

Brand Name	<b>ISAOHM®<sup>1)</sup></b>				
Material Code	<b>2.4872</b>				
Abbreviation	<b>NiCr20AlSi</b>				
Chemical Composition (mass components) in %. Average values of alloy components					
<b>Ni</b> Rem.	<b>Cr</b> 20	<b>Al</b> 3.5	<b>Si</b> 1	<b>Mn</b> 0.5	<b>Fe</b> 0.5



### Features and Application Notes

ISAOHM® is especially characterized by its high resistivity, the low temperature coefficient, the low thermal EMF versus Copper, the high tensile strength and the high resistance to oxidation and chemical corrosion. The alloy is non-magnetic. ISAOHM® is suitable for high-value resistors and potentiometers for example for the automotive and consumer electronics industries as well as for measurement and control systems. ISAOHM® is also used for heating cords and cables. When used as material for high precision resistors the maximum working temperature in air is +250 °C. The maximum

working temperature in air is +250 °C; at higher temperatures the resistivity and temperature coefficient may be affected irreversibly. For others applications, for heating cords for instance, it can be used at higher temperatures, especially in non-oxidating atmosphere.

### Form of Delivery

ISAOHM® is supplied in the form of round wire in the dimension 0.01 to 0.60 mm Ø in bare, oxidized or enamelled condition, flat wires and stranded.

### Electrical Resistance in Annealed Condition

Temperature coefficient of electrical resistance between		Electrical resistivity <sup>2)</sup> in: $\mu\Omega \times \text{cm}$ (first line) and $\Omega / \text{CMF}$ (second line) Reference Values				
+20 °C and +105 °C $10^{-6}/\text{K}$	+20 °C tolerance $\pm 5\%$	+100 °C	+200 °C	+300 °C	+400 °C	+500 °C
<b>Stand.: <math>\pm 50</math></b>	<b>132</b>	<b>132</b>	<b>132</b>			
<b>Special: <math>\pm 3, \pm 10</math></b>	<b>794</b>	<b>794</b>	<b>794</b>			

### Physical Characteristics (Reference Values)

Density at +20 °C		Melting point	Specific heat at +20 °C	Thermal conductivity at +20 °C	Average linear thermal expansion coefficient between +20 °C and		Thermal EMF against copper at
$\text{g}/\text{cm}^3$	$\text{lb}/\text{cub in}$	°C	$\text{J}/\text{g K}$	$\text{W}/\text{m K}$	+100 °C	+400 °C	+20 °C
					$10^{-6}/\text{K}$	$10^{-6}/\text{K}$	$\mu\text{V}/\text{K}$
<b>8.00</b>	<b>0.29</b>	<b>+1,400</b>	<b>0.46</b>	<b>14.00</b>	<b>14.00</b>	<b>15.00</b>	<b>+1.00</b>

### Mechanical Properties at +20 °C in Annealed Condition

Tensile Strength <sup>3)</sup>		Elongation ( $L_0 = 100 \text{ mm}$ ) % at nominal diameter in mm				
<b>MPa</b>	<b>psi</b>	0.020 to 0.063	> 0.063 to 0.125	> 0.125 to 0.50	> 0.50 to 1.00	> 1.00
<b>1,000</b>	<b>145,000</b>	<b>≈ 8</b>	<b>≈ 15</b>	<b>≈ 20</b>	<b>≥ 20</b>	

The specifications of the electrical and physical properties generally reference the following standards:

<b>DIN 17 471</b>	Resistance Alloys – Properties
<b>ASTM B267</b>	Standard specification for wires for the production of wirewound resistors
<b>DIN 17 470</b>	Heating conductor alloys – Technical delivery conditions for round and flat wires
<b>ASTM B344</b>	Standard specification for drawn/rolled nickel-chromium and nickel-chromium-iron wires for electric heating elements

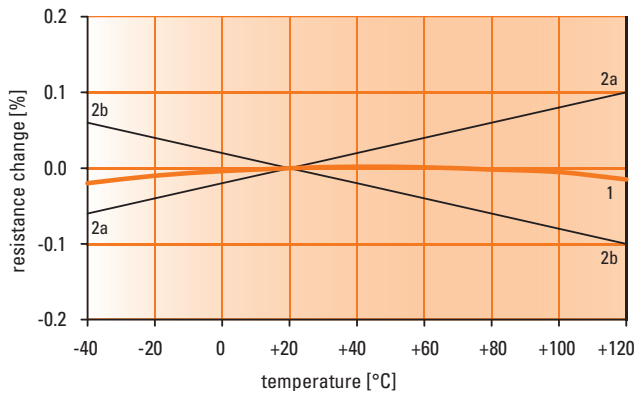
Properties and requirements depend on the material condition (formed, annealed ...) as well as the design (bare, insulated ...) and may deviate from the specified values.

1) ISAOHM® is a registered trademark of Isabellenhütte Heusler GmbH & Co. KG.

2) The resistivity of nickel-chromium alloys can be modified by special heat treatment (see Technical Information).

