Appendix B

Thermoelectric reference tables

The thermoelectric reference tables for the most common thermocouples are shown below. For each type of thermocouple, we show first the general polynomial, followed by the table of coefficients, and the explicit polynomials for both the direct and inverse use. The output of the direct polynomials is in microvolts (μV). Output of the inverse polynomials is in degrees Celsius (°C). The index 90 indicates the standard used (in this case the International Temperature Scale of 1990 [ITS-90]).

B.1 Type J thermocouples (iron/constantan)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−210 to 760	760 to 1200
C_0	0.0	$2.9645625681 \times 10^{5}$
C_1	$5.0381187815 \times 10^{1}$	$-1.4976127786 \times 10^{3}$
C_2	$3.0475836930 \times 10^{-2}$	3.1787103924
C_3	$-8.5681065720 \times 10^{-5}$	$-3.1847686701 \times 10^{-3}$
C_4	$1.3228195295 \times 10^{-7}$	$1.5720819004 \times 10^{-6}$
C_5	$-1.7052958337 \times 10^{-10}$	$-3.0691369056 \times 10^{-10}$
C_6	$2.0948090697 \times 10^{-13}$	
C_7	$-1.2538395336 \times 10^{-16}$	
C_8	$1.5631725697 \times 10^{-20}$	

Explicit Polynomial representations:

−210 °C to 760 °C

$E = 5.0381187815 \times 10^{1} T^{1} + 3.0475836930 \times 10^{-2} T^{2} - 8.5681065720 \times 10^{-5} T^{3} + 1.3228195295 \times 10^{-7} T^{4} - 1.7052958337 \times 10^{-10} T^{5} + 2.0948090697 \times 10^{-13} T^{6} - 1.2538395336 \times 10^{-16} T^{7} + 1.5631725697 \times 10^{-20} T^{8}$ [μV]

760 °C to 1200 °C

$E = 2.9645625681 \times 10^{5} - 1.4976127786 \times 10^{3} T + 3.1787103924 T^{2} - 3.1847686701 \times 10^{-3} T^{3} + 1.5720819004 \times 10^{-6} T^{4} - 3.0691369056 \times 10^{-10} T^{5}$ [μV]

Inverse polynomial:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [°C]$$

Table of coefficients

Temperature range [°C]	−210 to 0	0 to 760	760 to 1200
Voltage range [μV]	−8,095 to 0	0 to 42,919	42,919 to 69,553
C_0	0.0	0.0	$-3.11358187 \times 10^{3}$
C_1	1.9528268×10^{-2}	1.9528268×10^{-2}	$3.00543684 \times 10^{-1}$
C_2	$-1.2286185 \times 10^{-6}$	-2.001204×10^{-7}	$-9.94773230 \times 10^{-6}$
C_3	$-1.0752178 \times 10^{-9}$	1.036969×10^{-11}	$1.70276630 \times 10^{-10}$
C_4	$-5.9086933 \times 10^{-13}$	$-2.549687 \times 10^{-16}$	$-1.43033468 \times 10^{-15}$
C_5	$-1.7256713 \times 10^{-16}$	3.585153×10^{-21}	$4.73886084 \times 10^{-21}$
C_6	$-2.8131513 \times 10^{-20}$	$-5.344285 \times 10^{-26}$	
C_7	$-2.3963370 \times 10^{-24}$	5.099890×10^{-31}	
C_8	$-8.3823321 \times 10^{-29}$		
Error range	0.03 °C to −0.05 °C	0.04 °C to −0.04 °C	0.03 °C to −0.04 °C

Explicit polynomial representations:

−210 °C to 0 °C

$T_{90} = 1.9528268 \times 10^{-2}E^1 - 1.2286185 \times 10^{-6}E^2 - 1.0752178 \times 10^{-9}E^3 - 5.9086933 \times 10^{-13}E^4 - 1.7256713 \times 10^{-16}E^5 - 2.8131513 \times 10^{-20}E^6 - 2.3963370 \times 10^{-24}E^7 - 8.3823321 \times 10^{-29}E^8$ [°C]

0 °C to 760 °C

$T_{90} = 1.9528268 \times 10^{-2}E^1 - 2.001204 \times 10^{-7}E^2 + 1.036969 \times 10^{-11}E^3 - 2.549687 \times 10^{-16}E^4 + 3.585153 \times 10^{-21}E^5 - 5.344285 \times 10^{-26}E^6 + 5.099890 \times 10^{-31}E^7$ [°C]

760 °C to 1200 °C

$T_{90} = -3.11358187 \times 10^{3} + 3.00543684 \times 10^{-1}E^1 - 9.94773230 \times 10^{-6}E^2 + 1.70276630 \times 10^{-10}E^3 - 1.43033468 \times 10^{-15}E^4 + 4.73886084 \times 10^{-21}E^5$ [°C]

B.2 Type K thermocouples (chromel/alumel)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Above 0 °C the polynomial is of the form $E = \sum_{i=0}^{n} c_i (t_{90})^i + \alpha_0 e^{\alpha_1 (t_{90} - 126.9686)^2}$. [μV]

