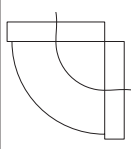
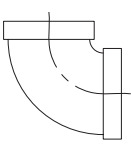
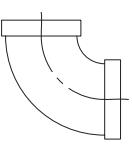
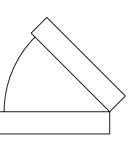
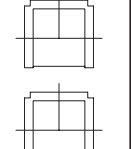
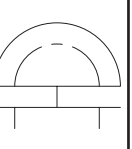
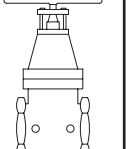
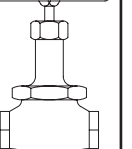
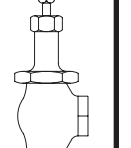


## Engineering Data

**Table 3 - Friction Losses Through Pipe Fittings in Terms of Equivalent Lengths of Standard Pipe**

									
Size of Pipe (Small Dia.)	Standard Elbow	Medium Radius Elbow	Long Radius Elbow	45° Elbow	Tee	Return Bend	Gate Valve Open	Globe Valve Open	Angle Valve Open
Length of Straight Pipe Giving Equivalent Resistance Flow									
½"	1.5	1.4	1.1	.77	3.4	3.8	.35	16	8.4
¾"	2.2	1.8	1.4	1.0	4.5	5.0	.47	22	12
1"	2.7	2.3	1.7	1.3	5.8	6.1	.60	27	15
1¼"	3.7	3.0	2.4	1.6	7.8	8.5	.80	37	18
1½"	4.3	3.6	2.8	2.0	9.0	10	.95	44	22
2"	5.5	4.6	3.5	2.5	11	13	1.2	57	28
2½"	6.5	5.4	4.2	3.0	14	15	1.4	66	33
3"	8.1	6.8	5.1	3.8	17	18	1.7	85	42
3½"	9.5	8.0	6.0	4.4	19	21	2.0	99	50
4"	11.0	9.1	7.0	5.0	22	24	2.3	110	58
4½"	12.0	10	7.9	5.6	24	27	2.6	130	61
5"	14.0	12	8.9	6.1	27	31	2.9	140	70
6"	16.0	14	11	7.7	33	37	3.5	160	83
8"	21.0	18	14	10	43	49	4.5	220	110
10"	26.0	22	17	13	56	61	5.7	290	140
12"	32.0	26	20	15	66	73	6.7	340	170
14"	36.0	31	23	17	76	85	8	390	190
16"	42.0	35	27	19	87	100	9	430	220
18"	46.0	40	30	21	100	110	10.2	500	250
20"	52.0	43	34	23	110	120	12	560	280
22"	58.0	50	37	25	130	140	13	610	310
24"	63.0	53	40	28	140	150	14	680	340
30"	79.0	68	50	35	165	190	17	860	420
36"	94.0	79	60	43	200	220	20	1000	500
42"	120.0	95	72	50	240	260	23	1200	600
48"	135.0	110	82	58	275	300	26	1400	680

From "Engineering Data on Flow of Fluids In Pipes." - Crane Co.

**Table 4 - Capacities Of Water Piping In Buildings - Length 100 Ft. In U.S. Gallons Per Minute**

Size Pipe	½	¾	1	1¼	1½	2	2½	3	4
Pressure									
17 lbs.	3.2	9.1	18.7	33.5	51.6	106	200	290	589
30 lbs.	5	14	28	52	78	160	308	436	885
40 lbs.	6	16	33	60	90	184	350	504	1023
50 lbs.	6.5	17.5	37	70	101	206	390	564	1143
60 lbs.	7	19.5	40	76	110	226	430	617	1252
75 lbs.	7.5	22	45	85	123	253	480	690	1400
100 lbs.	9	25	52	99	142	292	558	797	1607

## Engineering Data

### Friction Loss For Water At 60° F Per 100 Feet Of Pipe

New Schedule 40 Steel Pipe - The friction values are from the Hydraulic Institute Pipe Friction Manual. (Copyright 1961). No allowance has been made for age, differences in any abnormal conditions of interior surface.

Any factor of safety must be estimated from the conditions and the requirements of each installation. For average new installations it is suggested that at least 15% be added to these friction loss values as a reasonable factor of safety.

