

THERMAL EXPANSION OF PIPE TABLE

Thermal Expansion of Pipe in Inches Per 100 Feet							
Saturated Steam Vacuum in HG below 212°F., Pressure, PSIG	Temp. Degrees Fahr.	Carbon and Carbon Molyb- denum			18 Cr.- 8 Ni Stainless Steel		Copper
		Cast Iron	Wrought Iron	4-6% Cr. Alloy Steel	Steel		
	-200	-1.058	-1.282	-1.289	-1.250	-2.030	-1.955
	-180	-0.982	-1.176	-1.183	-1.150	-1.850	-1.782
	-160	-0.891	-1.066	-1.073	-1.030	-1.670	-1.612
	-140	-0.797	-0.948	-0.955	-0.970	-1.480	-1.428
	-120	-0.697	-0.826	-0.833	-0.800	-1.300	-1.235
	-100	-0.593	-0.698	-0.705	-0.700	-0.900	-1.040
	-80	-0.481	-0.563	-0.570	-0.550	-0.880	-0.835
	-60	-0.368	-0.428	-0.435	-0.430	-0.670	-0.630
	-40	-0.248	-0.288	-0.295	-0.290	-0.450	-0.421
	-20	-0.127	-0.145	-0.152	-0.145	-0.225	-0.210
	0	0	0	0	0	0	0
	20	0.12	0.148	0.180	0.140	0.223	0.238
	32	0.209	0.230	0.280	0.234	0.356	0.366
	40	0.270	0.300	0.350	0.280	0.446	0.451
29.39	60	0.410	0.448	0.540	0.430	0.669	0.684
28.89	80	0.550	0.580	0.710	0.500	0.892	0.896
27.99	100	0.680	0.753	0.887	0.650	1.115	1.134
26.48	120	0.830	0.910	1.058	0.800	1.338	1.366
24.04	140	0.970	1.064	1.240	0.950	1.545	1.590
20.27	160	1.110	1.200	1.420	1.100	1.784	1.804
14.63	180	1.240	1.360	1.580	1.250	2.000	2.051
6.45	200	1.390	1.520	1.750	1.400	2.230	2.296
0	212	1.480	1.610	1.870	1.500	2.361	2.428
2.5	220	1.530	1.680	1.940	1.550	2.460	2.516
10.3	240	1.670	1.840	2.120	1.720	2.680	2.756
20.7	260	1.820	2.020	2.300	1.880	2.920	2.985
34.5	280	1.970	2.180	2.470	2.050	3.150	3.218
52.3	300	2.130	2.350	2.670	2.200	3.390	3.461
74.9	320	2.268	2.530	2.850	2.370	3.615	3.696
103.3	340	2.430	2.700	3.040	2.530	3.840	3.941
138.3	360	2.590	2.880	3.230	2.700	4.100	4.176
180.9	380	2.750	3.060	3.425	2.860	4.346	4.424
232.4	400	2.910	3.230	3.620	3.010	4.580	4.666
293.7	420	3.090	3.421	3.820	3.180	4.800	4.914
366.1	440	3.250	3.595	4.020	3.350	5.050	5.154
451.3	460	3.410	3.784	4.200	3.530	5.300	5.408
550.3	480	3.570	3.995	4.400	3.700	5.540	5.651
664.3	500	3.730	4.151	4.600	3.860	5.800	5.906
795.3	520	3.900	4.342	4.810	4.040	6.050	6.148
945.3	540	4.080	4.525	5.020	4.200	6.280	6.410
1115	560	4.250	4.730	5.220	4.400	6.520	6.648
1308	580	4.430	4.930	5.430	4.560	6.780	6.919
1525	600	4.600	5.130	5.620	4.750	7.020	7.184
1768	620	4.790	5.330	5.840	4.920	7.270	7.432
2041	640	4.970	5.530	6.050	5.100	7.520	7.689
2346	660	5.150	5.750	6.250	5.300	7.770	7.949
2705	680	5.330	5.950	6.470	5.480	8.020	8.196
3080	700	5.520	6.160	6.670	5.650	8.280	8.472
	720	5.710	6.360	6.880	5.850	8.520	8.708
	740	5.900	6.570	7.100	6.030	8.760	8.999
	760	6.090	6.790	7.320	6.220	9.050	9.256
	780	6.280	7.000	7.530	6.410	9.300	9.532
	800	6.470	7.230	7.730	6.610	9.580	9.788
	820	6.660	7.450	7.960	6.800	9.820	10.068
	840	6.850	7.660	8.180	7.000	10.100	10.308
	860	7.049	7.970	8.400	7.190	10.370	10.610
	880	7.248	8.100	8.630	7.380	10.630	10.971
	900	7.460	8.340	8.870	7.580	10.900	11.156
	920	7.668	8.540	9.070	7.770	11.180	11.421
	940	7.862	8.770	9.300	7.970	11.460	11.707
	960	8.073	8.990	9.520	8.170	11.730	11.976
	980	8.300	9.220	9.740	8.360	12.000	12.269
	1000	8.510	9.420	9.970	8.550	12.260	12.543
	1020		9.65		8.75	12.55	
	1040		9.87		8.95	12.82	
	1060		10.08		9.15	13.10	
	1080		10.32		9.35	13.37	
	1100		10.57		9.54	13.62	
	1120		10.75		9.75	13.91	
	1140		10.98		9.95	14.17	
	1160		11.21		10.15	14.45	
	1180		11.43		10.36	14.72	
	1200		11.63		10.49	14.98	
	1220		11.87		10.75	15.26	
	1240		12.10		10.95	15.53	
	1260		12.33		11.15	15.81	
	1280		12.55		11.35	16.08	
	1300		12.75		11.55	16.34	
	1320		12.98		11.75	16.62	
	1340		13.21		11.95	16.90	
	1360		13.42		12.15	17.17	
	1380		13.65		12.35	17.43	
	1400		13.87		12.54	17.70	
	1420					17.98	
	1440					18.25	
	1460					18.52	
	1480					18.80	
	1500					19.07	

From the Piping Handbook
by Sabin Crocker,
McGraw-Hill Publishing Co.
& Acme Paper No. 53-A-52, 1954

The first step in the selection of an expansion joints is to compute the exact change in the linear dimensions of the piping system; the next is to consider a safety factor. The actual expansion of a 100-foot length of pipe has been computed at different temperatures for various materials commonly used in piping.

Given:

150-foot-long, 6" diameter steel steam line
Maximum steam temperature in service.....380°F
Minimum winter temperature to be
encountered15°F

Calculated Traverse:

From the Table, the expansion of carbon steel pipe at:

380°F.....3.060 in. per 100ft. of pipe.
15°F......111 in. per 100ft. of pipe.
Difference2.949 in. per 100ft. of pipe.

For 150 feet of pipe the expansion is proportionately larger.

Thus, Calculated Traverse = $\frac{150}{100} \times 2.949" = 4.42"$

