



TECHNICAL INFORMATION

EXPANSION RATES FOR PIPING MATERIALS FROM 0°C (mm/m)

| Temperature °C | Carbon and Carbon Molybdenum steel | 4-6% Cr Alloy steel | 12% Cr Stainless steel | 18 Cr. 8 Ni. Stainless steel |
|-------------------|---------------------------------------|------------------------|---------------------------|---------------------------------|
| -130 | -1.27 | -1.25 | -1.17 | -1.96 |
| -120 | -1.19 | -1.17 | -1.09 | -1.82 |
| -110 | -1.11 | -1.09 | -1.01 | -1.68 |
| -100 | -1.03 | -0.98 | -0.91 | -1.55 |
| -90 | -0.94 | -0.94 | -0.87 | -1.39 |
| -80 | -0.84 | -0.82 | -0.76 | -1.23 |
| -70 | -0.74 | -0.75 | -0.70 | -1.08 |
| -60 | -0.64 | -0.64 | -0.60 | -0.93 |
| -50 | -0.54 | -0.55 | -0.52 | -0.78 |
| -40 | -0.43 | -0.44 | -0.42 | -0.62 |
| -30 | -0.32 | -0.33 | -0.31 | -0.47 |
| -20 | -0.21 | -0.22 | -0.21 | -0.31 |
| -10 | -0.10 | -0.11 | -0.10 | -0.15 |
| 0 | 0 | 0 | 0 | 0 |
| 10 | 0.11 | 0.10 | 0.10 | 0.15 |
| 20 | 0.22 | 0.20 | 0.20 | 0.31 |
| 30 | 0.33 | 0.33 | 0.31 | 0.51 |
| 40 | 0.45 | 0.42 | 0.40 | 0.65 |
| 50 | 0.57 | 0.53 | 0.50 | 0.81 |
| 60 | 0.69 | 0.63 | 0.60 | 0.98 |
| 70 | 0.80 | 0.74 | 0.70 | 1.15 |
| 80 | 0.92 | 0.85 | 0.80 | 1.32 |
| 90 | 1.03 | 0.96 | 0.91 | 1.49 |
| 100 | 1.15 | 1.07 | 1.02 | 1.66 |
| 110 | 1.27 | 1.19 | 1.12 | 1.83 |
| 120 | 1.38 | 1.31 | 1.22 | 2.00 |
| 130 | 1.51 | 1.43 | 1.33 | 2.17 |
| 140 | 1.64 | 1.54 | 1.43 | 2.34 |
| 150 | 1.78 | 1.66 | 1.54 | 2.52 |
| 160 | 1.92 | 1.78 | 1.65 | 2.69 |
| 170 | 2.05 | 1.88 | 1.77 | 2.87 |
| 180 | 2.18 | 2.02 | 1.87 | 3.01 |
| 190 | 2.31 | 2.14 | 1.98 | 3.23 |
| 200 | 2.44 | 2.26 | 2.10 | 3.41 |
| 210 | 2.58 | 2.39 | 2.22 | 3.59 |
| 220 | 2.72 | 2.52 | 2.34 | 3.78 |
| 230 | 2.86 | 2.64 | 2.45 | 3.96 |
| 240 | 3.00 | 2.77 | 2.57 | 4.14 |
| 250 | 3.13 | 2.89 | 2.68 | 4.32 |
| 260 | 3.27 | 3.02 | 2.80 | 4.50 |
| 270 | 3.42 | 3.16 | 2.93 | 4.68 |
| 280 | 3.57 | 3.29 | 3.05 | 4.87 |
| 290 | 3.17 | 3.42 | 3.17 | 5.06 |
| 300 | 3.85 | 3.55 | 3.29 | 5.24 |
| 310 | 4.00 | 3.69 | 3.42 | 5.48 |
| 320 | 4.16 | 3.82 | 3.54 | 5.61 |
| 330 | 4.31 | 3.96 | 3.67 | 5.81 |
| 340 | 4.46 | 4.08 | 3.79 | 6.00 |
| 350 | 4.62 | 4.23 | 3.92 | 6.18 |
| 360 | 4.77 | 4.36 | 4.04 | 6.38 |
| 370 | 4.93 | 4.49 | 4.16 | 6.57 |
| 380 | 5.09 | 4.63 | 4.28 | 6.76 |
| 390 | 5.25 | 4.78 | 4.41 | 6.96 |
| 400 | 5.41 | 4.92 | 4.54 | 7.15 |
| 410 | 5.57 | 5.07 | 4.68 | 7.34 |
| 420 | 5.73 | 5.21 | 4.81 | 7.54 |
| 430 | 5.89 | 5.35 | 4.94 | 7.74 |
| 440 | 6.06 | 5.50 | 5.08 | 7.94 |



