

# Hunter®

The Irrigation Innovators

The image displays three overlapping tables of friction loss data for Hunter irrigation systems. Each table is oriented at a different angle, creating a 3D effect. The tables provide technical specifications for various pipe sizes and flow rates, including:

- Flow Rate (GPM):** Values range from 1 to 20 GPM.
- Pipe Size (OD):** Values include 1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4", 6", 8", 10", 12", 15", 18", 20", 24", 30", 36", 42", 48", 60", 72", 84", 96", 108", 120", 144", 168", 192", 216", 240", 288", 336", 384", 432", 480", 528", 576", 624", 672", 720", 768", 816", 864", 912", 960.
- Friction Loss (ft/100 ft):** Values range from 0.05 to 10.00 ft/100 ft.
- Head Loss (ft/100 ft):** Values range from 0.05 to 10.00 ft/100 ft.
- Pressure Loss (psi/100 ft):** Values range from 0.05 to 10.00 psi/100 ft.

## FRICITION LOSS TABLES

**STATIC PRESSURE:** One foot of elevation change results in a change in static pressure of .433 psi.

Dynamic Pressure in a piping system (when water is flowing) varies according to these following five factors, but is always less than static pressure for that same point.

1. Velocity (of water—normally measured in feet per second)
2. Inside Diameter (of pipe)
3. Roughness (of inside wall of pipe)
4. Length (of pipe)
5. Change in Direction (such as elbows and tees)

**NOTE:** This does not include remote control valves, backflow prevention devices, etc. The manufacturers' performance charts must be consulted for pressure loss information.

**PIPE SIZING:** Two methods used to determine the pipe sizing are the *velocity limit method* which is recommended for main line sizing and the *friction factor method* for sizing laterals.

**VELOCITY LIMIT PIPE SIZING FORMULA**

Velocity of flow values is computed using the general equation:

$$V = .408 \frac{Q}{d^2}$$

- V = Velocity in feet per second
- Q = Flow Volume (GPM)
- d = Inside diameter of pipe

The shaded areas of charts indicate velocities over 5' per second and should be used with caution. Excess velocity could result in system damage from pressure surges.

**FRICITION FACTOR PIPE SIZING FORMULA**

$$F_f = \frac{P_o \times P_v}{L_c}$$

- F<sub>f</sub> = Allowable psi loss per 100' of pipe
- P<sub>o</sub> = Operating pressure of sprinkler
- P<sub>v</sub> = Allowable percentage pressure variance
- L<sub>c</sub> = Longest run of lateral line (critical length)

This formula is used to determine the allowable pressure loss per 100' of lateral pipe. Multiplying the operating pressure by the percentage variation and dividing that number by the longest run of pipe from the control valve to the farthest head (divided by 100' length) gives us the allowable loss. Using this number we can budget the pressure we are allowed to lose. And, it gives us a guideline by which each section of pipe can be sized.

**NOTE:** We recommend 10% as an acceptable operating pressure variation within a lateral line.

Friction pressure loss values are computed from the equation:

$$hf = \left[ 0.2083 \left( \frac{100}{C} \right)^{1.852} \left( \frac{Q^{1.852}}{d^{4.866}} \right) \right] \times .433 \text{ for psi loss per 100' pipe}$$

- hf = Friction loss per 100'
- C = Coefficient of retardation based on pipe material
- Q = Flow volume (GPM)
- d = Inside diameter of pipe

**NOTE:** For design capacity information, refer to the Design Capacity and Working Pressure Brochure and Worksheet (LIT-083 & LIT-082), or for computer software, the Irrigation System Design Calculator (LIT-235).



# FRICITION LOSS CHARACTERISTICS PVC SCHEDULE 80 IPS PLASTIC PIPE

(1120, 1220) C = 150

PSI loss per 100 feet of tube (PSI/100 FT)

Sizes 1/2" thru 6"  
Flow GPM 1 thru 600

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE												
OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD												
ID	0.546	0.742	0.957	1.278	1.500	1.939	2.323	2.900	3.826	5.761	ID												
WALL THK	0.147	0.154	0.179	0.191	0.200	0.218	0.276	0.300	0.337	0.432	WALL THK												
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	1.36	0.81	0.74	0.18	0.44	0.05	0.24	0.01	0.18	0.01	0.10	0.00											1
2	2.73	2.92	1.48	0.66	0.89	0.19	0.49	0.05	0.36	0.02	0.21	0.01	0.15	0.00									2
3	4.10	6.19	2.22	1.39	1.33	0.40	0.74	0.10	0.54	0.05	0.32	0.01	0.22	0.01									3
4	5.47	10.54	2.96	2.37	1.78	0.69	0.99	0.17	0.72	0.08	0.43	0.02	0.30	0.01									4
5	6.84	15.93	3.70	3.58	2.22	1.04	1.24	0.25	0.90	0.12	0.54	0.03	0.37	0.01	0.24	0.00							5
6	8.21	22.33	4.44	5.02	2.67	1.46	1.49	0.36	1.08	0.16	0.65	0.05	0.45	0.02	0.29	0.01							6
7	9.58	29.71	5.18	6.68	3.11	1.94	1.74	0.47	1.26	0.22	0.75	0.06	0.52	0.03	0.33	0.01							7
8	10.94	38.05	5.92	8.56	3.56	2.48	1.99	0.61	1.45	0.28	0.86	0.08	0.60	0.03	0.38	0.01							8
9	12.31	47.33	6.66	10.64	4.00	3.09	2.24	0.76	1.63	0.35	0.97	0.10	0.68	0.04	0.43	0.01							9
10	13.68	57.52	7.41	12.93	4.45	3.75	2.49	0.92	1.81	0.42	1.08	0.12	0.75	0.05	0.48	0.02	0.27	0.00					10
11	15.05	68.63	8.15	15.43	4.90	4.47	2.74	1.10	1.99	0.50	1.19	0.14	0.83	0.06	0.53	0.02	0.30	0.01					11
12	16.42	80.63	8.89	18.13	5.34	5.26	2.99	1.29	2.17	0.59	1.30	0.17	0.90	0.07	0.58	0.02	0.33	0.01					12
14			10.37	24.12	6.23	6.99	3.49	1.71	2.53	0.79	1.51	0.23	1.05	0.09	0.67	0.03	0.39	0.01					14
16			11.85	30.88	7.12	8.95	3.99	2.19	2.90	1.01	1.73	0.29	1.20	0.12	0.77	0.04	0.44	0.01					16
18			13.33	38.41	8.01	11.14	4.49	2.73	3.26	1.26	1.95	0.36	1.36	0.15	0.87	0.05	0.50	0.01					18
20			14.82	46.69	8.90	13.54	4.99	3.31	3.62	1.52	2.17	0.44	1.51	0.18	0.97	0.06	0.55	0.02					20
22			16.30	55.70	9.80	16.15	5.49	3.95	3.98	1.81	2.38	0.52	1.66	0.22	1.06	0.07	0.61	0.02					22
24			17.78	65.44	10.69	18.97	5.99	4.64	4.35	2.13	2.60	0.61	1.81	0.25	1.16	0.09	0.66	0.02					24
26			19.26	75.90	11.58	22.01	6.49	5.39	4.71	2.47	2.82	0.71	1.96	0.29	1.26	0.10	0.72	0.03					26
28					12.47	25.24	6.99	6.18	5.07	2.83	3.03	0.81	2.11	0.34	1.35	0.11	0.78	0.03					28
30					13.36	28.69	7.49	7.02	5.43	3.22	3.25	0.92	2.26	0.38	1.45	0.13	0.83	0.03	0.36	0.00			30
35					15.59	38.16	8.74	9.34	6.34	4.29	3.79	1.23	2.64	0.51	1.69	0.17	0.97	0.05	0.43	0.01			35
40					17.81	48.87	9.99	11.96	7.25	5.49	4.34	1.57	3.02	0.65	1.94	0.22	1.11	0.06	0.49	0.01			40
45							11.24	14.88	8.16	6.83	4.88	1.96	3.40	0.81	2.18	0.28	1.25	0.07	0.55	0.01			45
50							12.49	18.09	9.06	8.30	5.42	2.38	3.78	0.99	2.42	0.34	1.39	0.09	0.61	0.01			50
55							13.73	21.58	9.97	9.90	5.96	2.84	4.15	1.18	2.66	0.40	1.53	0.10	0.67	0.01			55
60							14.98	25.35	10.87	11.63	6.51	3.33	4.53	1.38	2.91	0.47	1.67	0.12	0.73	0.02			60
65							16.23	29.40	11.78	13.49	7.05	3.87	4.91	1.61	3.15	0.55	1.81	0.14	0.79	0.02			65
70							17.48	33.72	12.69	15.47	7.59	4.44	5.29	1.84	3.39	0.63	1.95	0.16	0.86	0.02			70
75							18.73	38.32	13.59	17.58	8.13	5.04	5.67	2.09	3.63	0.71	2.09	0.18	0.92	0.03			75
80							19.98	43.19	14.50	19.81	8.68	5.68	6.04	2.36	3.88	0.80	2.22	0.21	0.98	0.03			80
85									15.41	22.16	9.22	6.36	6.42	2.63	4.12	0.90	2.36	0.23	1.04	0.03			85
90									16.32	24.64	9.76	7.07	6.80	2.93	4.36	1.00	2.50	0.26	1.10	0.04			90
95									17.22	27.23	10.30	7.81	7.18	3.24	4.60	1.10	2.64	0.29	1.16	0.04			95
100									18.13	29.95	10.85	8.59	7.56	3.57	4.85	1.21	2.78	0.31	1.22	0.04			100
110									19.94	35.73	11.93	10.25	8.31	4.25	5.33	1.45	3.06	0.38	1.35	0.05			110
120											13.02	12.04	9.07	5.00	5.82	1.70	3.34	0.44	1.47	0.06			120
130											14.10	13.96	9.82	5.60	6.30	1.97	3.62	0.51	1.59	0.07			130
140											15.19	16.02	10.58	6.65	6.79	2.27	3.90	0.59	1.72	0.08			140
150											16.27	18.20	11.34	7.56	7.27	2.57	4.18	0.67	1.84	0.09			150
160											17.36	20.51	12.09	8.51	7.76	2.89	4.45	0.75	1.96	0.10			160
170											18.44	22.95	12.85	9.53	8.24	3.24	4.73	0.84	2.08	0.11			170
180											19.53	25.51	13.60	10.59	8.73	3.60	5.01	0.93	2.21	0.13			180
190													14.36	11.71	9.21	3.98	5.29	1.03	2.33	0.14			190
200													15.12	12.87	9.70	4.37	5.57	1.14	2.45	0.16			200
225													17.01	16.01	10.91	5.44	6.27	1.41	2.76	0.19			225
250													18.90	19.46	12.12	6.61	6.96	1.72	3.07	0.23			250
275															13.34	7.89	7.66	2.05	3.38	0.28			275
300															14.55	9.27	8.36	2.41	3.68	0.33			300
325															15.76	10.75	9.05	2.79	3.99	0.38			325
350															16.97	12.33	9.75	3.20	4.30	0.44			350
375															18.19	14.01	10.45	3.64	4.60	0.50			375
400															19.40	15.79	11.14	4.10	4.91	0.56			400
425																	11.84	4.59	5.22	0.63			425
450																	12.54	5.10	5.53	0.70			450
475																	13.23	5.64	5.83	0.77			475
500																	13.93	6.20	6.14	0.85			500
550																	15.32	7.40	6.76	1.01			550
600																	16.72	8.69	7.37	1.19			600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.