Table of coefficients

Temperature range [°C]	−270 to 0	0 to 1372
C_0	0.0	$-1.7600413686 \times 10^{1}$
C_1	$3.9450128025 \times 10^{1}$	$3.8921204975 \times 10^{1}$
C_2	$2.3622373598 \times 10^{-2}$	$1.8558770032 \times 10^{-2}$
C_3	$-3.2858906784 \times 10^{-4}$	$-9.9457592874 \times 10^{-5}$
C_4	$-4.9904828777 \times 10^{-6}$	$3.1840945719 \times 10^{-7}$
C_5	$-6.7509059173 \times 10^{-8}$	$-5.6072844889 \times 10^{-10}$
C_6	$-5.7410327428 \times 10^{-10}$	$5.6075059059 \times 10^{-13}$
C_7	$-3.1088872894 \times 10^{-12}$	$-3.2020720003 \times 10^{-16}$
C_8	$-1.0451609365 \times 10^{-14}$	$9.7151147152 \times 10^{-20}$
C_9	$-1.9889266878 \times 10^{-17}$	$-1.2104721275 \times 10^{-23}$
C_{10}	$-1.6322697486 \times 10^{-20}$	
α_0		1.185976×10^{2}
α_1		-1.183432×10^{-4}

Explicit polynomial representations:

−270 °C to 0 °C

$E = 3.9450128025 \times 10^{1} T^{1} + 2.3622373598 \times 10^{-2} T^{2} - 3.2858906784 \times 10^{-4} T^{3} - 4.9904828777 \times 10^{-6} T^{4} - 6.7509059173 \times 10^{-8} T^{5} - 5.7410327428 \times 10^{-10} T^{6} - 3.1088872894 \times 10^{-12} T^{7} - 1.0451609365 \times 10^{-14} T^{8} - 1.9889266878 \times 10^{-17} T^{9} - 1.6322697486 \times 10^{-20} T^{10}$ [μV]

0° C to 1372 °C

$E = -1.7600413686 \times 10^{1} + 3.8921204975 \times 10^{1} T^{1} + 1.8558770032 \times 10^{-2} T^{2} - 9.9457592874 \times 10^{-5} T^{3} + 3.1840945719 \times 10^{-7} T^{4} - 5.6072844889 \times 10^{-10} T^{5} + 5.6075059059 \times 10^{-13} T^{6} - 3.2020720003 \times 10^{-16} T^{7} + 9.7151147152 \times 10^{-20} T^{8} - 1.2104721275 \times 10^{-23} T^{9} + 1.185976 \times 10^{2} e^{-1.183432 \times 10^{-4} (T - 126.9686)^2}$ [μV]

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [°C]$$

Table of coefficients

Temperature range [°C]	–200 to 0	0 to 500	500 to 1372
Voltage range [μV]	−5,891 to 0	0 to 20,644	20,644 to 54.886
C_0	0.0	0.0	-1.318058×10^{2}
C_1	2.5173462×10^{-2}	2.508355×10^{-2}	4.830222×10^{-2}
C_2	$-1.1662878 \times 10^{-6}$	7.860106×10^{-8}	-1.646031×10^{-6}
C_3	$-1.0833638 \times 10^{-9}$	$-2.503131 \times 10^{-10}$	5.464731×10^{-11}
C_4	$-8.9773540 \times 10^{-13}$	8.315270×10^{-14}	$-9.650715 \times 10^{-16}$
C_5	$-3.7342377 \times 10^{-16}$	$-1.228034 \times 10^{-17}$	8.802193×10^{-21}
C_6	$-8.6632643 \times 10^{-20}$	9.804036×10^{-22}	$-3.110810 \times 10^{-26}$
C_7	$-1.0450598 \times 10^{-23}$	$-4.413030 \times 10^{-26}$	
C_8	$-5.1920577 \times 10^{-28}$	1.057734×10^{-30}	
C_9		$-1.052755 \times 10^{-35}$	
Error range	0.04 °C to −0.02 °C	0.04 °C to −0.05 °C	0.06 °C to −0.05 °C

Explicit polynomial representations:

–200 °C to 0 °C

$T_{90} = 2.5173462 \times 10^{-2}E^{1} - 1.1662878 \times 10^{-6}E^{2} - 1.0833638 \times 10^{-9}E^{3} - 8.9773540 \times 10^{-13}E^{4} - 3.7342377 \times 10^{-16}E^{5} - 8.6632643 \times 10^{-20}E^{6} - 1.0450598 \times 10^{-23}E^{7} - 5.1920577 \times 10^{-28}E^{8}$ [°C]

0 °C to 500 °C

$T_{90} = 2.508355 \times 10^{-2}E^{1} + 7.860106 \times 10^{-8}E^{2} - 2.503131 \times 10^{-10}E^{3} + 8.315270 \times 10^{-14}E^{4} - 1.228034 \times 10^{-17}E^{5} + 9.804036 \times 10^{-22}E^{6} - 4.413030 \times 10^{-26}E^{7} + 1.057734 \times 10^{-30}E^{8} - 1.052755 \times 10^{-35}E^{9}$ [°C]

500 °C to 1372 °C

$T_{90} = -1.318058 \times 10^{2} + 4.830222 \times 10^{-2}E^{1} - 1.646031 \times 10^{-6}E^{2} + 5.464731 \times 10^{-11}E^{3} - 9.650715 \times 10^{-16}E^{4} + 8.802193 \times 10^{-21}E^{5} - 3.110810 \times 10^{-26}E^{6}$ [°C]