15 Year Old Pipe - The friction values for Old Pipe are based on Williams and Hazen coefficient of C=100. Values for 3 inch and larger sizes are for cast iron pipe; smaller sizes refer to steel pipe. For existing older type installations, these higher values are generally used for estimating friction losses.

Sewage Lines - To keep raw sewage in suspension in force mains, velocities above 2½ feet per second are generally recommended.

Capacity U.S. Gallon per Minute	½" Pipe				¾" Pipe				1" Pipe				1¼" Pipe				1½" Pipe			
	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe
	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet
1	1.086	.0113	1.66	2.10	.602	.0033	.26	.43	.371	.00214	.114	.168	.....	.....	.....	.....	.....	.....	.....	.....
2	2.11	.0683	4.78	7.57	1.20	.0332	1.21	1.93	.743	.00637	.378	.595	.429	.00266	.102	.197	.316	.00154	.0492	.041
3	3.17	.136	10.00	16.00	1.81	.0506	2.80	4.08	1.114	.01927	.772	1.26	.644	.00444	.207	.316	.473	.00347	.098	.156
4	4.85	.277	17.10	27.3	2.41	.0800	4.21	6.94	1.48	.0342	1.29	2.14	.606	.01144	.342	.564	.630	.00418	.164	.267
5	5.98	.422	26.80	41.2	3.01	.141	6.32	10.5	1.86	.0528	1.93	3.34	1.073	.0179	.508	.633	.750	.00965	.242	.403
8	6.54	.624	36.00	37.60	3.61	.203	5.87	14.2	2.22	.0771	2.68	4.54	1.24	.0237	.704	1.30	.946	.0130	.333	.565
9	8.48	1.109	52.70	94.30	4.81	.300	16.0	25.0	2.97	.137	4.84	7.73	1.73	.0434	1.18	2.04	1.2	.0247	.656	.842
10	10.68	1.73	92.80	143.00	6.02	.563	23.0	37.0	3.71	.214	6.60	11.7	2.10	.0712	1.77	3.08	1.55	.0368	.829	1.45
13	.....	.....	.....	.....	9.03	1.27	49.7	101.3	6.87	.682	14.8	26.0	3.23	.1000	3.76	4.53	2.37	.0673	1.74	3.04
20	.....	.....	.....	.....	12.00	2.25	56.1	136.0	7.42	.857	25.1	42.1	4.28	.266	8.34	11.10	3.18	.154	2.94	5.24
23	.....	.....	.....	.....	.....	.....	.....	.....	9.28	1.37	36.5	64.0	5.37	.440	9.74	16.8	3.94	.341	4.40	8.3
30	.....	.....	.....	.....	.....	.....	.....	.....	11.1	1.93	54.8	80.0	6.44	.644	13.6	23.3	4.73	.347	6.20	11.1
33	.....	.....	.....	.....	.....	.....	.....	.....	12.0	2.62	74.3	119.0	7.51	.878	18.2	31.2	5.82	.473	8.40	14.7
40	.....	.....	.....	.....	.....	.....	.....	.....	14.6	3.43	95.0	152.0	8.61	1.14	23.6	45.0	6.30	.618	10.79	19.6
43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.67	1.43	28.6	50.0	7.09	.780	13.51	22.2
50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.7	1.79	36.0	62.4	7.88	.965	16.4	28.5
60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.6	2.57	51.0	54.7	8.48	1.39	23.2	40.0
70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.0	3.50	68.8	114	11.03	1.89	31.3	53.7
80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.2	4.58	89.2	144	12.6	2.47	40.8	68.1
90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19.3	5.79	112	176	14.2	2.13	81.0	94.7
100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.8	3.88	82.2	103
125	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19.72	6.04	98.8	157
150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23.8	8.65	137	218

