

# Pressure Ratings of Steel Pipe

Based on ASTM A53 Grade B or A106 Grade B Seamless  
ANSI B31.1, 1977 with allowances for connections and fittings  
reduces these working pressures approx. 25%

PIPE		PRESSURE-PSI		WATER HAMMER FACTOR	PIPE		PRESSURE-PSI		WATER HAMMER FACTOR
NOM. SIZE INCHES	SCH. NO.	WORKING	BURST		NOM. SIZE INCHES	SCH. NO.	WORKING	BURST	
1/8	40	3500	20,200	63.4	2 1/2	160	4200	15,700	5.43
1/8	80	4800	28,000		2 1/2	XXS	6900	23,000	7.82
1/4	40	2100	19,500		3	40	1600	7,400	2.60
1/4	80	4350	26,400		3	80	2600	10,300	2.92
3/8	40	1700	16,200		3	160	4100	15,000	3.56
3/8	80	3800	22,500		3	XXS	6100	20,500	4.64
1/2	40	2300	15,600		3 1/2	40	1500	6,800	1.94
1/2	80	4100	21,000		3 1/2	80	2400	9,500	2.17
1/2	160	7300	26,700		4	40	1400	6,300	1.51
1/2	XXS	12300	42,100		4	80	2300	9,000	1.67
3/4	40	2000	12,900	36.1	4	160	4000	14,200	2.08
3/4	80	3500	17,600	44.5	4	XXS	5300	18,000	2.47
3/4	169	8500	25,000		5	40	1300	5,500	.960
3/4	XXS	10000	35,000		5	80	2090	8,100	1.06
1	40	2100	12,100	22.3	5	160	3850	13,500	1.32
1	80	3500	15,900	26.8	5	XXS	4780	16,200	1.49
1	160	5700	22,300	36.9	6	40	1210	5,100	.666
1	XXS	9500	32,700	68.3	6	80	2070	7,800	.738
1 1/4	40	1800	10,100	12.9	6	160	3760	13,000	.912
1 1/4	80	3000	13,900	15.0	6	XXS	4660	15,000	1.02
1 1/4	160	4400	18,100	18.2	8	40	1100	4,500	.385
1 1/4	XXS	7900	27,700	30.5	8	80	1870	6,900	.422
1 1/2	40	1700	9,100	9.46	8	160	3700	12,600	.529
1 1/2	80	2800	12,600	10.9	8	XXS	3560	12,200	.519
1 1/2	160	4500	17,700	13.7	10	40	1030	4,100	.244
1 1/2	XXS	7200	25,300	20.3	10	*80	1800	6,600	
2	40	1500	7,800	5.74	10	160	3740	12,500	.340
2	80	2500	11,000	6.52	10	XXS	3300	11,200	
2	160	4600	17,500	8.60	12	@40	1000	3,800	
2	XXS	6300	22,100	10.9	12	**80	1800	6,500	
2 1/2	40	1900	8,500	4.02	12	160	3700	12,300	.239
2 1/2	80	2800	11,500	4.54	12	XXS	2700	9,400	

The allowable pressures were calculated by the formula in the Code for Pressure Piping, ASA B31.1-1955, Section 3, par. 324(a),

$$P = \frac{25(t-C)}{D-2y(t-C)}$$

where P = allowable pressure in lb per sq in. (gauge)  
 S = allowable working stress in lb per sq in.  
 D = outside diameter in inches  
 t = design thickness in inches, or 12 1/2% less than the nominal thickness shown in the table  
 C = allowance in inches for corrosion and/or mechanical strength (C=0.05" has been used above for all pipe sizes)  
 y = a coefficient having values for ferritic steels, as follows:

0.4 up to and including 900°F  
 0.5 for 950°F  
 0.7 for 1000°F and above

The allowable working stresses were obtained from the Code for Pressure Piping, ASA B31.1.1-1955, Table 12.

Hydraulic machinery piping is not covered by the Code for Pressure Piping, but it is current practice to use stresses comparable with those given for Refinery and Oil Transportation Piping, Div. A. The allowable working

pressures at 100°F tabulated above accordingly may be used, provided that water hammer or shock conditions are considered by reducing these values by the product of the flow rate in gallons per minute and the Water Hammer Factor tabulated above.