B.3 Type T thermocouples (copper/constantan)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−270 to 0	0 to 400
C_0	0.0	0.0
C_1	$3.8748106364 \times 10^{1}$	$3.8748106364 \times 10^{1}$
C_2	$4.4194434347 \times 10^{-2}$	$3.3292227880 \times 10^{-2}$
C_3	$1.1844323105 \times 10^{-4}$	$2.0618243404 \times 10^{-4}$
C_4	$2.0032973554 \times 10^{-5}$	$-2.1882256846 \times 10^{-6}$
C_5	$9.0138019559 \times 10^{-7}$	$1.0996880928 \times 10^{-8}$
C_6	$2.2651156593 \times 10^{-8}$	$-3.0815758772 \times 10^{-11}$
C_7	$3.6071154205 \times 10^{-10}$	$4.5479135290 \times 10^{-14}$
C_8	$3.8493939883 \times 10^{-12}$	$-2.7512901673 \times 10^{-17}$
C_9	$2.8213521925 \times 10^{-14}$	
C_{10}	$1.4251594779 \times 10^{-16}$	
C_{11}	$4.8768662286 \times 10^{-19}$	
C_{12}	$1.0795539270 \times 10^{-21}$	
C_{13}	$1.3945027062 \times 10^{-24}$	
C_{14}	$7.9795153927 \times 10^{-28}$	

Explicit polynomial representations:

−270 °C to 0 °C

$E = 3.8748106364 \times 10^{1} T^{1} + 4.4194434347 \times 10^{-2} T^{2} + 1.1844323105 \times 10^{-4} T^{3} + 2.0032973554 \times 10^{-5} T^{4} + 9.0138019559 \times 10^{-7} T^{5} + 2.2651156593 \times 10^{-8} T^{6} + 3.6071154205 \times 10^{-10} T^{7} + 3.8493939883 \times 10^{-12} T^{8} + 2.8213521925 \times 10^{-14} T^{9} + 1.4251594779 \times 10^{-16} T^{10} + 4.8768662286 \times 10^{-19} T^{11} + 1.0795539270 \times 10^{-21} T^{12} + 1.3945027062 \times 10^{-24} T^{13} + 7.9795153927 \times 10^{-28} T^{14}$ [μV]

0 °C to 400 °C

$E = 3.8748106364 \times 10^{1} T^{1} + 3.3292227880 \times 10^{-2} T^{2} + 2.0618243404 \times 10^{-4} T^{3} - 2.1882256846 \times 10^{-6} T^{4} + 1.0996880928 \times 10^{-8} T^{5} - 3.0815758772 \times 10^{-11} T^{6} + 4.5479135290 \times 10^{-14} T^{7} - 2.7512901673 \times 10^{-17} T^{8}$ [μV]

Inverse polynomials:

$$T_{90} = \sum c_i E^i \quad [°C]$$

Table of coefficients

Temperature range [°C]	−200 to 0	0 to 400
Voltage range [μV]	−5,603 to 0	0 to 20,872
C_0	0.0	0.0
C_1	2.5949192×10^{-2}	2.59280×10^{-2}
C_2	$-2.1316967 \times 10^{-7}$	-7.602961×10^{-7}
C_3	$7.9018692 \times 10^{-10}$	4.637791×10^{-11}
C_4	$4.2527777 \times 10^{-13}$	$-2.165394 \times 10^{-15}$
C_5	$1.3304473 \times 10^{-16}$	6.048144×10^{-20}
C_6	$2.0241446 \times 10^{-20}$	$-7.293422 \times 10^{-25}$
C_7	$1.2668171 \times 10^{-24}$	
Error range	0.04 °C to −0.02 °C	0.03 °C to −0.03 °C

Explicit polynomial representations:

−200 °C to 0 °C

$T_{90} = 2.5949192 \times 10^{-2} E^1 - 2.1316967 \times 10^{-7} E^2 + 7.9018692 \times 10^{-10} E^3 + 4.2527777 \times 10^{-13} E^4 + 1.3304473 \times 10^{-16} E^5 + 2.0241446 \times 10^{-20} E^6 + 1.2668171 \times 10^{-24} E^7$ [°C]

0 °C to 400 °C

$T_{90} = 2.592800 \times 10^{-2} E^1 - 7.602961 \times 10^{-7} E^2 + 4.637791 \times 10^{-11} E^3 - 2.165394 \times 10^{-15} E^4 + 6.048144 \times 10^{-20} E^5 - 7.293422 \times 10^{-25} E^6$ [°C]

B.4 Type E thermocouples (chromel/constantan)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−270 to 0	0 to 1000
C_0	0.0	0.0
C_1	$5.8665508708 \times 10^{1}$	$5.8665508710 \times 10^{1}$
C_2	$4.5410977124 \times 10^{-2}$	$4.5032275582 \times 10^{-2}$
C_3	$-7.7998048686 \times 10^{-4}$	$2.8908407212 \times 10^{-5}$
C_4	$-2.5800160843 \times 10^{-5}$	$-3.3056896652 \times 10^{-7}$
C_5	$-5.9452583057 \times 10^{-7}$	$6.5024403270 \times 10^{-10}$
C_6	$-9.3214058667 \times 10^{-9}$	$-1.9197495504 \times 10^{-13}$
C_7	$-1.0287605534 \times 10^{-10}$	$-1.2536600497 \times 10^{-15}$
C_8	$-8.0370123621 \times 10^{-13}$	$2.1489217569 \times 10^{-18}$
C_9	$-4.3979497391 \times 10^{-15}$	$-1.4388041782 \times 10^{-21}$
C_{10}	$-1.6414776355 \times 10^{-17}$	$3.5960899481 \times 10^{-25}$
C_{11}	$-3.9673619516 \times 10^{-20}$	

