



Brand Name	MANGANIN®¹⁾		
Material Code	2.1362		
Abbreviation	CuMn12Ni		
Chemical Composition (mass components) in % Average values of alloy components			
Cu	Mn	Ni	
Rem.	12	2	

Form of Delivery

Manganin® is supplied in the form of round wires in the range 8.0 to 0.02 mm diam. in bare or enamelled condition, also with rayon or silk covering. The product line includes sheets, ribbons, flat wires, rods and tubes.

Features and Application Notes

The precision resistance alloy MANGANIN®, developed by us, is especially characterized by low temperature coefficient between 20 and 50° C with parabolic shape of the R/T curve, high stability of electrical resistance, low thermo EMF against copper and good working properties. Due to these features MANGANIN® is the standard material for precision, standard and shunt resistors. The maximum working temperature in air is 140°C. When used for precision resistors, however, the temperature should not exceed 60°C.

Electrical Resistance (Reference Values)

Temperature coefficient ²⁾ of electrical resistance between 20 °C and 50 °C 10 ⁻⁶ /K	Electrical resistivity in: µΩ x cm (first line) & CMF (second line) Reference Values					
	20°C	100°C	200°C	300°C	400°C	500°C
	Perm. Dev.: ±5%					
-10 to +10	43	43	-	-	-	-
	259	259	-	-	-	-

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 20°C
g/cm ³	lb/cub in	°C	J/g K	W/m K	100°C 10 ⁻⁶ /K	400°C 10 ⁻⁶ /K	µV/K
8.4	0.30	960	0.41	22	18	19.5	-0.6

Strength Properties at 20 °C in annealed Condition³⁾

Tensile Strength ⁴⁾		Elongation (L ₀ =100mm) % at nominal diameter in mm				
MPa	lb / sq in	0.02 to 0.063	0.063 to 0.125	0.125 to 0.5	0.5 to 1	over 1
390	56550	≈12	≈18	≈20	≥20	≥25

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

2) this value applies to temperatures between 20 and 50°C. Upon request it can be adjusted to a certain degree.

3) Other characteristic values are: Modulus of elasticity = 1.3×10^5 MPa, pressure coefficient of electrical resistance = 2.3×10^{-7} cm²/N.

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

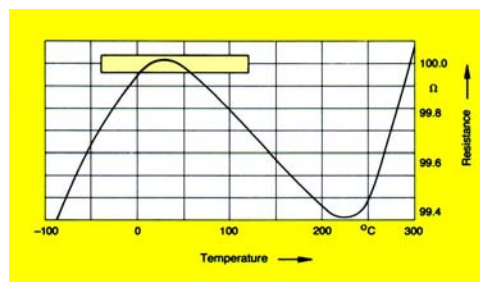
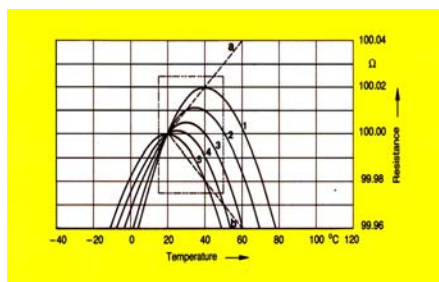
Notes on Treatment

MANGANIN® can be worked easily. Though the alloy can be soldered, it develops in air a thin oxide film; this must be removed before working. MANGANIN® is not suitable for dip-tinning. MANGANIN® can, however, be brazed and welded. Resistors made of MANGANIN® must be aged in order to remove mechanical stress.

Special Remarks on the Temperature Coefficient

The variation of the electrical resistance vs. temperature in the range between -10 and +80°C, referred to 20°C, is shown in Graph 1. Because of the parabolic shape of the curves of resistance vs. temperature, one cannot speak of an ideal curve; instead five possible curves are shown. The resistance variations of the alloy supplied by us normally lie between curves 1 and 5. The cut-out in the temperature range from 15 to 50°C corresponds with the generally known values of Graph 1255. The dotted straight lines a and b apply to a temperature coefficient $\alpha = \pm 10$ ppm/K in the temperature range between 20 and 80°C. Between 20 and 105°C the temperature coefficient increases to ± 50 ppm/K. The possible resistance variations in the range from -100 to + 300°C are presented in another scale in Graph 2. Graph 1 is an enlarged view of the cut-out.

