

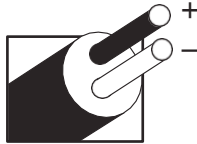
# Thermocouple Reference Tables

TYPE

Reference  
Tables  
N.I.S.T.  
Monograph 175  
Revised to  
ITS-90



Iron  
vs.  
Copper-Nickel



MAXIMUM TEMPERATURE RANGE

Thermocouple Grade  
0 to 750°C, 32 to 1382°F

Extension Grade  
0 to 200°C, 32 to 392°F

LIMITS OF ERROR  
(whichever is greater)  
Standard: 2.2°C or 0.75%  
Special: 1.1°C or 0.4%

COMMENTS, BARE WIRE ENVIRONMENT:  
Reducing, Vacuum, Inert; Limited Use in  
Oxidising at High Temperatures;  
Not Recommended for Low Temperatures

TEMPERATURE IN DEGREES °C  
REFERENCE JUNCTION AT 0°C

Thermoelectric Voltage in Millivolts

| °C   | -10    | -9     | -8     | -7     | -6     | -5     | -4     | -3     | -2     | -1     | 0      | °C   | °C  | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | °C  |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|
| -200 | -8.095 | -8.076 | -8.057 | -8.037 | -8.017 | -7.996 | -7.976 | -7.955 | -7.934 | -7.912 | -7.890 | -200 | 500 | 27.393 | 27.449 | 27.505 | 27.561 | 27.617 | 27.673 | 27.729 | 27.785 | 27.841 | 27.897 | 27.953 | 500 |
| -190 | -7.890 | -7.868 | -7.846 | -7.824 | -7.801 | -7.778 | -7.755 | -7.731 | -7.707 | -7.683 | -7.659 | -190 | 510 | 27.953 | 28.010 | 28.066 | 28.122 | 28.178 | 28.234 | 28.291 | 28.347 | 28.403 | 28.460 | 28.516 | 510 |
| -180 | -7.659 | -7.634 | -7.610 | -7.585 | -7.559 | -7.534 | -7.508 | -7.482 | -7.456 | -7.429 | -7.403 | -180 | 520 | 28.516 | 28.572 | 28.629 | 28.685 | 28.741 | 28.798 | 28.854 | 28.911 | 28.967 | 29.024 | 29.080 | 520 |
| -170 | -7.403 | -7.376 | -7.348 | -7.321 | -7.293 | -7.265 | -7.237 | -7.209 | -7.181 | -7.152 | -7.123 | -170 | 530 | 29.080 | 29.137 | 29.194 | 29.250 | 29.307 | 29.363 | 29.420 | 29.477 | 29.534 | 29.590 | 29.647 | 530 |
| -160 | -7.123 | -7.094 | -7.064 | -7.035 | -7.005 | -6.975 | -6.944 | -6.914 | -6.883 | -6.853 | -6.821 | -160 | 540 | 29.647 | 29.704 | 29.761 | 29.818 | 29.874 | 29.931 | 29.988 | 30.045 | 30.102 | 30.159 | 30.216 | 540 |
| -150 | -6.821 | -6.790 | -6.759 | -6.727 | -6.695 | -6.663 | -6.631 | -6.598 | -6.566 | -6.533 | -6.500 | -150 | 550 | 30.216 | 30.273 | 30.330 | 30.387 | 30.444 | 30.502 | 30.559 | 30.616 | 30.673 | 30.730 | 30.788 | 550 |
| -140 | -6.500 | -6.467 | -6.433 | -6.400 | -6.366 | -6.332 | -6.298 | -6.263 | -6.229 | -6.194 | -6.159 | -140 | 560 | 30.788 | 30.845 | 30.902 | 30.960 | 31.017 | 31.074 | 31.132 | 31.189 | 31.247 | 31.304 | 31.362 | 560 |
| -130 | -6.159 | -6.124 | -6.089 | -6.054 | -6.018 | -5.982 | -5.946 | -5.910 | -5.874 | -5.838 | -5.801 | -130 | 570 | 31.362 | 31.419 | 31.477 | 31.535 | 31.592 | 31.650 | 31.708 | 31.766 | 31.823 | 31.881 | 31.939 | 570 |
