FLUID POWER
Design Data Sheet

Revised Sheet 73 - Womack Design Data File

STEEL TUBING-PRESSURE AND FLOW RATINGS FOR HYDRAULIC PLUMBING

Pressure ratings are for annealed steel tubing "hydraulic grade" having a tensile strength of 55,000 PSI (the kind most often used for plumbing hydraulic systems). See notes on back for adjustment to other steels. Pressure ratings are shown for S.F. (safety factors) from 2 to 6. A factor of 4 is recommended for general service. On shockless systems a smaller factor is sometimes used.

GPM ratings are shown for flow velocities from 10 through 30 f/s (feet per second). A general guideline is to use 10 f/s on systems operating at a maximum pressure of 1,000 PSI; 15 f/s on systems having maximum pressures from 1,000 to 2,000 PSI; 20 f/s if system pressure is in the range of 2,000 to 3,500 PSI; and a velocity of 30 f/s on systems designed for pressures higher than 3,500 PSI.

	Wall, Inches	0.025	0.032	0.035	0.042	0.049	0.058	0.065	0.072	0.083	0.095	0.109
3/8" O.D. TUBING 55,000 PSI Tensile	Inside Area	0.0830	0.0760	0.0731	0.0665	0.0603	0.0527	0.0471	0.0419	0.0343	0.0269	0.0194
	PSI @ S.F. = 6	**1,220**	**1,560**	**1,710**	**2,050**	**2,400**	**2,840**	**3,180**	**3,520**	**4,060**	**4,640**	**5,330**
	PSI @ S.F. = 5	**1,470**	**1,880**	**2,050**	**2,460**	**2,880**	**3,400**	**3,800**	**4,220**	**4,870**	**5,570**	**6,390**
	PSI @ S.F. = 4	**1,830**	**2,350**	**2,570**	**3,080**	**3,590**	**4,250**	**4,770**	**5,280**	**7,300**	**6,970**	**7,990**
	PSI @ S.F. = 3	**2,440**	**3,150**	**3,420**	**4,100**	**4,790**	**5,670**	**6,350**	**7,040**	**8,120**	**9,290**	**10,650**
	PSI @ S.F. = 2	**3,670**	**4,690**	**5,130**	**6,160**	**7,190**	**8,500**	**9,530**	**10,550**	**12,150**	**13,900**	**16,000**
	GPM @ 10 f/s	*2.59*	*2.37*	*2.28*	*2.07*	*1.88*	*1.64*	*1.47*	*1.31*	*1.07*	*0.84*	*0.61*
	GPM @ 15 f/s	*3.88*	*3.55*	*3.42*	*3.11*	*2.82*	*2.46*	*2.20*	*1.96*	*1.60*	*1.26*	*0.91*
	GPM @ 20 f/s	*5.17*	*4.74*	*4.56*	*4.15*	*3.76*	*3.29*	*2.94*	*2.61*	*2.14*	*1.68*	*1.21*
	GPM @ 30 f/s	*7.76*	*7.11*	*6.84*	*6.22*	*5.64*	*4.93*	*4.40*	*3.92*	*3.21*	*2.52*	*1.81*
1/2" O.D. TUBING 55,000 PSI Tensile	Inside Area	0.1590	0.1493	0.1452	0.1359	0.1269	0.1158	0.1075	0.0995	0.0876	0.0754	0.0625
	PSI @ S.F. = 6	**920**	**1,170**	**1,280**	**1,540**	**1,800**	**2,130**	**2,380**	**2,640**	**3,040**	**3,480**	**4,000**
	PSI @ S.F. = 5	**1,100**	**1,400**	**1,540**	**1,850**	**2,150**	**2,550**	**2,860**	**3,170**	**3,650**	**4,180**	**4,800**
	PSI @ S.F. = 4	**1,380**	**1,760**	**1,920**	**2,310**	**2,700**	**3,190**	**3,580**	**3,960**	**4,560**	**5,220**	**6,000**
	PSI @ S.F. = 3	**1,830**	**2,350**	**2,570**	**3,080**	**3,590**	**4,250**	**4,770**	**5,280**	**6,090**	**6,970**	**8,000**
