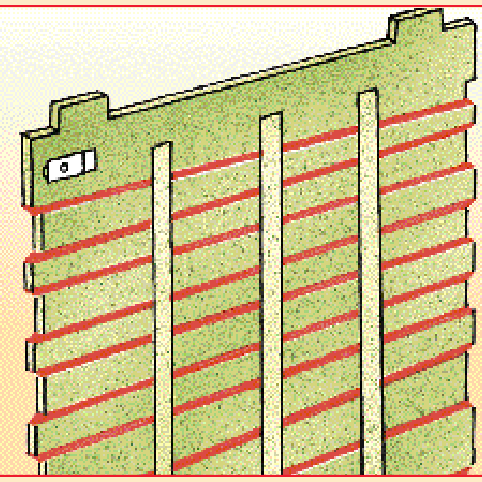
Characteristics
Straight or corrugated heating conductor is wound on one or both sides of a micanite sheet or separated micanite strips. Typically ribbons are used.

Recommended Alloy
NIKROTHAL 80, NIKROTHAL 60, KANTHAL D and AF.

Surface Load
Wire: 4-7 W/cm^2 *(25-45 W/in^2)* (toasters)
< 13 W/cm^2 *(<26-52 W/in^2)*
(wire-wound elements).

Typical Applications
Toasters; also, convectionheating, low-watt aquarium heaters.

Fig. 26



Zig-zag Elements

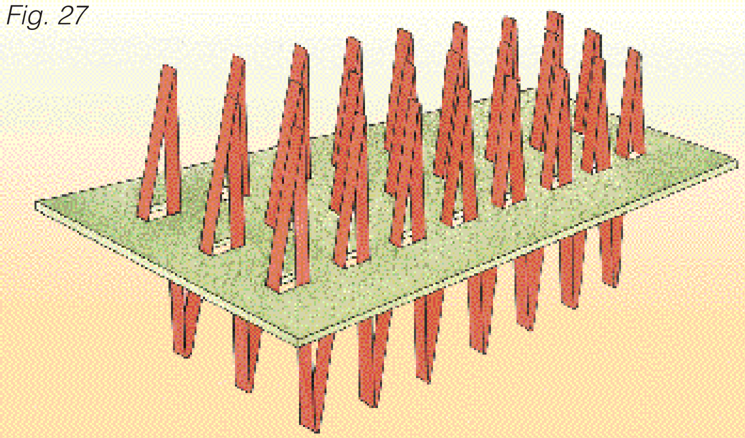
Characteristics
Deep-corrugated ribbon is supported by micanite sheets. Also radial shape.

Recommended Alloy
KANTHAL D, AF and NIKROTHAL 40.

Surface Load
Wire: 9 W/cm^2 (60 W/in^2).

Typical Applications
Fan-heaters.

Fig. 27



Porcupine Elements

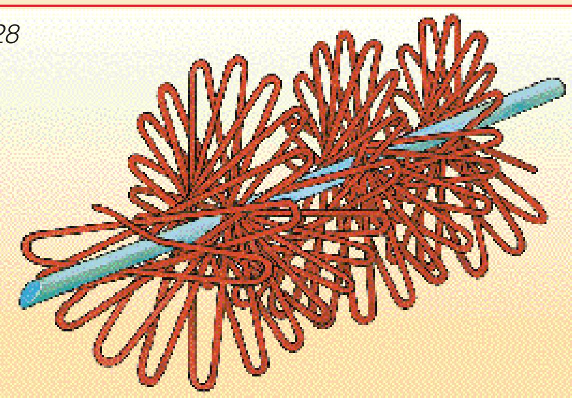
Characteristics
Heating conductor consists of hairpin-shaped wire bends protruding in all directions, with hole in centre. Element is supported by central insulated rod or insulating tube around its circumference.

Recommended Alloy
KANTHAL D, AF.
NIKROTHAL 80.

Surface Load
Wire: 4 W/cm^2 *(25 W/in^2)* natural convection,
<12 W/cm^2 *(75 W/in^2)* forced convection.

Typical Applications
Hot air guns, radiators, convectors, tumble driers, domestic ovens with forced convections. Also, regulating resistors. (However, not commonly used in domestic appliances.).

Fig. 28



Coils immersed in water

Characteristics
Wire coils operating directly in water.

Recommended Alloy
KANTHAL D and AF.
NIKROTHAL 80.

Surface Load
Wire: Depending on water velocity, 20-60 W/cm^2 *(130-390 W/in^2)* (even higher figures occur.).

Typical Applications
Instantaneous water heaters, steam generators, showers.

Fig. 29 The Scanning Electron Microscope is a powerful tool for material development and trouble shooting.

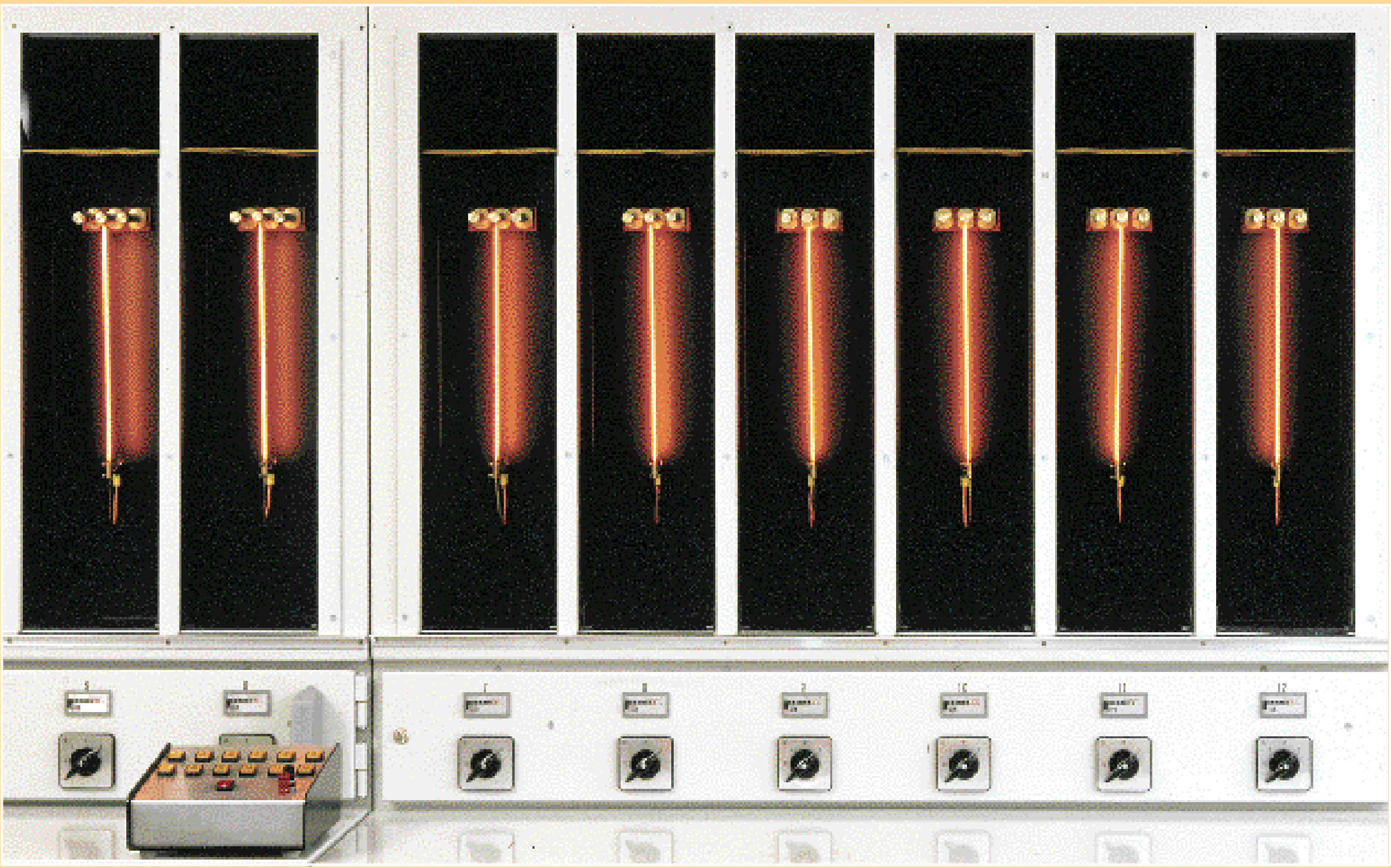


Fig. 30 Performance of resistance wire is monitored in a fully computer controlled test. The statistically analyzed results are used for quality assurance and material development.

