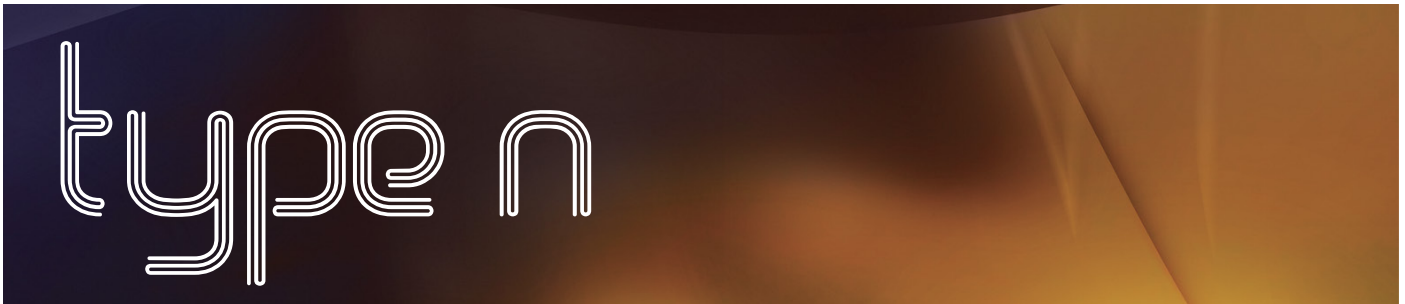


Thermocouple Alloys



Type N thermocouple has been developed with silicon content which provides:

- Much longer life due to improved oxidation resistance of the negative NN leg
- Longer exposure to high temperature without gradual drift EMF
- Better reliability of EMF drift and short term EMF changes.

Please note that Aperam Alloys Rescal type K thermocouple has been developed with silicon content instead of aluminium content and problems listed above are considerably reduced. However type N provides better resistance to oxidation at elevated temperatures and good lifetime in applications where sulfur is present.

Those advantages are particularly interesting for use in aerospace, nuclear or semi-conductors industries.

1. Chemical composition and mechanical properties

Alloy	Chemical composition			Melting point. °C	Resistivity	Density g/cm ³	Temp. coef. of resistance (x10 ⁻⁶ /°C)	Linear expansion (coef. x10 ⁻⁶ /°C)	Thermal Conductivity (W m ⁻¹ °C ⁻¹ at 20°C)
	Ni	Cr	Si						
NP (+)	84.4	14.2	+	1420	100	8.53	88	17	13
NN (-)	95.6	-	4.4	1420	36.5	8.58	678	17	27

Resistivity: micro ohm-cm at 20°C - Temperature Coefficient and linear expansion Coefficient by °C from 20 up to 100°C.

2. Maximum operating temperatures

Please note that the data below are given as indicative values.

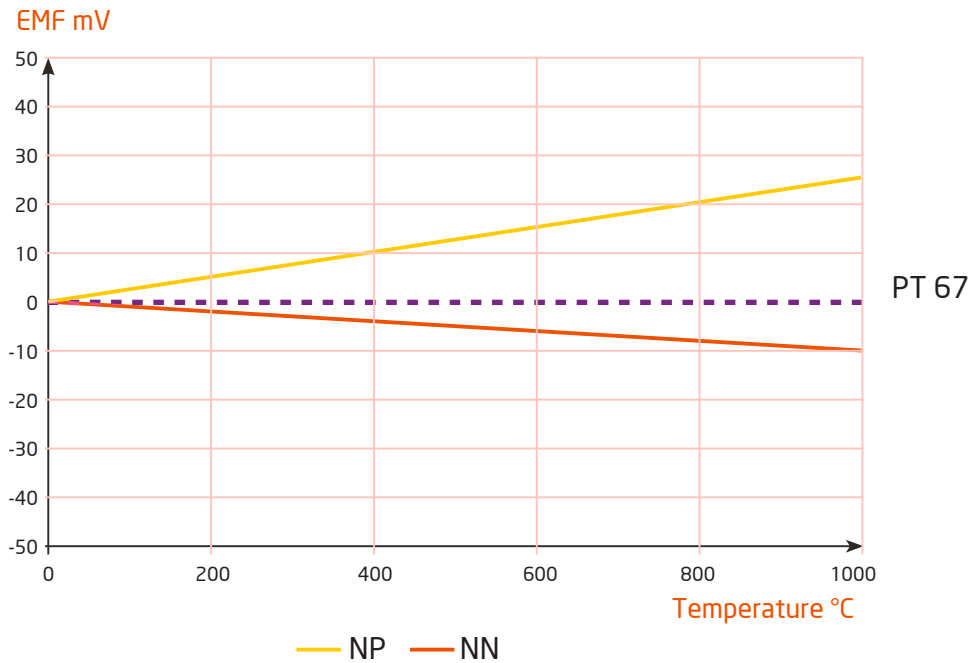
As per norm ASTM

Thermocouple	Dia 3.26 mm	Dia 1.63 mm	Dia 0.81 mm	Dia 0.51 mm	Dia 0.25 mm
NP - NN	1260 °C	1090 °C	980 °C	870 °C	760 °C

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3. NP and NN vs Platinum

Nominal EMF for type N thermocouple vs Pt 67*



* For extension cables EMF values: please refer to thermocouple graphics until 200°C

