

Fluid Power Design Data Sheet



REVISED SHEET 73 - EVOLUTION 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 safety factors (SF) 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).

	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	1220	1560	1710	2050	2400	2840	3180	3520	4060	4640	5330
	PSI @ S.F. = 5	1470	1880	2050	2460	2880	3400	3800	4220	4870	5570	6390
	PSI @ S.F. = 4	1830	2350	2570	3080	3590	4250	4770	5280	7300	6970	7990
	PSI @ S.F. = 3	2440	3150	3420	4100	4790	5670	6350	7040	8120	9290	10,650
	PSI @ S.F. = 2	3670	4690	5130	6160	7190	8500	9530	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	1170	1280	1540	1800	2130	2380	2640	3040	3480	4000
	PSI @ S.F. = 5	1100	1400	1540	1850	2150	2550	2860	3170	3650	4180	4800
	PSI @ S.F. = 4	1380	1760	1920	2310	2700	3190	3580	3960	4560	5220	6000
	PSI @ S.F. = 3	1830	2350	2570	3080	3590	4250	4770	5280	6090	6970	8000
	PSI @ S.F. = 2	2750	3520	3850	4620	5390	6380	7150	7920	9130	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	1030	1230	1440	1700	1910	2110	2430	2790	3200
	PSI @ S.F. = 5	880	1130	1230	1480	1720	2040	2290	2530	2920	3340	3840
	PSI @ S.F. = 4	1100	1400	1540	1850	2160	2550	2860	3170	3650	4180	4800
	PSI @ S.F. = 3	1470	1880	2050	2460	2870	3400	3810	4220	4870	5570	6390
	PSI @ S.F. = 2	2200	2800	3080	3700	4320	5100	5720	6340	7300	8360	9600
	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	1030	1200	1420	1590	1760	2030	2320	2660
	PSI @ S.F. = 5	730	1030	1030	1230	1440	1700	1900	2110	2430	2790	3200
	PSI @ S.F. = 4	920	1280	1280	1540	1800	2130	2380	2640	3040	3480	4000
	PSI @ S.F. = 3	1220	1710	1710	2050	2400	2840	3180	3520	4060	4640	5330
	PSI @ S.F. = 2	1840	2560	2560	3080	3600	4260	4760	5280	6080	6960	8000
	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	1030	1210	1360	1500	1740	1990	2280
	PSI @ S.F. = 5	630	800	880	1060	1230	1460	1630	1810	2090	2390	2740
	PSI @ S.F. = 4	790	1000	1100	1320	1540	1820	2040	2260	2600	2990	3420
	PSI @ S.F. = 3	1050	1340	1470	1760	2050	2430	2720	3020	3480	3980	4570
	PSI @ S.F. = 2	1580	2000	2200	2640	3080	3640	4080	4520	5200	5980	6840
	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	1060	1190	1320	1520	1740	2000
	PSI @ S.F. = 5	550	700	770	920	1080	1280	1430	1580	1830	2090	2400
	PSI @ S.F. = 4	690	880	960	1150	1350	1590	1790	4980	2280	2610	3000
	PSI @ S.F. = 3	920	1170	1280	1540	1800	2130	2380	2640	3040	3480	4000
	PSI @ S.F. = 2	1380	1760	1920	2300	2700	3180	3580	3960	4560	5220	6000
	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
1 1/4" 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	1060	1220	1390	1600
	PSI @ S.F. = 5	440	560	610	740	860	1020	1140	1270	1460	1670	1920
	PSI @ S.F. = 4	550	700	770	920	1080	1280	1430	1580	1820	2090	2400
	PSI @ S.F. = 3	730	940	1030	1230	1440	1700	1900	2110	2430	2790	3200
	PSI @ S.F. = 2	1100	1400	1540	1840	2160	2560	2860	3160	3640	4180	4800
	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
1 1/2" 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	1014	1161	1332
	PSI @ S.F. = 5	370	470	510	610	720	850	950	1050	1210	1390	1600
	PSI @ S.F. = 4	460	590	640	770	900	1060	1190	1320	1520	1740	2000
	PSI @ S.F. = 3	610	780	850	1030	1200	1420	1590	1760	2030	2320	2660
	PSI @ S.F. = 2	920	1180	1280	1540	1800	2120	2380	2640	3040	3480	4000
	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

A general guideline is to use 10 f/s on systems operating at a maximum pressure of 1000 PSI; 15 f/s on systems having maximum pressures from 1000 to 2000 PSI; 20 f/s if system pressure is in the range of 2000 to 3500 PSI; and a velocity of 30 f/s on systems designed for pressures higher than 3500 PSI. 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.

$$P = 2t \times S \div O$$

P = burst pressure, PSI;

t = wall thickness in inches;

S = tensile strength in PSI;

O = outside diameter in inches.

The following formula was used for calculating flow capacity.

$$GPM = V \times A \div 0.3208$$

V = velocity in feet per second;

A = inside area in square inches.