| Temperature °C | Carbon and Carbon Molybdenum steel | 4-6% Cr Alloy steel | 12% Cr Stainless steel | 18 Cr. 8 Ni. Stainless steel |
|----------------|------------------------------------|---------------------|------------------------|------------------------------|
| 450 | 6.22 | 5.65 | 5.22 | 8.13 |
| 460 | 6.39 | 5.79 | 5.35 | 8.33 |
| 470 | 6.56 | 5.94 | 5.48 | 8.53 |
| 480 | 6.73 | 6.08 | 5.61 | 8.73 |
| 490 | 6.89 | 6.22 | 5.74 | 8.93 |
| 500 | 7.05 | 6.39 | 5.89 | 9.14 |
| 510 | 7.21 | 6.52 | 6.01 | 9.34 |
| 520 | 7.38 | 6.67 | 6.15 | 9.54 |
| 530 | 7.54 | 6.82 | 6.29 | 9.75 |
| 540 | 7.71 | 6.97 | 6.43 | 9.95 |
| 550 | 7.84 | 7.11 | 6.56 | 10.16 |
| 560 | 8.05 | 7.26 | 6.70 | 10.36 |
| 570 | 8.22 | 7.41 | 6.84 | 10.56 |
| 580 | 8.40 | 7.56 | 6.97 | 10.77 |
| 590 | 8.57 | 7.71 | 7.11 | 10.97 |
| 600 | 8.73 | 7.85 | 7.24 | 11.13 |
| 610 | 8.89 | 7.99 | 7.37 | 11.38 |
| 620 | 9.04 | 8.14 | 7.50 | 11.58 |
| 630 | 9.20 | 8.28 | 7.63 | 11.79 |
| 640 | 9.36 | 8.43 | 7.77 | 11.99 |
| 650 | 9.53 | 8.58 | 7.91 | 12.20 |
| 660 | 9.70 | 8.74 | 8.05 | 12.40 |
| 670 | 9.87 | 8.90 | 8.19 | 12.60 |
| 680 | 10.03 | 9.06 | 8.33 | 12.81 |
| 690 | 10.20 | 9.21 | 8.46 | 13.01 |
| 700 | 10.37 | 9.35 | 8.59 | 13.22 |
| 710 | 10.54 | 9.52 | 8.74 | 13.42 |
| 720 | 10.71 | 9.67 | 8.87 | 13.62 |
| 730 | 10.87 | 9.82 | 9.01 | 13.83 |
| 740 | 11.04 | 9.97 | 9.15 | 14.03 |
| 750 | 11.21 | 10.12 | 9.28 | 14.24 |
| 760 | 11.38 | 10.27 | 9.41 | 14.44 |
| 770 | | | | 14.67 |
| 780 | | | | 14.90 |
| 790 | | | | 15.14 |
| 800 | | | | 15.37 |
| 810 | | | | 15.60 |

