Friction Loss in Pipe Fittings - Steel Pipe, Schedule 40

(Continued)

Fitting	Condition	L_E/d	Friction Loss for Water in Terms of Equivalent Length of Straight Pipe - feet												
			Nominal Pipe Size, inch												
			6	8	10	12	14	16	18	20	24	30	32	34	36
			Actual Inside Pipe Diameter, inch												
			6.065	7.981	10.02	11.94	13.12	15.00	16.88	18.81	22.62	28.50	30.62	32.62	34.50
Ball Valve	Full Open	*3*	1.52	2.00	2.51	2.98	3.28	3.75	4.22	4.70	5.66	7.13	7.66	8.16	8.63
Butterfly Valve	Full Open, $\alpha = 0^o$	*40*	20.2	26.6	33.4	39.8	43.7	50.0	56.3	62.7	75.4	100	100	110	120
	$\alpha = 5^o$	*3*	1.52	2.00	2.51	2.98	3.28	3.75	4.22	4.70	5.66	7.13	7.66	8.16	8.63
	$\alpha = 10^o$	*16*	8.09	10.6	13.4	15.9	17.5	20.0	22.5	25.1	30.2	38.0	40.8	43.5	46.0
	$\alpha = 20^o$	*85*	43.0	56.5	71.0	84.5	93.0	106	120	133	160	202	217	231	244
	$\alpha = 40^o$	*950*	480	632	793	945	1,040	1,190	1,340	1,490	1,790	2,260	2,420	2,580	2,730
Check Valve, Full Open	Ball	*150*	75.8	99.8	125	149	164	188	211	235	283	356	383	408	431
	Clearway	*50*	25.3	33.3	41.8	49.7	54.7	62.5	70.3	78.4	94.3	119	128	136	144
	Conventional	*133*	67.2	88.5	111	132	145	166	187	208	251	316	339	362	382
	Disk	*500*	253	333	418	497	547	625	703	784	943	1,190	1,280	1,360	1,400
	Hinged	*110*	55.6	73.2	91.9	109	120	138	155	172	207	261	281	299	316
	Swing	*92*	46.5	61.2	76.8	91.5	101	115	129	144	173	219	235	250	265
Cock Valve	Full Open, Thru Flow	*18*	9.10	12.0	15.0	17.9	19.7	22.5	25.3	28.2	33.9	42.8	45.9	48.9	51.8
	Three-way, Straight Thru	*44*	22.2	29.3	36.7	43.8	48.1	55.0	61.9	69.0	83.0	105	112	120	127
	Three-way, Branch	*140*	70.8	93.1	117	139	153	175	197	219	264	333	357	381	403
Diaphragm Valve	Full Open	*125*	63.2	83.1	104	124	137	156	176	196	236	297	319	340	359
	3/4 Open	*140*	70.8	93.1	117	139	153	175	197	219	264	333	357	381	403
	1/2 Open	*235*	119	156	196	234	257	294	330	368	443	558	600	639	676
Foot Valve w/ Strainer	With poppet lift-type disc	*420*	212	279	351	418	459	525	591	658	792	1,000	1,070	1,140	1,210
	With hinged disc	*75*	37.9	49.9	62.6	74.6	82.0	93.8	105	118	141	178	191	204	216
Gate Valve	Full Open	*10*	5.05	6.65	8.35	9.95	10.9	12.5	14.1	15.7	18.9	23.8	25.5	27.2	28.8
	3/4 Open	*35*	17.7	23.3	29.2	34.8	38.3	43.8	49.2	54.9	66.0	83.1	89.3	95.2	101
	1/2 Open	*160*	80.9	106	134	159	175	200	225	251	302	380	408	435	460
	1/4 Open	*900*	455	599	752	895	984	1,130	1,270	1,410	1,700	2,140	2,300	2,450	2,590
Globe Valve, Full Open	Straight	*340*	172	226	284	338	372	425	478	533	641	808	868	924	978
	Straight - 1/2 Open	*470*	238	313	392	468	514	588	661	737	886	1,120	1,200	1,280	1,350
	Wing or Pin Guided Disc	*450*	227	299	376	448	492	563	633	705	848	1,070	1,150	1,220	1,290
	Y-pattern, Stem at 60°	*175*	88.4	116	146	174	191	219	246	274	330	416	447	476	503
	Y-pattern, Stem at 45°	*145*	73.3	96.4	121	144	159	181	204	227	273	344	370	394	417
	90° Branch	*170*	85.9	113	142	169	186	213	239	267	321	404	434	462	489
Plug Valve	Branch	*90*	45.5	59.9	75.2	89.5	98.4	113	127	141	170	214	230	245	259
	Straight Thru	*18*	9.10	12.0	15.0	17.9	19.7	22.5	25.3	28.2	33.9	42.8	45.9	48.9	51.8
	3-way Thru Flow	*30*	15.2	20.0	25.1	29.8	32.8	37.5	42.2	47.0	56.6	71.3	76.6	81.6	86.3
Water Meters	Wheel	*300*	152	200	251	298	328	375	422	470	566	713	766	816	863
	Disk	*400*	202	266	334	398	437	500	563	627	754	950	1,020	1,090	1,150
	Piston	*600*	303	399	501	597	656	750	844	941	1,130	1,430	1,530	1,630	1,730

Notes for Friction Loss in Pipe Fittings:

Values in **Friction Loss in Pipe Fittings, Plastic Pipe, Schedule 80** were compiled, adapted, and extrapolated from:
Industrial Thermoplastic and Thermoset Piping Systems: A Manual For Consulting Engineers, Plant Engineers, Process Engineers, Pollution Control Engineers, Piping Estimators, 1980, PPS, Inc., 225 Old Brunswick Road, Piscataway, NJ 08854

Values in **Friction Loss in Pipe Fittings, Steel Pipe, Schedule 40**, are based on the equation: $L_E = (L_E/d)*(d/12)$; where L_E is the Equivalent Length in feet and d is the actual Inside Diameter in inches.
L_E/d was compiled from several sources including:

Flow of Fluids Through Valves, Fittings, and Pipe, Technical Paper No. 410, Crane Company, Chicago, IL, 1969.

Analysis of Water Distribution Systems, Thomas M. Walski, Van Nostrand Reinhold Company, 1984.

Lyon's Encyclopedia of Valves, Jerry L. Lyons and Carl Askland, Van Nostrand Reinhold Company, 1975.

PUMP.NET

Piping Handbook, Sabin Crocker, McGraw-Hill Book Company, 1945.

SST.TEES.AC.UK