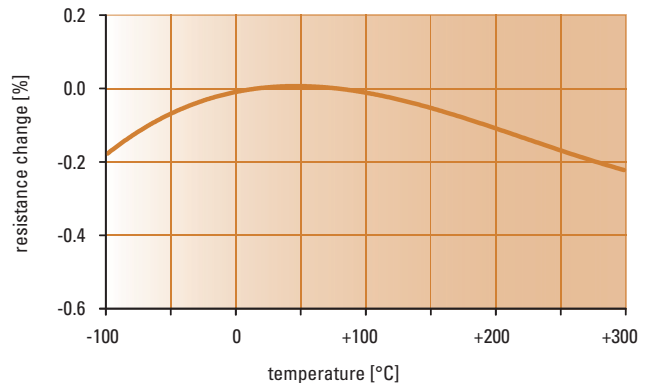
3) This value applies to wires of 0.6 mm Ø. For thinner wires the minimum values will substantially increase, depending on the dimension.

Nominal Diameter	Cross Section	Weight per 1,000 m	DC Resistance Referred to Length at +20 °C			
mm	mm <sup>2</sup>	g	Nominal Value	Tolerance	Minimum Value	Maximum Value
0.010	0.00007854	0.628	16,807	±10 %	15,126	18,487
0.011	0.00009503	0.760	13,890		12,501	15,279
0.013	0.0001327	1.06	9,945		8,950	10,939
0.014	0.0001539	1.23	8,575		7,717	9,432
0.016	0.0002011	1.61	6,565		5,909	7,222
0.018	0.0002545	2.04	5,187		4,669	5,706
0.020	0.0003142	2.51	4,202		3,866	4,538
0.022	0.0003801	3.04	3,473		3,195	3,750
0.025	0.0004909	3.93	2,689		2,474	2,904
0.028	0.0006158	4.93	2,144		1,972	2,315
0.030	0.0007069	5.65	1,867	1,718	2,017	
0.032	0.0008042	6.43	1,641	1,510	1,773	
0.036	0.001018	8.14	1,297	1,193	1,401	
0.040	0.001257	10.10	1,050	966	1,135	
0.045	0.001590	12.70	830	764	896	
0.050	0.001963	15.70	672	619	726	
0.056	0.002463	19.70	536	493	579	
0.060	0.002827	22.60	467	430	504	
0.063	0.003117	24.90	424	390	457	
0.070	0.003848	30.80	343	316	370	
0.071	0.003959	31.70	333	307	360	
0.080	0.005027	40.20	263	242	284	
0.090	0.006362	50.90	208	191	224	
0.100	0.007854	62.80	168	155	182	
0.110	0.009503	76.00	139	132	146	
0.112	0.009852	78.80	134	127	141	
0.120	0.01131	90.50	117	111	123	
0.125	0.01227	98.20	108	102	113	
0.130	0.01327	106.00	99.4	94.5	104	
0.140	0.01539	123.00	85.7	81.5	90.0	
0.150	0.01767	141.00	74.7	71.0	78.4	
0.160	0.02011	161.00	65.7	62.4	68.9	
0.180	0.02545	204.00	51.9	49.3	54.5	
0.200	0.03142	251.00	42.0	39.9	44.1	
0.220	0.03801	304.00	34.7	33.0	36.5	
0.224	0.03941	315.00	33.5	31.8	35.2	
0.250	0.04909	393.00	26.9	25.5	28.2	
0.280	0.06158	493.00	21.4	20.4	22.5	
0.300	0.07069	565.00	18.7	17.7	19.6	
0.315	0.07793	623.00	16.9	16.1	17.8	
0.350	0.09621	770.00	13.7	13.0	14.4	
0.355	0.09898	792.00	13.3	12.7	14.0	
0.400	0.1257	1,010.00	10.5	9.98	11.0	
0.450	0.1590	1,270.00	8.30	7.88	8.71	
0.500	0.1963	1,570.00	6.72	6.39	7.06	
0.550	0.2376	1,900.00	5.56	5.28	5.83	
0.560	0.2463	1,970.00	5.36	5.09	5.63	
0.600	0.2827	2,260.00	4.67	4.44	4.90	
0.630	0.3117	2,490.00	4.23	4.02	4.45	
0.650	0.3318	2,660.00	3.98	3.78	4.18	
0.700	0.3848	3,080.00	3.43	3.26	3.60	
0.710	0.3959	3,170.00	3.33	3.17	3.50	



1 ppm =  $1 \cdot 10^{-6} = 0.0001 \%$ , 1,000 ppm =  $1 \cdot 10^{-3} = 0.1 \%$ .

Graph 1: Electrical Resistance vs. Temperature (range -40 °C to +120 °C)



Graph 2: Electrical Resistance vs. Temperature (range -100 °C to +300 °C)

**Notes on Treatment** // ISAOHM® can easily be welded and brazed. Under certain conditions soldering is possible (see Technical Information).

#### Special Remarks on the Temperature Coefficient (TC).

**For further technical details please see Technical Information** // The temperature dependence of ISAOHM® in the range between -40 and +120 °C, referred to +20 °C, is shown in graph 1, page 3.

Curve 1 represents the typical R(T)-curve. Due to the very flat behaviour between +20 and +60 °C TC-values as low as 1 ppm/K can be produced. The straight lines 2a and 2b apply to a TC = ±10 ppm/K. Wires with a temperature coefficient in this range meet the requirements of DIN 46463 and can be used as precision resistance wires.