

# 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                | 2½               | 160      | 4200         | 15,700 | 5.43                |
| 1/8              | 80       | 4800         | 28,000 |                     | 2½               | 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 |                     | 3½               | 40       | 1500         | 6,800  | 1.94                |
| 1/2              | 80       | 4100         | 21,000 |                     | 3½               | 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                |
| 1¼               | 40       | 1800         | 10,100 | 12.9                | 6                | 160      | 3760         | 13,000 | .912                |
| 1¼               | 80       | 3000         | 13,900 | 15.0                | 6                | XXS      | 4660         | 15,000 | 1.02                |
| 1¼               | 160      | 4400         | 18,100 | 18.2                | 8                | 40       | 1100         | 4,500  | .385                |
| 1¼               | XXS      | 7900         | 27,700 | 30.5                | 8                | 80       | 1870         | 6,900  | .422                |
| 1½               | 40       | 1700         | 9,100  | 9.46                | 8                | 160      | 3700         | 12,600 | .529                |
| 1½               | 80       | 2800         | 12,600 | 10.9                | 8                | XXS      | 3560         | 12,200 | .519                |
| 1½               | 160      | 4500         | 17,700 | 13.7                | 10               | 40       | 1030         | 4,100  | .244                |
| 1½               | 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  |                     |
| 2½               | 40       | 1900         | 8,500  | 4.02                | 12               | 160      | 3700         | 12,300 | .239                |
| 2½               | 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        |