| -120 | -5.801 | -5.764 | -5.727 | -5.690 | -5.653 | -5.616 | -5.578 | -5.541 | -5.503 | -5.465 | -5.426 | -120 | 580 | 31.939 | 31.997 | 32.055 | 32.113 | 32.171 | 32.229 | 32.287 | 32.345 | 32.403 | 32.461 | 32.519 | 580 |
| -110 | -5.426 | -5.388 | -5.350 | -5.311 | -5.272 | -5.233 | -5.194 | -5.155 | -5.116 | -5.076 | -5.037 | -110 | 590 | 32.519 | 32.577 | 32.636 | 32.694 | 32.752 | 32.810 | 32.869 | 32.927 | 32.985 | 33.044 | 33.102 | 590 |
| -100 | -5.037 | -4.997 | -4.957 | -4.917 | -4.877 | -4.836 | -4.796 | -4.755 | -4.714 | -4.674 | -4.633 | -100 | 600 | 33.102 | 33.161 | 33.219 | 33.278 | 33.337 | 33.395 | 33.454 | 33.513 | 33.571 | 33.630 | 33.689 | 600 |
| -90  | -4.633 | -4.591 | -4.550 | -4.509 | -4.467 | -4.425 | -4.384 | -4.342 | -4.300 | -4.257 | -4.215 | -90  | 610 | 33.689 | 33.748 | 33.807 | 33.866 | 33.925 | 33.984 | 34.043 | 34.102 | 34.161 | 34.220 | 34.279 | 610 |
| -80  | -4.215 | -4.173 | -4.130 | -4.088 | -4.045 | -4.002 | -3.959 | -3.916 | -3.872 | -3.829 | -3.786 | -80  | 620 | 34.279 | 34.338 | 34.397 | 34.457 | 34.516 | 34.575 | 34.635 | 34.694 | 34.754 | 34.813 | 34.873 | 620 |
| -70  | -3.786 | -3.742 | -3.698 | -3.654 | -3.610 | -3.566 | -3.522 | -3.478 | -3.434 | -3.389 | -3.346 | -70  | 630 | 34.873 | 34.932 | 34.992 | 35.051 | 35.111 | 35.171 | 35.230 | 35.290 | 35.350 | 35.410 | 35.470 | 630 |
| -60  | -3.344 | -3.300 | -3.255 | -3.210 | -3.165 | -3.120 | -3.075 | -3.029 | -2.984 | -2.938 | -2.893 | -60  | 640 | 35.470 | 35.530 | 35.590 | 35.650 | 35.710 | 35.770 | 35.830 | 35.890 | 35.950 | 36.010 | 36.071 | 640 |
| -50  | -2.893 | -2.847 | -2.801 | -2.755 | -2.709 | -2.663 | -2.617 | -2.571 | -2.524 | -2.478 | -2.431 | -50  | 650 | 36.071 | 36.131 | 36.191 | 36.252 | 36.312 | 36.373 | 36.433 | 36.494 | 36.554 | 36.615 | 36.675 | 650 |
| -40  | -2.431 | -2.385 | -2.338 | -2.291 | -2.244 | -2.197 | -2.150 | -2.103 | -2.055 | -2.008 | -1.961 | -40  | 660 | 36.675 | 36.736 | 36.797 | 36.858 | 36.918 | 36.979 | 37.040 | 37.101 | 37.162 | 37.223 | 37.284 | 660 |
| -30  | -1.961 | -1.913 | -1.865 | -1.818 | -1.770 | -1.722 | -1.674 | -1.626 | -1.578 | -1.530 | -1.482 | -30  | 670 | 37.284 | 37.345 | 37.406 | 37.467 | 37.528 | 37.589 | 37.650 | 37.711 | 37.772 | 37.833 | 37.894 | 670 |
| -20  | -1.482 | -1.433 | -1.385 | -1.338 | -1.289 | -1.239 | -1.190 | -1.142 | -1.093 | -1.044 | -0.995 | -20  | 680 | 37.896 | 37.958 | 38.019 | 38.081 | 38.142 | 38.204 | 38.265 | 38.327 | 38.389 | 38.450 | 38.512 | 680 |
| -10  | -0.995 | -0.946 | -0.896 | -0.847 | -0.798 | -0.749 | -0.699 | -0.650 | -0.600 | -0.550 | -0.501 | -10  | 690 | 38.512 | 38.574 | 38.636 | 38.698 | 38.760 | 38.822 | 38.884 | 38.946 | 39.008 | 39.070 | 39.132 | 690 |
