
British Standard

International thermocouple reference tables

Part 8. Nickel-chromium-silicon/nickel-silicon
(nicrosil/nisil) thermocouples including composition
Type N

Tables de référence internationales pour les thermocouples
Partie 8. Thermocouples au nickel-chrome-silicium/nickel-silicium
(nicrosil/nisil)—Type N—Composition

Internationale Bezugstabellen für Thermoelemente
Teil 8. Thermoelemente aus Nickel-Chrom-Silizium/Nickel-Silizium
(Nicrosil/Nisil) des Typs N sowie deren Zusammensetzung

Foreword

This Part of BS 4937 has been prepared under the direction of the Industrial-process Measurement and Control Standards Committee. This new thermocouple combination has been developed as the result of a cooperative programme between the Materials Research Laboratories of the Australian Department of Defence and the National Bureau of Standards (NBS) of the United States of America*. It has been introduced because it offers superior stability and a higher working temperature than the extensively used nickel-chromium/nickel-aluminium thermocouple (Type K). In order to obtain the desired characteristics for the thermocouple elements it is essential that the formulation given in section 2.4 of NBS Monograph 161 be adhered to. Consequently, this Part of BS 4937 includes requirements regarding composition.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

*US Department of Commerce, National Bureau of Standards Monograph 161, 1978.



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(nicrosil/nisil) thermocouples including
composition Type N

Correction

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Table 3. Nickel-chromium-silicon/nickel-silicon (nicrosil/nisil). Type N.
E.M.F.: temperature

Under the column for temperature 0 °C and against the E.M.F. value of 34500 µV,
delete '945.8' and substitute '954.8'.

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Specification

1 Scope

This Part of BS 4937 specifies the composition of Type N thermocouple conductors and gives the British Standard International Thermocouple Reference Tables which are for use in converting thermocouple voltages into their equivalent measured temperatures.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Composition

The composition and compositional tolerances in terms of percentage of the total, by mass, for the main alloying constituents of nicrosil and nisil shall be as given in table 1.

Table 1. Composition and compositional tolerances		
Positive element Nickel-chromium- silicon (nicrosil)	Constituent	Negative element Nickel-silicon (nisil)
%		%
14.2 ± 0.5	Cr	0.02 max.
1.4 ± 0.2	Si	4.4 ± 0.2
0.15 max.	Fe	0.15 max.
0.05 max.	C	0.05 max.
—	Mg	0.05 to 0.2
Balance	Ni	Balance
NOTE. These compositional tolerances are greater than those given in NBS Monograph 161. They may be amended as experience of the actual properties of the thermocouples is gained. It should be noted that compliance with this requirement for composition does not of itself guarantee compliance with the requirement for e.m.f./temperature relationship.		

3 Reference tables

The reference tables (tables 2 and 3) are for converting thermocouple voltages into their equivalent measured temperatures. The tables give the definitive values; the power series expansions from which they are derived are given in appendix A.

The e.m.f. tolerances for the manufacture of thermocouple wire are as given for Type K thermocouples in BS 4937 : Part 20. The tables are based on IPTS-68 (International Practical Temperature Scale of 1968).

NOTE. The approximations given in appendix B, in which temperature is expressed as a function of e.m.f. over limited ranges, are for information only.

Table 2. Nickel-chromium-silicon/nickel-silicon (nicrosil/nisil) thermocouples. Type N
Temperature : e.m.f.

