

# THERMAL MOVEMENTS

## THERMAL MOVEMENTS IN INCHES PER 100 FEET

Examples:

A 3" steel pipe line is 138 feet long. Maximum temperature the line will encounter is 450°F. Lowest temperature is 100°F.

Calculation:

From the chart - the expansion of steel pipe at:  
450°F      3.16 inches per 100 feet of pipe

100°F      .22 inches per 100 feet of pipe

Difference 2.94 inches per 100 feet of pipe

$$\frac{138}{100} \times 2.94 = 4.06'' \text{ total change in length}$$

A 4" stainless steel line is 50 feet long. Maximum temperature the line will encounter is 575°F. Lowest temperature is -175°F.

Calculation:

From the chart - the expansion of stainless steel pipe at:  
575°F      5.93 inches per 100 feet pipe

-175°F      2.49 inches per 100 feet of pipe (contraction)

Total 8.42 inches per 100 feet of pipe

$$\frac{50}{100} \times 8.42 = 4.21'' \text{ total change in length}$$

Thermal expansion of pipe data by permission of Expansion Joint Manufacturers Association, Inc.

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Saturated Steam Pressure	Temp. Degrees F.	Carbon C Mo. 3Cr Mo Steel	Austen. Stainl. Steel	Monel	Inconel	25Cr 20Ni	Aluminum	Wrought Iron	70Cu 30Ni
VACUUM, INCHES OF HG	-325	-2.37	-3.85	-2.62		-3.00	-4.69	-2.70	-3.15
	-300	-2.24	-3.62	-2.50		-2.83	-4.43	-2.55	-2.98
	-275	-2.11	-3.40	-2.38		-2.66	-4.17	-2.41	-2.81
	-250	-1.98	-3.17	-2.26	-2.30	-2.49	-3.91	-2.26	-2.63
	-225	-1.84	-2.95	-2.14	-2.17	-2.32	-3.66	-2.11	-2.46
	-200	-1.71	-2.72	-2.03	-2.04	-2.15	-3.40	-1.96	-2.29
	-175	-1.58	-2.49	-1.91	-1.87	-1.98	-3.14	-1.82	-2.12
	-150	-1.45	-2.27	-1.79	-1.70	-1.81	-2.88	-1.67	-1.95
	-125	-1.30	-2.01	-1.59	-1.54	-1.60	-2.58	-1.49	-1.76
	-100	-1.15	-1.75	-1.38	-1.37	-1.39	-2.27	-1.32	-1.55
	-75	-1.00	-1.50	-1.18	-1.17	-1.19	-1.97	-1.14	-1.34
	-50	-0.84	-1.24	-0.98	-0.97	-0.98	-1.67	-0.96	-1.12
-25	-0.67	-0.98	-0.77	-0.76	-0.76	-1.32	-0.77	-0.90	
0	-0.50	-0.72	-0.57	-0.56	-0.57	-0.97	-0.57	-0.67	
25	-0.32	-0.46	-0.37	-0.36	-0.37	-0.63	-0.37	-0.43	
PRESSURE PSI GAUGE	50	-0.14	-0.21	-0.16	-0.16	-0.16	-0.28	0.17	-0.19
	70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100	0.22	0.33	0.27	0.26	0.27	0.45	0.25	0.30
	125	0.41	0.61	0.50	0.48	0.50	0.83	0.47	0.55
	150	0.60	0.89	0.74	0.70	0.73	1.22	0.69	0.81
	175	0.80	1.17	0.98	0.93	0.97	1.61	0.91	1.07
	200	1.00	1.46	1.22	1.15	1.21	2.00	1.14	1.33
	225	1.20	1.74	1.47	1.39	1.45	2.42	1.37	1.60
	250	1.40	2.03	1.71	1.63	1.69	2.83	1.60	1.86
	275	1.61	2.32	1.96	1.86	1.94	3.25	1.83	2.13
	300	1.82	2.61	2.21	2.10	2.19	3.67	2.06	2.40
	325	2.04	2.91	2.47	2.34	2.44	4.09	2.30	2.68
PRESSURE PSI GAUGE	350	2.25	3.20	2.72	2.57	2.69	4.52	2.54	2.96
	375	2.48	3.50	2.98	2.81	2.94	4.95	2.77	3.24
	400	2.70	3.80	3.25	3.05	3.20	5.39	3.01	3.52
	425	2.93	4.10	3.51	3.30	3.46	5.83	3.25	3.80
	450	3.16	4.40	3.78	3.54	3.72	6.27	3.50	4.08
	475	3.39	4.70	4.06	3.79	3.98	6.72	3.74	4.36
	500	3.62	5.01	4.33	4.03	4.24	7.17	3.99	4.64
	525	3.86	5.31	4.61	4.28	4.51	7.63	4.24	4.92
	550	4.10	5.62	4.89	4.53	4.78	8.09	4.50	5.20
	575	4.35	5.93	5.17	4.77	5.05	8.56	4.75	5.48
	600	4.60	6.24	5.46	5.02	5.33	9.03	5.01	5.76
	625	4.85	6.56	5.75	5.29	5.60		5.27	6.04
PRESSURE PSI GAUGE	650	5.11	6.87	6.04	5.54	5.88		5.53	6.32
	675	5.36	7.18	6.34	5.80	6.16		5.79	6.60
	700	5.62	7.50	6.64	6.06	6.44		6.06	6.88
	725	5.89	7.82	6.94	6.32	6.73		6.32	7.16
	750	6.16	8.15	7.24	6.58	7.02		6.59	7.44
	775	6.43	8.47	7.54	6.84	7.31		6.85	7.72
	800	6.70	8.80	7.85	7.10	7.60		7.12	8.00
	825	6.97	9.13	8.16	7.38	7.89		7.40	8.28
	850	7.25	9.46	8.48	7.67	8.19		7.68	8.56
	875	7.53	9.79	8.80	7.95	8.48		7.97	8.84
	900	7.81	10.12	9.12	8.23	8.78		8.26	9.12
	925	8.08	10.46	9.44	8.52	9.07		8.53	9.40
PRESSURE PSI GAUGE	950	8.35	10.80	9.77	8.80	9.36		8.81	9.68
	975	8.62	11.14	10.09	9.09	9.66		9.08	9.96
	1000	8.89	11.48	10.42	9.37	9.95		9.36	10.24