

## PRESSURE LOSS TABLES

These tables may be used for sizing fluid passages between hydraulic components when flow rates are known. Tabulations are based on a hydraulic oil having a viscosity of 155 SUS (33.1CS) and a specific gravity of 1.0.

These pressure losses vary from the values in the tables with changes in temperature, viscosity, ID roughness and number of bends or fittings. It is suggested that values obtained from the tables be multiplied by a factor of two or three to provide an adequate safety margin.

These notes and formulae apply to the pressure loss charts for SAE Tubes, Hoses, and Pipe.

Flow is laminar if  $N_r < 2,000$

Flow is turbulent if  $N_r > 4,000$

Flow is transitional if  $N_r > 2,000 < 4,000$

To correct the pressure drop values for specific gravity other than 1.0, multiply the pressure drop values by the new specific gravity.

Corrections for viscosity changes may be made directly to all laminar flow pressure drop values by multiplying the values shown in the table by the ratio of  $\frac{\text{NEW VALUE (CS)}}{33.1}$

if the new value  $CS > 33.1$ . For new values below 33.1 CS, the Reynolds number ( $N_r$ ) may change to a value above 2,000, in which case a complete new calculation should be made. This condition of  $N_r > 2,000$  will most likely occur near the boundary that divides transitional and laminar flow sections of this table.

Correction for viscosity changes in the transitional and turbulent flow pressure drop values may be made by multiplying the values shown in the table by  $\sqrt[4]{\frac{\text{NEW VALUE CS}}{33.1}}$  if new value  $CS > 33.1$ .

$$\sqrt[4]{\frac{\text{NEW VALUE (CS)}}{33.1}}$$

If a correction is being made to the values near the boundary between transitional and laminar flow, a complete new calculation may be required if  $N_r$  has reduced below 2,000. If  $N_r$  falls below 2,000, recalculation both  $N_r$  and the pressure drop from the formulas shown below.

$$\Delta P = \frac{215 \times 10^{-4} (fpLQ^2)}{d^5}$$

Where :  $\Delta P$  = Pressure loss (PSIG/ft length)

$f$  = Friction factor of  $64/N_r$ , when  $N_r$  is less than 2,000 or  $f = 0.316/N_r^{0.25}$  for values  $N_r > 2,000$

$p$  = Density (62.4 lbs./ft<sup>3</sup>)

$L$  = 1 ft.

$$N_r = \frac{3162 \times Q}{\mu d}$$

Where:  $\mu$  = Viscosity in centistokes (33.1 cs)

$Q$  = Flow rate (GPM)

$d$  = ID (inches)

## PRESSURE LOSSES IN METRIC TUBES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (mm) x WALL (mm)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	1 FPS		2 FPS		3 FPS		4 FPS		5 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
4 x 0.75	0.157	0.098	0.030	0.008	2.291	0.024	4.582	0.047	6.874	0.071	9.165	0.094	11.456	0.118
4 x 1	0.157	0.079	0.039	0.005	3.526	0.015	7.052	0.031	10.578	0.046	14.104	0.061	17.630	0.076
6 x 1	0.236	0.157	0.040	0.019	0.893	0.060	1.785	0.121	2.678	0.181	3.571	0.241	4.464	0.302
6 x 1.5	0.236	0.118	0.059	0.011	1.580	0.034	3.161	0.068	4.741	0.102	6.322	0.136	7.902	0.170
6 x 2	0.236	0.079	0.079	0.005	3.526	0.015	7.052	0.031	10.578	0.046	14.104	0.061	17.630	0.076
6 x 2.5	0.236	0.059	0.089	0.003	6.322	0.009	12.643	0.017	18.965	0.026	25.286	0.034	31.608	0.043
8 x 1	0.315	0.236	0.040	0.044	0.395	0.136	0.790	0.273	1.185	0.409	1.580	0.545	1.975	0.682
8 x 1.5	0.315	0.197	0.059	0.030	0.567	0.095	1.134	0.190	1.701	0.285	2.268	0.380	2.835	0.475
8 x 2	0.315	0.157	0.079	0.019	0.893	0.060	1.785	0.121	2.678	0.181	3.571	0.241	4.464	0.302
8 x 2.5	0.315	0.118	0.099	0.011	1.580	0.034	3.161	0.068	4.741	0.102	6.322	0.136	7.902	0.170
10 x 1	0.394	0.315	0.040	0.078	0.222	0.243	0.444	0.486	0.665	0.729	0.887	0.972	1.109	1.215
10 x 1.5	0.394	0.276	0.059	0.060	0.289	0.186	0.578	0.373	0.867	0.559	1.155	0.746	1.444	0.932
10 x 2	0.394	0.236	0.079	0.044	0.395	0.136	0.790	0.273	1.185	0.409	1.580	0.545	1.975	0.682
10 x 2.5	0.394	0.197	0.099	0.030	0.567	0.095	1.134	0.190	1.701	0.285	2.268	0.380	2.835	0.475
10 x 3	0.394	0.157	0.119	0.019	0.893	0.060	1.785	0.121	2.678	0.181	3.571	0.241	4.464	0.302
12 x 1	0.472	0.394	0.039	0.122	0.142	0.380	0.284	0.760	0.425	1.140	0.567	1.520	0.709	1.900
12 x 1.5	0.472	0.354	0.059	0.098	0.176	0.307	0.351	0.614	0.527	0.920	0.702	1.227	0.878	1.534
12 x 2	0.472	0.315	0.079	0.078	0.222	0.243	0.444	0.486	0.665	0.729	0.887	0.972	1.109	1.215
12 x 2.5	0.472	0.276	0.098	0.060	0.289	0.186	0.578	0.373	0.867	0.559	1.155	0.746	1.444	0.932
12 x 3	0.472	0.236	0.118	0.044	0.395	0.136	0.790	0.273	1.185	0.409	1.580	0.545	1.975	0.682
12 x 3.5	0.472	0.197	0.138	0.030	0.567	0.095	1.134	0.190	1.701	0.285	2.268	0.380	2.835	0.475
15 x 1.5	0.591	0.472	0.060	0.175	0.099	0.545	0.198	1.091	0.296	1.636	0.395	2.182	0.494	2.727
15 x 2	0.591	0.433	0.079	0.147	0.117	0.459	0.235	0.918	0.352	1.377	0.469	1.836	0.587	2.295
15 x 2.5	0.591	0.394	0.099	0.122	0.142	0.380	0.284	0.760	0.425	1.140	0.567	1.520	0.709	1.900
15 x 3	0.591	0.354	0.119	0.098	0.176	0.307	0.351	0.614	0.527	0.920	0.702	1.227	0.878	1.534
16 x 2	0.63	0.472	0.079	0.175	0.099	0.545	0.198	1.091	0.296	1.636	0.395	2.182	0.494	2.727
16 x 2.5	0.63	0.433	0.099	0.147	0.117	0.459	0.235	0.918	0.352	1.377	0.469	1.836	0.587	2.295
16 x 3	0.63	0.394	0.118	0.122	0.142	0.380	0.284	0.760	0.425	1.140	0.567	1.520	0.709	1.900
18 x 1.5	0.709	0.591	0.059	0.274	0.063	0.855	0.126	1.710	0.189	2.565	0.252	3.421	0.315	4.276
18 x 2	0.709	0.551	0.079	0.238	0.072	0.743	0.145	1.487	0.217	2.230	0.290	2.973	0.362	3.716
18 x 2.5	0.709	0.512	0.099	0.206	0.084	0.642	0.168	1.284	0.252	1.925	0.336	2.567	0.420	3.209
18 x 3	0.709	0.472	0.119	0.175	0.099	0.545	0.198	1.091	0.296	1.636	0.395	2.182	0.494	2.727
20 x 2.5	0.787	0.591	0.098	0.274	0.063	0.855	0.126	1.710	0.189	2.565	0.252	3.421	0.315	4.276
20 x 3	0.787	0.551	0.118	0.238	0.072	0.743	0.145	1.487	0.217	2.230	0.290	2.973	0.362	3.716
20 x 3.5	0.787	0.512	0.138	0.206	0.084	0.642	0.168	1.284	0.252	1.925	0.336	2.567	0.420	3.209
20 x 4	0.787	0.472	0.158	0.175	0.099	0.545	0.198	1.091	0.296	1.636	0.395	2.182	0.494	2.727
22 x 2	0.866	0.709	0.079	0.395	0.044	1.231	0.088	2.461	0.131	3.692	0.175	4.923	0.219	6.153
22 x 2.5	0.866	0.669	0.099	0.352	0.049	1.096	0.098	2.191	0.148	3.287	0.197	4.383	0.246	5.479
22 x 3	0.866	0.63	0.118	0.312	0.055	0.972	0.111	1.943	0.166	2.915	0.222	3.887	0.277	4.859
25 x 2	0.984	0.827	0.079	0.537	0.032	1.674	0.064	3.349	0.097	5.023	0.129	6.698	0.161	8.372
25 x 2.5	0.984	0.787	0.099	0.486	0.036	1.516	0.071	3.033	0.107	4.549	0.142	6.065	0.178	7.582
25 x 3	0.984	0.748	0.118	0.439	0.039	1.370	0.079	2.740	0.118	4.109	0.157	5.479	0.197	6.849
25 x 4	0.984	0.669	0.158	0.352	0.049	1.096	0.098	2.191	0.148	3.287	0.197	4.383	0.246	5.479
25 x 4.5	0.984	0.63	0.177	0.312	0.055	0.972	0.111	1.943	0.166	2.915	0.222	3.887	0.277	4.859
25 x 5	0.984	0.591	0.197	0.274	0.063	0.855	0.126	1.710	0.189	2.565	0.252	3.421	0.315	4.276
28 x 2	1.102	0.945	0.079	0.701	0.025	2.186	0.049	4.373	0.074	6.559	0.099	8.745	0.123	10.932
28 x 2.5	1.102	0.906	0.098	0.645	0.027	2.010	0.054	4.019	0.080	6.029	0.107	8.038	0.134	10.048
28 x 3	1.102	0.866	0.118	0.589	0.029	1.836	0.059	3.672	0.088	5.508	0.117	7.344	0.147	9.180
28 x 4	1.102	0.787	0.158	0.486	0.036	1.516	0.071	3.033	0.107	4.549	0.142	6.065	0.178	7.582
28 x 5	1.102	0.709	0.197	0.395	0.044	1.231	0.088	2.461	0.131	3.692	0.175	4.923	0.219	6.153
30 x 3	1.181	0.945	0.118	0.701	0.025	2.186	0.049	4.373	0.074	6.559	0.099	8.745	0.123	10.932
30 x 4	1.181	0.866	0.158	0.589	0.029	1.836	0.059	3.672	0.088	5.508	0.117	7.344	0.147	9.180
30 x 5	1.181	0.787	0.197	0.486	0.036	1.516	0.071	3.033	0.107	4.549	0.142	6.065	0.178	7.582
35 x 2	1.378	1.22	0.079	1.169	0.015	3.644	0.030	7.288	0.044	10.932	0.059	14.576	0.074	18.220
35 x 2.5	1.378	1.181	0.098	1.095	0.016	3.415	0.032	6.829	0.047	10.244	0.063	13.659	0.079	17.074
35 x 3	1.378	1.142	0.118	1.024	0.017	3.193	0.034	6.386	0.051	9.579	0.067	12.772	0.084	15.965
35 x 4	1.378	1.063	0.158	0.887	0.019	2.766	0.039	5.533	0.058	8.299	0.078	11.066	0.097	13.832
35 x 5	1.378	0.984	0.197	0.760	0.023	2.371	0.045	4.741	0.068	7.112	0.091	9.482	0.114	11.853
35 x 6	1.378	0.906	0.236	0.645	0.027	2.010	0.054	4.019	0.080	6.029	0.107	8.038	0.134	10.048
38 x 4	1.496	1.181	0.158	1.095	0.016	3.415	0.032	6.829	0.047	10.244	0.063	13.659	0.079	17.074
38 x 5	1.496	1.102	0.197	0.954	0.018	2.973	0.036	5.946	0.054	8.919	0.072	11.893	0.091	14.866
38 x 6	1.496	1.024	0.236	0.824	0.021	2.567	0.042	5.134	0.063	7.702	0.084	10.269	0.105	12.836
38 x 7	1.496	0.945	0.276	0.701	0.025	2.186	0.049	4.373	0.074	6.559	0.099	8.745	0.123	10.932
42 x 3	1.654	1.417	0.119	1.577	0.011	4.916	0.022	9.832	0.033	14.747	0.044	19.663	0.055	24.579
42 x 4	1.654	1.339	0.158	1.408	0.012	4.390	0.025	8.779	0.037	13.169	0.049	17.558	0.061	21.948