| 0    | -0.501 | -0.451 | -0.401 | -0.351 | -0.301 | -0.251 | -0.201 | -0.151 | -0.101 | -0.050 | 0.000  | 0    | 700 | 39.132 | 39.194 | 39.256 | 39.318 | 39.381 | 39.443 | 39.505 | 39.568 | 39.630 | 39.693 | 39.755 | 700 |
| 10   | 0.000  | 0.050  | 0.101  | 0.151  | 0.202  | 0.253  | 0.303  | 0.354  | 0.405  | 0.456  | 0.507  | 10   | 710 | 39.755 | 39.818 | 39.880 | 39.943 | 40.005 | 40.068 | 40.131 | 40.193 | 40.256 | 40.319 | 40.382 | 710 |
| 20   | 0.507  | 0.558  | 0.609  | 0.660  | 0.711  | 0.762  | 0.814  | 0.865  | 0.916  | 0.968  | 1.019  | 20   | 720 | 40.382 | 40.445 | 40.508 | 40.570 | 40.633 | 40.696 | 40.759 | 40.822 | 40.886 | 40.949 | 41.012 | 720 |
| 30   | 1.019  | 1.071  | 1.122  | 1.174  | 1.226  | 1.277  | 1.329  | 1.381  | 1.433  | 1.485  | 1.537  | 30   | 730 | 41.012 | 41.075 | 41.138 | 41.201 | 41.263 | 41.326 | 41.391 | 41.455 | 41.518 | 41.581 | 41.645 | 730 |
| 40   | 1.537  | 1.589  | 1.641  | 1.693  | 1.745  | 1.797  | 1.849  | 1.902  | 1.954  | 2.006  | 2.059  | 40   | 740 | 41.645 | 41.708 | 41.772 | 41.835 | 41.899 | 41.962 | 42.026 | 42.090 | 42.153 | 42.217 | 42.281 | 740 |
| 50   | 2.059  | 2.111  | 2.164  | 2.216  | 2.269  | 2.322  | 2.374  | 2.427  | 2.480  | 2.532  | 2.585  | 50   | 750 | 42.281 | 42.344 | 42.408 | 42.472 | 42.536 | 42.599 | 42.663 | 42.727 | 42.791 | 42.855 | 42.919 | 750 |
| 60   | 2.585  | 2.638  | 2.691  | 2.744  | 2.797  | 2.850  | 2.903  | 2.956  | 3.009  | 3.062  | 3.116  | 60   | 760 | 42.919 | 42.983 | 43.047 | 43.111 | 43.175 | 43.239 | 43.303 | 43.367 | 43.431 | 43.495 | 43.559 | 760 |
| 70   | 3.116  | 3.169  | 3.222  | 3.275  | 3.329  | 3.382  | 3.436  | 3.489  | 3.543  | 3.596  | 3.650  | 70   | 770 | 43.559 | 43.624 | 43.688 | 43.752 | 43.817 | 43.881 | 43.945 | 44.010 | 44.074 | 44.139 | 44.203 | 770 |
| 80   | 3.650  | 3.703  | 3.757  | 3.810  | 3.864  | 3.918  | 3.971  | 4.025  | 4.079  | 4.133  | 4.187  | 80   | 780 | 44.203 | 44.267 | 44.332 | 44.396 | 44.461 | 44.525 | 44.590 | 44.655 | 44.719 | 44.784 | 44.848 | 780 |
| 90   | 4.187  | 4.240  | 4.294  | 4.348  | 4.402  | 4.456  | 4.510  | 4.564  | 4.618  | 4.672  | 4.726  | 90   | 790 | 44.848 | 44.913 | 44.977 | 45.042 | 45.107 | 45.171 | 45.236 | 45.301 | 45.365 | 45.430 | 45.494 | 790 |
| 100  | 4.726  | 4.781  | 4.835  | 4.889  | 4.943  | 4.997  | 5.052  | 5.106  | 5.160  | 5.215  | 5.269  | 100  | 800 | 45.494 | 45.559 | 45.624 | 45.688 | 45.753 | 45.818 | 45.882 | 45.947 | 46.011 | 46.076 | 46.141 | 800 |
| 110  | 5.269  | 5.323  | 5.378  | 5.432  | 5.487  | 5.541  | 5.595  | 5.650  | 5.705  | 5.759  | 5.814  | 110  | 810 | 46.141 | 46.205 | 46.270 | 46.334 | 46.399 | 46.464 | 46.528 | 46.593 | 46.657 | 46.722 | 46.786 | 810 |