KANTHAL A, AF, AE
Wire inch SWG

A: 0.325 – 0.002 in
AE: 0.039 – 0.008 in
AF: 0.325 – 0.004 in
Resistivity Ω/cir.mil ft 837
Density, lb/cu.in 0.258

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

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

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
C_t	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

Diameter SWG	Diameter inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
0	0.324	0.00796	1530	255	12.2	82.4
1	0.300	0.00929	1220	219	11.3	70.7
2	0.276	0.0110	948	185	10.4	59.8
3	0.252	0.0132	722	154	9.50	49.9
4	0.232	0.0155	563	131	8.75	42.3
5	0.212	0.0186	430	109	7.99	35.3
6	0.192	0.0227	319	89.6	7.24	29.0
7	0.176	0.0270	246	75.3	6.64	24.3
8	0.160	0.0327	185	62.2	6.03	20.1
9	0.144	0.0403	135	50.4	5.43	16.3
10	0.128	0.0510	94.6	39.8	4.83	12.9
11	0.116	0.0621	70.4	32.7	4.37	10.6
12	0.104	0.0773	50.7	26.3	3.92	8.49
13	0.0920	0.0988	35.1	20.6	3.47	6.65
14	0.0800	0.131	23.1	15.6	3.02	5.03
15	0.0720	0.161	16.8	12.6	2.71	4.07
16	0.0640	0.204	11.8	10.0	2.41	3.22
17	0.0560	0.267	7.92	7.63	2.11	2.46
18	0.0480	0.363	4.99	5.60	1.81	1.81
19	0.0400	0.523	2.89	3.89	1.51	1.26
20	0.0360	0.645	2.10	3.15	1.36	1.02
21	0.0320	0.816	1.48	2.49	1.21	0.804
22	0.0280	1.07	0.990	1.91	1.06	0.616
23	0.0240	1.45	0.623	1.40	0.905	0.452
24	0.0220	1.73	0.480	1.18	0.829	0.380
25	0.0200	2.09	0.361	0.973	0.754	0.314
26	0.0180	2.58	0.263	0.788	0.679	0.254
27	0.0164	3.11	0.199	0.654	0.618	0.211
28	0.0148	3.82	0.146	0.533	0.558	0.172
29	0.0136	4.52	0.113	0.450	0.513	0.145
30	0.0124	5.44	0.0860	0.374	0.467	0.121
31	0.0116	6.21	0.0704	0.327	0.437	0.106
32	0.0108	7.17	0.0568	0.284	0.407	0.0916
33	0.0100	8.36	0.0451	0.243	0.377	0.0785
34	0.00920	9.88	0.0351	0.206	0.347	0.0665
35	0.00840	11.8	0.0267	0.172	0.317	0.0554
36	0.00760	14.5	0.0198	0.140	0.287	0.0454
37	0.00680	18.1	0.0142	0.112	0.256	0.0363
38	0.00600	23.2	0.00974	0.0875	0.226	0.0283
39	0.00520	30.9	0.00634	0.0658	0.196	0.0212
40	0.00480	36.3	0.00499	0.0560	0.181	0.0181
41	0.00440	43.2	0.00384	0.0471	0.166	0.0152
42	0.00400	52.3	0.00289	0.0389	0.151	0.0126
43	0.00360	64.5	0.00210	0.0315	0.136	0.0102
44	0.00320	81.6	0.00148	0.0249	0.121	0.00804
45	0.00280	107	0.000990	0.0191	0.106	0.00616
46	0.00240	145	0.000623	0.0140	0.0905	0.00452
47	0.00200	209	0.000361	0.00973	0.0754	0.00314
48	0.00160	327	0.000185	0.00622	0.0603	0.00201

KANTHAL A, AF, AE
Ribbon inch

Resistivity Ω/sq.mil ft 657
Density, lb/cu.in 0.258

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

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

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
C_t	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

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
1/8	0.057	0.100	43.6	20.3	4.37	6.56
	0.051	0.112	37.7	18.2	4.22	5.87
	0.045	0.127	32.2	16.0	4.08	5.18
	0.040	0.143	27.7	14.2	3.96	4.60
	0.036	0.159	24.4	12.8	3.86	4.14
	0.032	0.178	21.1	11.4	3.77	3.68
	0.029	0.197	18.8	10.3	3.70	3.34
	0.025	0.228	15.8	8.90	3.60	2.88
	0.023	0.248	14.3	8.19	3.55	2.65
	0.020	0.286	12.2	7.12	3.48	2.30
	0.018	0.317	10.8	6.41	3.43	2.07
	0.016	0.357	9.48	5.70	3.38	1.84
	0.014	0.408	8.18	4.98	3.34	1.61
	0.013	0.439	7.54	4.63	3.31	1.50
	0.011	0.519	6.29	3.92	3.26	1.27
	0.010	0.571	5.67	3.56	3.24	1.15
	0.0089	0.642	5.01	3.17	3.21	1.02
	0.0080	0.714	4.47	2.85	3.19	0.920
	0.0071	0.804	3.94	2.53	3.17	0.817
	0.0063	0.906	3.48	2.24	3.15	0.725
3/32	0.057	0.134	27.1	15.2	3.62	4.92
	0.051	0.149	23.3	13.6	3.47	4.40
	0.045	0.169	19.7	12.0	3.33	3.88
	0.040	0.190	16.9	10.7	3.21	3.45
	0.036	0.211	14.7	9.61	3.11	3.11
	0.032	0.238	12.7	8.54	3.02	2.76
	0.029	0.263	11.2	7.74	2.95	2.50
	0.025	0.305	9.36	6.68	2.85	2.16
	0.023	0.331	8.46	6.14	2.80	1.98
	0.020	0.381	7.17	5.34	2.73	1.73
	0.018	0.423	6.34	4.81	2.68	1.55
	0.016	0.476	5.54	4.27	2.63	1.38
	0.014	0.544	4.76	3.74	2.59	1.21
	0.013	0.586	4.37	3.47	2.56	1.12
	0.011	0.692	3.63	2.94	2.51	0.949
	0.010	0.761	3.27	2.67	2.49	0.863
	0.0089	0.855	2.88	2.38	2.46	0.768
	0.0080	0.952	2.57	2.14	2.44	0.690
	0.0071	1.07	2.26	1.90	2.42	0.612
	0.0063	1.21	1.99	1.68	2.40	0.543
	0.0056	1.36	1.75	1.50	2.38	0.483
	0.0050	1.52	1.56	1.34	2.37	0.431
1/16	0.032	0.357	6.35	5.70	2.27	1.84
	0.029	0.394	5.58	5.16	2.20	1.67
	0.025	0.457	4.60	4.45	2.10	1.44
	0.023	0.497	4.13	4.09	2.05	1.32
	0.020	0.571	3.47	3.56	1.98	1.15
	0.018	0.634	3.04	3.20	1.93	1.04
	0.016	0.714	2.64	2.85	1.88	0.920
	0.014	0.816	2.25	2.49	1.84	0.805
	0.013	0.879	2.06	2.31	1.81	0.748
	0.011	1.04	1.70	1.96	1.76	0.633
	0.010	1.14	1.52	1.78	1.74	0.575
	0.0089	1.28	1.34	1.58	1.71	0.512
	0.0080	1.43	1.19	1.42	1.69	0.460
	0.0071	1.61	1.04	1.26	1.67	0.408
	0.0063	1.81	0.911	1.12	1.65	0.362
	0.0056	2.04	0.801	0.997	1.63	0.322
	0.0050	2.28	0.709	0.890	1.62	0.288
	0.0045	2.54	0.634	0.801	1.61	0.259
	0.0040	2.86	0.559	0.712	1.60	0.230