INTAKE LINES
RETURN LINES
  


  


  
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FLOWS ARE LAMINAR

# PRESSURE LOSSES IN METRIC TUBES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (mm) x WALL (mm)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	10 FPS		15 FPS		20 FPS		25 FPS		30 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
					4 x 0.75	0.157	0.098	0.030	0.008	22.912	0.235	34.369	0.353	45.825
4 x 1	0.157	0.079	0.039	0.005	35.259	0.153	52.889	0.229	70.518	0.306	88.148	0.382	105.777	0.458
6 x 1	0.236	0.157	0.040	0.019	8.927	0.603	13.391	0.905	17.855	1.207	22.319	1.509	26.782	1.810
6 x 1.5	0.236	0.118	0.059	0.011	15.804	0.341	23.706	0.511	31.608	0.682	39.509	0.852	47.411	1.023
6 x 2	0.236	0.079	0.079	0.005	35.259	0.153	52.889	0.229	70.518	0.306	88.148	0.382	105.777	0.458
6 x 2.5	0.236	0.059	0.089	0.003	63.215	0.085	94.823	0.128	126.430	0.170	158.038	0.213	189.645	0.256
8 x 1	0.315	0.236	0.040	0.044	3.951	1.364	5.926	2.045	7.902	2.727	9.877	3.409	11.853	4.091
8 x 1.5	0.315	0.197	0.059	0.030	5.670	0.950	8.505	1.425	11.340	1.900	14.175	2.375	17.010	2.850
8 x 2	0.315	0.157	0.079	0.019	8.927	0.603	13.391	0.905	17.855	1.207	22.319	1.509	26.782	1.810
8 x 2.5	0.315	0.118	0.099	0.011	15.804	0.341	23.706	0.511	31.608	0.682	39.509	0.852	47.411	1.023
10 x 1	0.394	0.315	0.040	0.078	2.218	2.429	3.327	3.644	4.435	4.859	5.544	6.073	10.589	7.288
10 x 1.5	0.394	0.276	0.059	0.060	2.889	1.865	4.333	2.797	5.777	3.730	7.222	4.662	8.666	5.595
10 x 2	0.394	0.236	0.079	0.044	3.951	1.364	5.926	2.045	7.902	2.727	9.877	3.409	11.853	4.091
10 x 2.5	0.394	0.197	0.099	0.030	5.670	0.950	8.505	1.425	11.340	1.900	14.175	2.375	17.010	2.850
10 x 3	0.394	0.157	0.119	0.019	8.927	0.603	13.391	0.905	17.855	1.207	22.319	1.509	26.782	1.810
12 x 1	0.472	0.394	0.039	0.122	1.418	3.801	2.126	5.701	2.835	7.601	5.818	9.501	8.005	11.402
12 x 1.5	0.472	0.354	0.059	0.098	1.756	3.068	2.634	4.602	3.512	6.136	6.651	7.670	9.151	9.204
12 x 2	0.472	0.315	0.079	0.078	2.218	2.429	3.327	3.644	4.435	4.859	5.544	6.073	10.589	7.288
12 x 2.5	0.472	0.276	0.098	0.060	2.889	1.865	4.333	2.797	5.777	3.730	7.222	4.662	8.666	5.595
12 x 3	0.472	0.236	0.118	0.044	3.951	1.364	5.926	2.045	7.902	2.727	9.877	3.409	11.853	4.091
12 x 3.5	0.472	0.197	0.138	0.030	5.670	0.950	8.505	1.425	11.340	1.900	14.175	2.375	17.010	2.850
15 x 1.5	0.591	0.472	0.060	0.175	0.988	5.454	1.482	8.181	3.142	10.909	4.642	13.636	6.387	16.363
15 x 2	0.591	0.433	0.079	0.147	1.174	4.590	1.761	6.885	3.499	9.180	5.171	11.475	7.114	13.771
15 x 2.5	0.591	0.394	0.099	0.122	1.418	3.801	2.126	5.701	2.835	7.601	5.818	9.501	8.005	11.402
15 x 3	0.591	0.354	0.119	0.098	1.756	3.068	2.634	4.602	3.512	6.136	6.651	7.670	9.151	9.204
16 x 2	0.63	0.472	0.079	0.175	0.988	5.454	1.482	8.181	3.142	10.909	4.642	13.636	6.387	16.363
16 x 2.5	0.63	0.433	0.099	0.147	1.174	4.590	1.761	6.885	3.499	9.180	5.171	11.475	7.114	13.771
16 x 3	0.63	0.394	0.118	0.122	1.418	3.801	2.126	5.701	2.835	7.601	5.818	9.501	8.005	11.402
18 x 1.5	0.709	0.591	0.059	0.274	0.630	8.551	0.945	12.827	2.372	17.103	3.505	21.378	4.822	25.654
18 x 2	0.709	0.551	0.079	0.238	0.725	7.433	1.087	11.149	2.589	14.866	3.826	18.582	5.264	22.299
18 x 2.5	0.709	0.512	0.099	0.206	0.839	6.418	1.259	9.627	2.838	12.836	4.194	16.045	5.770	19.254
18 x 3	0.709	0.472	0.119	0.175	0.988	5.454	1.482	8.181	3.142	10.909	4.642	13.636	6.387	16.363
20 x 2.5	0.787	0.591	0.098	0.274	0.630	8.551	0.945	12.827	2.372	17.103	3.505	21.378	4.822	25.654
20 x 3	0.787	0.551	0.118	0.238	0.725	7.433	1.087	11.149	2.589	14.866	3.826	18.582	5.264	22.299
20 x 3.5	0.787	0.512	0.138	0.206	0.839	6.418	1.259	9.627	2.838	12.836	4.194	16.045	5.770	19.254
20 x 4	0.787	0.472	0.158	0.175	0.988	5.454	1.899	8.181	3.142	10.909	4.642	13.636	6.387	16.363
22 x 2	0.866	0.709	0.079	0.395	0.438	12.307	1.142	18.460	1.889	24.614	2.792	30.767	3.841	36.921
22 x 2.5	0.866	0.669	0.099	0.352	0.492	10.957	1.228	16.436	2.031	21.915	3.002	27.393	4.130	32.872
22 x 3	0.866	0.63	0.118	0.312	0.554	9.717	1.324	14.576	2.190	19.434	3.236	24.293	4.452	29.151
25 x 2	0.984	0.827	0.079	0.537	0.322	16.744	0.942	25.116	1.558	33.489	2.303	41.861	3.168	50.233
25 x 2.5	0.984	0.787	0.099	0.486	0.355	15.164	1.002	22.746	1.658	30.327	2.450	37.909	3.371	45.491
25 x 3	0.984	0.748	0.118	0.439	0.393	13.698	1.068	20.547	1.767	27.396	2.611	34.245	3.592	41.094
25 x 4	0.984	0.669	0.158	0.352	0.492	10.957	1.228	16.436	2.031	21.915	3.002	27.393	4.130	32.872
25 x 4.5	0.984	0.63	0.177	0.312	0.554	9.717	1.324	14.576	2.190	19.434	3.236	24.293	4.452	29.151
25 x 5	0.984	0.591	0.197	0.274	0.630	8.551	1.434	12.827	2.372	17.103	3.505	21.378	4.822	25.654
28 x 2	1.102	0.945	0.079	0.701	0.392	21.863	0.797	32.795	1.319	43.727	1.949	54.659	2.682	65.590
28 x 2.5	1.102	0.906	0.098	0.645	0.413	20.096	0.840	30.144	1.390	40.192	2.055	50.240	2.827	60.288
28 x 3	1.102	0.866	0.118	0.589	0.437	18.361	0.889	27.541	1.471	36.722	2.174	45.902	2.991	55.082
28 x 4	1.102	0.787	0.158	0.486	0.355	15.164	1.002	22.746	1.658	30.327	2.450	37.909	3.371	45.491
28 x 5	1.102	0.709	0.197	0.395	0.438	12.307	1.142	18.460	1.889	24.614	2.792	30.767	3.841	36.921
30 x 3	1.181	0.945	0.118	0.701	0.392	21.863	0.797	32.795	1.319	43.727	1.949	54.659	2.682	65.590
30 x 4	1.181	0.866	0.158	0.589	0.437	18.361	0.889	27.541	1.471	36.722	2.174	45.902	2.991	55.082
30 x 5	1.181	0.787	0.197	0.486	0.355	15.164	1.002	22.746	1.658	30.327	2.450	37.909	3.371	45.491
35 x 2	1.378	1.22	0.079	1.169	0.285	36.440	0.579	54.660	0.959	72.879	1.417	91.099	1.949	109.319
35 x 2.5	1.378	1.181	0.098	1.095	0.297	34.147	0.603	51.221	0.998	68.294	1.475	85.368	2.030	102.442
35 x 3	1.378	1.142	0.118	1.024	0.310	31.929	0.629	47.894	1.041	63.858	1.538	79.823	2.117	95.787
35 x 4	1.378	1.063	0.158	0.887	0.339	27.664	0.688	41.497	1.139	55.329	1.683	69.161	2.315	82.993
35 x 5	1.378	0.984	0.197	0.760	0.373	23.705	0.758	35.558	1.254	47.411	1.853	59.263	2.550	71.116
35 x 6	1.378	0.906	0.236	0.645	0.413	20.096	0.840	30.144	1.390	40.192	2.055	50.240	2.827	60.288
38 x 4	1.496	1.181	0.158	1.095	0.297	34.147	0.603	51.221	0.998	68.294	1.475	85.368	2.030	102.442
38 x 5	1.496	1.102	0.197	0.954	0.324	29.732	0.658	44.597	1.089	59.463	1.609	74.329	2.213	89.195
38 x 6	1.496	1.024	0.236	0.824	0.355	25.672	0.721	38.508	1.193	51.343	1.763	64.179	2.426	77.015
38 x 7	1.496	0.945	0.276	0.701	0.392	21.863	0.797	32.795	1.319	43.727	1.949	54.659	2.682	65.590
42 x 3	1.654	1.417	0.119	1.577	0.236	49.158	0.481	73.737	0.795	98.316	1.175	122.895	1.616	147.474
42 x 4	1.654	1.339	0.158	1.408	0.254	43.895	0.516	65.843	0.853	87.790	1.261	109.738	1.735	131.685