4. Couple NP/NN EMF reference table (mV)

°C	0	10	20	30	40	50	60	70	80	90	100
0	0.000	0.261	0.525	0.793	1.065	1.340	1.619	1.902	2.189	2.479	2.774
100	2.774	3.072	3.374	3.680	3.989	4.302	4.618	4.937	5.260	5.585	5.913
200	5.913	6.245	6.579	6.916	7.255	7.597	7.941	8.288	8.637	8.988	9.341
300	9.341	9.696	10.054	10.413	10.774	11.136	11.501	11.867	12.234	12.603	12.974
400	12.974	13.346	13.719	14.094	14.469	14.846	15.225	15.604	15.984	16.362	16.748
500	16.748	17.131	17.515	17.900	18.286	18.672	19.059	19.447	19.835	20.224	20.613
600	20.613	21.003	21.393	21.784	22.175	22.566	22.958	23.350	23.742	24.134	24.527
700	24.527	24.919	25.312	25.705	26.098	26.491	26.883	27.276	27.669	28.062	28.455
800	28.455	28.847	29.240	29.632	30.024	30.416	30.807	31.199	31.590	31.981	32.371
900	32.371	32.769	33.151	33.541	33.930	34.319	34.707	35.095	35.482	35.869	36.256
1000	36.256	36.641	37.027	37.411	37.796	38.179	38.562	38.944	39.326	39.706	40.087
1100	40.087	40.466	40.845	41.223	41.600	41.976	42.352	42.727	43.101	43.474	43.846
1200	43.846	44.218	44.588	44.958	45.326	45.694	46.060	46.426	46.789	47.152	47.513
1300	47.513										

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5. Conversion tables

NP wire

B&S or AWG					SWG					Metric			
B&S or AWG	Dia mm	Ohm/m	Length m / kg	Weight g / m	SWG	Dia mm	Ohm/m	Length m / kg	Weight g / m	Diameter mm	Ohm/m	Length m / kg	Weight g / m
8	3.251	0.1205	14.1	70.8	10	3.251	0.12	14.1	70.8	4	0.0795	9.35	107
10	2.591	0.189	22.3	44.9	13	2.591	0.233	27.3	36.6	3.26	0.1205	14.1	70.81
11	2.311	0.238	27.9	35.8	14	2.311	0.308	36.1	27.7	3	0.141	16.5	60.3
12	2.057	0.301	35.3	28.3	15	2.057	0.38	44.6	22.4	2.5	0.204	23.9	41.8
13	1.829	0.38	44.6	22.4	16	1.829	0.481	56.5	17.7	2.05	0.302	35.3	28.35
14	1.626	0.481	56.5	17.7	18	1.626	0.607	71.4	14	1.8	0.392	46.1	21.7
16	1.295	0.759	89	11.2	19	1.295	1.233	144.6	6.91	1.63	0.479	56.5	17.71
20	0.813	1.233	225.8	4.43	21	0.813	1.926	178.7	4.43	1.29	0.765	89	11.24
24	0.311	4.876	571	1.75	25	0.311	4.934	578.4	1.73	0.81	1.94	227.5	4.43
28	0.32	12.43	1457	0.686	30	0.32	12.83	1504	0.665	0.5	5.092	597	1.75
32	0.203	30.9	3622	0.276	35	0.203	28.06	3290	0.304	0.3	14.14	1658	0.69
										0.2	31.83	3731	0.28

NN wire

B&S or AWG					SWG					Metric			
B&S or AWG	Dia mm	Ohm/m	Length m / kg	Weight g / m	SWG	Dia mm	Ohm/m	Length m / kg	Weight g / m	Diameter mm	Ohm/m	Length m / kg	Weight g / m
										4	0.029	9.26	108
8	3.251	0.0439	14	71.2	10	3.251	0.0439	14	71.2	3.26	0.0439	14	71.22
10	2.591	0.0692	22.1	45.2	13	2.591	0.0851	27.2	36.8	3	0.0516	16.5	60.6
11	2.311	0.087	27.8	35.9	14	2.311	0.112	36	27.8	2.5	0.0743	23.7	42.1
12	2.057	0.1098	35.1	28.5	15	2.057	0.139	44.4	22.5	2.05	0.0878	35.1	28.51
13	1.829	0.139	44.4	22.5	16	1.829	0.176	56.1	17.8	1.8	0.143	45.9	21.8
14	1.626	0.176	56.1	17.8	18	1.626	0.312	99.8	10.01	1.63	0.175	56.1	17.82
16	1.295	0.277	88.5	11.3	19	1.295	0.45	143.7	6.95	1.29	0.279	88.5	11.3
20	0.813	0.703	224.5	4.45	21	0.813	0.703	224.5	4.45	0.81	0.708	226	4.45
24	0.311	1.779	568.3	1.76	25	0.311	1.801	575	1.74	0.5	1.856	586	1.7
28	0.32	4.538	1449	0.69	30	0.32	4.683	1495	0.668	0.3	5.163	1649	0.61
32	0.203	11.27	3601	0.277	35	0.203	10.24	3271	0.305	0.2	11.62	3710	0.28

Any intermediate diameter non above listed can be supplied upon request.

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