Thus if the flow rate is 100 gpm in a 2" extra strong line, the shock pressure created by water hammer is 100 x 6.52 = 652 lbs. per sq. in.; by deducting this from the value of 2500 lb per sq in. shown in the table the allowable static working pressure is found to be 1848 lb per sq in.

Burst pressures for pipe were calculated using formula

$$P = \frac{25t}{OD}$$

Where P = internal burst pressure, psig  
 S = allowable stress (60,000 psi)  
 OD = outside diameter of tube in inches  
 t = nominal wall thickness

NOTES: \*Not extra strong. Schedule 60 is extra strong in this size.

\*\* Not extra strong. Extra strong does not have a schedule number in this size! (ID of 12" XS is 11.75 Inches)

@ Not standard weight. Standard weight does not have a schedule number in this size! (ID of 12" Standard is 12.00 Inches).

# Steel Pipe- Size, Schedule and Flow Rates

## Standard Pipe - Schedule 40

PIPE SIZE	OD	WALL	ID	INT AREA	WT/ FT	GPM @ 2 FPS	GPM @ 5 FPS	GPM @ 10 FPS	GPM @ 15 FPS	GPM @ 20 FPS	GPM @ 25 FPS
1/8	.405	.068	.269	.057	.245	.35	.89	1.8	2.7	3.5	4.4
1/4	.540	.088	.364	.104	.425	.65	1.6	3.2	4.9	6.5	8.1
3/8	.675	.091	.493	.191	.567	1.2	3.0	6.0	9.0	12.0	15.0
1/2	.840	.109	.622	.304	.852	1.9	4.8	9.5	12.0	19.0	23.8
3/4	1.050	.113	.824	.533	1.132	3.3	8.4	16.7	25.1	33.4	41.8
1	1.315	.133	1.049	.864	1.679	5.4	13.5	27.0	40.6	54.1	67.7
1 1/4	1.660	.140	1.380	1.495	2.273	9.4	23.4	46.8	70.3	93.7	117
1 1/2	1.900	.145	1.610	2.036	2.718	12.7	31.9	63.7	95.6	127	159
2	2.375	.154	2.067	3.356	3.653	21.0	52.5	105	157	210	263
2 1/2	2.875	.203	2.469	4.788	5.793	30.0	75.0	150	225	300	375
3	3.500	.216	3.068	7.393	7.575	46.3	116	232	347	463	579
3 1/2	4.000	.226	3.548	9.886	9.109	61.9	155	310	465	619	774
4	4.500	.237	4.026	12.73	10.79	79.7	199	399	598	797	997
4 1/2	5.000	.247	4.506	15.95	12.54	99.9	250	499	749	998	1249
5	5.563	.258	5.047	20.01	14.62	125	313	627	940	1253	1567
6	6.625	.280	6.065	28.89	18.97	181	452	904	1357	1810	2262
7	7.625	.301	7.023	38.74	23.54	243	607	1213	1820	2427	3033
8	8.625	.322	7.981	50.03	28.55	313	783	1567	2350	3134	3917
10	10.75	.365	10.02	78.85	40.48	494	1235	2470	3705	4940	6175
12	12.75	.406	11.94	111.9	53.56	701	1753	3506	5259	7012	8765

## Extra Strong Pipe - XS - Schedule 80

WALL	ID	INT AREA	WT/ FT	GPM @ 2 FPS	GPM @ 5 FPS	GPM @ 10 FPS	GPM @ 15 FPS	GPM @ 20 FPS	GPM @ 25 FPS	PIPE SIZE
.095	.215	.036	.314	.23	.57	1.1	1.7	2.3	2.8	1/8
.119	.302	.072	.535	.45	1.1	2.2	3.4	4.5	5.6	1/4
.126	.423	.141	.738	.88	2.2	4.4	6.6	8.8	11.0	3/8
.147	.546	.234	1.087	1.5	3.7	7.3	11.0	14.7	18.3	1/2
.154	.742	.433	1.473	2.7	6.8	13.6	20.3	27.1	33.9	3/4
.179	.957	.719	2.171	4.5	11.3	22.5	33.8	45.0	56.3	1
.191	1.278	1.283	2.996	8.0	20.0	40.1	60.2	80.3	100	1 1/4
.200	1.500	1.767	3.631	11.1	27.7	55.3	83.0	110	138	1 1/2
.218	1.939	2.953	5.022	18.5	46.2	92.5	139	185	231	2
.276	2.323	4.238	7.661	26.5	66.4	133	199	265	332	2 1/2
.300	2.900	6.605	10.25	41.4	103	207	310	414	517	3
.318	3.364	8.888	12.50	55.7	139	278	418	557	696	3 1/2
.337	3.826	11.50	14.98	72.0	180	360	540	720	900	4
.355	4.290	14.45	17.61	90.5	226	453	679	905	1132	4 1/2
.375	4.813	18.19	20.78	114	285	570	855	1140	1425	5
.432	5.761	26.07	28.57	163	408	816	1225	1633	2041	6
.500	6.625	34.47	38.05	216	540	1080	1620	2160	2699	7
.500	7.625	45.66	43.39	286	715	1430	2145	2861	3576	8
.594	9.562	71.81	64.40	450	1125	2249	3374	4498	5623	10
.688	11.37	101.61	88.57	636	1591	3182	4774	6365	7956	12