RETURN LINES
HIGH PRESSURE LINES  
TRANSITIONAL
<===== FLOWS ARE TURBULENT =====>

## PRESSURE LOSSES IN SAE TUBES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	1 FPS		2 FPS		3 FPS		4 FPS		5 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
.125 x .028	0.125	0.069	0.028	0.004	4.622	0.012	9.244	0.023	13.866	0.035	18.488	0.047	23.110	0.058
.125 x .035	0.125	0.055	0.035	0.002	7.274	0.007	14.549	0.015	21.823	0.022	29.098	0.030	36.372	0.037
.188 x .028	0.188	0.132	0.028	0.014	1.263	0.043	2.526	0.085	3.789	0.128	5.052	0.171	6.315	0.213
.188 x .035	0.188	0.118	0.035	0.011	1.580	0.034	3.161	0.068	4.741	0.102	6.322	0.136	7.902	0.170
.250 x .028	0.250	0.194	0.028	0.030	0.585	0.092	1.169	0.184	1.754	0.276	2.339	0.369	2.923	0.461
.250 x .035	0.250	0.180	0.035	0.025	0.679	0.079	1.358	0.159	2.038	0.238	2.717	0.317	3.396	0.397
.250 x .049	0.250	0.152	0.049	0.018	0.952	0.057	1.905	0.113	2.857	0.170	3.810	0.226	4.762	0.283
.250 x .065	0.250	0.120	0.065	0.011	1.528	0.035	3.056	0.071	4.584	0.106	6.113	0.141	7.641	0.176
.312 x .028	0.312	0.256	0.028	0.051	0.336	0.160	0.672	0.321	1.007	0.481	1.343	0.642	1.679	0.802
.312 x .035	0.312	0.242	0.035	0.046	0.376	0.143	0.751	0.287	1.127	0.430	1.503	0.574	1.879	0.717
.312 x .049	0.312	0.214	0.049	0.036	0.481	0.112	0.961	0.224	1.442	0.336	1.922	0.448	2.403	0.561
.312 x .065	0.312	0.182	0.065	0.026	0.664	0.081	1.329	0.162	1.993	0.243	2.657	0.324	3.322	0.405
.375 x .028	0.375	0.319	0.028	0.080	0.216	0.249	0.432	0.498	0.649	0.747	0.865	0.997	1.081	1.246
.375 x .035	0.375	0.305	0.035	0.073	0.237	0.228	0.473	0.455	0.710	0.683	0.946	0.911	1.183	1.139
.375 x .049	0.375	0.277	0.049	0.060	0.287	0.188	0.574	0.376	0.860	0.564	1.147	0.751	1.434	0.939
.375 x .065	0.375	0.245	0.065	0.047	0.367	0.147	0.733	0.294	1.100	0.441	1.466	0.588	1.833	0.735
.500 x .035	0.500	0.430	0.035	0.145	0.119	0.453	0.238	0.905	0.357	1.358	0.476	1.811	0.595	2.263
.500 x .049	0.500	0.402	0.049	0.127	0.136	0.396	0.272	0.791	0.409	1.187	0.545	1.583	0.681	1.978
.500 x .065	0.500	0.370	0.065	0.108	0.161	0.335	0.321	0.670	0.482	1.005	0.643	1.341	0.804	1.676
.500 x .083	0.500	0.334	0.083	0.088	0.197	0.273	0.395	0.546	0.592	0.819	0.789	1.092	0.986	1.366
.625 x .035	0.625	0.555	0.035	0.242	0.071	0.754	0.143	1.508	0.214	2.262	0.286	3.016	0.357	3.771
.625 x .049	0.625	0.527	0.049	0.218	0.079	0.680	0.158	1.360	0.238	2.040	0.317	2.720	0.396	3.400
.625 x .065	0.625	0.495	0.065	0.192	0.090	0.600	0.180	1.200	0.269	1.800	0.359	2.400	0.449	2.999
.625 x .083	0.625	0.459	0.083	0.165	0.104	0.516	0.209	1.032	0.313	1.547	0.418	2.063	0.522	2.579
.625 x .095	0.625	0.435	0.095	0.149	0.116	0.463	0.233	0.927	0.349	1.390	0.465	1.853	0.581	2.316
.750 x .035	0.750	0.680	0.035	0.363	0.048	1.132	0.095	2.264	0.143	3.396	0.190	4.528	0.238	5.660
.750 x .049	0.750	0.652	0.049	0.334	0.052	1.041	0.104	2.082	0.155	3.122	0.207	4.163	0.259	5.204
.750 x .065	0.750	0.620	0.065	0.302	0.057	0.941	0.114	1.882	0.172	2.823	0.229	3.764	0.286	4.706
.750 x .083	0.750	0.584	0.083	0.268	0.065	0.835	0.129	1.670	0.194	2.505	0.258	3.340	0.323	4.175
.750 x .095	0.750	0.560	0.095	0.246	0.070	0.768	0.140	1.536	0.211	2.303	0.281	3.071	0.351	3.839
.750 x .190	0.750	0.532	0.109	0.222	0.078	0.693	0.156	1.386	0.233	2.079	0.311	2.772	0.389	3.465
.875 x .035	0.875	0.805	0.035	0.509	0.034	1.587	0.068	3.173	0.102	4.760	0.136	6.346	0.170	7.933
.875 x .049	0.875	0.777	0.049	0.474	0.036	1.478	0.073	2.956	0.109	4.434	0.146	5.912	0.182	7.390
.875 x .065	0.875	0.745	0.065	0.436	0.040	1.359	0.079	2.718	0.119	4.077	0.159	5.435	0.198	6.794
.875 x .083	0.875	0.709	0.083	0.395	0.044	1.231	0.088	2.461	0.131	3.692	0.175	4.923	0.219	6.153
.875 x .095	0.875	0.685	0.095	0.369	0.047	1.149	0.094	2.298	0.141	3.446	0.188	4.595	0.234	5.744
.875 x .109	0.875	0.657	0.109	0.339	0.051	1.057	0.102	2.114	0.153	3.170	0.204	4.227	0.255	5.284
1.000 x .035	1.000	0.930	0.035	0.679	0.025	2.117	0.051	4.235	0.076	6.352	0.102	8.470	0.127	10.587
1.000 x .049	1.000	0.902	0.049	0.639	0.027	1.992	0.054	3.984	0.081	5.976	0.108	7.968	0.135	9.960
1.000 x .065	1.000	0.870	0.065	0.594	0.029	1.853	0.058	3.706	0.087	5.559	0.116	7.412	0.145	9.265
1.000 x .083	1.000	0.834	0.083	0.546	0.032	1.703	0.063	3.406	0.095	5.109	0.127	6.812	0.158	8.514
1.000 x .095	1.000	0.810	0.095	0.515	0.034	1.606	0.067	3.213	0.101	4.819	0.134	6.425	0.168	8.031
1.000 x .109	1.000	0.782	0.109	0.480	0.036	1.497	0.072	2.994	0.108	4.491	0.144	5.989	0.180	7.486
1.000 x .120	1.000	0.760	0.120	0.454	0.038	1.414	0.076	2.828	0.114	4.242	0.152	5.656	0.190	7.071
1.125 x .049	1.125	1.027	0.049	0.828	0.021	2.582	0.042	5.164	0.063	7.747	0.083	10.329	0.104	12.911
1.125 x .065	1.125	0.995	0.065	0.778	0.022	2.424	0.044	4.848	0.067	7.271	0.089	9.695	0.111	12.119
1.125 x .083	1.125	0.959	0.083	0.722	0.024	2.252	0.048	4.503	0.072	6.755	0.096	9.006	0.120	11.258
1.125 x .095	1.125	0.935	0.095	0.687	0.025	2.140	0.050	4.281	0.076	6.421	0.101	8.561	0.126	10.702
1.125 x .109	1.125	0.907	0.109	0.646	0.027	2.014	0.053	4.028	0.080	6.042	0.107	8.056	0.134	10.070
1.125 x .120	1.125	0.885	0.120	0.615	0.028	1.918	0.056	3.835	0.084	5.753	0.112	7.670	0.140	9.588
1.250 x .049	1.250	1.152	0.049	1.042	0.017	3.249	0.033	6.498	0.050	9.747	0.066	12.996	0.083	16.245
1.250 x .065	1.250	1.120	0.065	0.985	0.018	3.071	0.035	6.142	0.053	9.213	0.070	12.284	0.088	15.355
1.250 x .083	1.250	1.084	0.083	0.923	0.019	2.877	0.037	5.754	0.056	8.630	0.075	11.507	0.094	14.384
1.250 x .095	1.250	1.060	0.095	0.882	0.020	2.751	0.039	5.502	0.059	8.253	0.078	11.003	0.098	13.754
1.250 x .109	1.250	1.032	0.109	0.836	0.021	2.607	0.041	5.215	0.062	7.822	0.083	10.430	0.103	13.037
1.250 x .120	1.250	1.01	0.120	0.801	0.022	2.497	0.043	4.995	0.065	7.492	0.086	9.990	0.108	12.487
1.500 x .065	1.500	1.370	0.065	1.474	0.012	4.595	0.023	9.190	0.035	13.785	0.047	18.380	0.059	22.976
1.500 x .083	1.500	1.334	0.083	1.398	0.012	4.357	0.025	8.714	0.037	13.070	0.049	17.427	0.062	21.784
1.500 x .095	1.500	1.310	0.095	1.348	0.013	4.201	0.026	8.403	0.038	12.604	0.051	16.806	0.064	21.007
1.500 x .109	1.500	1.282	0.109	1.291	0.013	4.024	0.027	8.048	0.040	12.071	0.054	16.095	0.067	20.119
1.500 x .120	1.500	1.260	0.120	1.247	0.014	3.887	0.028	7.774	0.042	11.661	0.055	15.547	0.069	19.434
1.750 x .065	1.750	1.620	0.065	2.061	0.008	6.425	0.017	12.850	0.025	19.276	0.034	25.701	0.042	32.126
1.750 x .083	1.750	1.584	0.083	1.971	0.009	6.143	0.018	12.286	0.026	18.428	0.035	24.571	0.044	30.714
1.750 x .095	1.750	1.560	0.095	1.911	0.009	5.958	0.018	11.916	0.027	17.874	0.036	23.832	0.045	29.790
1.750 x .109	1.750	1.532	0.109	1.843	0.009	5.746	0.019	11.492	0.028	17.238	0.038	22.984	0.047	28.730
1.750 x .120	1.750	1.510	0.120	1.791	0.010	5.582	0.019	11.164	0.029	16.747	0.039	22.329	0.048	27.911
2.000 x .065	2.000	1.870	0.065	2.746	0.006	8.561	0.013	17.123	0.019	25.684	0.025	34.245	0.050	42.806
2.000 x .083	2.000	1.834	0.083	2.642	0.007	8.235	0.013	16.470	0.020	24.704	0.026	32.939	0.051	41.174
2.000 x .095	2.000	1.810	0.095	2.573	0.007	8.021	0.013	16.041	0.020	24.062	0.027	32.083	0.052	40.104
2.000 x .109	2.000	1.782	0.109	2.494	0.007	7.774	0.014	15.549	0.021	23.323	0.028	31.098	0.053	38.872
2.000 x .120	2.000	1.760	0.120	2.433	0.007	7.584	0.014	15.167	0.021	22.751	0.028	30.335	0.054	37.918
2.000 x .134	2.000	1.732	0.134	2.356	0.007	7.344	0.015	14.689	0.022	22.033	0.029	29.377	0.055	36.722
2.250 x .065	2.250	2.120	0.065	3.530	0.005	11.003	0.010	22.007	0.015	33.010	0.020	44.014	0.042	55.157
2.250 x .083	2.250	2.084	0.083	3.411	0.005	10.633	0.010	21.266	0.015	31.899	0.020	42.531	0.043	53.164
2.250 x .095	2.250	2.060	0.095	3.333	0.005	10.389	0.010	20.779	0.016	31.168	0.021			

