

Equivalent K factors for sharp edged orifices in a straight tube

Sharp edge orifice Idelchik - page 221

D1	D0	Fo/F1	Idelchik	
			Results Table	Pipe K PFE orifice suggestions (based on Idelchik formula)
100.00	14.142	0.02	7000.00	7070.26
100.00	17.321	0.03	3100.00	3094.60
100.00	20.000	0.04	1670.00	1714.50
100.00	22.361	0.05	1050.00	1080.41
100.00	24.495	0.06	730.00	738.73
100.00	28.284	0.08	400.00	402.64
100.00	31.623	0.10	245.00	249.51
100.00	34.641	0.12	165.00	167.68
100.00	37.417	0.14	117.00	119.13
100.00	40.000	0.16	86.00	88.15
100.00	42.426	0.18	65.60	67.27
100.00	44.721	0.20	51.50	52.58
100.00	46.904	0.22	40.60	41.90
100.00	48.990	0.24	32.00	33.92
100.00	50.990	0.26	26.80	27.83
100.00	52.915	0.28	22.30	23.08
100.00	54.772	0.30	18.20	19.32
100.00	56.569	0.32	15.60	16.30
100.00	58.310	0.34	13.10	13.84
100.00	60.000	0.36	11.60	11.83
100.00	61.644	0.38	9.55	10.16
100.00	63.246	0.40	8.25	8.76
100.00	65.574	0.43	6.62	7.06
100.00	68.557	0.47	4.95	5.35
100.00	70.711	0.50	4.00	4.37
100.00	72.111	0.52	3.48	3.82
100.00	74.162	0.55	2.85	3.14
100.00	77.460	0.60	2.00	2.26
100.00	80.623	0.65	1.41	1.62
100.00	83.666	0.70	0.97	1.15
100.00	86.603	0.75	0.65	0.80
100.00	89.443	0.80	0.42	0.54
100.00	92.195	0.85	0.25	0.34
100.00	94.868	0.90	0.13	0.20
100.00	97.468	0.95	0.05	0.09
100.00	100.000	1.00	0.00	0.00

The above data relates to psuedo sharp edged orifice K factors to be used with pipe velocities

D1 = Pipe ID

Do = Orifice ID

Fo/F1 = Area ratio

Idelchik K values (Handbook of hydraulic resistance) page 221

$$K_o = [(1-(F_o/F_1))+0.707*(1-(F_o/F_1))^{0.375}]^2*(F_1/F_o)^2$$

For example a 4 " sch.40 pipe has an ID of 102.26 mm

If a sharp edge orifice of 50 mm is fitted to the pipe the F_o/F_1 area ratio would be $(50/102.26)^2 = 0.239$

From the table an area ratio of 0.24 has a pipe K factor of 33.92

If the velocity in the 4" pipe is 1.5 m/s the pressure loss through the orifice would be:

$$(33.92 \times 1.5 \times 1.5) / (2 \times 9.806) = 3.891 \text{ m hd.}$$