# FRICION LOSS CHARACTERISTICS PVC SCHEDULE 40 IPS PLASTIC PIPE



(1120, 1220) C = 150

PSI loss of 100 feet of tube (PSI/100 FT)

Sizes 1/2" thru 6"  
Flow GPM 1 thru 600

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE												
OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD												
ID	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065	ID												
WALL THK	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.237	0.280	WALL THK												
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	1.05	0.43	0.60	0.11	0.37	0.03	0.21	0.01	0.15	0.00													1
2	2.11	1.55	1.20	0.39	0.74	0.12	0.42	0.03	0.31	0.02	0.19	0.00											2
3	3.16	3.28	1.80	0.84	1.11	0.26	0.64	0.07	0.47	0.03	0.28	0.01	0.20	0.00									3
4	4.22	5.60	2.40	1.42	1.48	0.44	0.85	0.12	0.62	0.05	0.38	0.02	0.26	0.01									4
5	5.27	8.46	3.00	2.15	1.85	0.66	1.07	0.18	0.78	0.08	0.47	0.02	0.33	0.01	0.21	0.00							5
6	6.33	11.86	3.60	3.02	2.22	0.93	1.28	0.25	0.94	0.12	0.57	0.03	0.40	0.01	0.26	0.01							6
7	7.38	15.77	4.20	4.01	2.59	1.24	1.49	0.33	1.10	0.15	0.66	0.05	0.46	0.02	0.30	0.01							7
8	8.44	20.20	4.80	5.14	2.96	1.59	1.71	0.42	1.25	0.20	0.76	0.06	0.53	0.02	0.34	0.01							8
9	9.49	25.12	5.40	6.39	3.33	1.97	1.92	0.52	1.41	0.25	0.85	0.07	0.60	0.03	0.39	0.01							9
10	10.55	30.54	6.00	7.77	3.70	2.40	2.14	0.63	1.57	0.30	0.95	0.09	0.66	0.04	0.43	0.01							10
11	11.60	36.43	6.60	9.27	4.07	2.86	2.35	0.75	1.73	0.36	1.05	0.11	0.73	0.04	0.47	0.02							11
12	12.65	42.80	7.21	10.89	4.44	3.36	2.57	0.89	1.88	0.42	1.14	0.12	0.80	0.05	0.52	0.02	0.30	0.00					12
14	14.76	56.94	8.41	14.48	5.19	4.47	2.99	1.18	2.20	0.56	1.33	0.17	0.93	0.07	0.60	0.02	0.35	0.01					14
16	16.87	72.92	9.61	18.55	5.93	5.73	3.42	1.51	2.51	0.71	1.52	0.21	1.07	0.09	0.69	0.03	0.40	0.01					16
18	18.98	90.69	10.81	23.07	6.67	7.13	3.85	1.88	2.83	0.89	1.71	0.26	1.20	0.11	0.78	0.04	0.45	0.01					18
20	21.09	110.23	12.01	28.04	7.41	8.66	4.28	2.28	3.14	1.08	1.90	0.32	1.33	0.13	0.86	0.05	0.50	0.01					20
22			13.21	33.45	8.15	10.33	4.71	2.72	3.46	1.29	2.10	0.38	1.47	0.16	0.95	0.06	0.55	0.01					22
24			14.42	39.30	8.89	12.14	5.14	3.20	3.77	1.51	2.29	0.45	1.60	0.19	1.04	0.07	0.60	0.02					24
26			15.62	45.58	9.64	14.08	5.57	3.17	4.09	1.75	2.48	0.52	1.74	0.22	1.12	0.08	0.65	0.02					26
28			16.82	52.28	10.38	16.15	5.99	4.25	4.40	2.01	2.67	0.60	1.87	0.25	1.21	0.09	0.70	0.02					28
30			18.02	59.41	11.12	18.35	6.42	4.83	4.72	2.28	2.86	0.68	2.00	0.29	1.30	0.10	0.75	0.03					30
35					12.97	24.42	7.49	6.43	5.50	3.04	3.34	0.90	2.34	0.38	1.51	0.13	0.88	0.04	0.38	0.00			35
40					14.83	31.27	8.56	8.23	6.29	3.89	3.81	1.15	2.67	0.49	1.73	0.17	1.00	0.04	0.44	0.01			40
45					16.68	38.89	9.64	10.24	7.08	4.84	4.29	1.43	3.01	0.60	1.95	0.21	1.13	0.06	0.49	0.01			45
50					18.53	47.27	10.71	12.45	7.87	5.88	4.77	1.74	3.34	0.73	2.16	0.26	1.25	0.07	1.55	0.01			50
55							11.78	14.85	8.65	7.01	5.25	2.08	3.68	0.88	2.38	0.30	1.38	0.08	0.61	0.01			55
60							12.85	17.45	9.44	8.24	5.72	2.44	4.01	1.03	2.60	0.36	1.51	0.10	0.66	0.01			60
65							13.92	20.23	10.23	9.56	6.20	2.83	4.35	1.19	2.81	0.41	1.63	0.11	0.72	0.02			65
70							14.99	23.21	11.01	10.96	6.68	3.25	4.68	1.37	3.03	0.48	1.76	0.13	0.77	0.02			70
75							16.06	26.37	11.80	12.46	7.16	3.69	5.01	1.56	3.25	0.54	1.88	0.14	0.83	0.02			75
80							17.13	29.72	12.59	14.04	7.63	4.16	5.35	1.75	3.46	0.61	2.01	0.16	0.88	0.02			80
85							18.21	33.26	13.37	15.71	8.11	4.66	5.68	1.96	3.68	0.68	2.13	0.18	0.94	0.02			85
90							19.28	36.97	14.16	17.46	8.59	5.18	6.02	2.18	3.90	0.76	2.26	0.20	0.99	0.03			90
95									14.95	19.30	9.07	5.72	6.35	2.41	4.11	0.84	2.39	0.22	1.05	0.03			95
100									15.74	21.22	9.54	6.29	6.69	2.65	4.33	0.92	2.51	0.25	1.10	0.03			100
110									17.31	25.32	10.50	7.51	7.36	3.16	4.76	1.10	2.76	0.29	1.22	0.04			110
120									18.88	29.75	11.45	8.82	8.03	3.72	5.20	1.29	3.02	0.34	1.33	0.05			120
130											12.41	10.23	8.70	4.31	5.63	1.50	3.27	0.40	1.44	0.05			130
140											13.36	11.74	9.37	4.94	6.06	1.72	3.52	0.46	1.55	0.06			140
150											14.32	13.33	10.03	5.62	6.50	1.95	3.77	0.52	1.66	0.07			150
160											15.27	15.03	10.70	6.33	6.93	2.20	4.02	0.59	1.77	0.08			160
170											16.23	16.81	11.37	7.08	7.36	2.46	4.27	0.66	1.88	0.09			170
180											17.18	18.69	12.04	7.87	7.80	2.74	4.53	0.73	1.99	0.10			180
190											18.14	20.66	12.71	8.70	8.23	3.02	4.78	0.81	2.10	0.11			190
200											19.09	22.72	13.38	9.57	8.66	3.33	5.03	0.89	2.21	0.12			200
225													15.05	11.90	9.75	4.14	5.66	1.10	2.49	0.15			225
250													16.73	14.47	10.83	5.03	6.29	1.34	2.77	0.18			250
275													18.40	17.26	11.92	6.00	6.92	1.60	3.05	0.22			275
300															13.00	7.05	7.55	1.88	3.32	0.26			300
325															14.08	8.17	8.18	2.18	3.60	0.30			325
350															15.17	9.38	8.81	2.50	3.88	0.34			350
375															16.25	10.65	9.43	2.84	4.15	0.39			375
400															17.33	12.01	10.06	3.20	4.43	0.44			400
425															18.42	13.43	10.69	3.58	4.71	0.49			425
450															19.50	14.93	11.32	3.98	4.99	0.54			450
475																	11.95	4.40	5.26	0.60			475
500																	12.58	4.84	5.54	0.66			500
550																	13.84	5.77	6.10	0.79			550
600																	15.10	6.78	6.65	0.92			600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.



**FRICITION LOSS CHARACTERISTICS**  
**PVC CLASS 315 IPS PLASTIC PIPE**  
 (1120, 1220) SDR 13.5 C = 150  
 PSI loss per 100 feet of pipe (PSI/100 FT)