# PRESSURE LOSSES IN SAE TUBES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (mm) x WALL (mm)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	10 FPS		15 FPS		20 FPS		25 FPS		30 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
.125 x .028	0.125	0.069	0.028	0.004	46.220	0.117	69.329	0.175	92.439	0.233	115.549	0.291	138.659	0.350
.125 x .035	0.125	0.055	0.035	0.002	72.744	0.074	109.116	0.111	145.489	0.148	181.861	0.185	218.233	0.222
.188 x .028	0.188	0.132	0.028	0.014	12.629	0.427	18.944	0.640	25.258	0.853	31.573	1.066	37.888	1.280
.188 x .035	0.188	0.118	0.035	0.011	15.804	0.341	23.706	0.511	31.608	0.682	39.509	0.852	47.411	1.023
.250 x .028	0.250	0.194	0.028	0.030	5.847	0.921	8.770	1.382	11.694	1.843	14.617	2.304	17.541	2.764
.250 x .035	0.250	0.180	0.035	0.025	6.792	0.793	10.188	1.190	13.583	1.586	16.979	1.983	20.375	2.380
.250 x .049	0.250	0.152	0.049	0.018	9.524	0.566	14.287	0.848	19.049	1.131	23.811	1.414	28.573	1.697
.250 x .065	0.250	0.120	0.065	0.011	15.281	0.353	22.922	0.529	30.563	0.705	38.203	0.881	45.844	1.058
.312 x .028	0.312	0.256	0.028	0.051	3.358	1.604	5.037	2.407	6.715	3.209	8.394	4.011	10.073	4.813
.312 x .035	0.312	0.242	0.035	0.046	3.757	1.434	5.636	2.151	7.515	2.868	9.394	3.584	11.272	4.301
.312 x .049	0.312	0.214	0.049	0.036	4.805	1.121	7.208	1.682	9.610	2.242	12.013	2.803	14.415	3.364
.312 x .065	0.312	0.182	0.065	0.026	6.643	0.811	9.965	1.216	13.287	1.622	16.608	2.027	19.930	2.433
.375 x .028	0.375	0.319	0.028	0.080	2.162	2.491	3.244	3.737	4.325	4.983	5.406	6.228	10.423	7.474
.375 x .035	0.375	0.305	0.035	0.073	2.366	2.277	3.548	3.416	4.731	4.555	5.914	5.694	11.025	6.832
.375 x .049	0.375	0.277	0.049	0.060	2.868	1.879	4.302	2.818	5.736	3.757	7.170	4.696	8.604	5.636
.375 x .065	0.375	0.245	0.065	0.047	3.666	1.470	5.499	2.204	7.332	2.939	9.165	3.674	10.998	4.409
.500 x .035	0.500	0.430	0.035	0.145	1.190	4.527	1.785	6.790	3.530	9.054	5.216	11.317	7.176	13.580
.500 x .049	0.500	0.402	0.049	0.127	1.362	3.956	2.043	5.935	2.723	7.913	5.674	9.891	7.806	11.869
.500 x .065	0.500	0.370	0.065	0.108	1.607	3.352	2.411	5.027	3.215	6.703	6.294	8.379	8.659	10.055
.500 x .083	0.500	0.334	0.083	0.088	1.973	2.731	2.959	4.097	3.945	5.462	4.931	6.828	9.841	8.193
.625 x .035	0.625	0.555	0.035	0.242	0.714	7.541	1.072	11.312	2.566	15.082	3.791	18.853	5.216	22.624
.625 x .049	0.625	0.527	0.049	0.218	0.792	6.799	1.188	10.199	2.737	13.599	4.045	16.999	5.565	20.398
.625 x .065	0.625	0.495	0.065	0.192	0.898	5.999	1.347	8.998	2.960	11.998	4.374	14.997	6.018	17.996
.625 x .083	0.625	0.459	0.083	0.165	1.044	5.158	1.567	7.737	3.253	10.316	4.807	12.895	6.614	15.474
.625 x .095	0.625	0.435	0.095	0.149	1.163	4.633	1.744	6.949	3.479	9.265	5.141	11.582	7.073	13.898
.750 x .035	0.750	0.680	0.035	0.363	0.476	11.321	1.203	16.981	1.990	22.641	2.941	28.302	4.047	33.962
.750 x .049	0.750	0.652	0.049	0.334	0.518	10.408	1.268	15.611	2.098	20.815	3.100	26.019	4.265	31.223
.750 x .065	0.750	0.620	0.065	0.302	0.572	9.411	1.350	14.117	2.234	18.822	3.301	23.528	4.542	28.233
.750 x .083	0.750	0.584	0.083	0.268	0.645	8.350	1.455	12.525	2.407	16.700	3.558	20.875	4.895	25.050
.750 x .095	0.750	0.560	0.095	0.246	0.702	7.678	1.053	11.517	2.537	15.355	3.749	19.194	5.158	23.033
.750 x .190	0.750	0.532	0.109	0.222	0.778	6.929	1.166	10.394	2.705	13.858	3.997	17.323	5.500	20.787
.875 x .035	0.875	0.805	0.035	0.509	0.340	15.865	0.974	23.798	1.612	31.730	2.382	39.663	3.277	47.596
.875 x .049	0.875	0.777	0.049	0.474	0.364	14.781	1.018	22.171	1.685	29.562	2.490	36.952	3.425	44.342
.875 x .065	0.875	0.745	0.065	0.436	0.396	13.588	1.073	20.383	1.776	27.177	2.624	33.971	3.610	40.765
.875 x .083	0.875	0.709	0.083	0.395	0.438	12.307	1.142	18.460	1.889	24.614	2.792	30.767	3.841	36.921
.875 x .095	0.875	0.685	0.095	0.369	0.469	11.488	1.192	17.232	1.972	22.976	2.914	28.719	4.010	34.463
.875 x .109	0.875	0.657	0.109	0.339	0.510	10.568	1.256	15.852	2.078	21.136	3.071	26.420	4.225	31.703
1.000 x .035	1.000	0.930	0.035	0.679	0.400	21.175	0.813	31.762	1.346	42.350	1.989	52.937	2.736	63.525
1.000 x .049	1.000	0.902	0.049	0.639	0.416	19.919	0.845	29.879	1.398	39.338	2.066	49.798	2.843	59.757
1.000 x .065	1.000	0.870	0.065	0.594	0.435	18.531	0.884	27.796	1.463	37.062	2.162	46.327	2.974	55.592
1.000 x .083	1.000	0.834	0.083	0.546	0.316	17.029	0.932	25.543	1.542	34.058	2.279	42.572	3.135	51.087
1.000 x .095	1.000	0.810	0.095	0.515	0.335	16.063	0.967	24.094	1.599	32.126	2.364	40.157	3.252	48.189
1.000 x .109	1.000	0.782	0.109	0.480	0.360	14.972	1.010	22.457	1.671	29.943	2.470	37.429	3.398	44.915
1.000 x .120	1.000	0.760	0.120	0.454	0.381	14.141	1.047	21.212	1.732	28.282	2.559	35.353	3.521	42.423
1.125 x .049	1.125	1.027	0.049	0.828	0.353	25.822	0.719	38.734	1.189	51.645	1.757	64.556	2.417	77.467
1.125 x .065	1.125	0.995	0.065	0.778	0.368	24.238	0.748	36.357	1.237	48.477	1.828	60.596	2.515	72.715
1.125 x .083	1.125	0.959	0.083	0.722	0.385	22.516	0.783	33.774	1.295	45.032	1.914	56.290	2.633	67.548
1.125 x .095	1.125	0.935	0.095	0.687	0.397	21.403	0.808	32.105	1.337	42.806	1.975	53.508	2.718	64.210
1.125 x .109	1.125	0.907	0.109	0.646	0.413	20.140	0.839	30.211	1.389	40.281	2.052	50.351	2.823	60.421
1.125 x .120	1.125	0.885	0.120	0.615	0.426	19.175	0.865	28.763	1.432	38.351	2.116	47.938	2.911	57.526
1.250 x .049	1.250	1.152	0.049	1.042	0.306	32.491	0.622	48.736	1.030	64.982	1.522	81.227	2.094	97.472
1.250 x .065	1.250	1.120	0.065	0.985	0.317	30.711	0.645	46.066	1.067	61.422	1.576	76.777	2.169	92.132
1.250 x .083	1.250	1.084	0.083	0.923	0.330	28.768	0.672	43.152	1.111	57.537	1.642	71.921	2.259	86.305
1.250 x .095	1.250	1.060	0.095	0.882	0.340	27.508	0.691	41.263	1.143	55.017	1.689	68.771	2.323	82.525
1.250 x .109	1.250	1.032	0.109	0.836	0.351	26.074	0.714	39.112	1.182	52.149	1.746	65.186	2.402	78.223
1.250 x .120	1.250	1.010	0.120	0.801	0.361	24.975	0.734	37.462	1.214	49.949	1.794	62.436	2.468	74.924
1.500 x .065	1.500	1.370	0.065	1.474	0.247	45.951	0.501	68.927	0.829	91.902	1.225	114.878	1.686	137.853
1.500 x .083	1.500	1.334	0.083	1.398	0.255	43.568	0.518	65.352	0.857	87.136	1.267	108.920	1.743	130.704
1.500 x .095	1.500	1.310	0.095	1.348	0.261	42.014	0.530	63.022	0.877	84.029	1.296	105.036	1.783	126.043
1.500 x .109	1.500	1.282	0.109	1.291	0.268	40.238	0.545	60.356	0.901	80.475	1.331	100.594	1.832	120.713
1.500 x .120	1.500	1.260	0.120	1.247	0.274	38.868	0.557	58.303	0.921	77.737	1.361	97.171	1.872	116.605
1.750 x .065	1.750	1.620	0.065	2.061	0.200	64.252	0.406	96.378	0.672	128.504	0.994	160.629	1.367	192.755
1.750 x .083	1.750	1.584	0.083	1.971	0.206	61.428	0.418	92.142	0.692	122.856	1.022	153.570	1.406	184.284
1.750 x .095	1.750	1.560	0.095	1.911	0.210	59.581	0.426	89.371	0.705	119.161	1.042	148.951	1.433	178.742
1.750 x .109	1.750	1.532	0.109	1.843	0.214	57.461	0.436	86.191	0.721	114.922	1.066	143.652	1.466	172.383
1.750 x .120	1.750	1.510	0.120	1.791	0.218	55.822	0.444	83.734	0.734	111.645	1.085	139.556	1.493	167.467
2.000 x .065	2.000	1.870	0.065	2.746	0.167	85.613	0.340	128.419	0.562	171.225	0.831	214.032	1.143	256.838
2.000 x .083	2.000	1.834	0.083	2.642	0.171	82.348	0.348	123.522	0.576	164.696	0.851	205.870	1.171	247.044
2.000 x .095	2.000	1.810	0.095	2.573	0.174	80.207	0.354	120.311	0.585	160.414	0.865	200.518	1.190	240.621
2.000 x .109	2.000	1.782	0.109	2.494	0.177	77.745	0.361	116.617	0.597	155.489	0.882	194.362	1.214	233.234
2.000 x .120	2.000	1.760	0.120	2.433	0.180	75.837	0.366	113.755	0.606	151.674	0.896	189.592	1.233	227.511
2.000 x .134	2.000	1.732	0.134	2.356	0.184	73.443	0.374	110.165	0.619	146.886	0.914	183.608	1.258	220.329
2.250 x .065	2.250	2.120	0.065	3.530	0.143	110.034	0.290	165.051	0.480	220.068	0.710	275.085	0.977	330.102
2.250 x .083</														