Graph 1:
electrical resistance
vs.
temperature



Graph 2

For further technical details please have a look at the additional PDF "Technical Information"

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for any further questions please contact thermo@isabellenuette.de

Nominal Diameter d mm	Cross Section mm²	Cross Section square inch	Weight per 100 m g	DC Resistance Referred to Length at 20 °C Ω/m			
				Nominal Value	Tolerance	Minimum Value	Maximum Value
0,02	0,0003142	0,0000019	0,264	1369	± 10 %	1232	1506
0,022	0,0003801	0,0000023	0,319	1131		1018	1244
0,025	0,0004909	0,0000029	0,412	876		788	964
0,028	0,0006158	0,0000037	0,517	698		628	768
0,03	0,0007069	0,0000042	0,594	608		560	657
0,032	0,0008042	0,0000048	0,676	535	± 8 %	492	577
0,036	0,001018	0,000006	0,855	422		389	456
0,04	0,001257	0,000008	1,06	342		315	370
0,045	0,001590	0,000010	1,34	270		249	292
0,05	0,001963	0,000012	1,65	219		201	237
0,056	0,002463	0,000015	2,07	175		161	189
0,06	0,002827	0,000017	2,38	152		140	164
0,063	0,003117	0,000019	2,62	138		127	149
0,07	0,003848	0,000023	3,23	112		103	121
0,071	0,003959	0,000024	3,33	109		100	117
0,08	0,005027	0,000030	4,22	85,5		78,7	92,4
0,09	0,006362	0,000038	5,34	67,6		62,2	73,0
0,1	0,007854	0,000047	6,60	54,7		50,4	59,1
0,11	0,009503	0,000057	7,98	45,2	± 7 %	42,1	48,4
0,112	0,009852	0,000059	8,28	43,6		40,6	46,7
0,12	0,01131	0,00007	9,50	38,0		35,4	40,7
0,125	0,01227	0,00007	10,3	35,0		32,6	37,5
0,13	0,01327	0,00008	11,1	32,4		30,1	34,7
0,14	0,01539	0,00009	12,9	27,9		26,0	29,9
0,15	0,01767	0,00011	14,8	24,3		22,6	26,0
0,16	0,02011	0,00012	16,9	21,4		19,9	22,9
0,18	0,02545	0,00015	21,4	16,9	± 6 %	15,7	18,1
0,2	0,03142	0,00019	26,4	13,7		12,9	14,5
0,22	0,03801	0,00023	31,9	11,3		10,6	12,0
0,224	0,03941	0,00024	33,1	10,9		10,3	11,6
0,25	0,04909	0,00029	41,2	8,76		8,23	9,29
0,28	0,06158	0,00037	51,7	6,98		6,56	7,40
0,3	0,07069	0,00042	59,4	6,08	± 5 %	5,72	6,45
0,315	0,07793	0,00047	65,5	5,52		5,24	5,79
0,35	0,09621	0,00058	80,8	4,47		4,25	4,69
0,355	0,09898	0,00059	83,1	4,34		4,13	4,56
0,4	0,1257	0,0008	106	3,42		3,25	3,59
0,45	0,1590	0,0010	134	2,70		2,57	2,84
0,5	0,1963	0,0012	165	2,19	± 4 %	2,08	2,30
0,55	0,2376	0,0014	200	1,81		1,74	1,88
0,56	0,2463	0,0015	207	1,75		1,68	1,82
0,6	0,2827	0,0017	238	1,52		1,46	1,58
0,63	0,3117	0,0019	262	1,38		1,32	1,43
0,65	0,3318	0,0020	279	1,30		1,24	1,35
0,7	0,3848	0,0023	323	1,12		1,07	1,16
0,71	0,3959	0,0024	333	1,09		1,04	1,13
0,8	0,5027	0,0030	422	0,855		0,821	0,890
0,9	0,6362	0,0038	534	0,676		0,649	0,703
1,0	0,7854	0,0047	660	0,547		0,526	0,569
1,12	0,9852	0,0059	828	0,436		0,419	0,454
1,2	1,131	0,007	950	0,380		0,365	0,395
1,25	1,227	0,007	1031	0,350		0,336	0,364
1,4	1,539	0,009	1293	0,279		0,268	0,291
1,5	1,767	0,011	1484	0,243		0,234	0,253
1,6	2,011	0,012	1689	0,214		0,205	0,222
1,8	2,545	0,015	2138	0,169		0,162	0,176
2,0	3,142	0,019	2639	0,137		0,131	0,142
2,2	3,801	0,023	3193	0,113		0,109	0,118
2,24	3,941	0,024	3310	0,109		0,105	0,113
2,5	4,909	0,029	4123	0,0876		0,0841	0,0911
2,8	6,158	0,037	5172	0,0698		0,0670	0,0726
3,0	7,069	0,042	5938	0,0608		0,0584	0,0633
3,15	7,793	0,047	6546	0,0552		0,0530	0,0574
3,2	8,042	0,048	6756	0,0535		0,0513	0,0556
3,5	9,621	0,058	8082	0,0447		0,0429	0,0465
3,55	9,898	0,059	8314	0,0434		0,0417	0,0452
4,0	12,57	0,08	10556	0,0342		0,0328	0,0356
4,5	15,90	0,10	13360	0,0270		0,0260	0,0281
5,0	19,63	0,12	16493	0,0219		0,0210	0,0228
5,5	23,76	0,14	19957	0,0181		0,0174	0,0188
5,6	24,63	0,15	20689	0,0175		0,0168	0,0182
6,0	28,27	0,17	23750	0,0152		0,0146	0,0158
6,3	31,17	0,19	26185	0,0138		0,0132	0,0143
8,0	50,27	0,30	42223	0,00855		0,00821	0,00890