



Brand Name	<b>ALLOY 90<sup>1)</sup></b>				
Material Code	<b>2.0811</b>				
Abbreviation	<b>CuNi10</b>				
Chemical Composition (mass components) in %. Average values of alloy components					
<b>Cu</b> Rem.	<b>Ni</b> 10				

### Features and Application Notes

ALLOY 90 is especially noted for low resistivity and high resistance to oxidation and chemical corrosion. It is used for low-value resistors, for heating wires and mats in heating cords and in heating cables with low conductor temperatures, as well as for tube-weldings. Flat wires and stranded wires are used for protective switching. The maximum working temperature in air is +400 °C.

### Form of Delivery

ALLOY 90 is supplied in the form of round wires in the range 0.05 to 8.00 mm Ø in bare or enamelled condition, flat wires, stranded wires and ribbons.

**Notes on Treatment** // ALLOY 90 is easy to process. Copper-nickel alloys can be soft and hard soldered as well as welded by the known processes. On request we supply material tested according to DIN EN 60068-2-20.

### Electrical Resistance in Annealed Condition

Temperature coefficient of electrical resistance between 10 <sup>-6</sup> /K	Electrical resistivity in: μΩ x cm (first line) and Ω/CMF (second line) Reference Values					
	+20 °C tolerance ±10%	+100 °C	+200 °C	+300 °C	+400 °C	+500 °C
<b>+400 to +500</b>	<b>15</b>	<b>15.6</b>	<b>16.2</b>	<b>16.9</b>	<b>17.5</b>	
	<b>90</b>	<b>94</b>	<b>97</b>	<b>102</b>	<b>105</b>	

### Physical Characteristics (Reference Values)

Density at +20 °C		Melting point °C	Specific heat at +20 °C J/g K	Thermal conductivity at +20 °C W/m K	Average linear thermal expansion coefficient between +20 °C and		Thermal EMF against copper at +20 °C μV/K
g/cm <sup>3</sup>	lb/cub in				+100 °C	+400 °C	
<b>8.90</b>	<b>0.32</b>	<b>+1,100</b>	<b>0.38</b>	<b>59.00</b>	<b>10<sup>-6</sup>/K</b>	<b>10<sup>-6</sup>/K</b>	<b>-25.00</b>
					<b>16.00</b>	<b>17.50</b>	

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

Tensile Strength <sup>2)</sup>		Elongation (L <sub>0</sub> = 100 mm) % at nominal diameter in mm				
MPa	psi	0.020 to 0.063	> 0.063 to 0.125	> 0.125 to 0.50	> 0.50 to 1.00	> 1.00
<b>290</b>	<b>42,050</b>	<b>≈ 8</b>	<b>≈ 15</b>	<b>≈ 20</b>	<b>≥ 20</b>	<b>≥ 25</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) The number "90" indicates the resistivity, expressed in Ohm/cir. mil ft. (see Technical Information).

2) This value applies to wires of 2.0 mm diameter. For thinner wires the minimum values will substantially increase, depending on the dimensions.