# PRESSURE LOSSES IN SMALL PIPES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	1 FPS		2 FPS		3 FPS		4 FPS		5 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
1/8-10S	0.405	0.307	0.049	0.074	0.233	0.231	0.467	0.461	0.700	0.692	0.934	0.923	1.167	1.154
1/8-40 & STD	0.405	0.269	0.068	0.057	0.304	0.177	0.608	0.354	0.912	0.531	1.216	0.709	1.521	0.886
1/8-80 & XS	0.405	0.215	0.095	0.036	0.476	0.113	0.952	0.226	1.428	0.340	1.904	0.453	2.380	0.566
1/4-10S	0.540	0.410	0.065	0.132	0.131	0.412	0.262	0.823	0.393	1.235	0.524	1.646	0.655	2.058
1/4-40 & STD	0.540	0.364	0.088	0.104	0.166	0.324	0.332	0.649	0.498	0.973	0.664	1.298	0.830	1.622
1/4-80 & XS	0.540	0.302	0.119	0.072	0.241	0.223	0.483	0.447	0.724	0.670	0.965	0.893	1.206	1.116
3/8-10S	0.675	0.545	0.065	0.233	0.074	0.727	0.148	1.454	0.222	2.182	0.296	2.909	0.370	3.636
3/8-40 & STD	0.675	0.493	0.091	0.191	0.091	0.595	0.181	1.190	0.272	1.785	0.362	2.380	0.453	2.975
3/8-80 & XS	0.675	0.423	0.126	0.141	0.123	0.438	0.246	0.876	0.369	1.314	0.492	1.752	0.615	2.190
1/2-5S	0.840	0.710	0.065	0.396	0.044	1.234	0.087	2.468	0.131	3.702	0.175	4.937	0.218	6.171
1/2-10S	0.840	0.674	0.083	0.357	0.048	1.112	0.097	2.224	0.145	3.337	0.194	4.449	0.242	5.561
1/2-40,40S & STD	0.840	0.622	0.109	0.304	0.057	0.947	0.114	1.894	0.171	2.842	0.228	3.789	0.284	4.736
1/2-80,80S & XS	0.840	0.546	0.147	0.234	0.074	0.730	0.148	1.460	0.221	2.190	0.295	2.919	0.369	3.649
1/2-160	0.840	0.466	0.187	0.171	0.101	0.532	0.203	1.063	0.304	1.595	0.405	2.127	0.507	2.658
1/2-XXS	0.840	0.252	0.294	0.050	0.347	0.155	0.693	0.311	1.040	0.466	1.386	0.622	1.733	0.777
3/4-5S	1.050	0.920	0.065	0.665	0.026	2.072	0.052	4.144	0.078	6.217	0.104	8.289	0.130	10.361
3/4-10S	1.050	0.884	0.083	0.614	0.028	1.913	0.056	3.826	0.084	5.740	0.113	7.653	0.141	9.566
3/4-40,40S & STD	1.050	0.824	0.113	0.533	0.032	1.662	0.065	3.325	0.097	4.987	0.130	6.649	0.162	8.312
3/4-80,80S & XS	1.050	0.742	0.154	0.432	0.040	1.348	0.080	2.696	0.120	4.044	0.160	5.392	0.200	6.740
3/4-160	1.050	0.614	0.218	0.296	0.058	0.923	0.117	1.846	0.175	2.769	0.233	3.692	0.292	4.615
3/4-XXS	1.050	0.434	0.308	0.148	0.117	0.461	0.234	0.922	0.350	1.383	0.467	1.845	0.584	2.306
1-5S	1.315	1.185	0.065	1.103	0.016	3.438	0.031	6.876	0.047	10.314	0.063	13.752	0.078	17.189
1-10S	1.315	1.097	0.109	0.945	0.018	2.946	0.037	5.892	0.055	8.839	0.073	11.785	0.091	14.731
1-40,40S & STD	1.315	1.049	0.133	0.864	0.020	2.694	0.040	5.388	0.060	8.082	0.080	10.776	0.100	13.470
1-80,80S & XS	1.315	0.957	0.179	0.719	0.024	2.242	0.048	4.484	0.072	6.727	0.096	8.969	0.120	11.211
1-160	1.315	0.815	0.250	0.522	0.033	1.626	0.066	3.252	0.099	4.879	0.133	6.505	0.166	8.131
1-XXS	1.315	0.599	0.358	0.282	0.061	0.878	0.123	1.757	0.184	2.635	0.245	3.514	0.307	4.392
1 1/4-5S	1.660	1.530	0.065	1.839	0.009	5.731	0.019	11.462	0.028	17.193	0.038	22.924	0.047	28.656
1 1/4-10S	1.660	1.442	0.109	1.633	0.011	5.091	0.021	10.182	0.032	15.272	0.042	20.363	0.053	25.454
1 1/4-40,40S & STD	1.660	1.380	0.140	1.496	0.012	4.662	0.023	9.325	0.035	13.987	0.046	18.650	0.058	23.312
1 1/4-80,80S & STD	1.660	1.278	0.191	1.283	0.013	3.999	0.027	7.997	0.040	11.996	0.054	15.995	0.067	19.993
1 1/4-160	1.660	1.160	0.250	1.057	0.016	3.294	0.033	6.589	0.049	9.883	0.065	13.177	0.082	16.472
1 1/4-XXS	1.660	0.896	0.382	0.631	0.027	1.965	0.055	3.931	0.082	5.896	0.110	7.862	0.137	9.827
1 1/2-5S	1.900	1.770	0.065	2.461	0.007	7.670	0.014	15.340	0.021	23.010	0.028	30.680	0.053	38.351
1 1/2-10S	1.900	1.682	0.109	2.222	0.008	6.926	0.016	13.853	0.023	20.779	0.031	27.706	0.039	34.632
1 1/2-40,40S & STD	1.900	1.610	0.145	2.036	0.008	6.346	0.017	12.692	0.025	19.038	0.034	25.384	0.042	31.730
1 1/2-80,80S & STD	1.900	1.500	0.200	1.767	0.010	5.509	0.020	11.017	0.029	16.526	0.039	22.034	0.049	27.543
1 1/2-160	1.900	1.338	0.281	1.406	0.012	4.383	0.025	8.766	0.037	13.149	0.049	17.532	0.061	21.915
1 1/2-XXS	1.900	1.100	0.400	0.950	0.018	2.962	0.036	5.925	0.055	8.887	0.073	11.850	0.091	14.812
2-5S	2.375	2.245	0.065	3.958	0.004	12.339	0.009	24.678	0.013	37.018	0.027	49.357	0.040	61.696
2-10S	2.375	2.157	0.109	3.654	0.005	11.391	0.009	22.782	0.014	34.172	0.028	45.563	0.042	56.954
2-40,40S & STD	2.375	2.067	0.154	3.356	0.005	10.460	0.010	20.920	0.015	31.380	0.021	41.840	0.044	52.301
2-80,80S & XS	2.375	1.939	0.218	2.953	0.006	9.205	0.012	18.409	0.018	27.614	0.023	36.819	0.047	46.024
2-160	2.375	1.687	0.344	2.235	0.008	6.968	0.015	13.935	0.023	20.903	0.031	27.871	0.039	34.838
2-XXS	2.375	1.503	0.436	1.774	0.010	5.531	0.019	11.061	0.029	16.592	0.039	22.122	0.049	27.653
2 1/2-5S	2.875	2.709	0.083	5.764	0.003	17.967	0.006	35.934	0.009	53.901	0.021	71.868	0.031	89.835
2 1/2-10S	2.875	2.635	0.120	5.453	0.003	16.999	0.006	33.997	0.010	50.996	0.022	67.995	0.032	84.994
2 1/2-40,40S & STD	2.875	2.469	0.203	4.788	0.004	14.924	0.007	29.849	0.011	44.773	0.024	59.698	0.035	74.622
2 1/2-80,80S & XS	2.875	2.323	0.276	4.238	0.004	13.212	0.008	26.423	0.012	39.635	0.026	52.846	0.038	66.058
2 1/2-160	2.875	2.125	0.375	3.547	0.005	11.055	0.010	22.111	0.015	33.166	0.019	44.221	0.042	55.277
2 1/2-XXS	2.875	1.771	0.552	2.463	0.007	7.679	0.014	15.358	0.021	23.036	0.028	30.715	0.053	38.394

<b>INTAKE LINES</b>	<b>RETURN LINES</b>
<===== FLOWS ARE LAMINAR =====>	
	<b>TRANSITIONAL</b>

# PRESSURE LOSSES IN SMALL PIPES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	10 FPS		15 FPS		20 FPS		25 FPS		30 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
1/8-10S	0.405	0.307	0.049	0.074	2.335	2.307	3.502	3.461	4.670	4.615	5.837	5.769	10.935	6.922
1/8-40 & STD	0.405	0.269	0.068	0.057	3.041	1.772	4.562	2.657	6.082	3.543	7.603	4.429	9.123	5.315
1/8-80 & XS	0.405	0.215	0.095	0.036	4.760	1.132	7.141	1.698	9.521	2.263	11.901	2.829	14.281	3.395
1/4-10S	0.540	0.410	0.065	0.132	1.309	4.116	1.964	6.173	2.618	8.231	5.536	10.289	7.617	12.347
1/4-40 & STD	0.540	0.364	0.088	0.104	1.661	3.244	2.491	4.866	3.322	6.488	6.424	8.110	8.838	9.731
1/4-80 & XS	0.540	0.302	0.119	0.072	2.413	2.233	3.619	3.349	4.825	4.466	6.032	5.582	11.162	6.699
3/8-10S	0.675	0.545	0.065	0.233	0.741	7.272	1.111	10.908	2.625	14.544	3.879	18.180	5.336	21.816
3/8-40 & STD	0.675	0.493	0.091	0.191	0.905	5.950	1.358	8.926	2.975	11.901	4.397	14.876	6.049	17.851
3/8-80 & XS	0.675	0.423	0.126	0.141	1.230	4.381	1.845	6.571	2.460	8.761	5.324	10.952	7.325	13.142
1/2-5S	0.840	0.710	0.065	0.396	0.437	12.342	1.140	18.512	1.886	24.683	2.787	30.854	3.834	37.025
1/2-10S	0.840	0.674	0.083	0.357	0.484	11.122	1.216	16.683	2.013	22.244	2.974	27.804	4.092	33.365
1/2-40,40S & STD	0.840	0.622	0.109	0.304	0.569	9.472	1.345	14.208	2.225	18.944	3.288	23.680	4.524	28.416
1/2-80,80S & XS	0.840	0.546	0.147	0.234	0.738	7.299	1.107	10.948	2.619	14.597	3.870	18.247	5.324	21.896
1/2-160	0.840	0.466	0.187	0.171	1.013	5.317	1.520	7.975	3.192	10.633	4.717	13.291	6.490	15.950
1/2-XXS	0.840	0.252	0.294	0.050	3.465	1.555	5.198	2.332	6.884	3.109	10.172	3.887	13.995	6.664
3/4-5S	1.050	0.920	0.065	0.665	0.406	20.722	0.825	31.083	1.364	41.444	2.016	51.805	2.773	62.166
3/4-10S	1.050	0.884	0.083	0.614	0.426	19.132	0.867	28.698	1.434	38.264	2.119	47.830	2.915	57.396
3/4-40,40S & STD	1.050	0.824	0.113	0.533	0.324	16.623	0.946	24.935	1.566	33.264	2.313	41.558	3.183	49.869
3/4-80,80S & XS	1.050	0.742	0.154	0.432	0.400	13.479	1.079	20.219	1.785	26.958	2.637	33.698	3.629	40.437
3/4-160	1.050	0.614	0.218	0.296	0.584	9.230	1.367	13.845	2.261	18.460	3.342	23.074	4.598	27.689
3/4-XXS	1.050	0.434	0.308	0.148	1.168	4.611	1.752	6.917	3.489	9.223	5.156	11.529	7.094	13.834
1-5S	1.315	1.185	0.065	1.103	0.296	34.379	0.601	51.568	0.994	68.758	1.469	85.947	2.021	103.137
1-10S	1.315	1.097	0.109	0.945	0.325	29.462	0.662	44.194	1.095	58.925	1.618	73.656	2.226	88.387
1-40,40S & STD	1.315	1.049	0.133	0.864	0.344	26.941	0.700	40.411	1.158	53.881	1.711	67.351	2.354	80.822
1-80,80S & XS	1.315	0.957	0.179	0.719	0.386	22.422	0.785	33.633	1.298	44.844	1.919	56.056	2.640	67.267
1-160	1.315	0.815	0.250	0.522	0.331	16.262	0.959	24.393	1.587	32.524	2.345	40.655	3.227	48.786
1-XXS	1.315	0.599	0.358	0.282	0.613	8.784	1.410	13.176	2.332	17.569	3.447	21.961	4.742	26.353
1 1/4-5S	1.660	1.530	0.065	1.839	0.215	57.311	0.437	85.967	0.722	114.622	1.067	143.278	1.468	171.933
1 1/4-10S	1.660	1.442	0.109	1.633	0.231	50.908	0.470	76.362	0.778	101.816	1.149	127.270	1.581	152.724
1 1/4-40,40S & STD	1.660	1.380	0.140	1.496	0.244	46.624	0.173	69.937	0.822	93.249	1.214	116.561	1.671	139.873
1 1/4-80,80S & STD	1.660	1.278	0.191	1.283	0.269	39.987	0.202	59.980	0.905	79.974	1.337	99.967	1.839	119.960
1 1/4-160	1.660	1.160	0.250	1.057	0.304	32.944	0.617	49.415	1.021	65.887	1.509	82.359	2.076	98.831
1 1/4-XXS	1.660	0.896	0.382	0.631	0.419	19.655	0.852	29.482	1.410	39.310	2.083	49.137	2.866	58.965
1 1/2-5S	1.900	1.770	0.065	2.461	0.179	76.701	0.364	115.052	0.602	153.402	0.890	191.753	1.224	230.103
1 1/2-10S	1.900	1.682	0.109	2.222	0.191	69.264	0.388	103.896	0.642	138.528	0.948	173.160	1.305	207.792
1 1/2-40,40S & STD	1.900	1.610	0.145	2.036	0.201	63.461	0.410	95.191	0.678	126.922	1.001	158.652	1.378	190.383
1 1/2-80,80S & STD	1.900	1.500	0.200	1.767	0.220	55.086	0.448	82.628	0.740	110.171	1.094	137.714	1.505	165.257
1 1/2-160	1.900	1.338	0.281	1.406	0.254	43.830	0.516	65.744	0.854	87.659	1.262	109.574	1.736	131.489
1 1/2-XXS	1.900	1.100	0.400	0.950	0.324	29.624	0.659	44.436	1.091	59.248	1.612	74.059	2.218	88.871
2-5S	2.375	2.245	0.065	3.958	0.133	123.392	0.270	185.088	0.447	246.784	0.661	308.481	0.909	370.177
2-10S	2.375	2.157	0.109	3.654	0.140	113.908	0.284	170.862	0.470	227.817	0.695	284.771	0.956	341.725
2-40,40S & STD	2.375	2.067	0.154	3.356	0.147	104.601	0.300	156.902	0.496	209.202	0.733	261.503	1.008	313.803
2-80,80S & XS	2.375	1.939	0.218	2.953	0.160	92.047	0.325	138.071	0.537	184.094	0.794	230.118	1.092	276.142
2-160	2.375	1.687	0.344	2.235	0.190	69.676	0.386	104.515	0.639	139.353	0.945	174.191	1.300	209.029
2-XXS	2.375	1.503	0.436	1.774	0.220	55.306	0.446	82.959	0.739	110.612	1.091	138.265	1.502	165.918
2 1/2-5S	2.875	2.709	0.083	5.764	0.105	179.669	0.214	269.504	0.354	359.338	0.523	449.173	0.719	539.007
2 1/2-10S	2.875	2.635	0.120	5.453	0.109	169.987	0.221	254.981	0.366	339.975	0.541	424.968	0.744	509.962
2 1/2-40,40S & STD	2.875	2.469	0.203	4.788	0.118	149.244	0.240	223.866	0.397	298.488	0.587	373.110	0.807	447.732
2 1/2-80,80S & XS	2.875	2.323	0.276	4.238	0.127	132.115	0.259	198.173	0.429	264.231	0.633	330.289	0.871	396.346
2 1/2-160	2.875	2.125	0.375	3.547	0.142	110.554	0.290	165.830	0.479	221.107	0.708	276.384	0.974	331.661
2 1/2-XXS	2.875	1.771	0.552	2.463	0.179	76.788	0.364	115.182	0.602	153.576	0.889	191.970	1.223	230.363