Sizes 1/2" thru 6"  
 Flow GPM 1 thru 600

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE										
OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD										
ID	0.716	0.894	1.121	1.414	1.618	2.023	2.449	2.982	3.834	5.643	ID										
WALL THK	0.062	0.078	0.097	0.123	0.141	0.176	0.213	0.259	0.333	0.491	WALL THK										
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	0.79	0.22	0.51	0.07	0.32	0.02	0.20	0.01	0.15	0.00											1
2	1.59	0.78	1.02	0.27	0.64	0.09	0.40	0.03	0.31	0.01	0.19	0.00									2
3	2.38	1.65	1.53	0.56	0.97	0.19	0.61	0.06	0.46	0.03	0.29	0.01	0.20	0.00							3
4	3.18	2.82	2.04	0.96	1.29	0.32	0.81	0.10	0.62	0.05	0.39	0.02	0.27	0.01							4
5	3.97	4.26	2.55	1.45	1.62	0.48	1.02	0.16	0.77	0.08	0.49	0.03	0.34	0.01	0.22	0.00					5
6	4.77	5.97	3.06	2.03	1.94	0.67	1.22	0.22	0.93	0.11	0.59	0.04	0.40	0.02	0.27	0.01					6
7	5.57	7.95	3.57	2.70	2.27	0.90	1.42	0.29	1.09	0.15	0.69	0.05	0.47	0.02	0.32	0.01					7
8	6.36	10.18	4.08	3.45	2.59	1.15	1.63	0.37	1.24	0.19	0.79	0.06	0.54	0.03	0.36	0.01					8
9	7.16	12.66	4.59	4.30	2.92	1.43	1.83	0.46	1.40	0.24	0.89	0.08	0.61	0.03	0.41	0.01					9
10	7.95	15.38	5.10	5.22	3.24	1.74	2.04	0.56	1.55	0.29	0.99	0.10	0.68	0.04	0.45	0.01	0.27	0.00			10
11	8.75	18.35	5.61	6.23	3.57	2.07	2.24	0.67	1.71	0.35	1.09	0.12	0.74	0.05	0.50	0.02	0.30	0.01			11
12	9.55	21.56	6.12	7.32	3.89	2.43	2.44	0.79	1.87	0.41	1.19	0.14	0.81	0.05	0.55	0.02	0.33	0.01			12
14	11.14	28.69	7.14	9.74	4.54	3.24	2.85	1.05	2.18	0.54	1.39	0.18	0.95	0.07	0.64	0.03	0.38	0.01			14
16	12.73	36.74	8.16	12.47	5.19	4.15	3.26	1.34	2.49	0.70	1.59	0.23	1.08	0.09	0.73	0.04	0.44	0.01			16
18	14.32	45.69	9.18	15.51	5.84	5.16	3.67	1.67	2.80	0.87	1.79	0.29	1.22	0.12	0.82	0.04	0.49	0.01			18
20	15.91	55.54	10.20	18.86	6.49	6.27	4.08	2.03	3.11	1.05	1.99	0.35	1.36	0.14	0.91	0.05	0.55	0.02			20
22	17.50	66.26	11.23	22.50	7.14	7.48	4.48	2.42	3.42	1.25	2.19	0.42	1.49	0.17	1.00	0.06	0.61	0.02			22
24	19.10	77.84	12.25	26.43	7.79	8.79	4.89	2.84	3.74	1.47	2.39	0.50	1.63	0.20	1.10	0.08	0.66	0.02			24
26			13.27	30.65	8.44	10.19	5.30	3.29	4.05	1.71	2.59	0.58	1.76	0.23	1.19	0.09	0.72	0.03			26
28			14.29	35.16	9.09	11.69	5.71	3.78	4.36	1.96	2.79	0.66	1.90	0.26	1.28	0.10	0.77	0.03	0.35	0.00	28
30			15.31	39.95	9.74	13.29	6.12	4.29	4.67	2.23	2.99	0.75	2.04	0.30	1.37	0.11	0.83	0.03	0.38	0.01	30
35			17.86	53.15	11.36	17.68	7.14	5.71	5.45	2.96	3.48	1.00	2.38	0.39	1.60	0.15	0.97	0.04	0.44	0.01	35
40					12.98	22.64	8.16	7.31	6.23	3.80	3.98	1.28	2.72	0.51	1.83	0.19	1.11	0.06	0.51	0.01	40
45					14.61	28.15	9.18	9.10	7.01	4.72	4.48	1.59	3.06	0.63	2.06	0.24	1.24	0.07	0.57	0.01	45
50					16.23	34.22	10.20	11.06	7.79	5.74	4.98	1.94	3.40	0.76	2.29	0.29	1.38	0.09	0.64	0.01	50
55					17.85	40.83	11.22	13.19	8.57	6.85	5.48	2.31	3.74	0.91	2.52	0.35	1.52	0.10	0.70	0.02	55
60					19.48	47.97	12.24	15.50	9.35	8.04	5.98	2.71	4.08	1.07	2.75	0.41	1.66	0.12	0.76	0.02	60
65							13.26	17.97	10.13	9.33	6.48	3.15	4.42	1.24	2.98	0.48	1.80	0.14	0.83	0.02	65
70							14.28	20.62	10.90	10.70	6.97	3.61	4.76	1.42	3.21	0.55	1.94	0.16	0.89	0.02	70
75							15.30	23.43	11.68	12.16	7.47	4.10	5.10	1.62	3.44	0.62	2.08	0.18	0.96	0.03	75
80							16.32	26.40	12.46	13.71	7.97	4.62	5.44	1.82	3.67	0.70	2.22	0.21	1.02	0.03	80
85							17.34	29.54	13.24	15.33	8.47	5.17	5.78	2.04	3.89	0.78	2.35	0.23	1.08	0.04	85
90							18.36	32.84	14.02	17.05	8.97	5.75	6.12	2.27	4.12	0.87	2.49	0.26	1.15	0.04	90
95							19.38	36.30	14.80	18.84	9.47	6.35	6.46	2.51	4.35	0.96	2.63	0.28	1.21	0.04	95
100									15.58	20.72	9.96	6.99	6.80	2.76	4.58	1.06	2.77	0.31	1.28	0.05	100
110									17.14	24.72	10.96	8.34	7.48	3.29	5.04	1.26	3.05	0.37	1.40	0.06	110
120									18.70	29.04	11.96	9.79	8.16	3.87	5.50	1.48	3.33	0.44	1.53	0.07	120
130											12.96	11.36	8.84	4.48	5.96	1.72	3.60	0.51	1.66	0.08	130
140											13.95	13.03	9.52	5.14	6.42	1.97	3.88	0.58	1.79	0.09	140
150											14.95	14.81	10.20	5.84	6.88	2.24	4.16	0.66	1.92	0.10	150
160											15.95	16.69	10.88	6.59	7.34	2.53	4.44	0.74	2.04	0.11	160
170											16.94	18.67	11.56	7.37	7.79	2.83	4.71	0.83	2.17	0.13	170
180											17.94	20.75	12.24	8.19	8.25	3.14	4.99	0.93	2.30	0.14	180
190											18.94	22.94	12.92	9.05	8.71	3.47	5.27	1.02	2.43	0.16	190
200											19.93	25.23	13.60	9.95	9.17	3.82	5.55	1.12	2.56	0.17	200
225													15.30	12.38	10.32	4.75	6.24	1.40	2.88	0.21	225
250													17.00	15.05	11.47	5.77	6.93	1.70	3.20	0.26	250
275													18.70	17.95	12.61	6.89	7.63	2.03	3.52	0.31	275
300															13.76	8.09	8.32	2.38	3.84	0.36	300
325															14.91	9.39	9.02	2.76	4.16	0.42	325
350															16.05	10.77	9.71	3.17	4.48	0.48	350
375															17.20	12.23	10.40	3.60	4.80	0.55	375
400															18.35	13.79	11.10	4.06	5.12	0.62	400
425															19.49	15.42	11.79	4.54	5.44	0.69	425
450																	12.49	5.05	5.76	0.77	450
475																	13.18	5.58	6.08	0.85	475
500																	13.87	6.14	6.40	0.94	500
550																	15.26	7.32	7.04	1.12	550
600																	16.65	8.60	7.68	1.31	600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.

**FRICITION LOSS CHARACTERISTICS**  
**PVC CLASS 200 IPS PLASTIC PIPE**  
(1120, 1220) SDR 21 C = 150  
PSI loss per 100 feet of pipe (PSI/100 FT)



Sizes 3/4" thru 6"  
Flow GPM 1 thru 600

SIZE	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE												
OD	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD												
ID	.930	1.189	1.502	1.720	2.149	2.601	3.166	4.072	5.993	ID												
WALL THK	.060	0.063	0.079	0.090	0.113	0.137	0.167	0.214	0.316	WALL THK												
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.	
1	0.47	0.06	0.28	0.02	0.18	0.01	0.13	0.00													1	
2	0.94	0.22	0.57	0.07	0.36	0.02	0.27	0.01														2
3	1.42	0.46	0.86	0.14	0.54	0.04	0.41	0.02														3
4	1.89	0.79	1.15	0.24	0.72	0.08	0.55	0.04														4
5	2.36	1.20	1.44	0.36	0.90	0.12	0.68	0.06														5
6	2.83	1.68	1.73	0.51	1.08	0.16	0.82	0.08														6
7	3.30	2.23	2.02	0.67	1.26	0.22	0.96	0.11														7
8	3.77	2.85	2.30	0.86	1.44	0.28	1.10	0.14														8
9	4.25	3.55	2.59	1.07	1.62	0.34	1.24	0.18														9
10	4.72	4.31	2.88	1.30	1.80	0.42	1.37	0.22														10
11	5.19	5.15	3.17	1.56	1.98	0.50	1.51	0.26														11
12	5.66	6.05	3.46	1.83	2.17	0.59	1.65	0.30														12
14	6.60	8.05	4.04	2.43	2.53	0.78	1.93	0.40														14
16	7.55	10.30	4.61	3.11	2.89	1.00	2.20	0.52														16
18	8.49	12.81	5.19	3.87	3.25	1.24	2.48	0.64														18
20	9.43	15.58	5.77	4.71	3.61	1.51	2.75	0.78														20
22	10.38	18.58	6.34	5.62	3.97	1.80	3.03	0.93														22
24	11.32	21.83	6.92	6.60	4.34	2.12	3.30	1.09														24
26	12.27	25.32	7.50	7.65	4.70	2.46	3.58	1.27														26
28	13.21	29.04	8.08	8.78	5.06	2.82	3.86	1.46														28
30	14.15	33.00	8.65	9.98	5.42	3.20	4.13	1.66														30
35	16.51	43.91	10.10	13.27	6.32	4.26	4.82	2.20														35
40	18.87	56.23	11.54	17.00	7.23	5.45	5.51	2.82														40
45			12.98	21.14	8.13	6.78	6.20	3.51														45
50			14.42	25.70	9.04	8.24	6.89	4.26														50
55			15.87	30.66	9.94	9.83	7.58	5.09														55
60			17.31	36.02	10.85	11.55	8.27	5.97														60
65			18.75	41.77	11.75	13.40	8.96	6.93														65
70					12.65	15.37	9.65	7.95														70
75					13.56	17.47	10.34	9.03														75
80					14.46	19.68	11.03	10.18														80
85					15.37	22.02	11.72	11.39														85
90					16.27	24.48	12.41	12.66														90
95					17.18	27.06	13.10	13.99														95
100					18.08	29.76	13.79	15.39														100
110					19.89	35.50	15.17	18.36														110
120							16.54	21.57														120
130							17.92	25.02														130
140							19.30	28.70														140
150																						150
160							14.13	12.44														160
170							15.01	13.91														170
180							15.90	15.47														180
190							16.78	17.10														190
200							17.66	18.80														200
225																						225
250																						250
275																						275
300																						300
325																						325
350																						350
375																						375
400																						400
425																						425
450																						450
475																						475
500																						500
550																						550
600																						600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.



