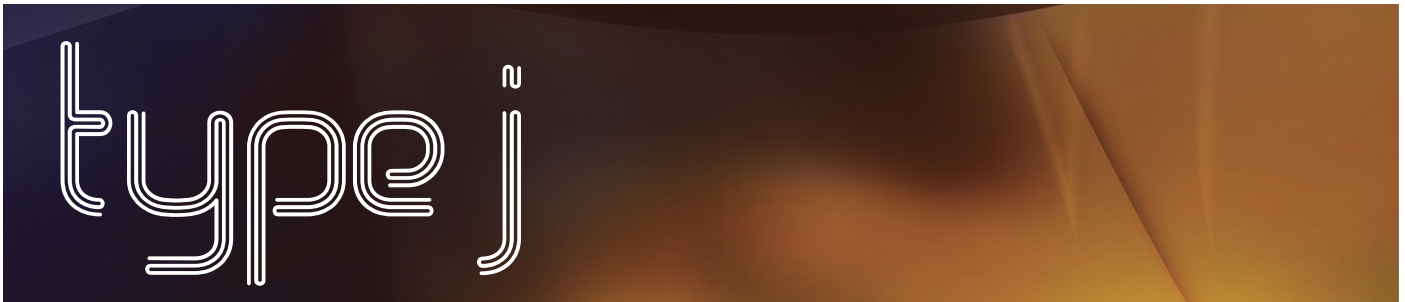


## Thermocouple Alloys



Type J Thermocouple is frequently used for its low cost and high EMF. It can be used in oxidizing conditions up to 760°C. For higher temperatures, it is recommended to use large wire diameters since the iron content of the positive leg (JP) will oxidize rapidly at these temperatures.

### 1. Chemical composition and mechanical properties

Alloy	Chemical composition			Melting point °C	Resistivity	Density g/cm <sup>3</sup>	Temp. coef. of resistance (x10 <sup>-6</sup> /°C)	Linear expansion (coef. x10 <sup>-6</sup> /°C)	Thermal Conductivity (W m <sup>-1</sup> °C <sup>-1</sup> at 20°C)
	Fe	Ni	Others						
JP (+)	100	-	-	1535	13	7.86	5000	11.7	66.2
JN (-)	-	44	Bal Cu -Mn+	1210	49	8.90	60	14	21.2

### 2. Maximum operating temperatures

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

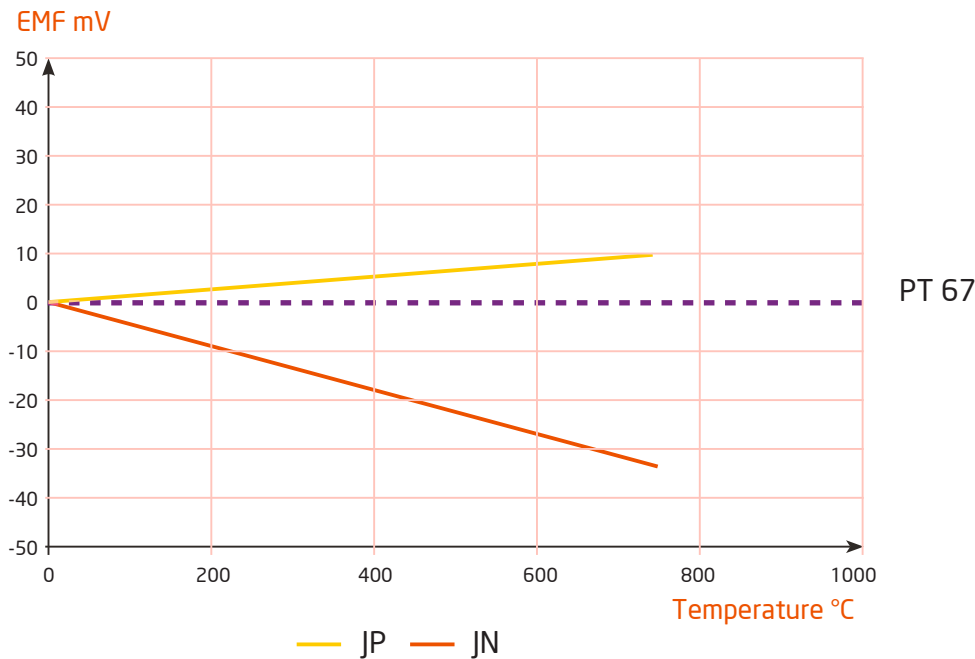
As per norm ASTM

Thermocouple	Dia 3.2 mm	Dia 1.6 mm	Dia 0.81 mm	Dia 0.51 mm	Dia 0.25 mm
JP - JN	760 °C	590 °C	480 °C	370 °C	320 °C

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### 3. JP and JN vs Platinum

Nominal EMF for type J thermocouple vs Pt 67\*



### 4. EMF calculation of a couple

The table below indicates by direct reading the standard EMF of a couple for any given temperature. To calculate the EMF of a couple to be matched, algebraic sum of the deviations values indicated on the labels of the material must be added to the standard value indicated on the table below, for a given temperature. The result is the exact EMF value of the couple at this given temperature.

