



Brand Name	ISA® 13¹⁾				
Material Code	2.1356				
Abbreviation	CuMn3				
Chemical Composition (mass components) in %.					
Average values of alloy components					
Cu	Mn				
Rem.	3				

Features and Application Notes

ISA® 13 is known for low resistivity and a relatively low temperature coefficient, as well as its relatively high corrosion resistance. It is used for low-value resistors and for heating wires and mats in heating cords and in heating cables. The maximum working temperature in air is +200 °C. ISA® 13 can also be used as welding wire, e. g. for building-up welding in copper-plated steel-tanks, as well as for tube-weldings.

Form of Delivery

ISA® 13 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

ISA® 13 is easy to process. The alloy 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 +20 °C and +105 °C 10 ⁻⁶ /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
+280 to +380	12.5	12.9	13.3			
	75	75	80			

Physical Characteristics (Reference Values)

Density at +20 °C		Melting point °C	Specific heat at +20 °C J/g K	Wärmeleitfähigkeit bei +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 ³	lb/cub in				+100 °C	+400 °C	
8.80	0.32	+1,050	0.39	84.00	10⁻⁶/K	10⁻⁶/K	+1.00
					15.50	18.00	

Mechanical Properties at +20 °C in Annealed Condition

Tensile Strength ²⁾		Elongation (L ₀ = 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
290	42,050	≈ 8	≈ 15	≈ 20	≥ 20	≥ 25

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

DIN 17 471	Resistance Alloys – Properties
ASTM B267	Standard specification for wires for the production of wirewound resistors
DIN 17 470	Heating conductor alloys – Technical delivery conditions for round and flat wires
ASTM B344	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) ISA® 13 is a registered trademark of Isabellenhütte Heusler GmbH & Co. KG.

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	Cross Section	Weight per 1.000 m	DC Resistance Referred to Length at +20 °C			
mm	mm ²	g	Nominal Value	Tolerance	Minimum Value	Maximum Value
0.050	0.001963	17.30	63.7	±8 %	58.6	68.8
0.056	0.002463	21.70	50.8		46.7	54.8
0.060	0.002827	24.90	44.2		40.7	47.7
0.063	0.003117	27.40	40.1		36.9	43.3
0.070	0.003848	33.90	32.5		29.9	35.1
0.071	0.003959	34.80	31.6		29.1	34.1
0.080	0.005027	44.20	24.9		22.9	26.9
0.090	0.006362	56.00	19.6		18.1	21.2
0.100	0.007854	69.10	15.9		14.6	17.2
0.110	0.009503	83.60	13.2		12.2	14.1
0.112	0.009852	86.70	12.7	11.8	13.6	
0.120	0.01131	99.50	11.1	10.3	11.8	
0.125	0.01227	108.00	10.2	9.47	10.9	
0.130	0.01327	117.00	9.42	±7 %	8.76	10.1
0.140	0.01539	135.00	8.12		7.55	8.69
0.150	0.01767	156.00	7.07		6.58	7.57
0.160	0.02011	177.00	6.22		5.78	6.65
0.180	0.02545	224.00	4.91		4.57	5.26
0.200	0.03142	276.00	3.98	3.74	4.22	
0.220	0.03801	335.00	3.29	3.09	3.49	
0.224	0.03941	347.00	3.17	±6 %	2.98	3.36
0.250	0.04909	432.00	2.55		2.39	2.70
0.280	0.06158	542.00	2.03		1.91	2.15
0.300	0.07069	622.00	1.77		1.66	1.87
0.315	0.07793	686.00	1.60		1.52	1.68
0.350	0.09621	847.00	1.30	1.23	1.36	
0.355	0.09898	871.00	1.26	±5 %	1.20	1.33
0.400	0.1257	1,110.00	0.995		0.945	1.04
0.450	0.1590	1,400.00	0.786		0.747	0.825
0.500	0.1963	1,730.00	0.637		0.605	0.668

Nominal Diameter mm	Cross Section mm ²	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	2,090.00	0.526		0.505	0.547
0.560	0.2463	2,170.00	0.508		0.487	0.528
0.600	0.2827	2,490.00	0.442		0.424	0.460
0.630	0.3117	2,740.00	0.401		0.385	0.417
0.650	0.3318	2,920.00	0.377		0.362	0.392
0.700	0.3848	3,390.00	0.325		0.312	0.338
0.710	0.3959	3,480.00	0.316		0.303	0.328
0.800	0.5027	4,420.00	0.249		0.239	0.259
0.900	0.6362	5,600.00	0.196		0.189	0.204
1.000	0.7854	6,910.00	0.159		0.153	0.166
1.120	0.9852	8,670.00	0.127		0.122	0.132
1.200	1.131	9,950.00	0.111		0.106	0.115
1.250	1.227	10,800.00	0.102		0.0978	0.106
1.400	1.539	13,550.00	0.0812		0.0780	0.0844
1.500	1.767	15,550.00	0.0707		0.0679	0.0736
1.600	2.011	17,690.00	0.0622		0.0597	0.0647
1.800	2.545	22,390.00	0.0491		0.0472	0.0511
2.000	3.142	27,650.00	0.0398	±4 %	0.0382	0.0414
2.200	3.801	33,450.00	0.0329		0.0316	0.0342
2.240	3.941	34,680.00	0.0317		0.0305	0.0330
2.500	4.909	43,200.00	0.0255		0.0244	0.0265
2.800	6.158	54,190.00	0.0203		0.0195	0.0211
3.000	7.069	62,200.00	0.0177		0.0170	0.0184
3.150	7.793	68,580.00	0.0160		0.0154	0.0167
3.200	8.042	70,770.00	0.0155		0.0149	0.0162
3.500	9.621	84,670.00	0.0130		0.0125	0.0135
3.550	9.898	87,100.00	0.0126		0.0121	0.0131
4.000	12.57	110,580.00	0.00995		0.00955	0.0103
4.500	15.90	139,960.00	0.00786		0.00755	0.00817
5.000	19.63	172,790.00	0.00637		0.00611	0.00662
5.500	23.76	209,070.00	0.00526		0.00505	0.00547
5.600	24.63	216,750.00	0.00508		0.00487	0.00528
6.000	28.27	248,810.00	0.00442		0.00424	0.00460
6.300	31.17	274,320.00	0.00401		0.00385	0.00417
8.000	50.27	442,340.00	0.00249		0.00239	0.00259