**FRICITION LOSS CHARACTERISTICS**  
**PVC CLASS 160 IPS PLASTIC PIPE**  
 (1120, 1220) SDR 26 C = 150  
 PSI loss per 100 feet of pipe (PSI/100 FT)

Sizes 1" thru 6"  
 Flow GPM 1 thru 600

SIZE	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE												
OD	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD												
ID	1.195	1.532	1.754	2.193	2.655	3.230	4.154	6.115	ID												
WALL THK	0.060	0.064	0.073	0.091	0.110	0.135	0.173	0.225	WALL THK												
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	0.28	0.02	0.17	0.01	0.13	0.00															1
2	0.57	0.06	0.34	0.02	0.26	0.01	0.16	0.00													2
3	0.85	0.14	0.52	0.04	0.39	0.02	0.25	0.01													3
4	1.14	0.23	0.69	0.07	0.53	0.04	0.33	0.01	0.23	0.00											4
5	1.42	0.35	0.86	0.11	0.66	0.05	0.42	0.02	0.28	0.01											5
6	1.71	0.49	1.04	0.15	0.79	0.08	0.50	0.03	0.34	0.01	0.20	0.00									6
7	1.99	0.66	1.21	0.20	0.92	0.10	0.59	0.03	0.40	0.01	0.27	0.01									7
8	2.28	0.84	1.39	0.25	1.06	0.13	0.67	0.04	0.46	0.02	0.31	0.01									8
9	2.57	1.05	1.56	0.31	1.19	0.16	0.76	0.05	0.52	0.02	0.35	0.01									9
10	2.85	1.27	1.73	0.38	1.32	0.20	0.84	0.07	0.57	0.03	0.39	0.01									10
11	3.14	1.52	1.91	0.45	1.45	0.23	0.93	0.08	0.63	0.03	0.43	0.01									11
12	3.42	1.78	2.08	0.53	1.59	0.28	1.01	0.09	0.69	0.04	0.46	0.01	0.28	0.00							12
14	3.99	2.37	2.43	0.71	1.85	0.37	1.18	0.12	0.81	0.05	0.54	0.02	0.33	0.01							14
16	4.57	3.04	2.78	0.91	2.12	0.47	1.35	0.16	0.92	0.06	0.62	0.02	0.37	0.01							16
18	5.14	3.78	3.12	1.13	2.38	0.58	1.52	0.20	1.04	0.08	0.70	0.03	0.42	0.01							18
20	5.71	4.59	3.47	1.37	2.65	0.71	1.69	0.24	1.15	0.09	0.78	0.04	0.47	0.01							20
22	6.28	5.48	3.82	1.64	2.91	0.85	1.86	0.29	1.27	0.11	0.86	0.04	0.52	0.01							22
24	6.85	6.44	4.17	1.92	3.18	1.00	2.03	0.34	1.38	0.13	0.93	0.05	0.56	0.02							24
26	7.42	7.47	4.51	2.23	3.44	1.15	2.20	0.39	1.50	0.15	1.01	0.06	0.61	0.02							26
28	7.99	8.57	4.86	2.56	3.71	1.32	2.37	0.45	1.62	0.18	1.09	0.07	0.66	0.02							28
30	8.57	9.74	5.21	2.91	3.97	1.50	2.54	0.51	1.73	0.20	1.17	0.08	0.70	0.02							30
35	9.99	12.95	6.08	3.87	4.64	2.00	2.96	0.68	2.02	0.27	1.36	0.10	0.82	0.03	0.38	0.00					35
40	11.42	16.59	6.95	4.95	5.30	2.56	3.39	0.86	2.31	0.34	1.56	0.13	0.94	0.04	0.43	0.01					40
45	12.85	20.63	7.82	6.16	5.96	3.19	3.81	1.08	2.60	0.42	1.75	0.16	1.06	0.05	0.49	0.01					45
50	14.28	25.07	8.69	7.49	6.63	3.88	4.24	1.31	2.89	0.52	1.95	0.20	1.18	0.06	0.54	0.01					50
55	15.71	29.91	9.56	8.93	7.29	4.62	4.66	1.56	3.18	0.62	2.15	0.24	1.30	0.07	0.60	0.01					55
60	17.14	35.14	10.43	10.49	7.95	5.43	5.09	1.83	3.47	0.72	2.34	0.28	1.41	0.08	0.65	0.01					60
65	18.57	40.76	11.29	12.17	8.62	6.30	5.51	2.12	3.76	0.84	2.54	0.32	1.53	0.09	0.70	0.01					65
70	19.99	46.76	12.16	13.96	9.28	7.23	5.93	2.44	4.05	0.96	2.73	0.37	1.65	0.11	0.76	0.02					70
75			13.03	15.86	9.94	8.21	6.36	2.77	4.34	1.09	2.93	0.42	1.77	0.12	0.81	0.02					75
80			13.90	17.88	10.60	9.25	6.78	3.12	4.63	1.23	3.12	0.47	1.89	0.14	0.87	0.02					80
85			14.77	20.00	11.27	10.35	7.21	3.49	4.91	1.38	3.32	0.53	2.00	0.16	0.92	0.02					85
90			15.64	22.23	11.93	11.51	7.63	3.88	5.20	1.53	3.51	0.59	2.12	0.17	0.98	0.03					90
95			16.51	24.58	12.59	12.72	8.05	4.29	5.49	1.69	3.71	0.65	2.24	0.19	1.03	0.03					95
100			17.38	27.03	13.26	13.99	8.48	4.72	5.78	1.86	3.91	0.72	2.36	0.21	1.09	0.03					100
110			19.12	32.24	14.58	16.69	9.33	5.63	6.36	2.22	4.30	0.86	2.60	0.25	1.20	0.04					110
120					15.91	19.61	10.18	6.61	6.94	2.61	4.69	1.01	2.83	0.30	1.30	0.05					120
130					17.24	22.74	11.02	7.67	7.52	3.03	5.08	1.17	3.07	0.34	1.41	0.05					130
140					18.56	26.09	11.87	8.80	8.10	3.47	5.47	1.34	3.31	0.39	1.52	0.06					140
150					19.89	29.64	12.72	10.00	8.68	3.94	5.86	1.52	3.54	0.45	1.63	0.07					150
160							13.57	11.27	9.26	4.45	6.25	1.71	3.78	0.50	1.74	0.08					160
170							14.42	12.61	9.83	4.97	6.64	1.92	4.01	0.56	1.85	0.09					170
180							15.27	14.02	10.41	5.53	7.03	2.13	4.25	0.63	1.96	0.10					180
190							16.11	15.49	10.99	6.11	7.43	2.35	4.49	0.69	2.07	0.11					190
200							16.96	17.03	11.57	6.72	7.82	2.59	4.72	0.76	2.18	0.12					200
225							19.08	21.19	13.02	8.36	8.79	3.22	5.31	0.95	2.45	0.14					225
250									14.47	10.16	9.77	3.91	5.91	1.15	2.72	0.18					250
275									15.91	12.12	10.75	4.67	6.50	1.37	3.00	0.21					275
300									17.36	14.24	11.73	5.49	7.09	1.61	3.27	0.25					300
325									18.81	16.51	12.70	6.36	7.68	1.87	3.54	0.29					325
350											13.68	7.30	8.27	2.15	3.81	0.33					350
375											14.66	8.29	8.86	2.44	4.09	0.37					375
400											15.64	9.35	9.45	2.75	4.36	0.42					400
425											16.62	10.46	10.04	3.07	4.63	0.47					425
450											17.59	11.62	10.63	3.42	4.90	0.52					450
475											18.57	12.85	11.23	3.78	5.18	0.58					475
500											19.55	14.13	11.82	4.15	5.45	0.63					500
550													13.00	4.96	6.00	0.76					550
600													14.18	5.82	6.54	0.89					600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.

# FRICITION LOSS CHARACTERISTICS PVC CLASS 125 IPS PLASTIC PIPE

(1120, 1220) SDR 32.5 C = 150

PSI loss per 100 feet of pipe (PSI/100 FT)



Sizes 1" thru 6"  
Flow GPM 1 thru 600

SIZE	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE
OD	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD
ID	1.211	1.548	1.784	2.229	2.699	3.284	4.224	6.217	ID
WALL THK	0.052	0.056	0.058	0.073	0.088	0.108	0.138	0.204	WALL THK

FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	0.27	0.02	0.17	0.01	0.12	0.00															1
2	0.55	0.06	0.34	0.02	0.25	0.01	0.16	0.00													2
3	0.83	0.13	0.51	0.04	0.38	0.02	0.24	0.01													3
4	1.11	0.22	0.68	0.07	0.51	0.03	0.32	0.01	0.22	0.00											4
5	1.39	0.33	0.85	0.10	0.64	0.05	0.41	0.02	0.28	0.01											5
6	1.66	0.46	1.02	0.14	0.76	0.07	0.49	0.02	0.33	0.01											6
7	1.94	0.62	1.19	0.19	0.89	0.09	0.57	0.03	0.39	0.01	0.26	0.00									7
8	2.22	0.79	1.36	0.24	1.02	0.12	0.65	0.04	0.44	0.02	0.30	0.01									8
9	2.50	0.98	1.53	0.30	1.15	0.15	0.73	0.05	0.50	0.02	0.34	0.01									9
10	2.78	1.19	1.70	0.36	1.28	0.18	0.82	0.06	0.56	0.02	0.37	0.01									10
11	3.06	1.42	1.87	0.43	1.41	0.22	0.90	0.07	0.61	0.03	0.41	0.01									11
12	3.33	1.67	2.04	0.51	1.53	0.25	0.98	0.09	0.67	0.03	0.45	0.01	0.27	0.00							12
14	3.89	2.22	2.38	0.67	1.79	0.34	1.14	0.11	0.78	0.05	0.52	0.02	0.32	0.01							14
16	4.45	2.85	2.72	0.86	2.05	0.43	1.31	0.15	0.89	0.06	0.60	0.02	0.36	0.01							16
18	5.00	3.54	3.06	1.07	2.30	0.54	1.47	0.18	1.00	0.07	0.68	0.03	0.41	0.01							18
20	5.56	4.31	3.40	1.30	2.56	0.65	1.64	0.22	1.12	0.09	0.75	0.03	0.45	0.01							20
22	6.12	5.14	3.74	1.56	2.82	0.78	1.80	0.26	1.23	0.10	0.83	0.04	0.50	0.01							22
24	6.67	6.04	4.08	1.83	3.07	0.92	1.97	0.31	1.34	0.12	0.90	0.05	0.54	0.01							24
26	7.23	7.00	4.42	2.12	3.33	1.06	2.13	0.36	1.45	0.14	0.98	0.05	0.59	0.02							26
28	7.78	8.03	4.76	2.43	3.58	1.22	2.29	0.41	1.56	0.16	1.05	0.06	0.64	0.02							28
30	8.34	9.13	5.10	2.76	3.84	1.39	2.46	0.47	1.68	0.18	1.13	0.07	0.68	0.02							30
35	9.73	12.14	5.95	3.68	4.48	1.84	2.87	0.62	1.96	0.25	1.32	0.09	0.80	0.03	0.36	0.00					35
40	11.12	15.55	6.81	4.71	5.12	2.36	3.28	0.80	2.24	0.31	1.51	0.12	0.91	0.04	0.42	0.01					40
45	12.51	19.34	7.66	5.86	5.76	2.94	3.69	0.99	2.52	0.39	1.70	0.15	1.02	0.04	0.47	0.01					45
50	13.91	23.50	8.51	7.12	6.40	3.57	4.10	1.21	2.80	0.48	1.89	0.18	1.14	0.05	0.52	0.01					50
55	15.30	28.04	9.36	8.49	7.05	4.26	4.51	1.44	3.08	0.57	2.08	0.22	1.25	0.06	0.58	0.01					55
60	16.69	32.94	10.21	9.98	7.69	5.00	4.92	1.69	3.36	0.67	2.26	0.26	1.37	0.08	0.63	0.01					60
65	18.08	38.21	11.06	11.57	8.33	5.80	5.33	1.96	3.64	0.77	2.45	0.30	1.48	0.09	0.68	0.01					65
70	19.47	43.83	11.91	13.27	8.97	6.65	5.74	2.25	3.92	0.89	2.64	0.34	1.60	0.10	0.73	0.02					70
75			12.76	15.08	9.61	7.56	6.15	2.56	4.20	1.01	2.83	0.39	1.71	0.11	0.79	0.02					75
80			13.62	17.00	10.25	8.52	6.56	2.88	4.48	1.14	3.02	0.44	1.82	0.13	0.84	0.02					80
85			14.47	19.02	10.89	9.53	6.98	3.23	4.76	1.27	3.21	0.49	1.94	0.14	0.89	0.02					85
90			15.32	21.14	11.53	10.60	7.39	3.59	5.04	1.41	3.40	0.54	2.05	0.16	0.95	0.02					90
95			16.17	23.37	12.17	11.71	7.80	3.96	5.32	1.56	3.59	0.60	2.17	0.18	1.00	0.03					95
100			17.02	25.69	12.81	12.88	8.21	4.36	5.60	1.72	3.78	0.66	2.28	0.19	1.05	0.03					100
110			18.72	30.65	14.10	15.37	9.03	5.20	6.16	2.05	4.16	0.79	2.51	0.23	1.16	0.04					110
120					15.38	18.06	9.85	6.11	6.72	2.41	4.53	0.93	2.74	0.27	1.26	0.04					120
130					16.66	20.94	10.67	7.09	7.28	2.79	4.91	1.08	2.97	0.32	1.37	0.05					130
140					17.94	24.02	11.49	8.13	7.84	3.20	5.29	1.23	3.20	0.36	1.47	0.06					140
150					19.22	27.30	12.31	9.24	8.40	3.64	5.67	1.40	3.43	0.41	1.58	0.06					150
160							13.13	10.41	8.96	4.10	6.05	1.58	3.65	0.46	1.68	0.07					160
170							13.96	11.65	9.52	4.59	6.43	1.77	3.88	0.52	1.79	0.08					170
180							14.78	12.95	10.08	5.10	6.80	1.96	4.11	0.58	1.90	0.09					180
190							15.60	14.31	10.64	5.64	7.18	2.17	4.34	0.64	2.00	0.10					190
200							16.42	15.74	11.20	6.20	7.56	2.39	4.57	0.70	2.11	0.11					200
225							18.47	19.57	12.60	7.72	8.51	2.97	5.14	0.87	2.37	0.13					225
250									14.00	9.38	9.45	3.61	5.71	1.06	2.63	0.16					250
275									15.40	11.19	10.40	4.31	6.28	1.27	2.90	0.19					275
300									16.80	13.15	11.34	5.06	6.86	1.49	3.16	0.23					300
325									18.20	15.25	12.29	5.87	7.43	1.72	3.43	0.26					325
350									19.60	17.49	13.24	6.73	8.00	1.98	3.69	0.30					350
375											14.18	7.65	8.57	2.25	3.95	0.34					375
400											15.13	8.62	9.14	2.53	4.22	0.39					400
425											16.07	9.65	9.71	2.83	4.48	0.43					425
450											17.02	10.72	10.29	3.15	4.75	0.48					450
475											17.96	11.85	10.86	3.48	5.01	0.53					475
500											18.91	13.03	11.43	3.83	5.27	0.58					500
550													12.57	4.57	5.80	0.70					550
600													13.72	5.37	6.33	0.82					600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.





**FRICION LOSS CHARACTERISTICS  
POLYETHYLENE (PE)  
SDR-PRESSURE RATED TUBE**  
(2306, 3206, 3306) SDR 7, 9, 11.5, 15 C = 140  
PSI loss per 100 feet of tube (PSI/100 FT)  
Sizes 1/2" thru 6"  
Flow GPM 1 thru 600

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE										
ID	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065	ID										
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	1.05	0.49	0.60	0.12	0.37	0.04	0.21	0.01	0.15	0.00	0.09	0.00									1
2	2.10	1.76	1.20	0.45	0.74	0.14	0.42	0.04	0.31	0.02	0.19	0.01									2
3	3.16	3.73	1.80	0.95	1.11	0.29	0.64	0.08	0.47	0.04	0.28	0.01	0.20	0.00							3
4	4.21	6.35	2.40	1.62	1.48	0.50	0.85	0.13	0.62	0.06	0.38	0.02	0.26	0.01							4
5	5.27	9.60	3.00	2.44	1.85	0.76	1.07	0.20	0.78	0.09	0.47	0.03	0.33	0.01	0.21	0.00					5
6	6.32	13.46	3.60	3.43	2.22	1.06	1.28	0.28	0.94	0.13	0.57	0.04	0.40	0.02	0.26	0.01					6
7	7.38	17.91	4.20	4.56	2.59	1.41	1.49	0.37	1.10	0.18	0.66	0.05	0.46	0.02	0.30	0.01					7
8	8.43	22.93	4.80	5.84	2.96	1.80	1.71	0.47	1.25	0.22	0.76	0.07	0.53	0.03	0.34	0.01					8
9	9.49	28.52	5.40	7.26	3.33	2.24	1.92	0.59	1.41	0.28	0.85	0.08	0.60	0.03	0.39	0.01					9
10	10.54	34.67	6.00	8.82	3.70	2.73	2.14	0.72	1.57	0.34	0.95	0.10	0.66	0.04	0.43	0.01					10
11	11.60	41.36	6.00	10.53	4.07	3.25	2.35	0.86	1.73	0.40	1.05	0.12	0.73	0.05	0.47	0.02	0.27	0.00			11
12	12.65	48.60	7.21	12.37	4.44	3.82	2.57	1.01	1.88	0.48	1.14	0.14	0.80	0.06	0.52	0.02	0.30	0.01			12
14	14.76	64.65	8.41	16.46	5.19	5.08	2.99	1.34	2.20	0.63	1.33	0.19	0.93	0.08	0.60	0.03	0.35	0.01			14
16	16.87	82.79	9.61	21.07	5.93	6.51	3.42	1.71	2.51	0.81	1.52	0.24	1.07	0.10	0.69	0.04	0.40	0.01			16
18	18.98	102.97	10.81	26.21	6.67	8.10	3.85	2.13	2.83	1.01	1.71	0.30	1.20	0.13	0.78	0.04	0.45	0.01			18
20			12.01	31.86	7.41	9.84	4.28	2.59	3.14	1.22	1.90	0.36	1.33	0.15	0.86	0.05	0.50	0.01			20
22			13.21	38.01	8.15	11.74	4.71	3.09	3.46	1.46	2.10	0.43	1.47	0.18	0.95	0.06	0.55	0.02			22
24			14.42	44.65	8.89	13.79	5.14	3.63	3.77	1.72	2.29	0.51	1.60	0.21	1.04	0.07	0.60	0.02			24
26			15.62	41.79	9.64	16.00	5.57	4.21	4.09	1.99	2.48	0.59	1.74	0.25	1.12	0.09	0.65	0.02			26
28			16.82	59.41	10.38	18.35	5.99	4.83	4.40	2.28	2.67	0.68	1.87	0.29	1.21	0.10	0.70	0.03			28
30			18.02	67.50	11.12	20.85	6.42	5.49	4.72	2.59	2.86	0.77	2.00	0.32	1.30	0.11	0.75	0.03	0.33	0.00	30
35					12.97	27.74	7.49	7.31	5.50	3.45	3.34	1.02	2.34	0.43	1.51	0.15	0.88	0.04	0.38	0.01	35
40					14.83	35.53	8.56	9.36	6.29	4.42	3.81	1.31	2.67	0.55	1.73	0.19	1.00	0.05	0.44	0.01	40
45					16.68	44.19	9.64	11.64	7.08	5.50	4.29	1.63	3.01	0.69	1.95	0.24	1.13	0.06	0.49	0.01	45
50					18.53	53.71	10.71	14.14	7.87	6.68	4.77	1.98	3.34	0.83	2.16	0.29	1.25	0.08	0.55	0.01	50
55							11.78	16.87	8.65	7.97	5.25	2.36	3.68	1.00	2.38	0.35	1.38	0.09	0.61	0.01	55
60							12.85	19.82	9.44	9.36	5.72	2.78	4.01	1.17	2.60	0.41	1.51	0.11	0.66	0.01	60
65							13.92	22.99	10.23	10.86	6.20	3.22	4.35	1.36	2.81	0.47	1.63	0.13	0.72	0.02	65
70							14.99	26.37	11.01	12.46	6.68	3.69	4.68	1.56	3.03	0.54	1.76	0.14	0.77	0.02	70
75							16.06	29.97	11.80	14.16	7.16	4.20	5.01	1.77	3.25	0.61	1.88	0.16	0.83	0.02	75
80							17.13	33.77	12.59	15.95	7.63	4.73	5.35	1.99	3.46	0.69	2.01	0.18	0.88	0.03	80
85							18.21	37.79	13.37	17.85	8.11	5.29	5.68	2.23	3.68	0.77	2.13	0.21	0.94	0.03	85
90							19.28	42.01	14.16	19.84	8.59	5.88	6.02	2.48	3.90	0.86	2.26	0.23	0.99	0.03	90
95									14.95	21.93	9.07	6.50	6.35	2.74	4.11	0.95	2.39	0.25	1.05	0.03	95
100									15.74	24.12	9.54	7.15	6.69	3.01	4.33	1.05	2.51	0.28	1.10	0.04	100
110									17.31	28.77	10.50	8.53	7.36	3.59	4.76	1.25	2.76	0.33	1.22	0.05	110
120									18.88	33.80	11.45	10.02	8.03	4.22	5.20	1.47	3.02	0.39	1.33	0.05	120
130											12.41	11.62	8.70	4.90	5.63	1.70	3.27	0.45	1.44	0.06	130
140											13.36	13.33	9.37	5.62	6.06	1.95	3.52	0.52	1.55	0.07	140
150											14.32	15.15	10.03	6.38	6.50	2.22	3.77	0.59	1.66	0.08	150
160											15.27	17.08	10.70	7.19	6.93	2.50	4.02	0.67	1.77	0.09	160
170											16.23	19.11	11.37	8.05	7.36	2.80	4.27	0.75	1.88	0.10	170
180											17.18	21.24	12.04	8.95	7.08	3.11	4.53	0.83	1.99	0.11	180
190											18.14	23.48	12.71	9.89	8.23	3.44	4.78	0.92	2.10	0.12	190
200											19.09	25.81	13.38	10.87	8.66	3.78	5.03	1.01	2.21	0.14	200
225													15.05	13.52	9.75	4.70	5.66	1.25	2.49	0.17	225
250													16.73	16.44	10.83	5.71	6.29	1.52	2.77	0.21	250
275													18.40	19.61	11.92	6.82	6.92	1.82	3.05	0.25	275
300													13.00	8.01	7.55	2.13	3.32	0.29			300
325													14.08	9.29	8.18	2.48	3.60	0.34			325
350													15.17	10.65	8.81	2.84	3.88	0.39			350
375													16.25	12.10	9.43	3.23	4.15	0.44			375
400													17.33	13.64	10.06	3.64	4.43	0.50			400
425													18.42	15.26	10.69	4.07	4.71	0.55			425
450													19.50	16.97	11.32	4.52	4.99	0.62			450
475																	11.95	5.00	5.26	0.68	475
500																	12.58	5.50	5.54	0.75	500
550																	13.84	6.56	6.10	0.89	550
600																	15.10	7.70	6.65	1.05	600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.