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
3/64	0.029	0.525	3.47	3.87	1.82	1.25
	0.025	0.609	2.83	3.34	1.73	1.08
	0.023	0.662	2.53	3.07	1.68	0.992
	0.020	0.761	2.11	2.67	1.61	0.863
	0.018	0.846	1.84	2.40	1.56	0.776
	0.016	0.952	1.59	2.14	1.51	0.690
	0.014	1.09	1.34	1.87	1.46	0.604
	0.013	1.17	1.23	1.74	1.44	0.561
	0.011	1.38	1.00	1.47	1.39	0.474
	0.010	1.52	0.896	1.34	1.37	0.431
	0.0089	1.71	0.782	1.19	1.34	0.384
	0.0080	1.90	0.692	1.07	1.32	0.345
	0.0071	2.14	0.604	0.948	1.30	0.306
	0.0063	2.42	0.528	0.841	1.28	0.272
	0.0056	2.72	0.463	0.748	1.26	0.242
	0.0050	3.05	0.409	0.668	1.25	0.216
	0.0045	3.38	0.364	0.601	1.23	0.194
	0.0040	3.81	0.321	0.534	1.22	0.173
	0.0035	4.35	0.278	0.467	1.21	0.151
	0.0031	4.91	0.244	0.414	1.20	0.134
1/32	0.016	1.43	0.794	1.42	1.13	0.460
	0.014	1.63	0.666	1.25	1.09	0.403
	0.013	1.76	0.604	1.16	1.06	0.374
	0.011	2.08	0.488	0.979	1.01	0.316
	0.010	2.28	0.433	0.890	0.990	0.288
	0.0089	2.57	0.375	0.792	0.964	0.256
	0.0080	2.86	0.330	0.712	0.942	0.230
	0.0071	3.22	0.286	0.632	0.920	0.204
	0.0063	3.63	0.249	0.561	0.901	0.181
	0.0056	4.08	0.217	0.498	0.884	0.161
	0.0050	4.57	0.190	0.445	0.870	0.144
	0.0045	5.08	0.169	0.401	0.858	0.129
	0.0040	5.71	0.148	0.356	0.846	0.115
	0.0035	6.53	0.128	0.312	0.834	0.101
	0.0031	7.37	0.112	0.276	0.824	0.0891
	0.0028	8.16	0.100	0.249	0.817	0.0805
	0.0025	9.14	0.0887	0.223	0.810	0.0719
	0.0022	10.4	0.0773	0.196	0.803	0.0633
1/64	0.0089	5.13	0.115	0.396	0.589	0.128
	0.0080	5.71	0.0993	0.356	0.567	0.115
	0.0071	6.43	0.0848	0.316	0.545	0.102
	0.0063	7.25	0.0726	0.280	0.526	0.0906
	0.0056	8.16	0.0624	0.249	0.509	0.0805
	0.0050	9.14	0.0542	0.223	0.495	0.0719
	0.0045	10.2	0.0476	0.200	0.483	0.0647
	0.0040	11.4	0.0412	0.178	0.471	0.0575
	0.0035	13.1	0.0352	0.156	0.459	0.0503
	0.0031	14.7	0.0305	0.138	0.449	0.0446
	0.0028	16.3	0.0271	0.125	0.442	0.0403
	0.0025	18.3	0.0238	0.111	0.435	0.0359
	0.0022	20.8	0.0206	0.0979	0.428	0.0316

KANTHAL D
Wire inch SWG

0.325–0.0008 in
Resistivity Ω/cir.mil ft 812
Density, lb/cu.in 0.262

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

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

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
C_t	1.00	1.00	1.01	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.07	1.07	1.08	1.08

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
0	0.324	0.00774	1580	259	12.2	82.4
1	0.300	0.00902	1250	222	11.3	70.7
2	0.276	0.0107	976	188	10.4	59.8
3	0.252	0.0128	743	157	9.50	49.9
4	0.232	0.0151	580	133	8.75	42.3
5	0.212	0.0181	442	111	7.99	35.3
6	0.192	0.0220	329	91.0	7.24	29.0
7	0.176	0.0262	253	76.5	6.64	24.3
8	0.160	0.0317	190	63.2	6.03	20.1
9	0.144	0.0392	139	51.2	5.43	16.3
10	0.128	0.0496	97.4	40.5	4.83	12.9
11	0.116	0.0603	72.5	33.2	4.37	10.6
12	0.104	0.0751	52.2	26.7	3.92	8.49
13	0.0920	0.0959	36.2	20.9	3.47	6.65
14	0.0800	0.127	23.8	15.8	3.02	5.03
15	0.0720	0.157	17.3	12.8	2.71	4.07
16	0.0640	0.198	12.2	10.1	2.41	3.22
17	0.0560	0.259	8.15	7.74	2.11	2.46
18	0.0480	0.352	5.13	5.69	1.81	1.81
19	0.0400	0.508	2.97	3.95	1.51	1.26
20	0.0360	0.627	2.17	3.20	1.36	1.02
21	0.0320	0.793	1.52	2.53	1.21	0.804
22	0.0280	1.04	1.02	1.94	1.06	0.616
23	0.0240	1.41	0.642	1.42	0.905	0.452
24	0.0220	1.68	0.494	1.20	0.829	0.380
25	0.0200	2.03	0.371	0.988	0.754	0.314
26	0.0180	2.51	0.271	0.800	0.679	0.254
27	0.0164	3.02	0.205	0.664	0.618	0.211
28	0.0148	3.71	0.151	0.541	0.558	0.172
29	0.0136	4.39	0.117	0.457	0.513	0.145
30	0.0124	5.28	0.0885	0.380	0.467	0.121
31	0.0116	6.03	0.0725	0.332	0.437	0.106
32	0.0108	6.96	0.0585	0.288	0.407	0.0916
33	0.0100	8.12	0.0464	0.247	0.377	0.0785
34	0.00920	9.59	0.0362	0.209	0.347	0.0665
35	0.00840	11.5	0.0275	0.174	0.317	0.0554
36	0.00760	14.1	0.0204	0.143	0.287	0.0454
37	0.00680	17.6	0.0146	0.114	0.256	0.0363
38	0.00600	22.6	0.0100	0.0889	0.226	0.0283
39	0.00520	30.0	0.00653	0.0668	0.196	0.0212
40	0.00480	35.2	0.00513	0.0569	0.181	0.0181
41	0.00440	41.9	0.00395	0.0478	0.166	0.0152
42	0.00400	50.8	0.00297	0.0395	0.151	0.0126
43	0.00360	62.7	0.00217	0.0320	0.136	0.0102
44	0.00320	79.3	0.00152	0.0253	0.121	0.00804
45	0.00280	104	0.00102	0.0194	0.106	0.00616
46	0.00240	141	0.000642	0.0142	0.0905	0.00452
47	0.00200	203	0.000371	0.00988	0.0754	0.00314
48	0.00160	317	0.000190	0.00632	0.0603	0.00201
49	0.00120	564	0.0000802	0.00356	0.0452	0.00113
50	0.00100	812	0.0000464	0.00247	0.0377	0.000785

KANTHAL D, DT

Ribbon inch

Resistivity Ω/sq.mil ft KANTHAL D 638
KANTHAL DT 648

Density, lb/cu.in 0.262

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

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

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
C_t	1.00	1.00	1.01	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.07	1.07	1.08	1.08

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
1/8	0.057	0.0973	44.9	20.6	4.37	6.56
	0.051	0.109	38.8	18.4	4.22	5.87
	0.045	0.123	33.1	16.3	4.08	5.18
	0.040	0.139	28.6	14.5	3.96	4.60
	0.036	0.154	25.1	13.0	3.86	4.14
	0.032	0.173	21.7	11.6	3.77	3.68
	0.029	0.191	19.3	10.5	3.70	3.34
	0.025	0.222	16.2	9.04	3.60	2.88
	0.023	0.241	14.7	8.32	3.55	2.65
	0.020	0.277	12.5	7.23	3.48	2.30
	0.018	0.308	11.1	6.51	3.43	2.07
	0.016	0.347	9.76	5.78	3.38	1.84
	0.014	0.396	8.42	5.06	3.34	1.61
	0.013	0.427	7.76	4.70	3.31	1.50
	0.011	0.504	6.47	3.98	3.26	1.27
	0.010	0.555	5.84	3.62	3.24	1.15
	0.0089	0.623	5.16	3.22	3.21	1.02
	0.0080	0.693	4.60	2.89	3.19	0.920
	0.0071	0.781	4.06	2.57	3.17	0.817
	0.0063	0.880	3.58	2.28	3.15	0.725
3/32	0.057	0.130	27.9	15.5	3.62	4.92
	0.051	0.145	24.0	13.8	3.47	4.40
	0.045	0.164	20.3	12.2	3.33	3.88
	0.040	0.185	17.4	10.8	3.21	3.45
	0.036	0.205	15.2	9.76	3.11	3.11
	0.032	0.231	13.1	8.68	3.02	2.76
	0.029	0.255	11.6	7.86	2.95	2.50
	0.025	0.296	9.64	6.78	2.85	2.16
	0.023	0.322	8.72	6.24	2.80	1.98
	0.020	0.370	7.38	5.42	2.73	1.73
	0.018	0.411	6.53	4.88	2.68	1.55
	0.016	0.462	5.70	4.34	2.63	1.38
	0.014	0.528	4.90	3.80	2.59	1.21
	0.013	0.569	4.50	3.53	2.56	1.12
	0.011	0.672	3.74	2.98	2.51	0.949
	0.010	0.739	3.37	2.71	2.49	0.863
	0.0089	0.831	2.97	2.41	2.46	0.768
	0.0080	0.924	2.64	2.17	2.44	0.690
	0.0071	1.04	2.32	1.93	2.42	0.612
	0.0063	1.17	2.05	1.71	2.40	0.543
	0.0056	1.32	1.81	1.52	2.38	0.483
	0.0050	1.48	1.60	1.36	2.37	0.431
1/16	0.032	0.347	6.54	5.78	2.27	1.84
	0.029	0.382	5.74	5.24	2.20	1.67
	0.025	0.444	4.73	4.52	2.10	1.44
	0.023	0.482	4.25	4.16	2.05	1.32
	0.020	0.555	3.57	3.62	1.98	1.15
	0.018	0.616	3.14	3.25	1.93	1.04
	0.016	0.693	2.72	2.89	1.88	0.920
	0.014	0.792	2.32	2.53	1.84	0.805
	0.013	0.853	2.12	2.35	1.81	0.748
	0.011	1.01	1.75	1.99	1.76	0.633
	0.010	1.11	1.57	1.81	1.74	0.575
	0.0089	1.25	1.37	1.61	1.71	0.512
	0.0080	1.39	1.22	1.45	1.69	0.460
	0.0071	1.56	1.07	1.28	1.67	0.408
	0.0063	1.76	0.938	1.14	1.65	0.362
	0.0056	1.98	0.825	1.01	1.63	0.322
	0.0050	2.22	0.730	0.904	1.62	0.288
	0.0045	2.46	0.652	0.814	1.61	0.259
	0.0040	2.77	0.576	0.723	1.60	0.230