<b>RETURN LINES</b>	<b>HIGH PRESSURE LINES</b>
TRANSITIONAL	<===== FLOWS ARE TURBULENT =====>

**PRESSURE LOSSES IN LARGE PIPES**

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSI/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	1 FPS		2 FPS		3 FPS		4 FPS		5 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
3 - 5S	3.500	3.334	0.083	8.730	0.0020	27.214	0.0040	54.427	0.0099	81.641	0.0163	108.854	0.0241	136.068
3-10S	3.500	3.260	0.120	8.347	0.0021	26.019	0.0041	52.038	0.0101	78.057	0.0168	104.076	0.0248	130.095
3-40, 40S & STD	3.500	3.068	0.216	7.393	0.0023	23.044	0.0047	46.089	0.0109	69.133	0.0181	92.178	0.0268	115.222
3-80, 80S & XS	3.500	2.900	0.300	6.605	0.0026	20.590	0.0052	41.180	0.0117	61.769	0.0194	82.359	0.0287	102.949
3-160	3.500	2.624	0.438	5.408	0.0032	16.857	0.0064	33.714	0.0096	50.571	0.0220	67.428	0.0325	84.285
3-XXS	3.500	2.300	0.600	4.155	0.0042	12.951	0.0083	25.902	0.0125	38.854	0.0260	51.805	0.0384	64.756
3 1/2 - 5S	4.000	3.834	0.083	11.545	0.0015	35.988	0.0030	71.976	0.0083	107.964	0.0137	143.953	0.0202	179.941
3 1/2-10S	4.000	3.760	0.120	11.104	0.0016	34.612	0.0031	69.225	0.0085	103.837	0.0140	138.449	0.0207	173.062
3 1/2-40, 40S & STD	4.000	3.548	0.226	9.887	0.0017	30.819	0.0035	61.639	0.0091	92.458	0.0151	123.277	0.0223	154.096
3 1/2-80, 80S & XS	4.000	3.364	0.318	8.888	0.0019	27.706	0.0039	55.411	0.0098	83.117	0.0161	110.822	0.0238	138.528
3 1/2-XXS	4.000	2.728	0.636	5.845	0.0030	18.220	0.0059	36.440	0.0089	54.659	0.0210	72.879	0.0310	91.099
4 - 5S	4.500	4.334	0.083	14.753	0.0012	45.987	0.0023	91.974	0.0071	137.960	0.0118	183.947	0.0174	229.934
4-10S	4.500	4.260	0.120	14.253	0.0012	44.430	0.0024	88.860	0.0073	133.289	0.0120	177.719	0.0178	222.149
4-40 & 40S	4.500	4.026	0.237	12.730	0.0014	39.683	0.0027	79.366	0.0078	119.049	0.0129	158.731	0.0190	198.414
4-80 & 80S	4.500	3.826	0.337	11.497	0.0015	35.838	0.0030	71.676	0.0083	107.514	0.0137	143.352	0.0203	179.191
4-120	4.500	3.624	0.438	10.315	0.0017	32.154	0.0034	64.307	0.0089	96.461	0.0147	128.615	0.0217	160.769
4-160	4.500	3.438	0.531	9.283	0.0019	28.938	0.0037	57.876	0.0095	86.814	0.0157	115.752	0.0232	144.689
4-XXS	4.500	3.152	0.674	7.803	0.0022	24.324	0.0044	48.647	0.0106	72.971	0.0175	97.294	0.0259	121.618
5 - 5S	5.563	5.345	0.109	22.438	0.0008	69.944	0.0027	139.888	0.0055	209.832	0.0090	279.776	0.0134	349.720
5-10S	5.563	5.295	0.134	22.020	0.0008	68.642	0.0027	137.283	0.0055	205.925	0.0092	274.566	0.0135	343.208
5-50 & 50S	5.563	5.047	0.258	20.006	0.0009	62.362	0.0029	124.724	0.0059	187.087	0.0097	249.449	0.0144	311.811
5-80 & 80S	5.563	4.813	0.375	18.194	0.0009	56.714	0.0031	113.427	0.0062	170.141	0.0103	226.854	0.0152	283.568
5-120	5.563	4.563	0.500	16.353	0.0011	50.975	0.0033	101.950	0.0067	152.925	0.0110	203.899	0.0163	254.874
5-160	5.563	4.313	0.625	14.610	0.0012	45.542	0.0035	91.084	0.0071	136.627	0.0118	182.169	0.0175	227.711
5-XXS	5.563	4.063	0.750	12.965	0.0013	40.416	0.0044	80.831	0.0077	121.247	0.0127	161.662	0.0188	202.078
6 - 5S	6.625	6.407	0.109	32.240	0.0005	100.500	0.0021	200.999	0.0044	301.499	0.0072	401.999	0.0107	502.498
6-10S	6.625	6.357	0.134	31.739	0.0005	98.937	0.0022	197.874	0.0044	296.812	0.0073	395.749	0.0108	494.686
6-60 & 60S	6.625	6.065	0.280	28.890	0.0006	90.057	0.0023	180.114	0.0047	270.171	0.0077	360.227	0.0114	450.284
6-80, 80S & STD	6.625	5.761	0.432	26.067	0.0007	81.255	0.0024	162.510	0.0050	243.765	0.0082	325.021	0.0122	406.276
6-120	6.625	5.501	0.562	23.767	0.0007	74.086	0.0026	148.173	0.0053	222.259	0.0087	296.346	0.0129	370.432
6-160	6.625	5.187	0.719	21.131	0.0008	65.870	0.0028	131.740	0.0057	197.610	0.0094	263.480	0.0139	329.350
6-XXS	6.625	4.897	0.864	18.834	0.0009	58.710	0.0030	117.421	0.0061	176.131	0.0101	234.842	0.0149	293.552
8-5S	8.625	8.407	0.109	55.510	0.0003	173.036	0.0015	346.073	0.0031	519.109	0.0051	692.145	0.0076	865.182
8-10S	8.625	8.329	0.148	54.485	0.0003	169.840	0.0015	339.681	0.0031	509.521	0.0052	679.361	0.0077	849.202
8-20	8.625	8.125	0.250	51.849	0.0003	161.623	0.0016	323.245	0.0032	484.868	0.0054	646.490	0.0079	808.113
8-30	8.625	8.071	0.277	51.162	0.0003	159.481	0.0016	318.963	0.0033	478.444	0.0054	637.925	0.0080	797.407
8-40, 40S, & STD	8.625	7.981	0.322	50.027	0.0003	155.944	0.0016	311.889	0.0033	467.833	0.0055	623.778	0.0081	779.722
8-60	8.625	7.813	0.406	47.943	0.0004	149.448	0.0017	298.896	0.0034	448.345	0.0056	597.793	0.0083	747.241
8-80, 80S & XS	8.625	7.625	0.500	45.664	0.0004	142.343	0.0017	284.685	0.0035	427.028	0.0058	569.370	0.0086	711.713
8-100	8.625	7.437	0.594	43.440	0.0004	135.410	0.0018	270.820	0.0036	406.230	0.0060	541.640	0.0088	677.050
8-120	8.625	7.187	0.719	40.568	0.0004	126.459	0.0019	252.918	0.0038	379.378	0.0062	505.837	0.0092	632.296
8-140	8.625	7.001	0.812	38.495	0.0004	119.998	0.0019	239.997	0.0039	359.995	0.0065	479.993	0.0095	599.992
8-XXS	8.625	6.875	0.875	37.122	0.0005	115.718	0.0020	231.436	0.0040	347.154	0.0066	462.872	0.0098	578.590
8-160	8.625	6.813	0.906	36.456	0.0004	113.640	0.0020	227.280	0.0040	340.921	0.0067	454.561	0.0099	568.201
10-5S	10.750	10.48	0.134	86.293	0.0003	268.995	0.0012	537.989	0.0024	806.984	0.0039	1,075.978	0.0058	1,344.973
10-10S	10.750	10.42	0.165	85.276	0.0003	265.822	0.0012	531.644	0.0024	797.465	0.0039	1,063.287	0.0058	1,329.109
10-20	10.750	10.250	0.250	82.516	0.0004	257.219	0.0012	514.438	0.0024	771.657	0.0040	1,028.876	0.0059	1,286.095
10-30	10.750	10.136	0.307	80.691	0.0004	251.529	0.0012	503.058	0.0025	754.588	0.0041	1,006.117	0.0060	1,257.646
10-40, 40S, & STD	10.750	10.020	0.365	78.854	0.0004	245.805	0.0012	491.610	0.0025	737.415	0.0041	983.220	0.0061	1,229.025
10-60, 60S & XS	10.750	9.750	0.500	74.662	0.0004	232.736	0.0013	465.473	0.0026	698.209	0.0043	930.946	0.0063	1,163.682
10-80	10.750	9.562	0.594	71.810	0.0004	223.848	0.0013	447.695	0.0026	671.543	0.0044	895.391	0.0065	1,119.238
10-100	10.750	9.312	0.719	68.104	0.0004	212.296	0.0013	424.591	0.0027	636.887	0.0045	849.183	0.0067	1,061.478
10-120	10.750	9.062	0.844	64.497	0.0004	201.050	0.0014	402.099	0.0028	603.149	0.0047	804.199	0.0069	1,005.248
10-140	10.750	8.750	1.000	60.132	0.0004	187.444	0.0015	374.888	0.0030	562.332	0.0049	749.776	0.0072	937.219
10-160	10.750	8.500	1.125	56.745	0.0003	176.886	0.0015	353.772	0.0031	530.657	0.0051	707.543	0.0075	884.429
12-5S	12.750	12.438	0.156	121.504	0.0003	378.753	0.0009	757.506	0.0019	1,136.259	0.0031	1,515.013	0.0047	1,893.766
12-10S	12.750	12.390	0.180	120.568	0.0003	375.835	0.0009	751.671	0.0019	1,127.506	0.0032	1,503.342	0.0047	1,879.177
12-20	12.750	12.25	0.250	117.859	0.0003	367.390	0.0010	734.780	0.0019	1,102.170	0.0032	1,469.560	0.0047	1,836.950
12-30	12.750	12.090	0.330	114.800	0.0003	357.856	0.0010	715.711	0.0020	1,073.567	0.0033	1,431.422	0.0048	1,789.278
12-STD & 40S	12.750	12.000	0.375	113.097	0.0003	352.548	0.0010	705.095	0.0020	1,057.643	0.0033	1,410.190	0.0049	1,762.738
12-40	12.750	11.938	0.406	111.932	0.0003	348.914	0.0010	697.828	0.0020	1,046.742	0.0033	1,395.656	0.0049	1,744.570
12-80S & XS	12.750	11.750	0.500	108.434	0.0003	338.011	0.0010	676.022	0.0020	1,014.033	0.0034	1,352.044	0.0050	1,690.055
12-60	12.750	11.626	0.562	106.157	0.0003	330.914	0.0010	661.829	0.0021	992.743	0.0034	1,323.658	0.0051	1,654.572
12-80	12.750	11.374	0.688	101.605	0.0003	316.724	0.0010	633.449	0.0021	950.173	0.0035	1,266.898	0.0052	1,583.622
12-100	12.750	11.062	0.844	96.107	0.0003	299.587	0.0011	599.173	0.0022	898.760	0.0036	1,198.347	0.0054	1,497.933
12-120	12.750	10.750	1.000	90.762	0.0003	282.925	0.0011	565.851	0.0023	848.776	0.0038	1,131.702	0.0056	1,414.627
12-140	12.750	10.500	1.125	86.590	0.0003	269.919	0.0012	539.838	0.0024	809.758	0.0039	1,079.677	0.0057	1,349.596
12-160	12.750	10.126	1.312	80.531	0.0004	251.033	0.0012	502.066	0.0025	753.099	0.0041	1,004.132	0.0060	1,255.166
14-5S	14.000	13.688	0.156	147.153	0.0002	458.707	0.0008	917.414	0.0017	1,376.120	0.0028	1,834.827	0.0041	2,293.534