# FRICTION LOSS CHARACTERISTICS

## SCHEDULE 40 STANDARD STEEL PIPE C=100

PSI loss per 100 feet of pipe (PSI/100 FT)



Sizes 1/2" thru 6"  
Flow GPM 1 thru 600

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	SIZE												
OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	OD												
ID	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065	ID												
WALL THK	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.237	0.280	WALL THK												
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	1.05	0.91	0.60	0.23	0.37	0.07	0.21	0.02	0.15	0.01	0.09	0.00	0.13	0.00									1
2	2.10	3.28	1.20	0.84	0.74	0.26	0.42	0.07	0.31	0.03	0.19	0.01	0.26	0.01									2
3	3.16	6.95	1.80	1.77	1.11	0.55	0.64	0.14	0.47	0.07	0.28	0.02	0.20	0.01	0.13	0.00							3
4	4.21	11.85	2.40	3.02	1.48	0.93	0.85	0.25	0.62	0.12	0.38	0.03	0.26	0.01	0.17	0.01							4
5	5.27	17.91	3.00	4.56	1.85	1.41	1.07	0.37	0.78	0.18	0.47	0.05	0.33	0.02	0.21	0.01							5
6	6.32	25.10	3.60	6.39	2.22	1.97	1.28	0.52	0.94	0.25	0.57	0.07	0.40	0.03	0.26	0.01							6
7	7.38	33.40	4.20	8.50	2.59	2.63	1.49	0.69	1.10	0.33	0.66	0.10	0.46	0.04	0.30	0.01							7
8	8.43	42.77	4.80	10.89	2.96	3.36	1.71	0.89	1.25	0.42	0.76	0.12	0.53	0.05	0.34	0.02	0.20	0.00					8
9	9.49	53.19	5.40	13.54	3.33	4.18	1.92	1.10	1.41	0.52	0.85	0.15	0.60	0.06	0.39	0.02	0.22	0.01					9
10	10.54	64.65	6.00	16.46	3.70	5.08	2.14	1.34	1.57	0.63	0.95	0.19	0.66	0.08	0.43	0.03	0.25	0.01					10
11	11.60	77.13	6.60	19.63	4.07	6.07	2.35	1.60	1.73	0.75	1.05	0.22	0.73	0.09	0.47	0.03	0.27	0.01					11
12	12.65	90.62	7.21	23.07	4.44	7.13	2.57	1.88	1.88	0.89	1.14	0.26	0.80	0.11	0.52	0.04	0.30	0.01					12
14	14.76	20.56	8.41	30.69	5.19	9.48	2.99	2.50	2.20	1.18	1.33	0.35	0.93	0.15	0.60	0.05	0.35	0.01					14
16	16.87	54.39	9.61	39.30	5.93	12.14	3.42	3.20	2.51	1.51	1.52	0.45	1.07	0.19	0.69	0.07	0.40	0.02					16
18	18.98	92.02	10.81	48.88	6.67	15.10	3.85	3.98	2.83	1.88	1.71	0.56	1.20	0.23	0.78	0.08	0.45	0.02					18
20			12.01	59.41	7.41	18.35	4.28	4.83	3.14	2.28	1.90	0.68	1.33	0.29	0.86	0.10	0.50	0.03					20
22			13.21	70.88	8.15	21.90	4.71	5.77	3.46	2.72	2.10	0.81	1.47	0.34	0.95	0.12	0.55	0.03	0.24	0.00			22
24			14.42	83.27	8.89	25.72	5.14	6.77	3.77	3.20	2.29	0.95	1.60	0.40	1.04	0.14	0.60	0.04	0.26	0.01			24
26			15.62	96.57	9.64	29.83	5.57	7.86	4.09	3.71	2.48	1.10	1.74	0.46	1.12	0.16	0.65	0.04	0.28	0.01			26
28			16.82	110.8	10.38	34.22	5.99	9.01	4.40	4.26	2.67	1.26	1.87	0.53	1.21	0.18	0.70	0.05	0.31	0.01			28
30			18.02	125.9	11.12	38.89	6.42	10.24	4.72	4.84	2.86	1.43	2.00	0.60	1.30	0.21	0.75	0.06	0.33	0.01			30
35					12.97	51.74	7.49	13.62	5.50	6.44	3.34	1.91	2.34	0.80	1.51	0.28	0.88	0.07	0.38	0.01			35
40					14.83	66.25	8.56	17.45	6.29	8.24	3.81	2.44	2.67	1.03	1.73	0.36	1.00	0.10	0.44	0.01			40
45					16.68	82.40	9.64	21.70	7.08	10.25	4.29	3.04	3.01	1.28	1.95	0.44	1.13	0.12	0.49	0.02			45
50					18.53	100.2	10.71	26.37	7.87	12.46	4.77	3.69	3.34	1.56	2.16	0.54	1.25	0.14	0.55	0.02			50
55							11.78	31.47	8.65	14.86	5.25	4.41	3.68	1.86	2.38	0.65	1.38	0.17	0.61	0.02			55
60							12.85	36.97	9.44	17.46	5.72	5.18	4.01	2.18	2.60	0.76	1.51	0.20	0.66	0.03			60
65							13.92	42.88	10.23	20.25	6.20	6.00	4.35	2.53	2.81	0.88	1.63	0.23	0.72	0.03			65
70							14.99	49.18	11.01	23.23	6.68	6.89	4.68	2.90	3.03	1.01	1.76	0.27	0.77	0.04			70
75							16.06	55.89	11.80	26.40	7.16	7.83	5.01	3.30	3.25	1.15	1.88	0.31	0.83	0.04			75
80							17.13	62.98	12.59	29.75	7.63	8.82	5.35	3.72	3.46	1.29	2.01	0.34	0.88	0.05			80
85							18.21	70.47	13.37	33.29	8.11	9.87	5.68	4.16	3.68	1.44	2.13	0.39	0.94	0.05			85
90							19.28	78.33	14.16	37.00	8.59	10.97	6.02	4.62	3.90	1.61	2.26	0.43	0.99	0.06			90
95									14.95	40.90	9.07	12.13	6.35	5.11	4.11	1.78	2.39	0.47	1.05	0.06			95
100									15.74	44.97	9.54	13.33	6.69	5.62	4.33	1.95	2.51	0.52	1.10	0.07			100
110									17.31	53.66	10.50	15.91	7.36	6.70	4.76	2.33	2.76	0.62	1.22	0.08			110
120									18.88	63.04	11.45	18.69	8.03	7.87	5.20	2.74	3.02	0.73	1.33	0.10			120
130											12.41	21.68	8.70	9.13	5.63	3.17	3.27	0.85	1.44	0.12			130
140											13.36	24.87	9.37	10.47	6.06	3.64	3.52	0.97	1.55	0.13			140
150											14.32	28.26	10.03	11.90	6.50	4.14	3.77	1.10	1.66	0.15			150
160											15.27	31.84	10.70	13.41	6.93	4.66	4.02	1.24	1.77	0.17			160
170											16.23	35.63	11.37	15.01	7.36	5.22	4.27	1.39	1.88	0.19			170
180											17.18	39.61	12.04	16.68	7.80	5.80	4.53	1.55	1.99	0.21			180
190											18.14	43.78	12.71	18.44	8.23	6.41	4.78	1.71	2.10	0.23			190
200											19.09	48.14	13.38	20.28	8.66	7.05	5.03	1.88	2.21	0.26			200
225															15.08	25.22	9.75	8.76	5.66	2.34	2.49	0.32	225
250															16.73	30.65	10.83	10.65	6.29	2.84	2.77	0.39	250
275															18.40	36.57	11.92	12.71	6.92	3.39	3.05	0.46	275
300																	13.00	14.93	7.55	3.98	3.32	0.54	300
325																	14.08	17.32	8.18	4.62	3.60	0.63	325
350																	15.17	19.87	8.81	5.30	3.88	0.72	350
375																	16.25	22.57	9.43	6.02	4.15	0.82	375
400																	17.33	25.44	10.06	6.78	4.43	0.92	400
425																	18.42	28.46	10.69	7.59	4.71	1.03	425
450																	19.50	31.64	11.32	8.43	4.99	1.15	450
475																		11.95	9.32	5.26	1.27		475
500																		12.58	10.25	5.54	1.40		500
550																		13.84	12.23	6.10	1.67		550
600																		15.10	14.37	6.65	1.96		600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.



