Resistance to Flow Through

Equivalent Length of Pipe Fittings & Valves

Internal Diameter	90° Long Radius Bend (radius > 3 x NB)	90° Short Radius Bend (radius > 2 x NB)	Elbow	Tee	Rubber Hose (minimum radius 10 x NB)	Diaphragm Valve Full Open	Full Bore Valve Roundway	Plug-lub Valve Rect Way	Tech Taylor Valve Ball Type
mm	EQUIVALENT LENGTH (m) OF STRAIGHT PIPE EQUIVALENT RESISTANCE FLOW								
25	0.52	0.70	0.82	1.77	0.30	2.56	—	0.37	—
32	0.73	0.91	1.13	2.38	0.40	3.29	—	0.49	—
40	0.85	1.10	1.31	2.74	0.49	3.44	1.19	0.58	—
50	1.07	1.40	1.68	3.35	0.55	3.66	1.43	0.73	—
65	1.28	1.65	1.98	4.27	0.70	4.60	1.52	0.85	—
80	1.55	2.07	2.47	5.18	0.85	4.88	1.92	1.04	0.20
90	1.83	2.44	2.90	5.79	1.01	—	—	1.22	—
100	1.13	2.77	3.35	6.71	1.16	7.62	2.19	1.40	0.23
115	2.41	3.05	3.66	7.32	1.28	—	—	1.58	—
125	2.71	3.66	4.27	8.23	1.43	13.11	3.05	1.77	0.30
150	3.35	4.27	4.88	10.06	1.55	18.29	3.11	2.13	0.37
200	4.27	5.49	6.40	13.11	2.41	19.81	7.92	2.74	0.82
250	5.18	6.71	7.92	17.07	2.99	21.34	10.67	3.47	0.61
300	6.10	7.92	9.75	20.12	3.35	28.96	15.85	4.08	0.76
350	7.01	9.45	10.97	23.16	4.27	28.96	—	4.88	0.91
400	8.23	10.67	12.8	26.52	4.88	—	—	5.49	1.04
450	9.14	12.19	14.02	30.48	5.49	—	—	6.22	1.16
500	10.36	13.11	15.85	33.53	6.10	—	—	7.32	1.25

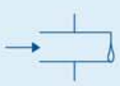
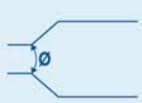
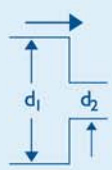
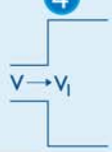
"Tech Taylor" Valves is a ball type changeover device used only on the delivery side of the pump.

Note: (i) For 135° bend, use 50% of equivalent length for 90° bend.

(ii) L, is the aggregate of equivalent lengths for all pipeline fittings and valves in a given pipeline.

Head Losses at Inlet - Contraction & Enlargement

Groups 1 to 5 in table show the approximate proportions of velocity head, $H_V = \frac{V^2}{2g}$, Which apply to certain conditions $g = 9.81\ m/s^2$. V is used to indicate the up stream velocity and V_1 the down stream velocity.

Group	Item	Head Loss
1	Loss of head at inlet Hi from pump hopper to pump or from storage tank to pump.	
	(a) Flush Connections.	$0.5\frac{V_1^2}{2g}$
	(b) Projecting Connection and dredge suction pipes.	$1.0\frac{V_1^2}{2g}$
	(c) Rounded Connection.	$0.05\frac{V_1^2}{2g}$
2 	Loss of head due to conical enlargement from pump discharge flange to discharge pipeline. included angle ø: 6° / 65°; factor K_e: 0.14 / 1.15 For conical enlargements, maximum head loss occurs when included angles is 65° when $K_e = 1.15$. Minimum head loss occurs when included angles 6° when $K_e = 0.14$	$K_e\frac{(V - V_1)^2}{2g}$
3 	Loss of head due to sudden contraction: K_c is factor or depending on ratio d_1/d_2 where d_1 is the large diameter and d_2 the small diameter as illustrated below. Ratio d_1/d_2: 1.2, 1.4, 1.6, 1.8, 2.0, 2.5, 3.0, 4.0, 5.0 Factor K_c: 0.08, 0.17, 0.25, 0.34, 0.37, 0.41, 0.43, 0.45, 0.46	$K_c\frac{V_1^2}{2g}$
4 	Loss of head due to sudden enlargement	$\frac{(V - V_1)^2}{2g}$
5 	Loss of head due to conical contraction e.g. Jet Nozzles	$K_g\frac{(V - V_1)^2}{2g}$