C_{12}	$-5.5827328721 \times 10^{-23}$	
C_{13}	$-3.4657842013 \times 10^{-26}$	

Explicit polynomial representations:

−270 °C to 0 °C

$E = 5.8665508708 \times 10^{1} T + 4.5410977124 \times 10^{-2} T^2 - 7.7998048686 \times 10^{-4} T^3 - 2.5800160843 \times 10^{-5} T^4 - 5.9452583057 \times 10^{-7} T^5 - 9.3214058667 \times 10^{-9} T^6 - 1.0287605534 \times 10^{-10} T^7 - 8.0370123621 \times 10^{-13} T^8 - 4.3979497391 \times 10^{-15} T^9 - 1.6414776355 \times 10^{-17} T^{10} - 3.9673619516 \times 10^{-20} T^{11} - 5.5827328721 \times 10^{-23} T^{12} - 3.4657842013 \times 10^{-26} T^{13}$ [μV]

0 °C to 1000 °C

$E = 5.8665508710 \times 10^{1} \mathrm{T} + 4.5032275582 \times 10^{-2} T^2 + 2.8908407212 \times 10^{-5} T^3 - 3.3056896652 \times 10^{-7} T^4 + 6.5024403270 \times 10^{-10} T^5 - 1.9197495504 \times 10^{-13} T^6 - 1.2536600497 \times 10^{-15} T^7 + 2.1489217569 \times 10^{-18} T^8 - 1.4388041782 \times 10^{-21} T^9 + 3.5960899481 \times 10^{-25} T^{10}$ μV

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−200 to 0	0 to 1000
Voltage range [μV]	−5,603 to 0	0 to 20,872
C_0	0.0	0.0
C_1	1.6977288×10^{-2}	1.7057035×10^{-2}
C_2	$-4.3514970 \times 10^{-7}$	$-2.3301759 \times 10^{-7}$
C_3	$-1.5859697 \times 10^{-10}$	$6.5435585 \times 10^{-12}$
C_4	$-9.2502871 \times 10^{-14}$	$-7.3562749 \times 10^{-17}$
C_5	$-2.6084314 \times 10^{-17}$	$-1.7896001 \times 10^{-21}$
C_6	$-4.1360199 \times 10^{-21}$	$8.4036165 \times 10^{-26}$
C_7	$-3.4034030 \times 10^{-25}$	$-1.3735879 \times 10^{-30}$
C_8	$-1.1564890 \times 10^{-29}$	$1.0629823 \times 10^{-35}$
C_9		$-3.2447087 \times 10^{-41}$
Error range	0.03 °C to −0.01 °C	0.02 °C to −0.02 °C

Explicit polynomial representations:

−200 °C to 0 °C

$T_{90} = 1.6977288 \times 10^{-2} E^1 - 4.3514970 \times 10^{-7} E^2 - 1.5859697 \times 10^{-10} E^3 - 9.2502871 \times 10^{-14} E^4 -$

$2.6084314 \times 10^{-17}E^5 - 4.1360199 \times 10^{-21}E^6 - 3.4034030 \times 10^{-25}E^7 - 1.1564890 \times 10^{-29}E^8$ [°C]

0 °C to 1000 °C

$T_{90} = 1.7057035 \times 10^{-2}E^1 - 2.3301759 \times 10^{-7}E^2 + 6.5435585 \times 10^{-12}E^3 - 7.3562749 \times 10^{-17}E^4 - 1.7896001 \times 10^{-21}E^5 + 8.4036165 \times 10^{-26}E^6 - 1.3735879 \times 10^{-30}E^7 + 1.0629823 \times 10^{-35}E^8 - 3.2447087 \times 10^{-41}E^9$ [°C]

B.5 Type N thermocouples (nickel-chromium/chromium-silicon)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	–270 to 0	0 to 1300
C_0	0.0	0.0
C_1	$2.6159105962 \times 10^{1}$	$2.5929394601 \times 10^{1}$
C_2	$1.0957484228 \times 10^{-2}$	$1.5710141880 \times 10^{-2}$
C_3	$-9.3841111554 \times 10^{-5}$	$4.3825627237 \times 10^{-5}$
C_4	$-4.6412039759 \times 10^{-8}$	$-2.5261169794 \times 10^{-7}$
C_5	$-2.6303357716 \times 10^{-9}$	$6.4311819339 \times 10^{-10}$
C_6	$-2.2653438003 \times 10^{-11}$	$-1.0063471519 \times 10^{-12}$
C_7	$-7.6089300791 \times 10^{-14}$	$9.9745338992 \times 10^{-16}$
C_8	$-9.3419667835 \times 10^{-17}$	$-6.0563245607 \times 10^{-19}$
C_9		$2.0849229339 \times 10^{-22}$
C_{10}		$-3.0682196151 \times 10^{-26}$