	PSI @ S.F. = 2	**2,750**	**3,520**	**3,850**	**4,620**	**5,390**	**6,380**	**7,150**	**7,920**	**9,130**	**10,450**	**12,000**
	GPM @ 10 f/s	*4.96*	*4.65*	*4.53*	*4.24*	*3.96*	*3.61*	*3.35*	*3.10*	*2.73*	*2.35*	*1.95*
	GPM @ 15 f/s	*7.43*	*6.98*	*6.79*	*6.35*	*5.93*	*5.41*	*5.03*	*4.65*	*4.10*	*3.53*	*2.92*
	GPM @ 20 f/s	*9.91*	*9.31*	*9.05*	*8.47*	*7.91*	*7.22*	*6.70*	*6.20*	*5.46*	*4.70*	*3.90*
	GPM @ 30 f/s	*14.9*	*14.0*	*13.6*	*12.7*	*11.9*	*10.8*	*10.1*	*9.30*	*8.19*	*7.05*	*5.84*
5/8" O.D. TUBING 55,000 PSI Tensile	Inside Area	0.2597	0.2472	0.2419	0.2299	0.2181	0.2035	0.1924	0.1817	0.1655	0.1486	0.1301
	PSI @ S.F. = 6	**730**	**940**	**1,030**	**1,230**	**1,440**	**1,700**	**1,910**	**2,110**	**2,430**	**2,790**	**3,200**
	PSI @ S.F. = 5	**880**	**1,130**	**1,230**	**1,480**	**1,720**	**2,040**	**2,290**	**2,530**	**2,920**	**3,340**	**3,840**
	PSI @ S.F. = 4	**1,100**	**1,400**	**1,540**	**1,850**	**2,160**	**2,550**	**2,860**	**3,170**	**3,650**	**4,180**	**4,800**
	PSI @ S.F. = 3	**1,470**	**1,880**	**2,050**	**2,460**	**2,870**	**3,400**	**3,810**	**4,220**	**4,870**	**5,570**	**6,390**
	PSI @ S.F. = 2	**2,200**	**2,800**	**3,080**	**3,700**	**4,320**	**5,100**	**5,720**	**6,340**	**7,300**	**4,360**	**9,600**
	GPM @ 10 f/s	*8.10*	*7.71*	*7.54*	*7.17*	*6.80*	*6.34*	*6.00*	*5.66*	*5.16*	*4.63*	*4.06*
	GPM @ 15 f/s	*12.1*	*11.6*	*11.3*	*10.7*	*10.2*	*9.52*	*9.00*	*8.50*	*7.38*	*6.95*	*6.08*
	GPM @ 20 f/s	*16.2*	*15.4*	*15.1*	*14.3*	*13.6*	*12.7*	*12.0*	*11.3*	*10.3*	*9.26*	*8.11*
	GPM @ 30 f/s	*24.3*	*23.1*	*22.6*	*21.5*	*20.4*	*19.0*	*18.0*	*17.0*	*15.5*	*13.9*	*12.2*
3/4" O.D. TUBING 55,000 PSI Tensile	Inside Area	0.3848	0.3632	0.3632	0.3484	0.3339	0.3157	0.3019	0.2884	0.2679	0.2463	0.2223
	PSI @ S.F. = 6	**610**	**860**	**860**	**1,030**	**1,200**	**1,420**	**1,590**	**1,760**	**2,030**	**2,320**	**2,660**
	PSI @ S.F. = 5	**730**	**1,030**	**1,030**	**1,230**	**1,440**	**1,700**	**1,900**	**2,110**	**2,430**	**2,790**	**3,200**
	PSI @ S.F. = 4	**920**	**1,280**	**1,280**	**1,540**	**1,800**	**2,130**	**2,380**	**2,640**	**3,040**	**3,480**	**4,000**
	PSI @ S.F. = 3	**1,220**	**1,710**	**1,710**	**2,050**	**2,400**	**2,840**	**3,180**	**3,520**	**4,060**	**4,640**	**5,330**
	PSI @ S.F. = 2	**1,840**	**2,560**	**2,560**	**3,080**	**3,600**	**4,260**	**4,760**	**5,280**	**6,080**	**6,960**	**8,000**
	GPM @ 10 f/s	*12.0*	*11.3*	*11.3*	*10.9*	*10.4*	*9.84*	*9.41*	*8.99*	*8.35*	*7.68*	*6.93*
	GPM @ 15 f/s	*18.0*	*17.0*	*17.0*	*16.3*	*15.6*	*14.8*	*14.1*	*13.5*	*12.5*	*11.5*	*10.4*
	GPM @ 20 f/s	*24.0*	*22.6*	*22.6*	*21.7*	*20.8*	*19.7*	*18.8*	*18.0*	*16.7*	*15.4*	*13.9*
	GPM @ 30 f/s	*36.0*	*34.0*	*34.0*	*32.6*	*31.6*	*29.5*	*28.2*	*27.0*	*25.1*	*23.0*	*20.8*