## Schedule 160 Pipe

PIPE SIZE	OD	WALL	ID	INT AREA	WT/ FT	GPM @ 2 FPS	GPM @ 5 FPS	GPM @ 10 FPS	GPM @ 15 FPS	GPM @ 20 FPS	GPM @ 25 FPS
1/2	.840	.187	.466	1.71	1.310	1.07	2.67	5.34	8.01	10.7	13.4
3/4	1.050	.218	.587	.271	1.940	1.70	4.24	8.49	12.7	17.0	21.2
1"	1.315	.250	.815	.522	2.850	3.27	8.17	16.3	24.5	32.7	40.8
1 1/4	1.660	.250	1.160	1.060	3.764	6.62	16.6	33.1	49.7	66.2	82.8
1 1/2	1.900	.281	1.338	1.410	4.862	8.81	22.0	44.0	66.1	88.1	110
2	2.375	.343	1.689	2.241	7.450	14.0	35.1	70.2	105	140	175
2 1/2	2.875	.375	2.125	3.542	10.01	22.2	55.5	111	167	222	278
3	3.500	.437	2.626	5.416	14.30	33.9	84.8	170	254	339	424
4	4.500	.531	3.438	9.283	22.52	58.2	145	291	436	582	727
5	5.563	.625	4.313	14.61	33.0	91.5	229	458	686	915	1144
6	6.625	.718	5.189	21.15	45.30	132	331	662	994	1325	1656
8	8.625	.906	6.813	36.44	74.70	230	571	1142	1713	2384	2855
10	10.75	1.125	8.500	56.75	115.64	355	889	1777	2666	3555	4443
12	12.75	1.312	10.126	80.53	160.33	504	1261	2523	3784	5045	6306

## Double Extra Strong Pipe

WALL	ID	INT AREA	WT/ FT	GPM @ 2 FPS	GPM @ 5 FPS	GPM @ 10 FPS	GPM @ 15 FPS	GPM @ 20 FPS	GPM @ 25 FPS	PIPE SIZE
.294	.252	.050	1.714	.32	.79	1.6	2.4	3.1	3.9	1/2
.308	.434	.148	2.440	.93	2.3	4.6	6.9	9.2	11.6	3/4
.358	.599	.282	3.659	1.8	4.4	8.8	13.3	17.7	22.1	1"
.382	.896	.630	5.214	4.0	9.9	19.8	29.6	39.5	49.4	1 1/4
.400	1.100	.950	6.408	6.0	14.9	29.8	44.6	59.5	74.4	1 1/2
.436	1.503	1.774	9.029	11.1	27.9	55.6	83.4	111	139	2
.552	1.771	2.463	13.70	15.4	38.6	77.1	116	154	193	2 1/2
.600	2.300	4.154	18.58	26.0	65.1	130	195	260	325	3
.674	3.152	7.803	27.54	48.9	122	244	367	488	611	4
.750	4.063	12.97	38.55	81.2	203	406	609	812	1015	5
.864	4.897	18.83	53.16	118	295	590	885	1180	1475	6
.875	6.875	37.12	72.42	233	581	1163	1744	2325	2907	8
1.000	8.750	60.13	104.1	377	942	1883	2825	3767	4709	10
1.000	10.75	90.76	125.5	569	1421	2843	4264	5686	7107	12