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
3/64	0.029	0.510	3.57	3.93	1.82	1.25
	0.025	0.592	2.92	3.39	1.73	1.08
	0.023	0.643	2.61	3.12	1.68	0.992
	0.020	0.739	2.17	2.71	1.61	0.863
	0.018	0.822	1.90	2.44	1.56	0.776
	0.016	0.924	1.63	2.17	1.51	0.690
	0.014	1.06	1.38	1.90	1.46	0.604
	0.013	1.14	1.26	1.76	1.44	0.561
	0.011	1.34	1.03	1.49	1.39	0.474
	0.010	1.48	0.923	1.36	1.37	0.431
	0.0089	1.66	0.806	1.21	1.34	0.384
	0.0080	1.85	0.712	1.08	1.32	0.345
	0.0071	2.08	0.622	0.963	1.30	0.306
	0.0063	2.35	0.544	0.854	1.28	0.272
	0.0056	2.64	0.477	0.759	1.26	0.242
	0.0050	2.96	0.421	0.678	1.25	0.216
	0.0045	3.29	0.375	0.610	1.23	0.194
	0.0040	3.70	0.330	0.542	1.22	0.173
	0.0035	4.23	0.286	0.475	1.21	0.151
	0.0031	4.77	0.251	0.420	1.20	0.134
1/32	0.016	1.39	0.818	1.45	1.13	0.460
	0.014	1.58	0.685	1.27	1.09	0.403
	0.013	1.71	0.622	1.18	1.06	0.374
	0.011	2.02	0.503	0.994	1.01	0.316
	0.010	2.22	0.446	0.904	0.990	0.288
	0.0089	2.49	0.387	0.804	0.964	0.256
	0.0080	2.77	0.340	0.723	0.942	0.230
	0.0071	3.12	0.295	0.642	0.920	0.204
	0.0063	3.52	0.256	0.569	0.901	0.181
	0.0056	3.96	0.223	0.506	0.884	0.161
	0.0050	4.44	0.196	0.452	0.870	0.144
	0.0045	4.93	0.174	0.407	0.858	0.129
	0.0040	5.55	0.153	0.362	0.846	0.115
	0.0035	6.34	0.132	0.316	0.834	0.101
	0.0031	7.16	0.115	0.280	0.824	0.0891
	0.0028	7.92	0.103	0.253	0.817	0.0805
	0.0025	8.87	0.0913	0.226	0.810	0.0719
	0.0022	10.1	0.0796	0.199	0.803	0.0633
1/64	0.0089	4.99	0.118	0.402	0.589	0.128
	0.0080	5.55	0.102	0.362	0.567	0.115
	0.0071	6.25	0.0873	0.321	0.545	0.102
	0.0063	7.04	0.0747	0.285	0.526	0.0906
	0.0056	7.92	0.0643	0.253	0.509	0.0805
	0.0050	8.87	0.0558	0.226	0.495	0.0719
	0.0045	9.86	0.0490	0.203	0.483	0.0647
	0.0040	11.1	0.0425	0.181	0.471	0.0575
	0.0035	12.7	0.0362	0.158	0.459	0.0503
	0.0031	14.3	0.0314	0.140	0.449	0.0446
	0.0028	15.8	0.0279	0.127	0.442	0.0403
	0.0025	17.7	0.0245	0.113	0.435	0.0359
	0.0022	20.2	0.0212	0.0994	0.428	0.0316

ALKROTHAL 14
Wire inch SWG

0.258–0.0040 in
Resistivity Ω/cir.mil ft 752
Density, lb/cu.in 0.263

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

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

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
C_t	1.00	1.01	1.02	1.03	1.04	1.05	1.08	1.09	1.10	1.11	1.11	1.12

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
0	0.324	0.00719	1700	260	12.2	82.4
1	0.300	0.00839	1350	223	11.3	70.7
2	0.276	0.0099	1050	189	10.4	59.8
3	0.252	0.0119	799	157	9.50	49.9
4	0.232	0.0140	624	133	8.75	42.3
5	0.212	0.0168	476	111	7.99	35.3
6	0.192	0.0205	353	91.4	7.24	29.0
7	0.176	0.0244	272	76.8	6.64	24.3
8	0.160	0.0295	205	63.5	6.03	20.1
9	0.144	0.0364	149	51.4	5.43	16.3
10	0.128	0.0461	105	40.6	4.83	12.9
11	0.116	0.0561	77.9	33.4	4.37	10.6
12	0.104	0.0698	56.2	26.8	3.92	8.49
13	0.0920	0.0892	38.9	21.0	3.47	6.65
14	0.0800	0.118	25.6	15.9	3.02	5.03
15	0.0720	0.146	18.6	12.8	2.71	4.07
16	0.0640	0.184	13.1	10.2	2.41	3.22
17	0.0560	0.241	8.77	7.77	2.11	2.46
18	0.0480	0.328	5.52	5.71	1.81	1.81
19	0.0400	0.472	3.20	3.97	1.51	1.26
20	0.0360	0.583	2.33	3.21	1.36	1.02
21	0.0320	0.737	1.64	2.54	1.21	0.804
22	0.0280	0.963	1.10	1.94	1.06	0.616
23	0.0240	1.31	0.690	1.43	0.905	0.452
24	0.0220	1.56	0.532	1.20	0.829	0.380
25	0.0200	1.89	0.399	0.991	0.754	0.314
26	0.0180	2.33	0.291	0.803	0.679	0.254
27	0.0164	2.81	0.220	0.667	0.618	0.211
28	0.0148	3.45	0.162	0.543	0.558	0.172
29	0.0136	4.08	0.126	0.458	0.513	0.145
30	0.0124	4.91	0.0952	0.381	0.467	0.121
31	0.0116	5.61	0.0779	0.334	0.437	0.106
32	0.0108	6.47	0.0629	0.289	0.407	0.0916
33	0.0100	7.55	0.0499	0.248	0.377	0.0785
34	0.00920	8.92	0.0389	0.210	0.347	0.0665
35	0.00840	10.7	0.0296	0.175	0.317	0.0554
36	0.00760	13.1	0.0219	0.143	0.287	0.0454
37	0.00680	16.3	0.0157	0.115	0.256	0.0363
38	0.00600	21.0	0.0108	0.0892	0.226	0.0283
39	0.00520	27.9	0.00702	0.0670	0.196	0.0212
40	0.00480	32.8	0.00552	0.0571	0.181	0.0181
41	0.00440	39.0	0.00425	0.0480	0.166	0.0152
42	0.00400	47.2	0.00320	0.0397	0.151	0.0126

ALKROTHAL 14

Ribbon inch

Resistivity Ω/sq.mil ft 591
Density, lb/cu.in 0.263

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

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

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
C_t	1.00	1.01	1.02	1.03	1.04	1.05	1.08	1.09	1.10	1.11	1.11	1.12