## Engineering Data

Capacity U.S. Gallon per Minute	2" Pipe				2½" Pipe				3" Pipe				4" Pipe			
	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe
	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet
6	.674	.00511	.1004	.157	.402	.00231	.0432	.073	.....	.....	.....	.....	.....	.....	.....	.....
8	.755	.00909	.166	.285	.536	.00447	.0712	.12	.....	.....	.....	.....	.....	.....	.....	.....
10	.956	.0142	.248	.421	.67	.00598	.105	.182	.434	.00292	.0372	.070	.....	.....	.....	.....
15	1.43	.0317	.517	1.08	1.01	.01583	.217	.381	.551	.00559	.0762	.149	.....	.....	.....	.....
20	1.91	.0568	.866	1.55	1.34	.0279	.302	.654	.868	.0117	.126	.254	.....	.....	.....	.....
25	2.3	.0888	1.28	2.73	1.58	.0438	.640	.85	1.088	.0163	.189	.383	.....	.....	.....	.....
30	2.87	.128	1.82	3.29	2.01	.0628	.783	1.39	1.30	.0263	.262	.537	.....	.....	.....	.....
35	3.36	.174	2.42	4.27	2.38	.0933	1.0	1.84	1.62	.0359	.347	.714	.882	.0021	.0947	.....
40	3.82	.227	3.1	5.60	2.68	.112	1.25	2.36	1.74	.0468	.443	.914	1.01	.0158	1.201	.....
45	4.3	.288	3.85	5.95	3.02	.141	1.5	2.92	1.95	.0593	.547	1.14	1.13	.018	1.475	.....
50	4.78	.355	4.67	8.46	3.35	.174	1.94	3.56	2.17	.0732	.552	1.28	1.26	.0247	.176	.34
60	5.74	.511	6.59	11.90	4.02	.251	2.72	4.87	2.60	.105	.924	1.94	1.51	.0355	.245	.47
70	6.59	.695	8.88	15.6	4.69	.342	3.83	5.64	3.04	.143	1.22	2.57	1.78	.0484	.325	.63
80	7.58	.929	11.4	20.2	5.36	.447	4.66	8.5	3.47	.187	1.57	3.30	2.02	.0532	.415	.81
90	8.8	1.15	14.2	23.1	6.03	.265	5.82	10.6	3.91	.237	1.96	4.10	2.27	.060	.516	1.01
100	9.56	1.42	17.4	30.5	6.70	.858	7.11	12.8	4.34	.2927	2.39	4.98	2.52	.0867	.624	1.32
125	11.97	2.24	27.04	34.2	8.38	.904	10.8	18.42	5.43	.456	3.71	8.65	3.15	.154	.958	1.85
150	14.3	3.25	38.0	64.7	10.08	1.57	15.4	27.3	6.51	.654	5.14	10.8	3.78	.222	1.32	2.53
175	16.78	4.25	51.3	91.2	11.73	2.14	20.7	37.14	7.50	.897	6.93	14.07	4.41	.302	1.78	3.44
200	19.1	5.68	66.3	110	13.4	2.72	26.7	46.3	8.68	1.17	5.90	18.0	5.04	.393	2.27	4.40
220	.....	.....	.....	.....	.....	.....	.....	.....	9.65	1.42	10.7	21.4	5.54	.478	2.72	5.28
240	.....	.....	.....	.....	.....	.....	.....	.....	10.4	1.59	12.6	25.2	6.06	.568	3.21	6.31
260	.....	.....	.....	.....	.....	.....	.....	.....	11.3	1.98	14.7	29.3	6.65	.667	3.74	7.20
280	.....	.....	.....	.....	.....	.....	.....	.....	12.2	2.29	15.9	33.3	7.06	.774	4.30	8.25
300	.....	.....	.....	.....	.....	.....	.....	.....	13.0	2.63	19.2	38.0	7.56	.888	4.88	9.30
320	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.05	1.01	5.51	10.0
340	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.57	1.14	6.19	11.8
360	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.07	1.28	6.92	13.1
380	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.58	1.43	7.68	14.5
400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.1	1.58	8.47	15.0
450	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.34	1.94	10.0	19.8
500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.6	2.47	13.0	24.0
550	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.9	2.99	15.7	25.8
600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16.1	3.55	16.6	33.8
650	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16.4	4.17	21.7	38.2
700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.6	4.84	25.0	45.0
750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18.9	5.55	28.6	51.1
800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20.2	6.32	32.4	57.6
850	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21.4	7.13	38.8	64.4
900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22.7	8.0	40.8	71.6