Explicit polynomial representations:

−270 °C to 0 °C

$E = 2.6159105962 \times 10^{1}T^1 + 1.0957484228 \times 10^{-2}T^2 - 9.3841111554 \times 10^{-5}T^3 - 4.6412039759 \times 10^{-8}T^4 - 2.6303357716 \times 10^{-9}T^5 - 2.2653438003 \times 10^{-11}T^6 - 7.6089300791 \times 10^{-14}T^7 - 9.3419667835 \times 10^{-17}T^8$ [μV]

0 °C to 1300 °C

$E = 2.5929394601 \times 10^{1}T^1 + 1.5710141880 \times 10^{-2}T^2 + 4.3825627237 \times 10^{-5}T^3 - 2.5261169794 \times 10^{-7}T^4 + 6.4311819339 \times 10^{-10}T^5 - 1.0063471519 \times 10^{-12}T^6 + 9.9745338992 \times 10^{-16}T^7 - 6.0863245607 \times 10^{-19}T^8 + 2.0849229339 \times 10^{-22}T^9 - 3.0682196151 \times 10^{-26}T^{10}$ [μV]

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [°C]$$

Table of coefficients

Temperature range [°C]	−200 to 0	0 to 600	600 to 1,300	0 to 1,300
Voltage range [μV]	−3990 to 0	0 to 20613	20613 to 47513	0 to 47513
C_0	0.0	0.0	1.972485×10^{1}	0.0
C_1	3.8436847×10^{-2}	3.86896×10^{-2}	3.300943×10^{-2}	3.8783277×10^{-2}
C_2	1.1010485×10^{-6}	-1.08267×10^{-6}	-3.915159×10^{-7}	$-1.1612344 \times 10^{-6}$
C_3	5.2229312×10^{-9}	4.70205×10^{-11}	9.855391×10^{-12}	$6.9525655 \times 10^{-11}$
C_4	$7.2060525 \times 10^{-12}$	-2.12169×10^{-18}	$-1.274371 \times 10^{-16}$	$-3.0090077 \times 10^{-15}$
C_5	$5.8488586 \times 10^{-15}$	-1.17272×10^{-19}	7.767022×10^{-22}	$8.8311584 \times 10^{-20}$
C_6	$2.7754916 \times 10^{-18}$	5.39280×10^{-24}		$-1.6213839 \times 10^{-24}$
C_7	$7.7075166 \times 10^{-22}$	-7.98156×10^{-29}		$1.6693362 \times 10^{-29}$
C_8	$1.1582665 \times 10^{-25}$			$-7.3117540 \times 10^{-35}$
C_9	$7.3138868 \times 10^{-30}$			
Error range	0.03 °C to −0.02 °C	0.03 °C to −0.01 °C	0.02 °C to −0.04 °C	0.06 °C to −0.06 °C

Explicit polynomial representations:

−200 °C to 0 °C

$T_{90} = 3.8436847 \times 10^{-2}E^1 + 1.1010485 \times 10^{-6}E^2 + 5.2229312 \times 10^{-9}E^3 + 7.2060525 \times 10^{-12}E^4 + 5.8488586 \times 10^{-15}E^5 + 2.7754916 \times 10^{-18}E^6 + 7.7075166 \times 10^{-22}E^7 + 1.1582665 \times 10^{-25}E^8 + 7.3138868 \times 10^{-30}E^9$ [°C]

0 °C to 600 °C

$T_{90} = 3.86896 \times 10^{-2}E^1 - 1.08267 \times 10^{-6}E^2 + 4.70205 \times 10^{-11}E^3 - 2.12169 \times 10^{-18}E^4 - 1.17272 \times 10^{-19}E^5 + 5.39280 \times 10^{-24}E^6 - 7.98156 \times 10^{-29}E^7$ [°C]

600 °C to 1300 °C

$T_{90} = 1.972485 \times 10^{1} + 3.300943 \times 10^{-2}E^1 - 3.915159 \times 10^{-7}E^2 + 9.855391 \times 10^{-12}E^3 - 1.274371 \times 10^{-16}E^4 + 7.767022 \times 10^{-22}E^5$ [°C]

0 °C to 1300 °C

$T_{90} = 3.8783277 \times 10^{-2}E^1 - 1.1612344 \times 10^{-6}E^2 + 6.9525655 \times 10^{-11}E^3 - 3.0090077 \times 10^{-15}E^4 +$

$8.8311584 \times 10^{-20}E^5 - 1.6213839 \times 10^{-24}E^6 + 1.6693362 \times 10^{-29}E^7 - 7.3117540 \times 10^{-35}E^8$ [°C]

B.6 Type B thermocouples (platinum [30%]/rhodium-platinum)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	0 to 630.615	630.615 to 1820
C_0	0.0	$-3.8938168621 \times 10^3$
C_1	$-2.4650818346 \times 10^{-1}$	2.8571747470×10^1
C_2	$5.9040421171 \times 10^{-3}$	$-8.4885104785 \times 10^{-2}$
C_3	$-1.3257931636 \times 10^{-6}$	$1.5785280164 \times 10^{-4}$
C_4	$1.5668291901 \times 10^{-9}$	$-1.6835344864 \times 10^{-7}$
C_5	$-1.6944529240 \times 10^{-12}$	$1.1109794013 \times 10^{-10}$
C_6	$6.2290347094 \times 10^{-16}$	$-4.4515431033 \times 10^{-14}$
C_7		$9.8975640821 \times 10^{-18}$
C_8		$-9.3791330289 \times 10^{-22}$