| 120  | 5.814  | 5.868  | 5.923  | 5.977  | 6.032  | 6.087  | 6.141  | 6.196  | 6.251  | 6.306  | 6.360  | 120  | 820 | 46.786 | 46.851 | 46.915 | 46.980 | 47.044 | 47.109 | 47.173 | 47.238 | 47.302 | 47.367 | 47.431 | 820 |
| 130  | 6.360  | 6.415  | 6.470  | 6.525  | 6.579  | 6.634  | 6.689  | 6.744  | 6.799  | 6.854  | 6.909  | 130  | 830 | 47.431 | 47.495 | 47.560 | 47.624 | 47.688 | 47.753 | 47.817 | 47.881 | 47.946 | 48.010 | 48.074 | 830 |
| 140  | 6.909  | 6.964  | 7.019  | 7.074  | 7.129  | 7.184  | 7.239  | 7.294  | 7.349  | 7.404  | 7.459  | 140  | 840 | 48.074 | 48.138 | 48.202 | 48.267 | 48.331 | 48.395 | 48.459 | 48.523 | 48.587 | 48.651 | 48.715 | 840 |
| 150  | 7.459  | 7.514  | 7.569  | 7.624  | 7.679  | 7.734  | 7.789  | 7.844  | 7.900  | 7.955  | 8.010  | 150  | 850 | 48.715 | 48.779 | 48.843 | 48.907 | 48.971 | 49.034 | 49.098 | 49.162 | 49.226 | 49.290 | 49.353 | 850 |
| 160  | 8.010  | 8.065  | 8.120  | 8.175  | 8.231  | 8.286  | 8.341  | 8.396  | 8.452  | 8.507  | 8.562  | 160  | 860 | 49.353 | 49.417 | 49.481 | 49.544 | 49.608 | 49.672 | 49.735 | 49.799 | 49.862 | 49.926 | 49.989 | 860 |
| 170  | 8.562  | 8.618  | 8.673  | 8.728  | 8.783  | 8.838  | 8.894  | 8.949  | 9.005  | 9.060  | 9.115  | 170  | 870 | 49.862 | 49.926 | 49.990 | 50.054 | 50.118 | 50.182 | 50.246 | 50.310 | 50.374 | 50.438 | 50.502 | 870 |
| 180  | 9.115  | 9.171  | 9.226  | 9.282  | 9.337  | 9.392  | 9.448  | 9.503  | 9.559  | 9.614  | 9.669  | 180  | 880 | 50.502 | 50.566 | 50.630 | 50.694 | 50.758 | 50.822 | 50.886 | 50.950 | 51.014 | 51.078 | 51.142 | 880 |
| 190  | 9.669  | 9.725  | 9.780  | 9.836  | 9.891  | 9.947  | 10.002 | 10.057 | 10.113 | 10.168 | 10.224 | 190  | 890 | 51.142 | 51.206 | 51.270 | 51.334 | 51.398 | 51.462 | 51.526 | 51.590 | 51.654 | 51.718 | 51.782 | 890 |
| 200  | 10.224 | 10.279 | 10.335 | 10.390 | 10.446 | 10.501 | 10.557 | 10.612 | 10.668 | 10.723 | 10.779 | 200  | 900 | 51.782 | 51.846 | 51.910 | 51.974 | 52.038 | 52.102 | 52.166 | 52.230 | 52.294 | 52.358 | 52.422 | 900 |
| 210  | 10.779 | 10.834 | 10.890 | 10.945 | 11.001 | 11.056 | 11.112 | 11.167 | 11.223 | 11.278 | 11.334 | 210  | 910 | 52.422 | 52.486 | 52.550 | 52.614 | 52.678 | 52.742 | 52.806 | 52.870 | 52.934 | 52.998 | 53.062 | 910 |
| 220  | 11.334 | 11.389 | 11.445 | 11.501 | 11.556 | 11.612 | 11.667 | 11.723 | 11.778 | 11.834 | 11.889 | 220  | 920 | 53.062 | 53.126 | 53.190 | 53.254 | 53.318 | 53.382 | 53.446 | 53.510 | 53.574 | 53.638 | 53.702 | 920 |
| 230  | 11.889 | 11.945 | 12.000 | 12.056 |        |        |        |        |        |        |        |      |     |        |        |        |        |        |        |        |        |        |        |        |     |