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# PRESSURE LOSSES IN LARGE PIPES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	10 FPS		15 FPS		20 FPS		25 FPS		30 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
3 - 5S	3.500	3.334	0.083	8.730	0.0811	272.136	0.1649	408.204	0.2728	544.272	0.4031	680.341	0.5547	816.409
3-10S	3.500	3.260	0.120	8.347	0.0834	260.190	0.1696	390.285	0.2806	520.380	0.4146	650.475	0.5704	780.570
3-40, 40S & STD	3.500	3.068	0.216	7.393	0.0900	230.444	0.1830	345.666	0.3027	460.888	0.4473	576.111	0.6154	691.333
3-80, 80S & XS	3.500	2.900	0.300	6.605	0.0966	205.898	0.1963	308.846	0.3248	411.795	0.4799	514.744	0.6603	617.693
3-160	3.500	2.624	0.438	5.408	0.1094	168.571	0.2224	252.856	0.3680	337.142	0.5438	421.427	0.7482	505.713
3-XXS	3.500	2.300	0.600	4.155	0.1290	129.512	0.2623	194.268	0.4339	259.024	0.6412	323.781	0.8822	388.537
3 1/2 - 5S	4.000	3.834	0.083	11.545	0.0681	359.881	0.1385	539.822	0.2291	719.763	0.3385	899.703	0.4658	1,079.644
3 1/2-10S	4.000	3.760	0.120	11.104	0.0698	346.123	0.1419	519.185	0.2347	692.247	0.3469	865.308	0.4773	1,038.370
3 1/2-40, 40S & STD	4.000	3.548	0.226	9.887	0.0750	308.193	0.1526	462.289	0.2524	616.385	0.3730	770.482	0.5132	924.578
3 1/2-80, 80S & XS	4.000	3.364	0.318	8.888	0.0802	277.056	0.1631	415.584	0.2698	554.111	0.3987	692.639	0.5485	831.167
3 1/2-XXS	4.000	2.728	0.636	5.845	0.1042	182.198	0.2119	273.297	0.3506	364.396	0.5180	455.495	0.7127	546.594
4 - 5S	4.500	4.334	0.083	14.753	0.0584	459.868	0.1188	689.802	0.1965	919.736	0.2904	1,149.669	0.3996	1,379.603
4-10S	4.500	4.260	0.120	14.253	0.0597	444.298	0.1214	666.447	0.2008	888.596	0.2968	1,110.745	0.4083	1,332.894
4-40 & 40S	4.500	4.026	0.237	12.730	0.0641	396.828	0.1303	595.243	0.2155	793.657	0.3185	992.071	0.4382	1,190.485
4-80 & 80S	4.500	3.826	0.337	11.497	0.0683	358.381	0.1388	537.572	0.2297	716.762	0.3394	895.953	0.4670	1,075.143
4-120	4.500	3.624	0.438	10.315	0.0731	321.537	0.1486	482.306	0.2458	643.075	0.3632	803.844	0.4997	964.612
4-160	4.500	3.438	0.531	9.283	0.0781	289.379	0.1587	434.068	0.2625	578.758	0.3880	723.447	0.5338	868.137
4-XXS	4.500	3.152	0.674	7.803	0.0870	243.236	0.1769	364.854	0.2926	486.472	0.4324	608.090	0.5950	729.708
5 - 5S	5.563	5.345	0.109	22.438	0.0450	699.440	0.0914	1,049.160	0.1512	1,398.880	0.2235	1,748.600	0.3075	2,098.321
5-10S	5.563	5.295	0.134	22.020	0.0455	686.416	0.0925	1,029.623	0.1530	1,372.831	0.2261	1,716.039	0.3111	2,059.247
5-50 & 50S	5.563	5.047	0.258	20.006	0.0483	623.622	0.0982	935.434	0.1625	1,247.245	0.2401	1,559.056	0.3303	1,870.867
5-80 & 80S	5.563	4.813	0.375	18.194	0.0513	567.136	0.1042	850.703	0.1724	1,134.271	0.2548	1,417.839	0.3505	1,701.407
5-120	5.563	4.563	0.500	16.353	0.0548	509.749	0.1144	764.623	0.1843	1,019.497	0.2723	1,274.372	0.3747	1,529.246
5-160	5.563	4.313	0.625	14.610	0.0588	455.422	0.1195	683.133	0.1977	910.844	0.2922	1,138.555	0.4020	1,366.266
5-XXS	5.563	4.063	0.750	12.965	0.0633	404.156	0.1288	606.234	0.2131	808.312	0.3149	1,010.389	0.4332	1,212.467
6 - 5S	6.625	6.407	0.109	32.240	0.0358	1,004.997	0.0729	1,507.495	0.1206	2,009.993	0.1782	2,512.492	0.2451	3,014.990
6-10S	6.625	6.357	0.134	31.739	0.0362	989.372	0.0736	1,484.058	0.1218	1,978.744	0.1799	2,473.430	0.2476	2,968.116
6-60 & 60S	6.625	6.065	0.280	28.890	0.0384	900.569	0.0781	1,350.853	0.1291	1,801.137	0.1908	2,251.421	0.2625	2,701.706
6-80, 80S & STD	6.625	5.761	0.432	26.067	0.0409	812.552	0.0832	1,218.827	0.1377	1,625.103	0.2035	2,031.379	0.2800	2,437.655
6-120	6.625	5.501	0.562	23.767	0.0434	740.864	0.0882	1,111.296	0.1459	1,481.728	0.2156	1,852.160	0.2966	2,222.592
6-160	6.625	5.187	0.719	21.131	0.0467	658.700	0.0949	988.050	0.1570	1,317.400	0.2320	1,646.750	0.3192	1,976.100
6-XXS	6.625	4.897	0.864	18.834	0.0502	587.104	0.1020	880.657	0.1687	1,174.209	0.2493	1,467.761	0.3430	1,761.313
8-5S	8.625	8.407	0.109	55.510	0.0255	1,730.363	0.0519	2,595.545	0.0859	3,460.726	0.1269	4,325.908	0.1746	5,191.089
8-10S	8.625	8.329	0.148	54.485	0.0258	1,698.404	0.0525	2,547.605	0.0869	3,396.807	0.1284	4,246.009	0.1766	5,095.211
8-20	8.625	8.125	0.250	51.849	0.0266	1,616.225	0.0542	2,424.338	0.0896	3,232.451	0.1324	4,040.563	0.1822	4,848.676
8-30	8.625	8.071	0.277	51.162	0.0269	1,594.813	0.0546	2,392.220	0.0903	3,189.627	0.1335	3,987.033	0.1837	4,784.440
8-40, 40S, & STD	8.625	7.981	0.322	50.027	0.0272	1,559.444	0.0554	2,339.166	0.0916	3,118.888	0.1354	3,898.610	0.1863	4,678.332
8-60	8.625	7.813	0.406	47.943	0.0280	1,494.482	0.0569	2,241.724	0.0941	2,988.965	0.1390	3,736.206	0.1913	4,483.477
8-80, 80S & XS	8.625	7.625	0.500	45.664	0.0288	1,423.426	0.0586	2,135.139	0.0970	2,846.852	0.1433	3,558.565	0.1972	4,270.278
8-100	8.625	7.437	0.594	43.440	0.0298	1,354.100	0.0605	2,031.150	0.1001	2,708.200	0.1479	3,385.250	0.2035	4,062.300
8-120	8.625	7.187	0.719	40.568	0.0311	1,264.592	0.0631	1,896.888	0.1044	2,529.184	0.1543	3,161.480	0.2123	3,793.776
8-140	8.625	7.001	0.812	38.495	0.0321	1,199.984	0.0652	1,799.975	0.1079	2,399.967	0.1595	2,999.959	0.2194	3,599.951
8-XXS	8.625	6.875	0.875	37.122	0.0328	1,157.179	0.0667	1,735.769	0.1104	2,314.358	0.1631	2,892.948	0.2245	3,471.537
8-160	8.625	6.813	0.906	36.456	0.0332	1,136.402	0.0675	1,704.603	0.1117	2,272.804	0.1650	2,841.005	0.2270	3,409.206
10-5S	10.750	10.48	0.134	86.293	0.0194	2,689.945	0.0394	4,034.918	0.0652	5,379.891	0.0963	6,724.864	0.1325	8,069.836
10-10S	10.750	10.42	0.165	85.276	0.0195	2,658.218	0.0397	3,987.327	0.0657	5,316.436	0.0970	6,645.545	0.1335	7,974.654
10-20	10.750	10.250	0.250	82.516	0.0199	2,572.189	0.0405	3,858.284	0.0670	5,144.378	0.0990	6,430.473	0.1362	7,716.567
10-30	10.750	10.136	0.307	80.691	0.0202	2,515.292	0.0411	3,772.938	0.0680	5,030.583	0.1004	6,288.229	0.1382	7,545.875
10-40, 40S, & STD	10.750	10.020	0.365	78.854	0.0205	2,458.049	0.0417	3,687.074	0.0689	4,916.099	0.1019	6,145.123	0.1402	7,374.148
10-60, 80S & XS	10.750	9.750	0.500	74.662	0.0212	2,327.364	0.0431	3,491.047	0.0713	4,654.729	0.1054	5,818.411	0.1450	6,982.093
10-80	10.750	9.562	0.594	71.810	0.0217	2,238.477	0.0442	3,357.715	0.0731	4,476.954	0.1080	5,596.192	0.1486	6,715.431
10-100	10.750	9.312	0.719	68.104	0.0225	2,122.956	0.0457	3,184.435	0.0756	4,245.913	0.1117	5,307.391	0.1536	6,368.869
10-120	10.750	9.062	0.844	64.497	0.0232	2,010.966	0.0473	3,015.744	0.0782	4,020.993	0.1155	5,026.241	0.1589	6,031.489
10-140	10.750	8.750	1.000	60.132	0.0243	1,874.439	0.0494	2,811.658	0.0817	3,748.878	0.1207	4,686.097	0.1660	5,623.316
10-160	10.750	8.500	1.125	56.745	0.0252	1,768.858	0.0512	2,653.287	0.0847	3,537.716	0.1251	4,422.145	0.1722	5,306.574
12-5S	12.750	12.438	0.156	121.504	0.0156	3,787.532	0.0318	5,681.297	0.0526	7,575.063	0.0778	9,468.829	0.1070	11,362.595
12-10S	12.750	12.390	0.180	120.568	0.0157	3,758.355	0.0320	5,637.532	0.0529	7,516.709	0.0781	9,395.887	0.1075	11,275.064
12-20	12.750	12.25	0.250	117.859	0.0159	3,673.900	0.0324	5,510.850	0.0536	7,347.800	0.0792	9,184.750	0.1090	11,021.700
12-30	12.750	12.090	0.330	114.800	0.0162	3,578.555	0.0330	5,367.833	0.0545	7,157.111	0.0806	8,946.389	0.1108	10,735.666
12-STD & 40S	12.750	12.000	0.375	113.097	0.0164	3,525.475	0.0333	5,288.213	0.0550	7,050.950	0.0813	8,813.688	0.1119	10,576.425
12-40	12.750	11.938	0.406	111.932	0.0165	3,489.139	0.0335	5,233.709	0.0554	6,978.279	0.0818	8,722.848	0.1126	10,467.418
12-80S & XS	12.750	11.750	0.500	108.434	0.0168	3,380.110	0.0341	5,073.166	0.0565	6,760.221	0.0835	8,450.276	0.1149	10,140.331
12-60	12.750	11.626	0.562	106.157	0.0170	3,309.145	0.0346	4,963.717	0.0573	6,618.290	0.0846	8,272.862	0.1164	9,927.435
12-80	12.750	11.374	0.688	101.605	0.0175	3,167.245	0.0356	4,750.867	0.0588	6,334.489	0.0870	7,918.111	0.1196	9,501.734
12-100	12.750	11.062	0.844	96.107	0.0181	2,995.867	0.0368	4,493.800	0.0609	5,991.733	0.0900	7,489.666	0.1239	8,987.600
12-120	12.750	10.750	1.000	90.762	0.0188	2,829.255	0.0382	4,243.882	0.0631	5,658.510	0.0933	7,073.137	0.1284	8,487.765
12-140	12.750	10.500	1.125	86.590	0.0193	2								