Temperature in °C : e.m.f. in μV First derivative of e.m.f. with respect to temperature (dE/dt $\mu\text{V}/^\circ\text{C}$)											Reference junction at 0 °C	
Temperature	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	Temperature	
-270	-4345.2 0.34										-270	
-260	-4335.7 1.57	-4337.2 1.44	-4338.6 1.32	-4339.9 1.19	-4341.0 1.06	-4342.0 0.94	-4342.9 0.81	-4343.6 0.69	-4344.3 0.57	-4344.8 0.46	-260	
-250	-4313.3 2.93	-4316.2 2.79	-4318.9 2.65	-4321.5 2.51	-4323.9 2.38	-4326.2 2.24	-4328.4 2.10	-4330.4 1.97	-4332.3 1.84	-4334.1 1.71	-250	
-240	-4277.0 4.34	-4281.3 4.19	-4285.4 4.05	-4289.4 3.91	-4293.2 3.77	-4296.9 3.63	-4300.5 3.49	-4303.9 3.34	-4307.2 3.20	-4310.3 3.06	-240	
-230	-4226.5 5.76	-4232.2 5.62	-4237.8 5.48	-4243.2 5.34	-4248.4 5.19	-4253.6 5.05	-4258.5 4.91	-4263.4 4.76	-4268.1 4.62	-4272.6 4.48	-230	
-220	-4161.8 7.18	-4168.9 7.04	-4175.9 6.90	-4182.7 6.76	-4189.4 6.62	-4195.9 6.48	-4202.3 6.33	-4208.6 6.19	-4214.7 6.05	-4220.7 5.91	-220	
-210	-4082.9 8.58	-4091.5 8.44	-4099.8 8.30	-4108.1 8.16	-4116.2 8.02	-4124.1 7.88	-4131.9 7.74	-4139.6 7.61	-4147.1 7.46	-4154.5 7.32	-210	
-200	-3990.4 9.93	-4000.2 9.80	-4010.0 9.67	-4019.6 9.53	-4029.0 9.40	-4038.4 9.26	-4047.5 9.12	-4056.6 8.99	-4065.5 8.85	-4074.3 8.71	-200	
-190	-3884.4 11.25	-3895.6 11.12	-3906.7 10.99	-3917.6 10.86	-3928.4 10.73	-3939.0 10.60	-3949.6 10.46	-3960.0 10.33	-3970.2 10.20	-3980.4 10.07	-190	
-180	-3765.6 12.52	-3778.0 12.39	-3790.3 12.27	-3802.5 12.14	-3814.6 12.01	-3826.6 11.89	-3838.4 11.76	-3850.1 11.63	-3861.7 11.51	-3873.1 11.38	-180	
-170	-3634.3 13.74	-3647.9 13.62	-3661.5 13.50	-3674.9 13.38	-3688.2 13.25	-3701.4 13.13	-3714.5 13.01	-3727.5 12.89	-3740.3 12.76	-3753.0 12.64	-170	
-160	-3491.0 14.91	-3505.8 14.80	-3520.6 14.68	-3535.2 14.56	-3549.7 14.45	-3564.1 14.33	-3578.3 14.21	-3592.5 14.10	-3606.5 13.98	-3620.5 13.86	-160	
-150	-3336.2 16.04	-3352.1 15.93	-3368.0 15.82	-3383.8 15.71	-3399.4 15.59	-3415.0 15.48	-3430.4 15.37	-3445.7 15.26	-3460.9 15.14	-3476.0 15.03	-150	
-140	-3170.3 17.12	-3187.4 17.01	-3204.3 16.91	-3221.2 16.80	-3237.9 16.69	-3254.6 16.59	-3271.1 16.48	-3287.5 16.37	-3303.9 16.26	-3320.1 16.15	-140	
-130	-2993.9 18.15	-3012.0 18.05	-3030.0 17.95	-3047.9 17.85	-3065.7 17.74	-3083.4 17.64	-3101.0 17.54	-3118.5 17.43	-3135.9 17.33	-3153.1 17.23	-130	
-120	-2807.5 19.13	-2826.6 19.03	-2845.6 18.94	-2864.4 18.84	-2883.2 18.74	-2901.9 18.65	-2920.5 18.55	-2939.0 18.45	-2957.4 18.35	-2975.7 18.25	-120	

Table 2. Temperature : e.m.f. (continued)