Explicit Polynomial representations:

0 °C to 630.615 °C

$E = -2.4650818346 \times 10^{-1}T + 5.9040421171 \times 10^{-3}T^2 - 1.3257931636 \times 10^{-6}T^3 + 1.5668291901 \times 10^{-9}T^4 - 1.6944529240 \times 10^{-12}T^5 + 6.2290347094 \times 10^{-16}T^6$ [μV]

630.615 °C to 1820 °C

$E = -3.8938168621 \times 10^3 + 2.8571747470 \times 10^1 T^1 - 8.4885104785 \times 10^{-2}T^2 + 1.5785280164 \times 10^{-4}T^3 - 1.6835344864 \times 10^{-7}T^4 + 1.1109794013 \times 10^{-10}T^5 - 4.4515431033 \times 10^{-14}T^6 + 9.8975640821 \times 10^{-18}T^7 - 9.3791330289 \times 10^{-22}T^8$ [μV]

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	250 to 700	700 to 1,820
Voltage range [μV]	291 to 2,431	2,431 to 13,820
C_0	9.4823321×10^{1}	2.1315071×10^{2}
C_1	6.9971500×10^{-1}	2.8510504×10^{-1}
C_2	$-8.4765304 \times 10^{-4}$	$-5.2742887 \times 10^{-5}$
C_3	1.0052644×10^{-6}	9.9160804×10^{-9}
C_4	$-8.3345952 \times 10^{-10}$	$-1.2965303 \times 10^{-12}$
C_5	$4.5508542 \times 10^{-13}$	$1.1195870 \times 10^{-16}$
C_6	$-1.5523037 \times 10^{-16}$	$-6.0625199 \times 10^{-21}$
C_7	$2.9886750 \times 10^{-20}$	$1.8661696 \times 10^{-25}$
C_8	$-2.4742860 \times 10^{-24}$	$-2.4878585 \times 10^{-30}$
Error range	0.03 °C to –0.02 °C	0.02 °C to –0.01 °C

Explicit polynomial representations:

250 °C to 700 °C

$$T_{90} = 9.4823321\times10^{1} + 6.9971500\times10^{-1}E^{1} - 8.4765304\times10^{-4}E^{2} + 1.0052644\times10^{-6}E^{3} - 8.3345952\times10^{-10}E^{4} + 4.5508542\times10^{-13}E^{5} - 1.5523037\times10^{-16}E^{6} + 2.9886750 \times 10^{-20}E^{7} - 2.4742860\times10^{-24}E^{8} \left[°\mathrm{C}\right]$$

700 °C to 1820 °C

$$T_{90} = 2.1315071\times10^{2} + 2.8510504\times10^{-1}E^{1} - 5.2742887\times10^{-5}E^{2} + 9.9160804\times10^{-9}E^{3} - 1.2965303\times10^{-12}E^{4} + 1.1195870\times10^{-16}E^{5} - 6.0625199\times10^{-21}E^{6} + 1.8661696\times10^{-25}E^{7} - 2.4878585\times10^{-30}E^{8} \quad \left[°\mathrm{C}\right] \qquad \text{B.7}$$

B.7 Type R thermocouples (platinum [13%]/rhodium-platinum)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu\mathrm{V}]$$

Table of coefficients

Temperature range [°C]	–50 to 1064.18	1064.18 to 1664.5	1664.5 to 1768.1
C_0	0.0	$2.95157925316 \times 10^{3}$	$1.52232118209 \times 10^{5}$
C_1	5.28961729765	−2.52061251332	$-2.68819888545 \times 10^{2}$
C_2	$1.39166589782 \times 10^{-2}$	$1.59564501865 \times 10^{-2}$	$1.71280280471 \times 10^{-1}$

C_3	$-2.38855693017 \times 10^{-5}$	$-7.64085947576 \times 10^{-6}$	$-3.45895706453 \times 10^{-5}$
C_4	$3.56916001063 \times 10^{-8}$	$2.05305291024 \times 10^{-9}$	$-9.34633971046 \times 10^{-12}$
C_5	$-4.62347666298 \times 10^{-11}$	$-2.93359668173 \times 10^{-13}$	
C_6	$5.00777441034 \times 10^{-14}$		
C_7	$-3.73105886191 \times 10^{-17}$		
C_8	$1.57716482367 \times 10^{-20}$		
C_9	$-2.81038625251 \times 10^{-24}$		

Explicit polynomial representations:

−50 °C to 1064.18 °C

$E = 5.28961729765T^1 + 1.39166589782 \times 10^{-2}T^2 - 2.38855693017 \times 10^{-5}T^3 + 3.56916001063 \times 10^{-8}T^4 - 4.62347666298 \times 10^{-11}T^5 + 5.00777441034 \times 10^{-14}T^6 - 3.73105886191 \times 10^{-17}T^7 + 1.57716482367 \times 10^{-20}T^8 - 2.81038625251 \times 10^{-24}T^9$ [μV]