## PRESSURE LOSSES IN HOSES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (IN.) x WALL (IN.)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	1 FPS		2 FPS		3 FPS		4 FPS		5 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
.125 hose	---	0.125	---	0.012	1.408	0.038	2.817	0.077	4.225	0.115	5.633	0.153	7.042	0.191
.188 hose	---	0.187	---	0.027	0.629	0.086	1.259	0.171	1.888	0.257	2.517	0.342	3.146	0.428
.250 hose	---	0.250	---	0.049	0.352	0.153	0.704	0.306	1.056	0.459	1.408	0.612	1.760	0.765
.375 hose	---	0.375	---	0.110	0.156	0.344	0.313	0.689	0.469	1.033	0.626	1.377	0.782	1.721
.406 hose	---	0.406	---	0.129	0.133	0.404	0.267	0.807	0.400	1.211	0.534	1.614	0.667	2.018
.438 hose	---	0.437	---	0.150	0.115	0.468	0.230	0.935	0.346	1.403	0.461	1.870	0.576	2.338
.500 hose	---	0.500	---	0.196	0.088	0.612	0.176	1.224	0.264	1.836	0.352	2.448	0.440	3.060
.625 hose	---	0.625	---	0.307	0.056	0.956	0.113	1.913	0.169	2.869	0.225	3.825	0.282	4.782
.750 hose	---	0.750	---	0.442	0.039	1.377	0.078	2.754	0.117	4.131	0.156	5.509	0.196	6.886
.875 hose	---	0.875	---	0.601	0.029	1.874	0.057	3.749	0.086	5.623	0.115	7.498	0.144	9.372
1.000 hose	---	1.000	---	0.785	0.022	2.448	0.044	4.896	0.066	7.345	0.088	9.793	0.110	12.241
1.125 hose	---	1.125	---	0.994	0.017	3.099	0.035	6.197	0.052	9.296	0.070	12.394	0.087	15.493
1.250 hose	---	1.250	---	1.227	0.014	3.825	0.028	7.651	0.042	11.476	0.056	15.302	0.070	19.127
1.375 hose	---	1.375	---	1.485	0.012	4.629	0.023	9.257	0.035	13.886	0.047	18.515	0.058	23.144
1.500 hose	---	1.500	---	1.767	0.010	5.509	0.020	11.017	0.029	16.526	0.039	22.034	0.049	27.543
1.812 hose	---	1.812	---	2.579	0.007	8.038	0.013	16.077	0.020	24.115	0.027	32.154	0.052	40.192
2.000 hose	---	2.000	---	3.142	0.006	9.793	0.011	19.586	0.017	29.379	0.022	39.172	0.046	48.965
2.375 hose	---	2.375	---	4.430	0.004	13.810	0.008	27.619	0.012	41.429	0.025	55.239	0.037	69.048
2.500 hose	---	2.500	---	4.909	0.004	15.302	0.007	30.603	0.011	45.905	0.023	61.206	0.035	76.508
3.000 hose	---	3.000	---	7.069	0.002	22.034	0.005	44.068	0.011	66.103	0.019	88.137	0.028	110.171
3.500 hose	---	3.500	---	9.621	0.002	29.991	0.004	59.982	0.009	89.973	0.015	119.964	0.023	149.955
4.000 hose	---	4.000	---	12.566	0.001	39.172	0.003	78.344	0.008	117.516	0.013	156.688	0.019	195.860
5.000 hose	---	5.000	---	19.635	0.001	61.206	0.003	122.412	0.006	183.618	0.010	244.825	0.015	306.031
6.000 hose	---	6.000	---	28.274	0.001	88.137	0.002	176.274	0.005	264.411	0.008	352.548	0.012	440.684
8.000 hose	---	8.000	---	50.265	0.000	156.688	0.002	313.376	0.003	470.063	0.005	626.751	0.008	783.439
10.000 hose	---	10.000	---	78.540	0.000	244.825	0.001	489.649	0.002	734.474	0.004	979.299	0.006	1224.123

INTAKE LINES
RETURN LINES  
===== FLOWS ARE LAMINAR =====>

## PRESSURE LOSSES IN HOSES

MATERIAL AND DIMENSIONS					PRESSURE LOSS (PSIG/FOOT) AT AVERAGE FLOW VELOCITY (FPS)									
SIZE OD (mm) x WALL (mm)	O.D. (IN.)	I.D. (IN.)	WALL (IN.)	AREA (SQ. IN.)	10 FPS		15 FPS		20 FPS		25 FPS		30 FPS	
					LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM	LOSS	GPM
.125 hose	---	0.125	---	0.012	14.083	0.383	21.125	0.574	28.167	0.765	35.208	0.956	42.250	1.148
.188 hose	---	0.187	---	0.027	6.293	0.856	9.439	1.284	12.586	1.712	15.732	2.140	18.878	2.568
.250 hose	---	0.250	---	0.049	3.521	1.530	5.281	2.295	7.042	3.060	8.802	3.825	10.562	4.590
.375 hose	---	0.375	---	0.110	1.565	3.443	2.347	5.164	3.130	6.886	6.189	8.607	8.515	10.329
.406 hose	---	0.406	---	0.129	1.335	4.036	2.002	6.053	2.670	8.071	5.604	10.089	7.710	12.107
.438 hose	---	0.437	---	0.150	1.152	4.675	1.728	7.013	3.459	9.351	5.112	11.688	7.033	14.026
.500 hose	---	0.500	---	0.196	0.880	6.121	1.320	9.181	2.923	12.241	4.320	15.302	5.943	18.362
.625 hose	---	0.625	---	0.307	0.563	9.563	1.337	14.345	2.212	19.127	3.268	23.909	4.497	28.690
.750 hose	---	0.750	---	0.442	0.391	13.771	1.064	20.657	1.761	27.543	2.602	34.428	3.580	41.314
.875 hose	---	0.875	---	0.601	0.432	18.744	0.878	28.117	1.452	37.489	2.146	46.861	2.953	56.233
1.000 hose	---	1.000	---	0.785	0.365	24.482	0.743	36.724	1.229	48.965	1.816	61.206	2.499	73.447
1.125 hose	---	1.125	---	0.994	0.315	30.986	0.641	46.478	1.061	61.971	1.568	77.464	2.157	92.957
1.250 hose	---	1.250	---	1.227	0.276	38.254	0.562	57.381	0.930	76.508	1.374	95.635	1.891	114.762
1.375 hose	---	1.375	---	1.485	0.245	46.287	0.499	69.431	0.825	92.574	1.220	115.718	1.678	138.861
1.500 hose	---	1.500	---	1.767	0.220	55.086	0.448	82.628	0.740	110.171	1.094	137.714	1.505	165.257
1.812 hose	---	1.812	---	2.579	0.174	80.384	0.353	120.577	0.585	160.769	0.864	200.961	1.189	241.153
2.000 hose	---	2.000	---	3.142	0.154	97.930	0.312	146.895	0.517	195.860	0.764	244.825	1.051	293.790
2.375 hose	---	2.375	---	4.430	0.124	138.096	0.252	207.145	0.417	276.193	0.616	345.241	0.848	414.289
2.500 hose	---	2.500	---	4.909	0.116	153.015	0.236	229.523	0.391	306.031	0.578	382.539	0.795	459.046
3.000 hose	---	3.000	---	7.069	0.093	220.342	0.188	330.513	0.311	440.684	0.460	550.855	0.633	661.027
3.500 hose	---	3.500	---	9.621	0.076	299.910	0.155	449.865	0.257	599.820	0.379	749.776	0.522	899.731
4.000 hose	---	4.000	---	12.566	0.065	391.719	0.131	587.579	0.217	783.439	0.321	979.299	0.442	1175.158
5.000 hose	---	5.000	---	19.635	0.049	612.062	0.099	918.092	0.164	1224.123	0.243	1530.154	0.334	1836.185
6.000 hose	---	6.000	---	28.274	0.039	881.369	0.079	1322.053	0.131	1762.738	0.193	2203.422	0.266	2644.106
8.000 hose	---	8.000	---	50.265	0.027	1566.878	0.055	2350.317	0.091	3133.756	0.135	3917.195	0.186	4700.633
10.000 hose	---	10.000	---	78.540	0.021	2448.247	0.042	3672.370	0.069	4896.493	0.102	6120.616	0.141	7344.740

RETURN LINES
HIGH PRESSURE LINES  
TRANSITIONAL <===== FLOWS ARE TURBULENT =====>