## Engineering Data

Capacity U.S. Gallon per Minute	5" Pipe				6" Pipe				8" Pipe				10" Pipe				12" Pipe			
	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe
	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet
50	.802	.00999	.0682	.115	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
60	.862	.0144	.0814	.161	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
70	1.12	.0196	.1076	.214	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
80	1.26	.0256	.136	.275	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
90	1.44	.0324	.169	.341	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
100	1.80	.040	.204	.415	1.11	.0192	.0842	.140	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
125	2.01	.0627	.318	.625	1.38	.030	.127	.280	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
150	2.41	.0918	.438	.873	1.67	.043	.177	.320	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
175	2.81	.123	.584	1.16	1.94	.0552	.238	.480	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
200	3.21	.160	.736	1.50	2.22	.0757	.299	.520	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
220	3.53	.193	.879	1.75	2.44	.0927	.357	.735	1.41	.0309	.0928	.181	.....	.....	.....	.....	.....	.....	.....	.....
240	3.85	.230	1.038	2.10	2.06	.110	.419	.863	1.54	.0358	.1088	.213	.....	.....	.....	.....	.....	.....	.....	.....
260	4.17	.270	1.20	2.43	2.89	.130	.487	1.0	1.67	.0432	.126	.247	.....	.....	.....	.....	.....	.....	.....	.....
280	4.49	.313	1.38	2.79	3.11	.150	.560	1.15	1.80	.0501	.144	.283	.....	.....	.....	.....	.....	.....	.....	.....
300	4.81	.360	1.58	3.17	3.33	.172	.637	1.29	1.92	.0575	.163	.322	.....	.....	.....	.....	.....	.....	.....	.....
320	5.13	.409	1.78	3.57	3.55	.196	.719	1.47	2.08	.0655	.184	.346	.....	.....	.....	.....	.....	.....	.....	.....
340	5.48	.422	2.00	3.99	3.76	.222	.806	1.54	2.18	.0739	.206	.408	.....	.....	.....	.....	.....	.....	.....	.....
360	5.77	.518	2.22	4.44	4.00	.240	.898	1.83	2.31	.0828	.229	.452	.....	.....	.....	.....	.....	.....	.....	.....
380	6.09	.577	2.46	4.90	4.22	.277	.993	2.02	2.44	.0973	.253	.496	.....	.....	.....	.....	.....	.....	.....	.....
400	6.41	.639	2.72	5.39	4.44	.307	1.09	2.21	2.57	.102	.279	.548	.....	.....	.....	.....	.....	.....	.....	.....
450	7.22	.809	3.41	6.70	5.00	.388	1.36	2.65	2.89	.129	.348	.681	1.63	.0521	.114	.21	.....	.....	.....	.....
500	8.02	.999	4.16	8.15	5.55	.479	1.66	2.80	3.21	.150	.424	.828	2.03	.0643	.138	.28	.....	.....	.....	.....
550	8.82	1.71	4.96	9.72	6.11	.580	1.99	2.93	3.53	.193	.507	.970	2.24	.0778	.164	.33	.....	.....	.....	.....
600	9.62	1.44	5.88	11.70	6.66	.690	2.34	4.7	3.85	.230	.597	1.14	2.44	.0928	.192	.38	.....	.....	.....	.....
650	10.4	1.69	6.87	13.2	7.22	.810	2.73	5.4	4.17	.271	.694	1.34	2.64	.109	.224	.46	.....	.....	.....	.....
700	11.2	1.96	7.93	15.2	7.77	.979	3.13	6.2	4.49	.313	.797	1.54	2.85	.126	.258	.52	2.01	.0626	.108	.22
750	12.0	2.25	9.08	17.5	8.33	1.08	3.57	7.0	4.81	.360	.907	1.74	3.08	.145	.291	.59	2.13	.0718	.134	.24