1064.18 °C to 1664.5 °C

$E = 2.95157925316 \times 10^3 - 2.52061251332T^1 + 1.59564501865 \times 10^{-2}T^2 - 7.64085947576 \times 10^{-6}T^3 + 2.05305291024 \times 10^{-9}T^4 - 2.93359668173 \times 10^{-13}T^5$ [μV]

1664.5 °C to 1768.1 °C

$E = 1.52232118209 \times 10^5 - 2.68819888545 \times 10^2T^1 + 1.71280280471 \times 10^{-1}T^2 - 3.45895706453 \times 10^{-5}T^3 - 9.34633971046 \times 10^{-12}T^4$ [μV]

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [°C]$$

Table of coefficients

Temperature range [°C]	−50 to 250	250 to 1200	1064 to 1664.5	1664.5 to 1768.1
Voltage range [μV]	−226 to 1923	1923 to 13228	11361 to 19769	19769 to 21103
C_0	0.0	1.334584505×10^1	-8.199599416×10^1	3.406177836×10^4
C_1	1.8891380×10^{-1}	$1.472644573 \times 10^{-1}$	$1.553962042 \times 10^{-1}$	−7.02372/171
C_2	$-9.3835290 \times 10^{-5}$	$-1.844024844 \times 10^{-5}$	$-8.342197663 \times 10^{-6}$	$5.582903813 \times 10^{-4}$
C_3	1.3068619×10^{-7}	$4.031129726 \times 10^{-9}$	$4.279433549 \times 10^{-10}$	$-1.952394635 \times 10^{-8}$

C_4	$-2.2703580 \times 10^{-10}$	$-6.249428360 \times 10^{-13}$	$-1.191577910 \times 10^{-14}$	$2.560740231 \times 10^{-13}$
C_5	$3.5145659 \times 10^{-13}$	$6.468412046 \times 10^{-17}$	$1.492290091 \times 10^{-19}$	
C_6	$-3.8953900 \times 10^{-16}$	$-4.458750426 \times 10^{-21}$		
C_7	$2.8239471 \times 10^{-19}$	$1.994710146 \times 10^{-25}$		
C_8	$-1.2607281 \times 10^{-22}$	$-5.313401790 \times 10^{-30}$		
C_9	$3.1353611 \times 10^{-26}$	$6.481976217 \times 10^{-35}$		
C_{10}	$-3.3187769 \times 10^{-30}$			
Error range	0.02 °C to –0.02 °C	0.005 °C to –0.005 °C	0.001 °C to –0.0005 °C	0.002 °C to –0.001 °C

Explicit polynomial representations:

−50 °C to 250 °C

$T_{90} = 1.8891380 \times 10^{-1}E^1 - 9.3835290 \times 10^{-5}E^2 + 1.3068619 \times 10^{-7}E^3 - 2.2703580 \times 10^{-10}E^4 + 3.5145659 \times 10^{-13}E^5 - 3.8953900 \times 10^{-16}E^6 + 2.8239471 \times 10^{-19}E^7 - 1.2607281 \times 10^{-22}E^8 + 3.1353611 \times 10^{-26}E^9 - 3.3187769 \times 10^{-30}E^{10}$ [°C]

250 °C to 1200 °C

$T_{90} = 1.334584505 \times 10^1 + 1.472644573 \times 10^1E^1 - 1.844024844 \times 10^{-5}E^2 + 4.031129726 \times 10^{-9}E^3 - 6.249428360 \times 10^{-13}E^4 + 6.468412046 \times 10^{-17}E^5 - 4.458750426 \times 10^{-21}E^6 + 1.994710146 \times 10^{-25}E^7 - 5.313401790 \times 10^{-30}E^8 + 6.481976217 \times 10^{-35}E^9$ [°C]

1064 °C to 1664.5 °C

$T_{90} = -8.199599416 \times 10^1 + 1.553962042 \times 10^{-1}E^1 - 8.342197663 \times 10^{-6}E^2 + 4.279433549 \times 10^{-10}E^3 - 1.191577910 \times 10^{-14}E^4 + 1.492290091 \times 10^{-19}E^5$ [°C]

1664.5 °C to 1768.1 °C

$T_{90} = 3.406177836 \times 10^4 - 7.023729171E^1 + 5.582903813 \times 10^{-4}E^2 - 1.952394635 \times 10^{-8}E^3 + 2.560740231 \times 10^{-13}E^4$ [°C]

B.8 Type S thermocouples (platinum [10%]/rhodium -platinum)

Polynomial:

$$E = \sum_{i=0}^{n} c_i (t_{90})^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−50 to 1064.18	1064.18 to 1664.5	1664.5 to 1768.1
C_0	0.0	$1.32900445085 \times 10^{3}$	$1.46628232636 \times 10^{5}$
C_1	5.40313308631	3.34509311344	$-2.58430516752 \times 10^{2}$
C_2	$1.25934289740 \times 10^{-2}$	$6.54805192818 \times 10^{-3}$	$1.63693574641 \times 10^{-1}$
C_3	$-2.32477968689 \times 10^{-5}$	$-1.64856259209 \times 10^{-6}$	$-3.30439046987 \times 10^{-5}$
C_4	$3.22028823036 \times 10^{-8}$	$1.29989605174 \times 10^{-11}$	$-9.43223690612 \times 10^{-12}$
C_5	$-3.31465196389 \times 10^{-11}$		
C_6	$2.55744251786 \times 10^{-14}$		
C_7	$-1.25068871393 \times 10^{-17}$		
C_8	$2.71443176145 \times 10^{-21}$		