Temperature in °C : e.m.f. in μV First derivative of e.m.f. with respect to temperature (dE/dt $\mu\text{V}/^\circ\text{C}$)												Reference junction at 0 °C	
Temperature	0	-1	-2	-3	-4	-5	-6	-7	-8	-9		Temperature	
-110	-2611.5 20.06	-2631.5 19.97	-2651.4 19.87	-2671.3 19.78	-2691.0 19.69	-2710.7 19.60	-2730.2 19.51	-2749.7 19.41	-2769.0 19.32	-2788.3 19.22		-110	
-100	-2406.6 20.92	-2427.4 20.84	-2448.2 20.76	-2469.0 20.67	-2489.6 20.58	-2510.1 20.50	-2530.6 20.41	-2550.9 20.32	-2571.2 20.23	-2591.4 20.15		-100	
-90	-2193.2 21.73	-2214.9 21.66	-2236.5 21.58	-2258.1 21.50	-2279.5 21.42	-2300.9 21.34	-2322.2 21.26	-2343.4 21.17	-2364.5 21.09	-2385.6 21.01		-90	
-80	-1972.1 22.48	-1994.5 22.41	-2016.9 22.34	-2039.2 22.26	-2061.4 22.19	-2083.6 22.12	-2105.7 22.04	-2127.7 21.97	-2149.6 21.89	-2171.4 21.81		-80	
-70	-1743.8 23.16	-1766.9 23.10	-1790.0 23.03	-1813.0 22.97	-1835.9 22.90	-1858.8 22.83	-1881.6 22.76	-1904.3 22.69	-1927.0 22.62	-1949.6 22.55		-70	
-60	-1509.0 23.78	-1532.8 23.72	-1556.5 23.66	-1580.1 23.60	-1603.7 23.54	-1627.2 23.48	-1650.6 23.42	-1674.0 23.36	-1697.3 23.29	-1720.6 23.23		-60	
-50	-1268.4 24.33	-1292.7 24.28	-1317.0 24.23	-1341.2 24.17	-1365.3 24.12	-1389.4 24.07	-1413.4 24.01	-1437.4 23.95	-1461.3 23.90	-1485.2 23.84		-50	
-40	-1022.6 24.82	-1047.4 24.77	-1072.1 24.73	-1096.8 24.68	-1121.5 24.63	-1146.1 24.58	-1170.7 24.54	-1195.2 24.49	-1219.6 24.44	-1244.0 24.38		-40	
-30	-772.2 25.24	-797.4 25.20	-822.6 25.16	-847.8 25.12	-872.9 25.08	-897.9 25.04	-922.9 25.00	-947.9 24.95	-972.9 24.91	-997.7 24.86		-30	
-20	-517.9 25.60	-543.5 25.57	-569.1 25.54	-594.6 25.50	-620.1 25.47	-645.5 25.43	-670.9 25.39	-696.3 25.36	-721.7 25.32	-747.0 25.28		-20	
-10	-260.3 25.91	-286.2 25.88	-312.1 25.85	-337.9 25.82	-363.7 25.79	-389.5 25.76	-415.3 25.73	-441.0 25.70	-466.7 25.67	-492.3 25.64		-10	
0	0.0 26.15	-26.1 26.13	-52.3 26.11	-78.4 26.09	-104.4 26.06	-130.5 26.04	-156.5 26.01	-182.5 25.99	-208.5 25.96	-234.4 25.93		0	
Temperature	0	1	2	3	4	5	6	7	8	9		Temperature	
0	0.0 25.90	25.9 25.93	51.9 25.96	77.8 26.00	103.9 26.03	129.9 26.07	156.0 26.10	182.1 26.14	208.3 26.17	234.5 26.20		0	
10	260.7 26.24	286.9 26.27	313.2 26.31	339.6 26.35	365.9 26.38	392.3 26.42	418.7 26.45	445.2 26.49	471.7 26.52	498.3 26.56		10	
20	524.8 26.60	551.5 26.63	578.1 26.67	604.8 26.71	631.5 26.74	658.3 26.78	685.1 26.82	711.9 26.85	738.8 26.89	765.7 26.93		20	
30	792.6 26.96	819.6 27.00	846.6 27.04	873.7 27.08	900.8 27.11	927.9 27.15	955.1 27.19	982.3 27.23	1009.5 27.26	1036.8 27.30		30	