800	12.8	2.56	10.22	19.4	8.68	1.23	4.03	8.0	5.13	.409	1.02	1.97	3.25	.165	.328	.67	2.39	.0817	.14	.27
850	13.6	2.69	11.8	21.7	9.44	1.38	4.53	8.95	5.45	.462	1.147	2.28	3.45	.186	.368	.75	2.44	.0922	.158	.31
900	14.4	3.24	12.9	24.2	9.99	1.55	5.05	10.11	5.77	.518	1.27	2.46	3.66	.206	.410	.83	2.58	.103	.173	.34
950	15.2	3.81	14.3	26.7	10.5	1.73	5.60	10.8	6.09	.577	1.41	2.87	3.87	.232	.458	.91	2.72	.115	.181	.39
1,000	16.0	4.00	15.5	29.4	11.1	1.92	6.17	12.04	6.41	.639	1.56	3.02	4.07	.257	.50	1.01	2.87	.138	.210	.41
1,100	17.6	4.84	19.0	35.0	12.2	2.32	7.41	14.31	7.05	.773	1.87	3.51	4.45	.311	.60	1.30	3.18	.154	.281	.49
1,200	19.2	5.76	22.5	41.1	13.3	2.76	8.78	16.69	7.70	.920	2.20	4.15	4.86	.370	.702	1.46	3.44	1.84	.298	.57
1,300	20.5	6.75	26.3	47.7	14.4	3.24	10.2	19.7	8.34	1.08	2.66	4.85	5.29	.435	.818	1.62	3.73	.216	.344	.67
1,400	22.8	7.83	30.4	54.7	15.5	3.76	11.8	22.5	8.88	1.25	2.95	5.50	5.70	.504	.94	1.87	4.01	.25	.395	.78
1,500	24.1	8.99	34.8	62.2	16.7	4.31	13.5	25.8	9.62	1.44	3.37	6.27	6.1	.579	1.07	2.09	4.30	.287	.450	.85
1,600	26.7	10.2	39.5	70.1	17.5	4.91	16.4	28.9	10.3	1.64	3.82	7.15	6.51	.659	1.21	2.39	4.89	.327	.509	.98
1,800	.....	.....	.....	.....	20.0	6.21	19.4	35.9	11.5	2.07	4.79	8.80	7.32	.834	1.52	2.93	6.16	.414	.636	1.21
2,000	.....	.....	.....	.....	22.2	7.67	23.8	43.6	12.8	2.56	5.86	10.71	8.14	1.03	1.88	3.65	6.73	.511	.776	1.81
2,500	.....	.....	.....	.....	.....	.....	.....	.....	16.03	3.99	9.1	15.3	10.17	1.56	2.86	5.44	7.17	.798	1.18	2.28
3,000	.....	.....	.....	.....	.....	.....	.....	.....	19.2	5.75	12.8	22.8	12.2	2.32	4.08	7.62	8.6	1.15	1.58	3.15
3,500	.....	.....	.....	.....	.....	.....	.....	.....	22.44	8.19	17.4	30.3	14.24	3.14	5.49	10.39	10.03	1.58	2.26	4.21
4,000	.....	.....	.....	.....	.....	.....	.....	.....	25.7	10.2	22.6	38.6	16.3	4.12	7.07	13.1	11.15	2.05	2.92	5.39
4,500	.....	.....	.....	.....	.....	.....	.....	.....	28.9	12.9	28.5	48.2	18.3	5.21	8.86	16.3	12.9	2.59	3.66	6.70
5,000	.....	.....	.....	.....	.....	.....	.....	.....	32.1	16.0	35.1	58.6	20.3	6.43	10.9	19.8	14.3	3.19	4.47	8.15
6,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24.4	9.26	15.6	27.7	17.2	4.5	6.39	11.4
7,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.5	12.6	21.1	36.9	20.1	6.26	8.63	15.2
8,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.6	16.5	27.8	48.5	22.8	8.17	11.2	19.4
9,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.6	20.8	34.6	51.2	25.5	10.3	14.1	24.7
10,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.7	25.7	42.5	75.4	28.7	12.8	17.4	29.4
12,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34.4	18.3	24.6	41.2
14,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.1	25	33.5	54.7
16,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45.9	33.7	43.7	73.2
18,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	51.6	41.4	55.2	91.8
20,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57.3	51.1	68.1	113.0