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
1/8	0.057	0.0901	48.5	20.7	4.37	6.56
	0.051	0.101	42.0	18.5	4.22	5.87
	0.045	0.114	35.8	16.3	4.08	5.18
	0.040	0.128	30.8	14.5	3.96	4.60
	0.036	0.143	27.1	13.1	3.86	4.14
	0.032	0.160	23.5	11.6	3.77	3.68
	0.029	0.177	20.9	10.5	3.70	3.34
	0.025	0.205	17.5	9.07	3.60	2.88
	0.023	0.223	15.9	8.35	3.55	2.65
	0.020	0.257	13.6	7.26	3.48	2.30
	0.018	0.285	12.0	6.53	3.43	2.07
	0.016	0.321	10.5	5.81	3.38	1.84
	0.014	0.367	9.09	5.08	3.34	1.61
	0.013	0.395	8.38	4.72	3.31	1.50
	0.011	0.467	6.99	3.99	3.26	1.27
	0.010	0.514	6.31	3.63	3.24	1.15
	0.0089	0.577	5.57	3.23	3.21	1.02
	0.0080	0.642	4.97	2.90	3.19	0.920
	0.0071	0.723	4.38	2.58	3.17	0.817
	0.0063	0.815	3.87	2.29	3.15	0.725
3/32	0.057	0.120	30.1	15.5	3.62	4.92
	0.051	0.134	25.9	13.9	3.47	4.40
	0.045	0.152	21.9	12.2	3.33	3.88
	0.040	0.171	18.8	10.9	3.21	3.45
	0.036	0.190	16.4	9.80	3.11	3.11
	0.032	0.214	14.1	8.71	3.02	2.76
	0.029	0.236	12.5	7.89	2.95	2.50
	0.025	0.274	10.4	6.81	2.85	2.16
	0.023	0.298	9.41	6.26	2.80	1.98
	0.020	0.342	7.97	5.44	2.73	1.73
	0.018	0.380	7.05	4.90	2.68	1.55
	0.016	0.428	6.16	4.36	2.63	1.38
	0.014	0.489	5.29	3.81	2.59	1.21
	0.013	0.527	4.86	3.54	2.56	1.12
	0.011	0.622	4.04	2.99	2.51	0.949
	0.010	0.685	3.64	2.72	2.49	0.863
	0.0089	0.769	3.20	2.42	2.46	0.768
	0.0080	0.856	2.85	2.18	2.44	0.690
	0.0071	0.964	2.51	1.93	2.42	0.612
	0.0063	1.09	2.21	1.71	2.40	0.543
	0.0056	1.22	1.95	1.52	2.38	0.483
	0.0050	1.37	1.73	1.36	2.37	0.431
1/16	0.032	0.321	7.07	5.81	2.27	1.84
	0.029	0.354	6.20	5.26	2.20	1.67
	0.025	0.411	5.11	4.54	2.10	1.44
	0.023	0.447	4.60	4.17	2.05	1.32
	0.020	0.514	3.86	3.63	1.98	1.15
	0.018	0.571	3.39	3.27	1.93	1.04
	0.016	0.642	2.94	2.90	1.88	0.920
	0.014	0.734	2.50	2.54	1.84	0.805
	0.013	0.790	2.29	2.36	1.81	0.748
	0.011	0.934	1.89	2.00	1.76	0.633
	0.010	1.03	1.69	1.81	1.74	0.575
	0.0089	1.15	1.48	1.62	1.71	0.512
	0.0080	1.28	1.32	1.45	1.69	0.460
	0.0071	1.45	1.15	1.29	1.67	0.408
	0.0063	1.63	1.01	1.14	1.65	0.362
	0.0056	1.83	0.891	1.02	1.63	0.322
	0.0050	2.05	0.789	0.907	1.62	0.288
	0.0045	2.28	0.705	0.817	1.61	0.259
	0.0040	2.57	0.622	0.726	1.60	0.230

Width in	Thickness in	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
3/64	0.029	0.472	3.86	3.95	1.82	1.25
	0.025	0.548	3.15	3.40	1.73	1.08
	0.023	0.595	2.82	3.13	1.68	0.992
	0.020	0.685	2.34	2.72	1.61	0.863
	0.018	0.761	2.05	2.45	1.56	0.776
	0.016	0.856	1.76	2.18	1.51	0.690
	0.014	0.978	1.49	1.91	1.46	0.604
	0.013	1.05	1.36	1.77	1.44	0.561
	0.011	1.24	1.12	1.50	1.39	0.474
	0.010	1.37	0.997	1.36	1.37	0.431
	0.0089	1.54	0.870	1.21	1.34	0.384
	0.0080	1.71	0.769	1.09	1.32	0.345
	0.0071	1.93	0.672	0.966	1.30	0.306
	0.0063	2.17	0.587	0.857	1.28	0.272
	0.0056	2.45	0.515	0.762	1.26	0.242
	0.0050	2.74	0.455	0.681	1.25	0.216
	0.0045	3.04	0.405	0.612	1.23	0.194
	0.0040	3.42	0.357	0.544	1.22	0.173
	0.0035	3.91	0.309	0.476	1.21	0.151
	0.0031	4.42	0.272	0.422	1.20	0.134
1/32	0.016	1.28	0.883	1.45	1.13	0.460
	0.014	1.47	0.740	1.27	1.09	0.403
	0.013	1.58	0.672	1.18	1.06	0.374
	0.011	1.87	0.543	0.998	1.01	0.316
	0.010	2.05	0.482	0.907	0.990	0.288
	0.0089	2.31	0.418	0.808	0.964	0.256
	0.0080	2.57	0.367	0.726	0.942	0.230
	0.0071	2.89	0.318	0.644	0.920	0.204
	0.0063	3.26	0.276	0.572	0.901	0.181
	0.0056	3.67	0.241	0.508	0.884	0.161
	0.0050	4.11	0.212	0.454	0.870	0.144
	0.0045	4.56	0.188	0.408	0.858	0.129
	0.0040	5.14	0.165	0.363	0.846	0.115
	0.0035	5.87	0.142	0.318	0.834	0.101
	0.0031	6.63	0.124	0.281	0.824	0.0891
	0.0028	7.34	0.111	0.254	0.817	0.0805
	0.0025	8.22	0.0986	0.227	0.810	0.0719
	0.0022	9.34	0.0860	0.200	0.803	0.0633
1/64	0.0089	4.62	0.128	0.404	0.589	0.128
	0.0080	5.14	0.110	0.363	0.567	0.115
	0.0071	5.79	0.0943	0.322	0.545	0.102
	0.0063	6.52	0.0807	0.286	0.526	0.0906
	0.0056	7.34	0.0694	0.254	0.509	0.0805
	0.0050	8.22	0.0602	0.227	0.495	0.0719
	0.0045	9.13	0.0529	0.204	0.483	0.0647
	0.0040	10.3	0.0459	0.181	0.471	0.0575
	0.0035	11.7	0.0391	0.159	0.459	0.0503
	0.0031	13.3	0.0339	0.141	0.449	0.0446
	0.0028	14.7	0.0301	0.127	0.442	0.0403
	0.0025	16.4	0.0265	0.113	0.435	0.0359
	0.0022	18.7	0.0229	0.0998	0.428	0.0316

KANTHAL 70, 52
Wire inch SWG

0.0720–0.0040 in		
Resistivity Ω/cir.mil ft	KANTHAL 52	223
	KANTHAL 70	126
Density, lb/cu.in	KANTHAL 52	0.296
	KANTHAL 70	0.305

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

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

To obtain resistance at working temperature multiply by the factor C_t in the following table:

°F	68	212	302	392	482	572	662	752	842	932
KANTHAL 70, C_t	1.00	135	1.57	1.80	2.05	2.30	2.56	2.82	3.10	3.40
KANTHAL 52, C_t	1.00	1.33	1.53	1.73	1.93	2.13	2.32	2.49	2.64	2.77