## FRICTION LOSS CHARACTERISTICS TYPE K COPPER WATER TUBE C = 140

PSI loss per 100 feet of tube (PSI/100 FT)

Sizes 1/2" thru 3"  
Flow GPM 1 thru 600

SIZE	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	SIZE											
OD	0.625	0.750	0.875	1.125	1.375	1.625	2.125	2.625	3.125	OD											
ID	0.527	0.652	0.745	0.995	1.245	1.481	1.959	2.435	2.907	ID											
WALL THK	0.049	0.049	0.065	0.065	0.065	0.072	0.083	0.095	0.109	WALL THK											
FLOW G.P.M.	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	VELOCITY F.P.S.	P.S.I. LOSS	FLOW G.P.M.
1	1.46	1.09	0.95	0.39	0.73	0.20	0.41	0.05	0.26	0.02	0.18	0.01	0.10	0.00							1
2	2.93	3.94	1.91	1.40	1.47	0.73	0.82	0.18	0.52	0.06	0.37	0.03	0.21	0.01							2
3	4.40	8.35	2.87	2.97	2.20	1.55	1.23	0.38	0.78	0.13	0.55	0.05	0.31	0.01	0.20	0.00					3
4	5.87	14.23	3.83	5.05	2.94	2.64	1.64	0.65	1.05	0.22	0.74	0.09	0.42	0.02	0.27	0.01	0.19	0.00			4
5	7.34	21.51	4.79	7.64	3.67	3.99	2.06	0.98	1.31	0.33	0.93	0.14	0.53	0.04	0.34	0.01	0.24	0.01			5
6	8.81	30.15	5.75	10.70	4.41	5.60	2.47	1.37	1.57	0.46	1.11	0.20	0.63	0.05	0.41	0.02	0.28	0.01			6
7	10.28	40.11	6.71	14.24	5.14	7.44	2.88	1.82	1.84	0.61	1.30	0.26	0.74	0.07	0.48	0.02	0.33	0.01			7
8	11.75	51.37	7.67	18.24	5.88	9.53	3.29	2.33	2.10	0.78	1.48	0.34	0.85	0.09	0.55	0.03	0.38	0.01			8
9	13.22	63.89	8.63	22.68	6.61	11.86	3.70	2.90	2.36	0.97	1.67	0.42	0.95	0.11	0.61	0.04	0.43	0.02			9
10	14.69	77.66	9.59	27.57	7.35	14.41	4.12	3.53	2.63	1.18	1.86	0.51	1.06	0.13	0.68	0.05	0.48	0.02			10
11	16.15	92.65	10.55	32.89	8.08	17.19	4.53	4.21	2.89	1.41	2.04	0.61	1.16	0.16	0.75	0.05	0.53	0.02			11
12	17.62	108.85	11.51	38.64	8.82	20.20	4.94	4.94	3.15	1.66	2.23	0.71	1.27	0.18	0.82	0.06	0.57	0.03			12
14			13.43	51.41	10.29	26.87	5.76	6.57	3.68	2.21	2.60	0.95	1.48	0.24	0.95	0.08	0.67	0.04			14
16			15.35	65.83	11.76	34.41	6.59	8.42	4.21	2.83	2.97	1.22	1.70	0.31	1.10	0.11	0.77	0.05			16
18			17.27	81.88	13.23	42.80	7.41	10.47	4.73	3.52	3.34	1.51	1.91	0.39	1.23	0.13	0.86	0.06			18
20			19.19	99.53	14.70	52.02	8.24	12.73	5.26	4.28	3.72	1.84	2.12	0.47	1.37	0.16	0.96	0.07			20
22					16.17	62.06	9.06	15.18	5.79	5.10	4.09	2.19	2.33	0.56	1.51	0.20	1.06	0.08			22
24					17.64	72.92	9.89	17.84	6.31	5.99	4.46	2.58	2.55	0.66	1.65	0.23	1.15	0.10			24
26					19.11	84.57	10.71	20.69	6.84	6.95	4.83	2.99	2.76	0.77	1.78	0.27	1.25	0.11			26
28							11.53	23.73	7.37	7.98	5.20	3.43	2.97	0.88	1.92	0.30	1.35	0.13			28
30							12.36	26.97	7.89	9.06	5.58	3.89	3.18	1.00	2.06	0.35	1.44	0.15			30
35							14.42	35.88	9.21	12.06	6.51	5.18	3.72	1.33	2.40	0.46	1.68	0.19			35
40							16.48	45.95	10.52	15.44	7.44	6.63	4.25	1.70	2.75	0.59	1.93	0.25			40
45							18.54	57.15	11.84	19.20	8.37	8.25	4.78	2.12	3.00	0.73	2.17	0.31			45
50									13.16	23.34	9.30	10.03	5.31	2.57	3.44	0.89	2.41	0.38			50
55									14.47	27.85	10.23	11.97	5.84	3.07	3.78	1.06	2.65	0.45			55
60									15.79	32.71	11.16	14.06	6.37	3.60	4.12	1.25	2.89	0.53			60
65									17.10	37.94	12.09	16.31	6.91	4.18	4.47	1.45	3.13	0.61			65
70									18.42	43.52	13.02	18.70	7.44	4.80	4.81	1.66	3.37	0.70			70
75									19.74	49.46	13.95	21.25	7.97	5.45	5.16	1.89	3.62	0.80			75
80											14.88	23.95	8.50	6.14	5.50	2.13	3.86	0.90			80
85											15.81	26.80	9.03	6.87	5.84	2.38	4.10	1.01			85
90											16.74	29.79	9.56	7.64	6.19	2.65	4.34	1.12			90
95											17.67	32.93	10.09	8.44	6.53	2.93	4.58	1.24			95
100											18.60	36.21	10.63	9.28	6.88	3.22	4.82	1.36			100
110															11.69	11.08	7.56	3.84	5.31	1.62	110
120															12.75	13.01	8.25	4.52	5.79	1.91	120
130															13.82	15.09	8.94	5.24	6.27	2.21	130
140															14.88	17.31	9.63	6.01	6.75	2.54	140
150															15.94	19.67	10.32	6.83	7.24	2.88	150
160															17.01	22.17	11.00	7.69	7.72	3.25	160
170															18.07	24.81	11.69	8.61	8.20	3.64	170
180															19.13	27.58	12.38	9.57	8.69	4.04	180
190																	13.07	10.58	9.17	4.47	190
200																	13.76	11.63	9.65	4.91	200
225																	15.48	14.47	10.86	6.11	225
250																	17.20	17.58	12.07	7.43	250
275																	18.92	20.98	13.27	8.86	275
300																			14.48	10.41	300
325																			15.69	12.07	325
350																			16.89	13.85	350
375																			18.10	15.73	375
400																			19.31	17.73	400
425																					425
450																					450
475																					475
500																					500
550																					550
600																					600

Note: Shaded areas of chart indicate velocities over 5' per second. Use with Caution.

**PRESSURE LOSS IN VALVES AND FITTINGS**  
Equivalent Length in Feet of Standard Steel Pipe

Nominal Pipe Size	Globe Valve	Angle Valve	Sprinkler Angle Valve	Gate Valve	Side Outlet Std. Tee	Run of Std. Tee	Std. Elbow	45° Elbow
1/2	17	9	2	0.4	4	1	2	1
3/4	22	12	3	0.5	5	2	3	1
1	27	15	4	0.6	6	2	3	2
1-1/4	38	18	5	0.8	8	3	4	2
1-1/2	45	22	6	1.0	10	3	5	2
2	58	28	7	1.2	12	4	6	3
2-1/2	70	35	9	1.4	14	5	7	3
3	90	45	11	1.8	18	6	8	4
4	120	60	15	2.3	23	7	11	5
6	170	85	20	3.3	33	12	17	8

**PRESSURE LOSS THROUGH COPPER AND BRONZE FITTINGS**

Nominal Tube Size	EQUIVALENT FEET OF STRAIGHT TUBING										
	WROUGHT COPPER					CAST BRONZE					
	90° Elbow	45° Elbow	Tee Run	Tee Side Outlet	90° Bend	180° Bend	90 Elbow	45° Elbow	Tee Run	Tee Slide Output	Compression Stop
3/8	1/2	1/2	1/2	1	1/2	1/2	1	1/2	1/2	2	9
1/2	1/2	1/2	1/2	1	1/2	1	1	1	1/2	2	13
5/8	1/2	1/2	1/2	2	1	1	2	1	1/2	3	17
3/4	1	1/2	1/2	2	1	2	2	1	1/2	3	21
1	1	1	1/2	3	2	2	4	2	1/2	5	30
1-1/4	2	1	1/2	4	2	3	5	2	1	7	-
1-1/2	2	2	1	5	2	4	8	3	1	9	-
2	2	2	1	7	3	8	11	5	2	12	-
2-1/2	2	3	2	9	4	16	14	8	2	16	-
3	3	4	-	-	5	20	18	11	2	20	-
3-1/2	4	-	-	-	7	24	24	14	2	31	-
4	-	-	-	-	8	28	28	17	2	37	-
5	-	-	-	-	10	37	41	22	2	48	-
6	-	-	-	-	13	47	52	28	2	61	-

**PRESSURE LOSS THROUGH SWING CHECK VALVES—PRESSURE LOSS (PSI)**

FLOW G.P.M.	VALVE SIZE						FLOW G.P.M.	VALVE SIZE					
	1/2	3/4	1	1-1/4	1-1/2	2		1-1/4	1-1/2	2	2-1/2	3	4
2	0.2						46	2.1	1.1	0.4			
3	0.5						48	2.2	1.2	0.5			
6	1.0	0.3					50	2.4	1.3	0.5			
8	1.7	0.5					55	2.9	1.5	0.6			
10	2.6	0.8	0.3				60	3.4	1.8	0.7			
12	3.6	1.1	0.5				65	3.9	2.0	0.8			
14	4.8	1.5	0.6				70	4.5	2.4	0.9	0.4		
16		2.0	0.9				75		2.7	1.0	0.5		
18		2.4	1.0				80		3.0	1.2	0.6		
20		3.0	1.2	0.4			90		3.7	1.5	0.7		
22		3.5	1.4	0.5			100		4.6	1.8	0.9	0.4	
24		4.1	1.7	0.6			120			2.5	1.2	0.5	
26		4.8	2.0	0.7	0.4		140			3.3	1.6	0.7	
28			2.2	0.8	0.5		160			4.3	2.1	0.9	0.3
30			2.5	0.9	0.5		180			5.3	2.6	1.1	0.4
32			2.9	1.1	0.6		200			6.5	3.1	1.4	0.5
34			3.2	1.2	0.6		250				4.7	2.1	0.7
36			3.6	1.3	0.7		300				6.6	2.9	1.0
38			3.9	1.5	0.8		350					3.8	1.3
40			4.3	1.6	0.8	0.3	400					4.9	1.7
42			4.7	1.7	0.9	0.3	450						2.1
44				1.9	1.0	0.4	500						2.6

### CLIMATE P.E.T.TABLE

Climate*	Inches Daily
Cool Humid	.10 -.15
Cool Dry	.15 -.20
Warm Humid	.15 -.20
Warm Dry	.20 -.25
Hot Humid	.20 -.30
Hot Dry	.30 -.45

▲  
Worst case

\*"Cool" equals under 70°F as an average mid-summer high.  
 "Warm" equals between 70° and 90°F as mid-summer highs.  
 "Hot" equals over 90°F. "Humid" equals over 50% as average mid-summer relative humidity (dry=under 50%).