## Engineering Data

Capacity U.S. Gallon per Minute	14" Pipe				16" Pipe				18" Pipe				20" Pipe				24" Pipe			
	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe	New Steel Pipe Schedule 40			15 Year Old Line Pipe
	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet	Velocity Feet per Second	Velocity Head to Feet	Friction Loss in Feet	Approx. Friction Loss in Feet
800	1.90	.0559	.0872	.13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
850	2.02	.0634	.093	.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
900	2.13	.0706	.106	.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
950	2.26	.0786	.120	.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,000	2.37	.0874	.131	.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,100	2.61	.106	.157	.23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,200	2.86	.126	.185	.26	2.18	.0736	.0963	.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,300	3.08	.148	.215	.31	2.36	.0865	.1106	.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,400	3.23	.171	.247	.36	2.54	.1004	.127	.18	2.01	.0527	.0719	.108	.....	.....	.....	.....	.....	.....	.....	.....
1,500	3.66	.197	.281	.39	2.72	.119	.148	.21	2.18	.0718	.082	.120	.....	.....	.....	.....	.....	.....	.....	.....
1,600	3.79	.224	.317	.44	2.90	.131	.163	.24	2.30	.0819	.092	.138	.....	.....	.....	.....	.....	.....	.....	.....
1,800	4.27	.283	.395	.55	3.27	.156	.203	.30	2.58	.1056	.114	.171	.....	.....	.....	.....	.....	.....	.....	.....
2,000	4.74	.349	.483	.81	3.63	.205	.248	.46	2.87	.126	.139	.206	.....	.....	.....	.....	.....	.....	.....	.....
2,500	5.93	.545	.738	1.07	4.84	.320	.377	.55	3.59	.20	.211	.314	2.89	.129	.123	.188	1.99	.0618	.0499	.07
3,000	7.11	.786	1.04	1.47	5.45	.461	.536	.80	4.30	.288	.297	.440	3.46	.186	.174	.254	2.39	.0891	.07	.10
3,500	8.3	1.07	1.40	1.99	6.35	.627	.718	1.06	5.02	.392	.397	.586	4.04	.254	.232	.351	2.79	.121	.0934	.14
4,000	9.48	1.4	1.81	2.55	7.26	.820	.921	1.33	5.74	.512	.511	.750	4.62	.331	.298	.449	3.19	.158	.12	.18
4,500	10.1	1.77	2.27	3.17	8.17	1.04	1.16	1.65	6.45	.647	.639	.932	5.19	.419	.372	.56	3.59	.20	.149	.226
5,000	11.9	2.18	2.78	3.85	9.08	1.28	1.41	2.01	7.17	.799	.781	1.13	5.77	.517	.455	.679	3.89	.247	.161	.27
6,000	14.2	3.14	3.96	5.39	10.9	1.84	2.01	2.82	8.51	1.15	1.11	1.59	6.02	.745	.645	.951	4.79	.356	.257	.38
7,000	15.6	4.28	5.32	7.17	12.7	2.51	2.69	3.75	10.0	1.57	1.49	2.11	8.08	1.014	.862	1.26	5.59	.485	.343	.52
8,000	19.0	5.59	6.9	9.18	14.5	3.28	3.49	4.79	11.5	2.05	1.93	2.70	9.23	1.32	1.11	1.82	6.38	.633	.441	.66
9,000	21.3	7.08	8.7	11.4	16.3	4.15	4.38	5.96	12.9	2.59	2.42	3.36	10.39	1.68	1.39	2.04	7.15	.801	.551	.82
10,000	23.7	8.74	10.7	13.9	18.2	5.12	5.38	7.25	14.3	3.2	2.97	4.06	11.5	2.07	1.70	2.45	7.98	.989	.571	1.0
12,000	28.6	12.5	15.2	19.4	21.6	7.38	7.68	10.2	17.2	4.6	4.21	5.72	13.8	2.98	2.44	3.43	9.58	1.42	.959	1.4
14,000	33.2	17.1	20.7	25.9	26.4	10.04	10.4	13.5	20.1	6.27	5.69	7.61	16.2	4.35	3.29	4.56	11.2	1.94	1.29	1.86
16,000	37.9	22.4	26.8	33.1	29.0	13.1	13.6	17.2	22.9	9.19	7.41	9.74	18.5	5.3	4.26	5.84	12.8	2.53	1.67	2.42
18,000	42.7	28.3	33.8	41.2	32.7	16.6	17.2	21.5	25.6	10.05	9.33	12.1	20.8	6.71	5.35	7.26	14.4	3.21	2.10	2.98
20,000	47.4	34.9	41.9	50.0	36.3	20.5	21.2	26.1	28.7	12.8	11.6	14.7	23.1	8.28	6.56	8.82	16.0	3.96	2.58	3.61