KANTHAL 70

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
16	0.0640	0.0308	78.4	11.8	2.41	3.22
17	0.0560	0.0402	52.5	9.01	2.11	2.46
18	0.0480	0.0547	33.1	6.62	1.81	1.81
19	0.0400	0.0788	19.1	4.60	1.51	1.26
20	0.0360	0.0972	14.0	3.73	1.36	1.02
21	0.0320	0.123	9.80	2.94	1.21	0.804
22	0.0280	0.161	6.57	2.25	1.06	0.616
23	0.0240	0.219	4.14	1.66	0.905	0.452
24	0.0220	0.260	3.19	1.39	0.829	0.380
25	0.0200	0.315	2.39	1.15	0.754	0.314
26	0.0180	0.389	1.74	0.931	0.679	0.254
27	0.0164	0.468	1.32	0.773	0.618	0.211
28	0.0148	0.575	0.970	0.630	0.558	0.172
29	0.0136	0.681	0.753	0.532	0.513	0.145
30	0.0124	0.819	0.570	0.442	0.467	0.121
31	0.0116	0.936	0.467	0.387	0.437	0.106
32	0.0108	1.08	0.377	0.335	0.407	0.0916
33	0.0100	1.26	0.299	0.287	0.377	0.0785
34	0.0092	1.49	0.233	0.243	0.347	0.0665
35	0.0084	1.79	0.177	0.203	0.317	0.0554
36	0.0076	2.18	0.131	0.166	0.287	0.0454
37	0.0068	2.72	0.0941	0.133	0.256	0.0363
38	0.0060	3.50	0.0646	0.103	0.226	0.0283
39	0.0052	4.66	0.0421	0.0777	0.196	0.0212
40	0.0048	5.47	0.0331	0.0662	0.181	0.0181
41	0.0044	6.51	0.0255	0.0557	0.166	0.0152
42	0.0040	7.88	0.0191	0.0460	0.151	0.0126

KANTHAL 52

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
16	0.0640	0.0544	44.3	11.4	2.41	3.22
17	0.0560	0.0711	29.7	8.75	2.11	2.46
18	0.0480	0.0968	18.7	6.43	1.81	1.81
19	0.0400	0.139	10.8	4.46	1.51	1.26
20	0.0360	0.172	7.89	3.62	1.36	1.02
21	0.0320	0.218	5.54	2.86	1.21	0.804
22	0.0280	0.284	3.71	2.19	1.06	0.616
23	0.0240	0.387	2.34	1.61	0.905	0.452
24	0.0220	0.461	1.80	1.35	0.829	0.380
25	0.0200	0.558	1.35	1.12	0.754	0.314
26	0.0180	0.688	0.986	0.904	0.679	0.254
27	0.0164	0.829	0.746	0.750	0.618	0.211
28	0.0148	1.02	0.548	0.611	0.558	0.172
29	0.0136	1.21	0.425	0.516	0.513	0.145
30	0.0124	1.45	0.322	0.429	0.467	0.121
31	0.0116	1.66	0.264	0.375	0.437	0.106
32	0.0108	1.91	0.213	0.325	0.407	0.0916
33	0.0100	2.23	0.169	0.279	0.377	0.0785
34	0.0092	2.63	0.132	0.236	0.347	0.0665
35	0.0084	3.16	0.100	0.197	0.317	0.0554
36	0.0076	3.86	0.0742	0.161	0.287	0.0454
37	0.0068	4.82	0.0532	0.129	0.256	0.0363
38	0.0060	6.19	0.0365	0.100	0.226	0.0283
39	0.0052	8.25	0.0238	0.0754	0.196	0.0212
40	0.0048	9.68	0.0187	0.0643	0.181	0.0181
41	0.0044	11.5	0.0144	0.0540	0.166	0.0152
42	0.0040	13.9	0.0108	0.0446	0.151	0.0126

NIKROTHAL 80, 70

Wire inch SWG

NIKROTHAL 80	0.325–0.00078 in	$in^2/\Omega = \frac{I^2 C_t}{p}$	I = Current
NIKROTHAL 70	0.39–0.0195 in		C_t = Temperature factor
Resistivity Ω/cir.mil ft	NIKROTHAL 80 655		p = Surface load W/in²
	NIKROTHAL 70 709		
Density, lb/cu.in	NIKROTHAL 80 0.300 NIKROTHAL 70 0.293		

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
NIKROTHAL 80 C_t	1.00	1.01	1.02	1.03	1.04	1.05	1.04	1.04	1.04	1.04	1.05	1.06	1.07
NIKROTHAL 70 C_t	1.00	1.01	1.02	1.03	1.04	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.06

To get NIKROTHAL 70, multiply the figures in the table with:

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
		1.083	**0.924**	**0.976**		
0	0.324	0.00624	1960	297	12.2	82.4
1	0.300	0.00728	1550	254	11.3	70.7
2	0.276	0.00860	1210	215	10.4	59.8
3	0.252	0.0103	921	180	9.50	49.9
4	0.232	0.0122	719	152	8.75	42.3
5	0.212	0.0146	548	127	7.99	35.3
6	0.192	0.0178	407	104	7.24	29.0
7	0.176	0.0211	314	87.6	6.64	24.3
8	0.160	0.0256	236	72.4	6.03	20.1
9	0.144	0.0316	172	58.6	5.43	16.3
10	0.128	0.0400	121	46.3	4.83	12.9
11	0.116	0.0487	89.8	38.0	4.37	10.6
12	0.104	0.0606	64.7	30.6	3.92	8.49
13	0.0920	0.0774	44.8	23.9	3.47	6.65
14	0.0800	0.102	29.5	18.1	3.02	5.03
15	0.0720	0.126	21.5	14.7	2.71	4.07
16	0.0640	0.160	15.1	11.6	2.41	3.22
17	0.0560	0.209	10.1	8.87	2.11	2.46
18	0.0480	0.284	6.37	6.51	1.81	1.81
19	0.0400	0.409	3.68	4.52	1.51	1.26
20	0.0360	0.505	2.69	3.66	1.36	1.02
21	0.0320	0.640	1.89	2.90	1.21	0.804
22	0.0280	0.835	1.26	2.22	1.06	0.616
23	0.0240	1.14	0.796	1.63	0.905	0.452
24	0.0220	1.35	0.613	1.37	0.829	0.380
25	0.0200	1.64	0.460	1.13	0.754	0.314
26	0.0180	2.02	0.336	0.916	0.679	0.254
27	0.0164	2.44	0.254	0.760	0.618	0.211
28	0.0148	2.99	0.187	0.619	0.558	0.172
29	0.0136	3.54	0.145	0.523	0.513	0.145
30	0.0124	4.26	0.110	0.435	0.467	0.121
31	0.0116	4.87	0.0898	0.380	0.437	0.106
32	0.0108	5.62	0.0725	0.330	0.407	0.0916
33	0.0100	6.55	0.0576	0.283	0.377	0.0785
34	0.00920	7.74	0.0448	0.239	0.347	0.0665
35	0.00840	9.28	0.0341	0.200	0.317	0.0554
36	0.00760	11.3	0.0253	0.163	0.287	0.0454
37	0.00680	14.2	0.0181	0.131	0.256	0.0363
38	0.00600	18.2	0.0124	0.102	0.226	0.0283
39	0.00520	24.2	0.00809	0.0765	0.196	0.0212
40	0.00480	28.4	0.00637	0.0651	0.181	0.0181
41	0.00440	33.8	0.00490	0.0547	0.166	0.0152
42	0.00400	40.9	0.00368	0.0452	0.151	0.0126
43	0.00360	50.5	0.00269	0.0366	0.136	0.0102
44	0.00320	64.0	0.00189	0.0290	0.121	0.00804
45	0.00280	83.5	0.00126	0.0222	0.106	0.00616
46	0.00240	114	0.000796	0.0163	0.0905	0.00452
47	0.00200	164	0.000460	0.0113	0.0754	0.00314
48	0.00160	256	0.000236	0.00724	0.0603	0.00201
49	0.00120	455	0.0000995	0.00407	0.0452	0.00113
50	0.00100	655	0.0000576	0.00283	0.0377	0.000785

NIKROTHAL 60
Wire inch SWG

0.258–0.0020 in
Resistivity Ω/cir.mil ft 668
Density, lb/cu.in 0.296

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

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

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	
C_t	1.00	1.02	1.04	1.05	1.06	1.08	1.09	1.09	1.10	1.10	1.11	1.12	1.13	