TEMPERATURE CONVERSION TABLE

| C | F | C | F | C | F | C | F | C | F | C | F | C | F | C | F | | | | | | | | |
|-------|-----------|------|-------|-----------|-------|------|-----------|-------|------|-----------|-------|------|------------|-------|-----|------------|-----|-----|------------|------|-----|------------|------|
| -22.8 | -9 | 15.8 | -8.89 | 16 | 60.8 | 5.00 | 41 | 105.8 | 18.9 | 66 | 150.8 | 32.8 | 91 | 195.8 | 127 | 260 | 500 | 266 | 510 | 950 | 404 | 760 | 1400 |
| -22.2 | -8 | 17.6 | -8.33 | 17 | 62.6 | 5.56 | 42 | 107.6 | 19.4 | 67 | 152.6 | 33.3 | 92 | 197.6 | 132 | 270 | 518 | 271 | 520 | 968 | 410 | 770 | 1418 |
| -21.7 | -7 | 19.4 | -7.78 | 18 | 64.4 | 6.11 | 43 | 109.4 | 20.0 | 68 | 154.4 | 33.9 | 93 | 199.4 | 138 | 280 | 536 | 277 | 530 | 986 | 416 | 780 | 1436 |
| -21.1 | -6 | 21.2 | -7.22 | 19 | 66.2 | 6.67 | 44 | 111.2 | 20.6 | 69 | 156.2 | 34.4 | 94 | 201.2 | 143 | 290 | 554 | 282 | 540 | 1004 | 421 | 790 | 1454 |
| -20.6 | -5 | 23.0 | -6.67 | 20 | 68.0 | 7.22 | 45 | 113.0 | 21.1 | 70 | 158.0 | 35.0 | 95 | 203.0 | 149 | 300 | 572 | 288 | 550 | 1022 | 427 | 800 | 1472 |
| -20.0 | -4 | 24.8 | -6.11 | 21 | 69.8 | 7.78 | 46 | 114.8 | 21.7 | 71 | 159.8 | 35.6 | 96 | 204.8 | 154 | 310 | 590 | 293 | 560 | 1040 | 432 | 810 | 1490 |
| -19.4 | -3 | 26.6 | -5.56 | 22 | 71.6 | 8.33 | 47 | 116.6 | 22.2 | 72 | 161.6 | 36.1 | 97 | 206.6 | 160 | 320 | 608 | 299 | 570 | 1058 | 438 | 820 | 1508 |
| -189 | -2 | 28.4 | -5.00 | 23 | 73.4 | 8.89 | 48 | 118.4 | 22.8 | 73 | 163.4 | 36.7 | 98 | 208.4 | 166 | 330 | 626 | 304 | 580 | 1076 | 443 | 830 | 1526 |
| -18.3 | -1 | 30.2 | -4.44 | 24 | 75.2 | 9.44 | 49 | 120.2 | 23.3 | 74 | 165.2 | 37.2 | 99 | 210.2 | 171 | 340 | 644 | 310 | 590 | 1094 | 449 | 840 | 1544 |
| -17.8 | 0 | 32.0 | -3.89 | 25 | 77.0 | 10.0 | 50 | 122.0 | 23.9 | 75 | 167.0 | 38 | 100 | 212 | 177 | 350 | 662 | 316 | 600 | 1112 | 455 | 850 | 1562 |
| -17.2 | 1 | 33.8 | -3.33 | 26 | 78.8 | 10.6 | 51 | 123.8 | 24.4 | 76 | 168.8 | 43 | 110 | 230 | 182 | 360 | 680 | 321 | 610 | 1130 | 460 | 860 | 1580 |
| -16.7 | 2 | 35.6 | -2.78 | 27 | 80.6 | 11.1 | 52 | 125.6 | 25.0 | 77 | 170.6 | 49 | 120 | 248 | 188 | 370 | 698 | 327 | 620 | 1148 | 466 | 870 | 1598 |
| -16.1 | 3 | 37.4 | -2.22 | 28 | 82.4 | 11.7 | 53 | 127.4 | 25.6 | 78 | 172.4 | 54 | 130 | 266 | 193 | 380 | 716 | 332 | 630 | 1166 | 471 | 880 | 1616 |
| -15.6 | 4 | 39.2 | -1.67 | 29 | 84.2 | 12.2 | 54 | 129.2 | 26.1 | 79 | 174.2 | 60 | 140 | 284 | 199 | 390 | 734 | 338 | 640 | 1184 | 477 | 890 | 1634 |
| -15.0 | 5 | 41.0 | -1.11 | 30 | 86.0 | 12.8 | 55 | 131.0 | 26.7 | 80 | 176.0 | 66 | 150 | 302 | 204 | 400 | 752 | 343 | 650 | 1202 | 482 | 900 | 1652 |
| -14.4 | 6 | 42.8 | -0.56 | 31 | 87.8 | 13.3 | 56 | 132.8 | 27.2 | 81 | 177.8 | 71 | 160 | 320 | 210 | 410 | 770 | 349 | 660 | 1220 | 488 | 910 | 1670 |
| -13.9 | 7 | 44.6 | 0 | 32 | 89.6 | 13.9 | 57 | 134.6 | 27.8 | 82 | 179.6 | 77 | 170 | 338 | 216 | 420 | 788 | 354 | 670 | 1238 | 493 | 920 | 1688 |
| -13.3 | 8 | 46.4 | 0.56 | 33 | 91.4 | 14.4 | 58 | 136.4 | 28.3 | 83 | 181.4 | 82 | 180 | 356 | 221 | 430 | 806 | 360 | 680 | 1256 | 499 | 930 | 1706 |
| -12.8 | 9 | 48.2 | 1.11 | 34 | 93.2 | 15.0 | 59 | 138.2 | 28.9 | 84 | 183.2 | 88 | 190 | 374 | 227 | 440 | 824 | 366 | 690 | 1274 | 504 | 940 | 1724 |
| -12.2 | 10 | 50.0 | 1.67 | 35 | 95.0 | 15.6 | 60 | 140.0 | 29.4 | 85 | 185.0 | 93 | 200 | 392 | 232 | 450 | 842 | 371 | 700 | 1292 | 510 | 950 | 1742 |
| -11.7 | 11 | 51.8 | 2.22 | 36 | 96.8 | 16.1 | 61 | 141.8 | 30.0 | 86 | 186.8 | 99 | 210 | 410 | 238 | 460 | 860 | 377 | 710 | 1310 | 516 | 960 | 1760 |
| -11.1 | 12 | 53.6 | 2.78 | 37 | 98.6 | 16.7 | 62 | 143.6 | 30.6 | 87 | 188.6 | 104 | 220 | 428 | 243 | 470 | 878 | 382 | 720 | 1328 | 521 | 970 | 1778 |
| -106 | 13 | 55.4 | 3.33 | 38 | 100.4 | 17.2 | 63 | 145.4 | 31.1 | 88 | 190.4 | 110 | 230 | 446 | 249 | 480 | 896 | 388 | 730 | 1346 | 527 | 980 | 1796 |
| -10.0 | 14 | 57.2 | 3.89 | 39 | 102.2 | 17.8 | 64 | 147.2 | 31.7 | 89 | 192.2 | 116 | 240 | 464 | 254 | 490 | 914 | 393 | 740 | 1364 | 532 | 990 | 1814 |

Read known temperature in **BOLD TYPE**. Equivalent temperature in degrees Centigrade will be found in left hand column. Corresponding temperature in degrees Fahrenheit will be found in column to the right.