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

### 5. Couple JP/JN EMF reference table (mV)

°C	0	10	20	30	40	50	60	70	80	90	100
0	0	0.507	1.019	1.536	2.058	2.585	3.115	3.649	4.186	4.725	5.268
100	5.268	5.812	6.359	6.907	7.547	8.008	8.56	9.113	9.667	10.222	10.777
200	10.777	11.332	11.887	12.442	12.998	13.553	14.108	14.663	15.217	15.771	16.325
300	16.325	16.879	17.432	17.984	18.537	19.089	19.64	20.192	20.743	21.295	21.846
400	21.846	22.397	22.949	23.501	24.054	24.607	25.161	25.716	26.272	26.829	27.388
500	27.388	27.949	28.511	29.075	29.642	30.21	30.782	31.356	31.933	32.513	33.096
600	33.096	33.683	34.273	34.867	35.464	36.066	36.671	37.28	37.893	38.51	39.13
700	39.13	39.754	40.382	41.013	41.647	42.283	42.922	43.563	44.207	44.852	45.498
800	45.498	46.144	46.79	47.434	48.076	48.716	49.354	49.989	50.62	51.249	51.875

### 6. Recommendations for use / general information

Type J thermocouples must not be used in sulphurous atmospheres over 500°C. In order to limit oxidation risks of pure iron at room temperature, Aperam Alloys Rescal is able to deliver copper-clad-iron or electro-copper-clad for the JP positive leg from 0.20 mm to 0.80 mm. The latter presents an excellent resistance to corrosion over time thanks to an external copper-clad up to 40-50 g/m<sup>2</sup> of wire.

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## 7. Conversion tables

### JP 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	0.0103	10.1	98.7
8	3.251	0.0156	15.3	65.2	10	3.251	0.0156	15.3	65.2	3.26	0.0157	15,3	65,2
10	2.591	0.0246	24.1	41.4	13	2.337	0.0303	29.7	33.7	3	0.0184	18,0	55,5
11	2.311	0.031	30.4	32.9	14	2.032	0.0401	39.2	25.5	2.5	0.0265	25,9	38,6
12	2.057	0.0391	38.3	26.1	15	1.829	0.0495	48.4	20.6	2.05	0.0394	38,6	25,9
13	1.829	0.0498	48.5	20.6	16	1.626	0.0626	61.3	16.3	1.8	0.0511	50,0	20,0
14	1.626	0.0626	61.3	16.3	18	1.219	0.111	109	9.17	1.63	0.0623	60,9	16,4
16	1.295	0.0987	96.6	10.3	19	1.016	0.16	157	6.37	1.29	0.0994	97,3	10,27
20	0.813	0.25	245.1	4.08	21	0.813	0.25	245	4.08	0.81	0.252	246,9	4,05
24	0.311	0.634	620	1.61	25	0.508	0.641	627.7	1.59	0.5	0.636	648	1,54
28	0.32	1.616	1582	0.632	30	0.315	1.668	1632	0.612	0.3	1.839	1800	0,555
32	0.203	4.016	3930	0.254	35	0.213	3.648	3570	0.28	0.2	4.138	4049	0,247

### JN 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	0.039	8.94	111
8	3.251	0.059	13.5	73.9	10	3.251	0.059	13.5	73.9	3.26	0.059	13,5	73,9
10	2.591	0.0929	21.3	46.9	13	2.337	0.114	26.2	38.2	3	0.0693	15,9	62,9
11	2.311	0.116	26.8	37.3	14	2.032	0.151	34.6	28.8	2.5	0.0998	22,9	43,7
12	2.057	0.147	33.8	29.6	15	1.829	0.186	42.7	23.4	2.05	0.148	34,0	29,3
13	1.829	0.186	42.7	23.4	16	1.626	0.236	54.1	18.5	1.8	0.192	44,1	22,6
14	1.626	0.236	54.1	18.5	18	1.219	0.419	96.2	10.4	1.63	0.235	53,2	18,6
16	1.295	0.372	85.3	11.7	19	1.016	0.604	138.6	7.21	1.29	0.375	85,9	11,6
20	0.813	0.943	216.4	4.62	21	0.813	0.943	216.4	4.62	0.81	0.951	218,0	4,58
24	0.311	2.389	548	1.82	25	0.508	2.417	554	1.8	0.5	5.092	572	1,75
28	0.32	6.092	1397	0.715	30	0.315	6.287	1441	0.693	0.3	6.932	1589	0,629
32	0.203	15.14	3471	0.288	35	0.213	13.75	3153	0.317	0.2	15.59	3576	0,279

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

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