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
0	0.324	0.00636	1920	293	12.2	82.4
1	0.300	0.00742	1520	251	11.3	70.7
2	0.276	0.00877	1190	213	10.4	59.8
3	0.252	0.0105	903	177	9.50	49.9
4	0.232	0.0124	705	150	8.75	42.3
5	0.212	0.0149	538	125	7.99	35.3
6	0.192	0.0181	399	103	7.24	29.0
7	0.176	0.0216	308	86.4	6.64	24.3
8	0.160	0.0261	231	71.4	6.03	20.1
9	0.144	0.0322	169	57.8	5.43	16.3
10	0.128	0.0408	118	45.7	4.83	12.9
11	0.116	0.0496	88.1	37.5	4.37	10.6
12	0.104	0.0618	63.5	30.2	3.92	8.49
13	0.0920	0.0789	43.9	23.6	3.47	6.65
14	0.0800	0.104	28.9	17.9	3.02	5.03
15	0.0720	0.129	21.1	14.5	2.71	4.07
16	0.0640	0.163	14.8	11.4	2.41	3.22
17	0.0560	0.213	9.91	8.75	2.11	2.46
18	0.0480	0.290	6.24	6.43	1.81	1.81
19	0.0400	0.418	3.61	4.46	1.51	1.26
20	0.0360	0.515	2.63	3.62	1.36	1.02
21	0.0320	0.652	1.85	2.86	1.21	0.804
22	0.0280	0.852	1.24	2.19	1.06	0.616
23	0.0240	1.16	0.780	1.61	0.905	0.452
24	0.0220	1.38	0.601	1.35	0.829	0.380
25	0.0200	1.67	0.451	1.12	0.754	0.314
26	0.0180	2.06	0.329	0.904	0.679	0.254
27	0.0164	2.48	0.249	0.750	0.618	0.211
28	0.0148	3.05	0.183	0.611	0.558	0.172
29	0.0136	3.61	0.142	0.516	0.513	0.145
30	0.0124	4.34	0.108	0.429	0.467	0.121
31	0.0116	4.96	0.0881	0.375	0.437	0.106
32	0.0108	5.73	0.0711	0.325	0.407	0.0916
33	0.0100	6.68	0.0564	0.279	0.377	0.0785
34	0.00920	7.89	0.0439	0.236	0.347	0.0665
35	0.00840	9.47	0.0334	0.197	0.317	0.0554
36	0.00760	11.6	0.0248	0.161	0.287	0.0454
37	0.00680	14.4	0.0177	0.129	0.256	0.0363
38	0.00600	18.6	0.0122	0.100	0.226	0.0283
39	0.00520	24.7	0.00794	0.0754	0.196	0.0212
40	0.00480	29.0	0.00624	0.0643	0.181	0.0181
41	0.00440	34.5	0.00481	0.0540	0.166	0.0152
42	0.00400	41.8	0.00361	0.0446	0.151	0.0126
43	0.00360	51.5	0.00263	0.0362	0.136	0.0102
44	0.00320	65.2	0.00185	0.0286	0.121	0.00804
45	0.00280	85.2	0.00124	0.0219	0.106	0.00616
46	0.00240	116	0.000780	0.0161	0.0905	0.00452
47	0.00200	167	0.000451	0.0112	0.0754	0.00314
48	0.00160	261	0.000231	0.00714	0.0603	0.00201

NIKROTHAL 40, 20
Wire inch SWG

0.258–0.0040 in

Resistivity Ω/cir.mil ft	NIKROTHAL 40	626
	NIKROTHAL 20	572
Density, lb/cu.in	NIKROTHAL 40	0.285
	NIKROTHAL 20	0.281

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

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

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
NIKROTHAL 40 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
NIKROTHAL 20 C_t	1.00	1.04	1.10	1.14	1.17	1.21	1.23	1.26	1.28	1.30	1.32	1.34

To get NIKROTHAL 20, multiply the figures in the table with:

Diameter SWG	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
		0.913	**1.095**	**0.987**		
0	0.324	0.00596	2050	282	12.2	82.4
1	0.300	0.00696	1630	242	11.3	70.7
2	0.276	0.00822	1270	205	10.4	59.8
3	0.252	0.00986	964	171	9.50	49.9
4	0.232	0.0116	752	145	8.75	42.3
5	0.212	0.0139	574	121	7.99	35.3
6	0.192	0.0170	426	99.0	7.24	29.0
7	0.176	0.0202	328	83.2	6.64	24.3
8	0.160	0.0245	247	68.8	6.03	20.1
9	0.144	0.0302	180	55.7	5.43	16.3
10	0.128	0.0382	126	44.0	4.83	12.9
11	0.116	0.0465	94.0	36.1	4.37	10.6
12	0.104	0.0579	67.7	29.1	3.92	8.49
13	0.0920	0.0740	46.9	22.7	3.47	6.65
14	0.0800	0.0978	30.8	17.2	3.02	5.03
15	0.0720	0.121	22.5	13.9	2.71	4.07
16	0.0640	0.153	15.8	11.0	2.41	3.22
17	0.0560	0.200	10.6	8.42	2.11	2.46
18	0.0480	0.272	6.66	6.19	1.81	1.81
19	0.0400	0.391	3.85	4.30	1.51	1.26
20	0.0360	0.483	2.81	3.48	1.36	1.02
21	0.0320	0.611	1.97	2.75	1.21	0.804
22	0.0280	0.798	1.32	2.11	1.06	0.616
23	0.0240	1.09	0.833	1.55	0.905	0.452
24	0.0220	1.29	0.641	1.30	0.829	0.380
25	0.0200	1.57	0.482	1.07	0.754	0.314
26	0.0180	1.93	0.351	0.870	0.679	0.254
27	0.0164	2.33	0.266	0.722	0.618	0.211
28	0.0148	2.86	0.195	0.588	0.558	0.172
29	0.0136	3.38	0.151	0.497	0.513	0.145
30	0.0124	4.07	0.115	0.413	0.467	0.121
31	0.0116	4.65	0.0940	0.361	0.437	0.106
32	0.0108	5.37	0.0759	0.313	0.407	0.0916
33	0.0100	6.26	0.0602	0.269	0.377	0.0785
34	0.00920	7.40	0.0469	0.227	0.347	0.0665
35	0.00840	8.87	0.0357	0.190	0.317	0.0554
36	0.00760	10.8	0.0264	0.155	0.287	0.0454
37	0.00680	13.5	0.0189	0.124	0.256	0.0363
38	0.00600	17.4	0.0130	0.0967	0.226	0.0283
39	0.00520	23.2	0.00847	0.0726	0.196	0.0212
40	0.00480	27.2	0.00666	0.0619	0.181	0.0181
41	0.00440	32.3	0.00513	0.0520	0.166	0.0152
42	0.00400	39.1	0.00385	0.0430	0.151	0.0126

NIKROTHAL 80, 60, 40

Ribbon inch

Resistivity Ω/sq.mil ft	
NIKROTHAL 80	514
NIKROTHAL 60	524
NIKROTHAL 40	491

Density, lb/cu.in	
NIKROTHAL 80	0.300
NIKROTHAL 60	0.296
NIKROTHAL 40	0.285

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

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

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
NIKROTHAL 80 C_t	1.00	1.01	1.02	1.03	1.04	1.05	1.04	1.04	1.04	1.04	1.05	1.06	1.07
NIKROTHAL 60 C_t	1.00	1.02	1.04	1.05	1.06	1.08	1.09	1.09	1.10	1.10	1.11	1.12	1.13
NIKROTHAL 40 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	

To get NIKROTHAL 60 and 40, multiply the figures in the table with:

N 60	**1.018**	**0.982**	**0.988**
N 40	**0.954**	**1.048**	**0.952**

Width in	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
1/8	0.057	0.0786	55.6	23.6	4.37	6.56
	0.051	0.0878	48.1	21.1	4.22	5.87
	0.045	0.100	41.0	18.6	4.08	5.18
	0.040	0.112	35.4	16.6	3.96	4.60
	0.036	0.124	31.1	14.9	3.86	4.14
	0.032	0.140	26.9	13.2	3.77	3.68
	0.029	0.154	23.9	12.0	3.70	3.34
	0.025	0.179	20.1	10.4	3.60	2.88
	0.023	0.195	18.2	9.52	3.55	2.65
	0.020	0.224	15.5	8.28	3.48	2.30
	0.018	0.249	13.8	7.45	3.43	2.07
	0.016	0.280	12.1	6.62	3.38	1.84
	0.014	0.320	10.4	5.80	3.34	1.61
	0.013	0.344	9.62	5.38	3.31	1.50
	0.011	0.407	8.02	4.55	3.26	1.27
	0.010	0.448	7.24	4.14	3.24	1.15
	0.0089	0.503	6.39	3.68	3.21	1.02
	0.0080	0.560	5.70	3.31	3.19	0.920
	0.0071	0.631	5.03	2.94	3.17	0.817
	0.0063	0.711	4.43	2.61	3.15	0.725
3/32	0.057	0.105	34.5	17.7	3.62	4.92
	0.051	0.117	29.7	ß	3.47	4.40
	0.045	0.133	25.1	14.0	3.33	3.88
	0.040	0.149	21.5	12.4	3.21	3.45
	0.036	0.166	18.8	11.2	3.11	3.11
	0.032	0.187	16.2	9.94	3.02	2.76
	0.029	0.206	14.3	9.00	2.95	2.50
	0.025	0.239	11.9	7.76	2.85	2.16
	0.023	0.260	10.8	7.14	2.80	1.98
	0.020	0.299	9.14	6.21	2.73	1.73
	0.018	0.332	8.09	5.59	2.68	1.55
	0.016	0.373	7.06	4.97	2.63	1.38
	0.014	0.426	6.06	4.35	2.59	1.21
	0.013	0.459	5.58	4.04	2.56	1.12
	0.011	0.543	4.63	3.42	2.51	0.949
	0.010	0.597	4.17	3.11	2.49	0.863
	0.0089	0.671	3.67	2.76	2.46	0.768
	0.0080	0.746	3.27	2.48	2.44	0.690
	0.0071	0.84	2.88	2.20	2.42	0.612
	0.0063	0.95	2.53	1.96	2.40	0.543
	0.0056	1.07	2.24	1.74	2.38	0.483
	0.0050	1.19	1.98	1.55	2.37	0.431
1/16	0.032	0.280	8.10	6.62	2.27	1.84
	0.029	0.309	7.11	6.00	2.20	1.67
	0.025	0.358	5.86	5.18	2.10	1.44
	0.023	0.389	5.27	4.76	2.05	1.32
	0.020	0.448	4.42	4.14	1.98	1.15
	0.018	0.498	3.88	3.73	1.93	1.04
	0.016	0.560	3.37	3.31	1.88	0.920
	0.014	0.640	2.87	2.90	1.84	0.805
	0.013	0.689	2.63	2.69	1.81	0.748
	0.011	0.814	2.17	2.28	1.76	0.633
	0.010	0.896	1.94	2.07	1.74	0.575
	0.0089	1.01	1.70	1.84	1.71	0.512
	0.0080	1.12	1.51	1.66	1.69	0.460
	0.0071	1.26	1.32	1.47	1.67	0.408
	0.0063	1.42	1.16	1.30	1.65	0.362

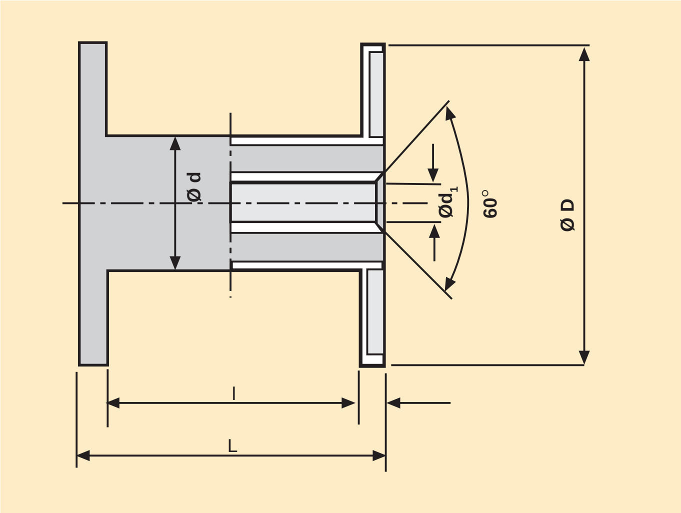
N 60	**1.018**	**0.982**	**0.988**
N 40	**0.954**	**1.048**	**0.952**

Width in	inch	Resistance at 68°F Ω/ft	in²/Ω at 68°F	Weight lb/1000 ft	Surface area in²/ft	Cross sectional area in² x 1000
	0.0056	1.60	1.02	1.16	1.63	0.322
	0.0050	1.79	0.904	1.04	1.62	0.288
	0.0045	1.99	0.808	0.932	1.61	0.259
	0.0040	2.24	0.713	0.828	1.60	0.230
3/64	0.029	0.412	4.42	4.50	1.82	1.25
	0.025	0.478	3.61	3.88	1.73	1.08
	0.023	0.519	3.23	3.57	1.68	0.992
	0.020	0.597	2.69	3.11	1.61	0.863
	0.018	0.663	2.35	2.79	1.56	0.776
	0.016	0.746	2.02	2.48	1.51	0.690
	0.014	0.853	1.71	2.17	1.46	0.604
	0.013	0.919	1.56	2.02	1.44	0.561
	0.011	1.09	1.28	1.71	1.39	0.474
	0.010	1.19	1.14	1.55	1.37	0.431
	0.0089	1.34	0.998	1.38	1.34	0.384
	0.0080	1.49	0.882	1.24	1.32	0.345
	0.0071	1.68	0.770	1.10	1.30	0.306
	0.0063	1.90	0.673	0.978	1.28	0.272
	0.0056	2.13	0.591	0.869	1.26	0.242
	0.0050	2.39	0.521	0.776	1.25	0.216
	0.0045	2.65	0.465	0.699	1.23	0.194
	0.0040	2.99	0.409	0.621	1.22	0.173
	0.0035	3.41	0.354	0.543	1.21	0.151
	0.0031	3.85	0.311	0.481	1.20	0.134
1/32	0.016	1.12	1.01	1.66	1.13	0.460
	0.014	1.28	0.849	1.45	1.09	0.403
	0.013	1.38	0.771	1.35	1.06	0.374
	0.011	1.63	0.623	1.14	1.01	0.316
	0.010	1.79	0.553	1.04	0.990	0.288
	0.0089	2.01	0.479	0.921	0.964	0.256
	0.0080	2.24	0.421	0.828	0.942	0.230
	0.0071	2.52	0.365	0.735	0.920	0.204
	0.0063	2.84	0.317	0.652	0.901	0.181
	0.0056	3.20	0.277	0.580	0.884	0.161
	0.0050	3.58	0.243	0.518	0.870	0.144
	0.0045	3.98	0.216	0.466	0.858	0.129
	0.0040	4.48	0.189	0.414	0.846	0.115
	0.0035	5.12	0.163	0.362	0.834	0.101
	0.0031	5.78	0.143	0.321	0.824	0.0891
	0.0028	6.40	0.128	0.290	0.817	0.0805
	0.0025	7.16	0.113	0.259	0.810	0.0719
	0.0022	8.14	0.0986	0.228	0.803	0.0633
1/64	0.0089	4.03	0.146	0.461	0.589	0.128
	0.0080	4.48	0.127	0.414	0.567	0.115
	0.0071	5.05	0.108	0.367	0.545	0.102
	0.0063	5.69	0.0925	0.326	0.526	0.0906
	0.0056	6.40	0.0796	0.290	0.509	0.0805
	0.0050	7.16	0.0691	0.259	0.495	0.0719
	0.0045	7.96	0.0607	0.233	0.483	0.0647
	0.0040	8.96	0.0526	0.207	0.471	0.0575
	0.0035	10.2	0.0448	0.181	0.459	0.0503
	0.0031	11.6	0.0389	0.160	0.449	0.0446
	0.0028	12.8	0.0346	0.145	0.442	0.0403
	0.0025	14.3	0.0304	0.129	0.435	0.0359
	0.0022	16.3	0.0263	0.114	0.428	0.0316

Delivery Forms for Wire and Ribbon

Wire

Wire of < 0.064 mm can be delivered on standard spools, such as shown in the figure. Only one length of wire is wound on each spool.



Types of Wire Spools.

Spool No.	Tare (lbs.)	Spool measurements (inches)				Typical wire dia.	Capacity (lbs.)
		flange D	barrel d	traverse l	bore d_1		
1	0.126	2 1/2	1 3/4	2	5/8	< .001	1/2
2	0.140	2 1/2	1 3/4	3	5/8	.001–.0045	1
8	0.180	3	1 3/4	3	5/8	.0035–.0101	2
13	0.450	5	3	3 1/2	5/8	.0035–.0179	5
32	0.650	6	3 1/2	3 1/2	5/8	.004–.0359	10
22	5.20	12	7	6	1 1/4	> .0359	50
24	7.20	14	6 1/2	6	1 1/4	> .0359	100

Pail Pack Wire diameters .0101”–.064” can also be supplied in pail packs.
Coil Wire diameters >.064 are usually supplied in coils with inner diameter 17”–20”.

Ribbon

Ribbon is most commonly supplied on the spools list below. However, many other spools are available upon request.

Types of Ribbon Spools.

Spool No.	Tare (lbs.)	Spool measurements (inches)				Capacity (lbs.)
		flange D	barrel d	traerse l	bore d_1	
DIN 80	0.155	3	2	2 1/2	5/8	2
DIN 100	0.28	4	2 1/2	3	5/8	3–4
DIN 125	0.43	5	3	4	5/8	7–8
No. 42	0.64	6	4	3	5/8	7
No. 32	0.65	6	3 1/2	3 1/2	5/8	10

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