Explicit polynomial representations:

−50 °C to 1064.18 °C

$E = 5.40313308631T^1 + 1.25934289740 \times 10^{-2}T^2 - 2.32477968689 \times 10^{-5}T^3 + 3.22028823036 \times 10^{-8}T^4 - 3.31465196389 \times 10^{-11}T^5 + 2.55744251786 \times 10^{-14}T^6 - 1.25068871393 \times 10^{-17}T^7 + 2.71443176145 \times 10^{-21}T^8$ [μV]

1064.18 °C to 1664.5 °C

$E = 1.32900445085 \times 10^{3} + 3.34509311344T^1 + 6.54805192818 \times 10^{-3}T^2 - 1.64856259209 \times 10^{-6}T^3 + 1.29989605174 \times 10^{-11}T^4$ [μV]

1664.5 °C to 1768.1 °C

$E = 1.46628232636 \times 10^{5} - 2.58430516752 \times 10^{2}T^1 + 1.63693574641 \times 10^{-1}T^2 - 3.30439046987 \times 10^{-5}T^3 - 9.43223690612 \times 10^{-12}T^4$ [μV]

Inverse polynomials:

$$T_{90} = \sum_{i=0}^{n} c_i E^i \quad [\mu V]$$

Table of coefficients

Temperature range [°C]	−50 to 250	250 to 1200	1064 to 1664.5	1664.5 to 1768.1

Voltage range [μV]	−235 to 1874	1874 to 11950	10332 to 17536	17536 to 18693
C_0	0.0	$1.291507177 \times 10^{1}$	$-8.087801117 \times 10^{1}$	$5.333875126 \times 10^{4}$
C_1	$1.84949460 \times 10^{-1}$	$1.466298863 \times 10^{-1}$	$1.621573104 \times 10^{-1}$	$-1.235892298 \times 10^{1}$
C_2	$-8.00504062 \times 10^{-5}$	$-1.534713402 \times 10^{-5}$	$-8.536869453 \times 10^{-6}$	$1.092657613 \times 10^{-3}$
C_3	$1.02237430 \times 10^{-7}$	$3.145945973 \times 10^{-9}$	$4.719686976 \times 10^{-10}$	$-4.265693686 \times 10^{-8}$
C_4	$-1.52248592 \times 10^{-10}$	$-4.163257839 \times 10^{-13}$	$-1.441693666 \times 10^{-14}$	$6.247205420 \times 10^{-13}$
C_5	$1.88821343 \times 10^{-13}$	$3.187963771 \times 10^{-17}$	$2.081618890 \times 10^{-19}$	
C_6	$-1.59085941 \times 10^{-16}$	$-1.291637500 \times 10^{-21}$		
C_7	$8.23027880 \times 10^{-20}$	$2.183475087 \times 10^{-26}$		
C_8	$-2.34181944 \times 10^{-23}$	$-1.447379511 \times 10^{-31}$		
C_9	$2.79786260 \times 10^{-27}$	$8.211272125 \times 10^{-36}$		
Error range	0.02°C to −0.02°C	0.01°C to −0.01°C	0.0002°C to −0.0002°C	0.002°C to −0.002°C

Explicit polynomial representations:

−50 °C to 250 °C

$T_{90} = 1.84949460 \times 10^{-1} E^1 - 8.00504062 \times 10^{-5} E^2 + 1.02237430 \times 10^{-7} E^3 - 1.52248592 \times 10^{-10} E^4 + 1.88821343 \times 10^{-13} E^5 - 1.59085941 \times 10^{-16} E^6 + 8.23027880 \times 10^{-20} E^7 - 2.34181944 \times 10^{-23} E^8 + 2.79786260 \times 10^{-27} E^9$ [°C]

250 °C to 1200 °C

$T_{90} = 1.291507177 \times 10^{1} + 1.466298863 \times 10^{-1} E^1 - 1.534713402 \times 10^{-5} E^2 + 3.145945973 \times 10^{-9} E^3 - 4.163257839 \times 10^{-13} E^4 + 3.187963771 \times 10^{-17} E^5 - 1.291637500 \times 10^{-21} E^6 + 2.183475087 \times 10^{-26} E^7 - 1.447379511 \times 10^{-31} E^8 + 8.211272125 \times 10^{-36} E^9$ [°C]

1064 °C to 1664.5 °C

$T_{90} = -8.087801117 \times 10^{1} + 1.621573104 \times 10^{-1} E^1 - 8.536869453 \times 10^{-6} E^2 + 4.719686976 \times 10^{-10} E^3 - 1.441693666 \times 10^{-14} E^4 + 2.081618890 \times 10^{-19} E^5$

1664.5 °C to 1768.1 °C

$$T_{90} = 5.333875126 \times 10^{4} - 1.235892298 \times 10^{1} E^{1} + 1.092657613 \times 10^{-3} E^{2} - 4.265693686 \times 10^{-8} E^{3} + 6.247205420 \times 10^{-13} E^{4} \ [^{\circ}\mathrm{C}]$$