	Wall, Inches	0.025	0.032	0.035	0.042	0.049	0.058	0.065	0.072	0.083	0.095	0.109
7/8″ O.D. TUBING 55,000 PSI Tensile	Inside Area	0.5346	0.5166	0.5090	0.4914	0.4742	0.4525	0.4359	0.4197	0.3948	0.3685	0.3390
	PSI @ S.F. = 6	**520**	**670**	**730**	**880**	**1,030**	**1,210**	**1,360**	**1,500**	**1,740**	**1,990**	**2,280**
	PSI @ S.F. = 5	**630**	**800**	**880**	**1,060**	**1,230**	**1,460**	**1,630**	**1,810**	**2,090**	**2,390**	**2,740**
	PSI @ S.F. = 4	**790**	**1,000**	**1,100**	**1,320**	**1,540**	**1,820**	**2,040**	**2,260**	**2,600**	**2,990**	**3,420**
	PSI @ S.F. = 3	**1,050**	**1,340**	**1,470**	**1,760**	**2,050**	**2,430**	**2,720**	**3,020**	**3,480**	**3,980**	**4,570**
	PSI @ S.F. = 2	**1,580**	**2,000**	**2,200**	**2,640**	**3,080**	**3,640**	**4,080**	**4,520**	**5,200**	**5,980**	**6,840**
	GPM @ 10 f/s	*16.7*	*16.1*	*15.9*	*15.3*	*14.8*	*14.1*	*13.6*	*13.1*	*12.3*	*11.5*	*10.6*
	GPM @ 15 f/s	*25.0*	*24.2*	*23.8*	*23.0*	*22.2*	*21.2*	*20.4*	*19.6*	*18.5*	*17.2*	*15.9*
	GPM @ 20 f/s	*33.3*	*32.2*	*31.7*	*30.6*	*29.6*	*28.2*	*27.2*	*26.2*	*24.6*	*23.0*	*21.1*
	GPM @ 30 f/s	*50.0*	*48.3*	*47.6*	*46.0*	*44.3*	*42.3*	*40.8*	*39.2*	*36.9*	*34.5*	*31.7*
1″ O.D. TUBING 55,000 PSI Tensile	Inside Area	0.7088	0.6881	0.6793	0.6590	0.6390	0.6138	0.5945	0.5755	0.5463	0.5153	0.4803
	PSI @ S.F. = 6	**460**	**590**	**640**	**770**	**900**	**1,060**	**1,190**	**1,320**	**1,520**	**1,740**	**2,000**
	PSI @ S.F. = 5	**550**	**700**	**770**	**920**	**1,080**	**1,280**	**1,430**	**1,580**	**1,830**	**2,090**	**2,400**
	PSI @ S.F. = 4	**690**	**880**	**960**	**1,150**	**1,350**	**1,590**	**1,790**	**4,980**	**2,280**	**2,610**	**3,000**
	PSI @ S.F. = 3	**920**	**1,170**	**1,280**	**1,540**	**1,800**	**2,130**	**2,380**	**2,640**	**3,040**	**3,480**	**4,000**
	PSI @ S.F. = 2	**1,380**	**1,760**	**1,920**	**2,300**	**2,700**	**3,180**	**3,580**	**3,960**	**4,560**	**5,220**	**6,000**
	GPM @ 10 f/s	*22.1*	*21.4*	*21.2*	*20.5*	*19.9*	*19.1*	*18.5*	*17.9*	*17.0*	*16.1*	*15.0*
	GPM @ 15 f/s	*33.1*	*32.2*	*31.8*	*30.8*	*29.9*	*28.7*	*27.8*	*26.9*	*25.5*	*24.1*	*22.5*
	GPM @ 20 f/s	*44.2*	*42.9*	*42.4*	*41.1*	*39.8*	*38.3*	*37.1*	*35.9*	*34.1*	*32.1*	*29.9*
	GPM @ 30 f/s	*66.3*	*64.3*	*63.5*	*61.6*	*59.8*	*57.4*	*55.6*	*53.8*	*51.1*	*48.2*	*44.9*
1¼″ O.D. TUBING 55,000 PSI Tensile	Inside Area	1.131	1.105	1.094	1.068	1.042	1.010	0.9852	0.967	0.9229	0.8825	0.8365
	PSI @ S.F. = 6	**365**	**470**	**515**	**615**	**720**	**850**	**950**	**1,060**	**1,220**	**1,390**	**1,600**
	PSI @ S.F. = 5	**440**	**560**	**610**	**740**	**860**	**1,020**	**1,140**	**1,270**	**1,460**	**1,670**	**1,920**
	PSI @ S.F. = 4	**550**	**700**	**770**	**920**	**1,080**	**1,280**	**1,430**	**1,580**	**1,820**	**2,090**	**2,400**
	PSI @ S.F. = 3	**730**	**940**	**1,030**	**1,230**	**1,440**	**1,700**	**1,900**	**2,110**	**2,430**	**2,790**	**3,200**
	PSI @ S.F. = 2	**1,100**	**1,400**	**1,540**	**1,840**	**2,160**	**2,560**	**2,860**	**3,160**	**3,640**	**4,180**	**4,800**