Length of String	2 3/4"	3 1/4"	3 1/2"	4"	4 3/8"	5"
Size service line copper	3/4"		1"		1 1/4"	
Size of service line galvanized		3/4"		1"		1 1/4"

### ESTIMATED SERVICE LINE SIZES

### PRESSURE LOSS THROUGH BRONZE GATE VALVES

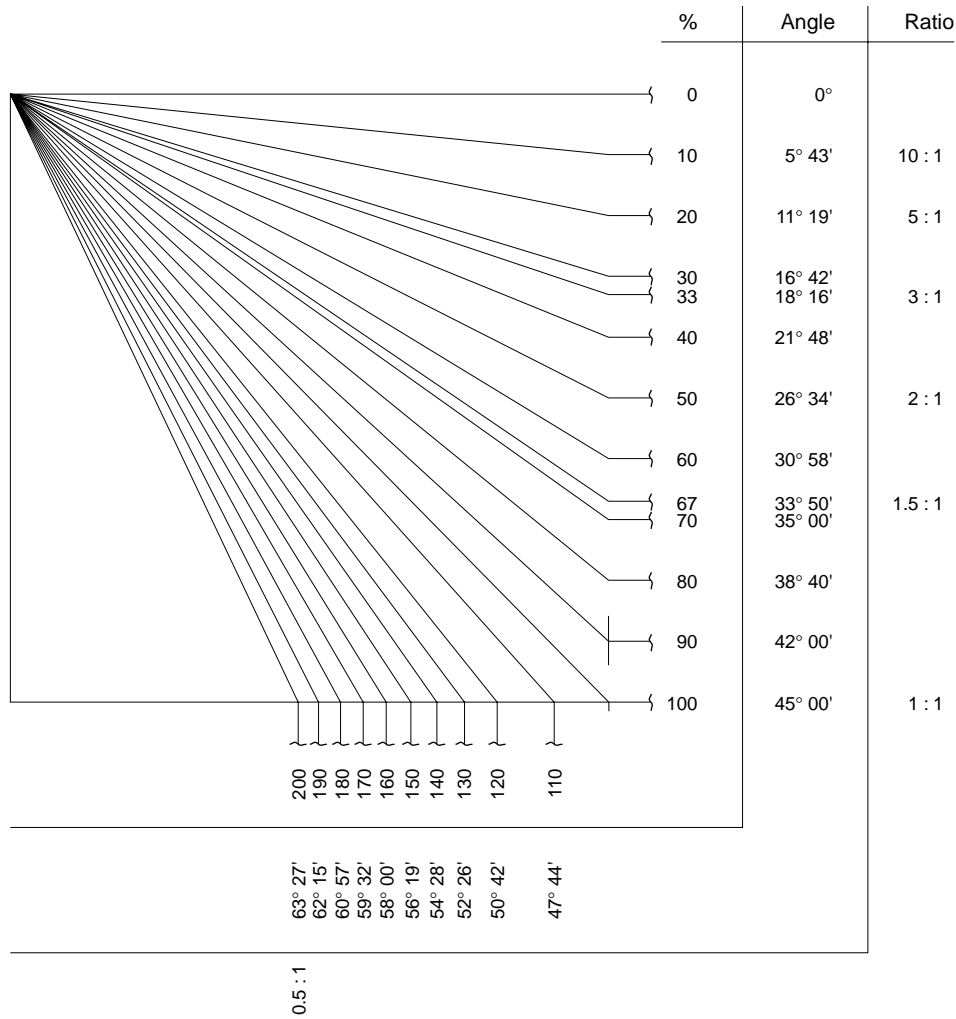
PRESSURE LOSS: (PSI)

GPM	VALVE SIZE								
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
1									
2	.01								
5	.06	.02							
8	.16	.05	.02						
10	.24	.08	.03	.01					
15		.17	.06	.02	.01				
20		.31	.11	.03	.02				
30			.24	.07	.04	.01			
40			.43	.13	.07	.02	.01		
50			.67	.21	.11	.04	.02		
60				.30	.15	.05	.03	.01	
80				.54	.28	.10	.05	.02	
100					.43	.15	.07	.03	
120					.62	.22	.10	.04	.02
140					.85	.30	.14	.06	
160						.40	.18	.07	.03
180						.50	.23	.09	
200						.62	.29	.11	.04
220							.42	.14	.05
240								.17	.06
260								.19	.07
280								.23	.09
300								.26	.10
350									.14
400									.18
450									.23
500									.28
550									.34
600									.40

### PRESSURE LOSS THROUGH WATER METERS AWWA STANDARD PRESSURE LOSS: (PSI)

FLOW G.P.M.	NORMAL SIZE							FLOW G.P.M.
	5/8	3/4	1	1 1/2	2	3	4	
1	0.2	0.1						1
2	0.3	0.2						2
3	0.4	0.3						3
4	0.6	0.5	0.1					4
5	0.9	0.6	0.2					5
6	1.3	0.7	0.3					6
7	1.8	0.8	0.4					7
8	2.3	1.0	0.5					8
9	3.0	1.3	0.6					9
10	3.7	1.6	0.7					10
11	4.4	1.9	0.8					11
12	5.1	2.2	0.9					12
13	6.1	2.6	1.0					13
14	7.2	3.1	1.1					14
15	8.3	3.6	1.2					15
16	9.4	4.1	1.4	0.4				16
17	10.7	4.6	1.6	0.5				17
18	12.0	5.2	1.8	0.6				18
19	13.4	5.8	2.0	0.7				19
20	15.0	6.5	2.2	0.8				20
22		7.9	2.8	1.0				22
24		9.5	3.4	1.2				24
26		11.2	4.0	1.4				26
28		13.0	4.6	1.6				28
30		15.0	5.3	1.8	0.7			30
32			6.0	2.1	0.8			32
34			6.9	2.4	0.9			34
36			7.8	2.7	1.0			36
38			8.7	3.0	1.2			38
40			9.6	3.3	1.3			40
42			10.6	3.6	1.4			42
44			11.7	3.9	1.5			44
46			12.8	4.2	1.6			46
48			13.9	4.5	1.7			48
50			15.0	4.9	1.9	0.7		50
52				5.3	2.1			52
54				5.7	2.2			54
56				6.2	2.3			56
58				6.7	2.5			58
60				7.2	2.7	1.0		60
65				8.3	3.2	1.1		65
70				9.8	3.7	1.3		70
75				11.3	4.3	1.5		75
80				12.8	4.9	1.6	0.7	80
90				16.1	6.2	2.0	0.8	90
100				20.0	7.8	2.5	0.9	100
110					9.5	2.9	1.0	110
120					11.3	3.4	1.2	120
130					13.0	3.9	1.4	130
140					15.1	4.5	1.6	140
150					17.3	5.1	1.8	150
160					20.0	5.8	2.1	160
170						6.5	2.4	170
180						7.2	2.7	180
190						8.0	3.0	190
200						9.0	3.2	200
220						11.0	3.9	220
240						13.0	4.7	240
260						15.0	5.5	260
280						17.3	6.3	280
300						20.0	7.2	300
350							10.0	350
400							13.0	400
450							16.2	450
500							20.0	500

## SLOPE REFERENCE CHARTS



## MAXIMUM PRECIPITATION RATES

The maximum PR values listed are as suggested by the United States Department of Agriculture. The values are average and may vary with respect to actual soil condition and condition of ground cover.

SOIL TEXTURE	MAXIMUM PRECIPITATION RATES: INCHES PER HOUR							
	0 to 5% slope		5 to 8% slope		8 to 12% slope		12%+ slope	
	Cover	Bare	Cover	Bare	Cover	Bare	Cover	Bare
Course sandy soils	2.00	2.00	2.00	1.50	1.50	1.00	1.00	0.50
Course sandy soils over compact subsoils	1.75	1.50	1.25	1.00	1.00	0.75	0.75	0.40
Light sandy loams uniform	1.75	1.00	1.25	0.80	1.00	0.60	0.75	0.40
Light sandy loams over compact subsoils	1.25	0.75	1.00	0.50	0.75	0.40	0.50	0.30
Uniform silt loams	1.00	0.50	0.80	0.40	0.60	0.30	0.40	0.20
Silt loams over compact subsoil	0.60	0.30	0.50	0.25	0.40	0.15	0.30	0.10
Heavy clay or clay loam	0.20	0.15	0.15	0.10	0.12	0.08	0.10	0.06

## CONVERSION FACTORS

TO CONVERT	FROM	TO	MULTIPLY BY
<b>AREA</b>	acres	foot <sup>2</sup>	43560
	acres	meter <sup>2</sup>	4046.8
	meter <sup>2</sup>	foot <sup>2</sup>	10.764
	foot <sup>2</sup>	inch <sup>2</sup>	144
	inch <sup>2</sup>	centemeter <sup>2</sup>	6.452
	hectares	meter <sup>2</sup>	10000
	hectares	acres	2.471
<b>POWER</b>	kilowatts	horsepower	1.3410
<b>FLOW</b>	foot <sup>3</sup> /minute	meter <sup>3</sup> /second	.0004719
	foot <sup>3</sup> /second	meter <sup>3</sup> /second	.02832
	yards <sup>3</sup> /minute	meter <sup>3</sup> /second	.01274
	gallon/minute	meter <sup>3</sup> /hour	.22716
	gallon/minute	liter/minute	3.7854
	gallon/minute	liter/second	.06309
	meter <sup>3</sup> /hour	liter/minute	16.645
	meter <sup>3</sup> /hour	liter/second	.2774
liter/minute	liter/second	60	
<b>LENGTH</b>	foot	inch	12
	inch	centimeter	2.540
	foot	meter	.30481
	kilometer	miles	.6214
	miles	foot	5280
	miles	meter	1609.34
	millimeter	inch	.03937
<b>PRESSURE</b>	PSI	kilopascals	6.89476
	PSI	bars	.068948
	bars	kilopascals	100
	PSI	feet of head	2.31
<b>VELOCITY</b>	feet/second	meter/second	.3048
<b>VOLUME</b>	feet <sup>3</sup>	gallon	7.481
	feet <sup>3</sup>	liter	28.32
	meter <sup>3</sup>	feet <sup>3</sup>	35.31
	meter <sup>3</sup>	yard <sup>3</sup>	1.3087
	yard <sup>3</sup>	feet <sup>3</sup>	27
	yard <sup>3</sup>	gallon	202
	acres/feet	foot <sup>3</sup>	43,560
	gallon	meter <sup>3</sup>	.003785
	gallon	liter	3.785
	imperial gallon	gallon	1.833