Nominal Diameter mm	Cross Section mm <sup>2</sup>	Weight per 1.000 m g	DC Resistance Referred to Length at +20 °C Ω/m			
			Nominal Value	Tolerance	Minimum Value	Maximum Value
0.050	0.001963	17.50	76.4	±8%	70.3	82.5
0.056	0.002463	21.90	60.9		56.0	65.8
0.060	0.002827	25.20	53.1		48.8	57.3
0.063	0.003117	27.70	48.1		44.3	52.0
0.070	0.003848	34.30	39.0		35.9	42.1
0.071	0.003959	35.20	37.9		34.9	40.9
0.080	0.005027	44.70	29.8		27.5	32.2
0.090	0.006362	56.60	23.6		21.7	25.5
0.100	0.007854	69.90	19.1		17.6	20.6
0.110	0.009503	84.60	15.8		14.7	16.9
0.112	0.009852	87.70	15.2	14.2	16.3	
0.120	0.01131	101.00	13.3	12.3	14.2	
0.125	0.01227	109.00	12.2	11.4	13.1	
0.130	0.01327	118.00	11.3	10.5	12.1	
0.140	0.01539	137.00	9.74	9.06	10.4	
0.150	0.01767	157.00	8.49	7.89	9.08	
0.160	0.02011	179.00	7.46	6.94	7.98	
0.180	0.02545	226.00	5.89	5.48	6.31	
0.200	0.03142	280.00	4.77	4.49	5.06	
0.220	0.03801	338.00	3.95	3.71	4.18	
0.224	0.03941	351.00	3.81	3.58	4.03	
0.250	0.04909	437.00	3.06	2.87	3.24	
0.280	0.06158	548.00	2.44	2.29	2.58	
0.300	0.07069	629.00	2.12	1.99	2.25	
0.315	0.07793	694.00	1.92	1.83	2.02	
0.350	0.09621	856.00	1.56	1.48	1.64	
0.355	0.09898	881.00	1.52	1.44	1.59	
0.400	0.1257	1,120.00	1.19	1.13	1.25	
0.450	0.1590	1,420.00	0.943	0.896	0.990	
0.500	0.1963	1,750.00	0.764	0.726	0.802	

Nominal Diameter mm	Cross Section mm <sup>2</sup>	Weight per 1.000 m g	DC Resistance Referred to Length at +20 °C Ω/m			
			Nominal Value	Tolerance	Minimum Value	Maximum Value
0.550	0.2376	2,110.00	0.631		0.606	0.657
0.560	0.2463	2,190.00	0.609		0.585	0.633
0.600	0.2827	2,520.00	0.531		0.509	0.552
0.630	0.3117	2,770.00	0.481		0.462	0.500
0.650	0.3318	2,950.00	0.452		0.434	0.470
0.700	0.3848	3,430.00	0.390		0.374	0.405
0.710	0.3959	3,520.00	0.379		0.364	0.394
0.800	0.5027	4,470.00	0.298		0.286	0.310
0.900	0.6362	5,660.00	0.236		0.226	0.245
1.000	0.7854	6,990.00	0.191		0.183	0.199
1.120	0.9852	8,770.00	0.152		0.146	0.158
1.200	1.131	10,070.00	0.133		0.127	0.138
1.250	1.227	10,920.00	0.122		0.117	0.127
1.400	1.539	13,700.00	0.0974		0.0935	0.101
1.500	1.767	15,730.00	0.0849		0.0815	0.0883
1.600	2.011	17,900.00	0.0746		0.0716	0.0776
1.800	2.545	22,650.00	0.0589		0.0566	0.0613
2.000	3.142	27,960.00	0.0477	±4%	0.0458	0.0497
2.200	3.801	33,830.00	0.0395		0.0379	0.0410
2.240	3.941	35,070.00	0.0381		0.0365	0.0396
2.500	4.909	43,690.00	0.0306		0.0293	0.0318
2.800	6.158	54,800.00	0.0244		0.0234	0.0253
3.000	7.069	62,910.00	0.0212		0.0204	0.0221
3.150	7.793	69,360.00	0.0192		0.0185	0.0200
3.200	8.042	71,580.00	0.0187		0.0179	0.0194
3.500	9.621	85,630.00	0.0156		0.0150	0.0162
3.550	9.898	88,090.00	0.0152		0.0145	0.0158
4.000	12.57	111,840.00	0.0119		0.0115	0.0124
4.500	15.90	141,550.00	0.00943		0.00905	0.00981
5.000	19.63	174,750.00	0.00764		0.00733	0.00795
5.500	23.76	211,450.00	0.00631		0.00606	0.00657
5.600	24.63	219,210.00	0.00609		0.00585	0.00633
6.000	28.27	251,640.00	0.00531		0.00509	0.00552
6.300	31.17	277,440.00	0.00481		0.00462	0.00500
8.000	50.27	447,360.00	0.00298		0.00286	0.00310