	GPM @ 10 f/s	*35.3*	*34.4*	*34.1*	*33.3*	*32.5*	*31.5*	*30.7*	*29.9*	*28.8*	*27.5*	*26.1*
	GPM @ 15 f/s	*52.9*	*51.7*	*51.2*	*49.9*	*48.7*	*47.2*	*46.1*	*44.9*	*43.2*	*41.3*	*39.1*
	GPM @ 20 f/s	*70.5*	*68.9*	*68.2*	*66.6*	*65.0*	*63.0*	*61.4*	*59.9*	*57.5*	*55.0*	*52.2*
	GPM @ 30 f/s	*106*	*103*	*102*	*100*	*97.4*	*94.5*	*92.1*	*89.8*	*86.3*	*85.5*	*78.1*
1½″ O.D. TUBING 55,000 PSI Tensile	Inside Area	1.651	1.612	1.606	1.575	1.544	1.504	1.474	1.444	1.398	1.348	1.291
	PSI @ S.F. = 6	**305**	**390**	**430**	**515**	**600**	**710**	**795**	**880**	**1,014**	**1,161**	**1,332**
	PSI @ S.F. = 5	**370**	**470**	**510**	**610**	**720**	**850**	**950**	**1,050**	**1,210**	**1,390**	**1,600**
	PSI @ S.F. = 4	**460**	**590**	**640**	**770**	**900**	**1,060**	**1,190**	**1,320**	**1,520**	**1,740**	**2,000**
	PSI @ S.F. = 3	**610**	**780**	**850**	**1,030**	**1,200**	**1,420**	**1,590**	**1,760**	**2,030**	**2,320**	**2,660**
	PSI @ S.F. = 2	**920**	**1,180**	**1,280**	**1,540**	**1,800**	**2,120**	**2,380**	**2,640**	**3,040**	**3,480**	**4,000**
	GPM @ 10 f/s	*51.5*	*50.2*	*50.1*	*49.1*	*48.1*	*46.9*	*45.9*	*45.0*	*43.6*	*42.0*	*40.2*
	GPM @ 15 f/s	*77.2*	*75.4*	*75.1*	*73.6*	*72.2*	*70.3*	*68.9*	*67.5*	*65.4*	*63.0*	*60.4*
	GPM @ 20 f/s	*103*	*101*	*100*	*98.2*	*96.3*	*93.8*	*91.9*	*90.0*	*87.2*	*84.0*	*80.5*
	GPM @ 30 f/s	*154*	*151*	*150*	*147*	*144*	*141*	*138*	*135*	*131*	*126*	*121*
2″ O.D. TUBING 55,000 PSI Tensile	Inside Area	2.986	2.944	2.926	2.883	2.841	2.788	2.746	2.705	2.642	2.573	2.490
	PSI @ S.F. = 6	**230**	**295**	**320**	**385**	**450**	**530**	**595**	**660**	**760**	**870**	**1,000**
	PSI @ S.F. = 5	**270**	**350**	**390**	**460**	**540**	**640**	**710**	**790**	**910**	**1,040**	**1,200**
	PSI @ S.F. = 4	**340**	**440**	**480**	**580**	**670**	**800**	**890**	**990**	**1,140**	**1,300**	**1,500**
	PSI @ S.F. = 3	**460**	**590**	**640**	**770**	**900**	**1,060**	**1,190**	**1,320**	**1,520**	**1,740**	**2,000**
	PSI @ S.F. = 2	**680**	**880**	**960**	**1,160**	**1,340**	**1,600**	**1,780**	**1,980**	**2,280**	**2,600**	**3,000**
	GPM @ 10 f/s	*93.1*	*91.8*	*91.2*	*89.4*	*88.6*	*86.9*	*85.6*	*84.3*	*82.4*	*80.2*	*77.6*
	GPM @ 15 f/s	*139*	*138*	*137*	*135*	*133*	*130*	*128*	*126*	*123*	*120*	*116*
	GPM @ 20 f/s	*186*	*184*	*182*	*180*	*177*	*174*	*171*	*169*	*165*	*160*	*233*
	GPM @ 30 f/s	*279*	*275*	*274*	*270*	*266*	*261*	*257*	*253*	*247*	*241*	*233*

For steels with tensile strength other than 55,000 PSI, pressure ratings are proportional to tensile strength. Barlow's Formula was used for pressure calculations.

P = 2t × S ÷ 0

P = burst pressure, PSI;
t = wall thickness in inches;
S = tensile strength in PSI;
0 = outside diameter in inches.

The following formula was used for calculating flow capacity.

GPM = V × A ÷ 0.3208

V = velocity in feet per second;
A = inside area in square inches.

Published by:
WOMACK EDUCATIONAL PUBLICATIONS
Womack Machine Supply Co.
13835 Senlac Dr.
Farmers Branch, TX 75234
Tel: 800-859-9801 Fax: 214-630-5314
www.womack-educational.com