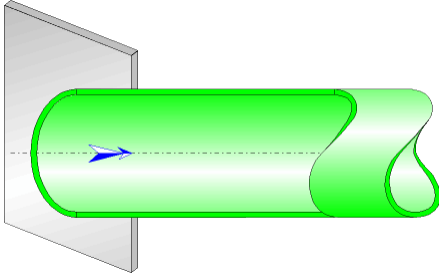




Flush-mounted sharp-edged entrance mounted at a distance Circular Cross-Section (IDELCHIK)



Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a flush-mounted sharp-edged entrance of piping mounted at a distance.

The head loss by friction in the piping is not taken into account in this component.

Model formulation:

Hydraulic diameter (m):

$$D_h = D_0$$

Pipe cross-sectional area (m²):

$$F_0 = \pi \cdot \frac{D_0^2}{4}$$

Mean velocity in pipe (m/s):

$$w_0 = \frac{Q}{F_0}$$

Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

Reynolds number in pipe:

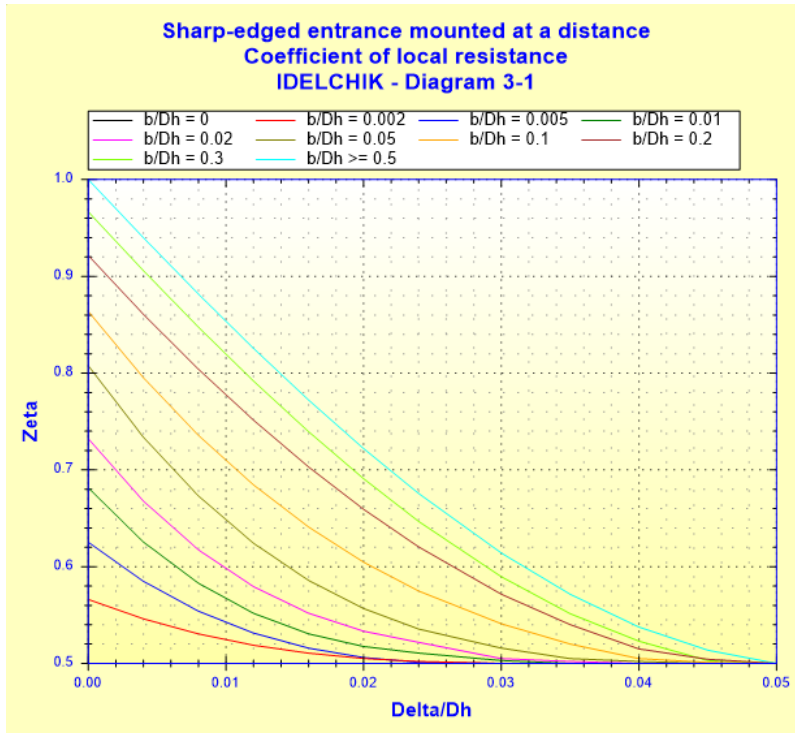
$$Re = \frac{w_0 \cdot D_0}{\nu}$$

Local resistance coefficient:

■ $\delta_l / D_h \leq 0.05$

$$\zeta_{loc} = f\left(\frac{\delta_1}{D_h}, \frac{b}{D_h}\right)$$

([1] diagram 3.1)



■ $\delta_1/D_h > 0.05$

$$\zeta_{loc} = 0.5$$

([1] diagram 3.1)

Total pressure loss coefficient (based on mean velocity in pipe):

$$\zeta = \zeta_{loc}$$

Total pressure loss (Pa):

$$\Delta P = \zeta \cdot \frac{\rho \cdot w_0^2}{2}$$

Total head loss of fluid (m):

$$\Delta H = \zeta \cdot \frac{w_0^2}{2 \cdot g}$$

Hydraulic power loss (W):

$$Wh = \Delta P \cdot Q$$

Symbols, Definitions, SI Units:

D_h	Hydraulic diameter (m)
D_0	Pipe diameter (m)
F_0	Pipe cross-sectional area (m ²)
Q	Volume flow rate (m ³ /s)
w_0	Mean velocity in pipe (m/s)

G	Mass flow rate (kg/s)
Re	Reynolds number in pipe ()
b	Distance from the wall (m)
δ_1	Pipe thickness (m)
ζ_{loc}	Local resistance coefficient ()
ζ	Total pressure loss coefficient (based on mean velocity in pipe) ()
ΔP	Total pressure loss (Pa)
ΔH	Total head loss of fluid (m)
Wh	Hydraulic power loss (W)
ρ	Fluid density (kg/m ³)
ν	Fluid kinematic viscosity (m ² /s)
g	Gravitational acceleration (m/s ²)

Validity range:

- turbulent flow regime ($Re \geq 10^4$)

Example of application:

The screenshot shows the HydraulCalc software interface for a calculation of a sharp-edged entrance. The fluid is Water @ 1 atm [HC] with a temperature of 20 °C and a pressure of 1.013 bar. The pipe has a diameter of 0.0703 m and a distance from the wall of 0.1 m. The mass flow rate is 4.9910 kg/s, and the mean velocity is 1.288 m/s (turbulent). The pressure loss is 0.005217526 bar, and the head loss is 0.0533 m of fluid. The complementary results table is as follows:

Designation	Symbol	Value	Unit
Hydraulic diameter	D_h	0.0703	m
Pipe cross-section area	F_0	0.003881508	m ²
Relative thickness	Δ/D_h	0.0284495	
Relative distance	b/D_h	1.422475	
Reynolds number	Re	90251	
Coefficient of local resistance (Diagram 3-1)	ζ_{loc}	0.6299925	
Pressure loss coefficient (based on the mean pipe velocity)	ζ	0.6299925	
Hydraulic power loss	Wh	2.608763	W

References:

[1] Handbook of Hydraulic Resistance, 3rd Edition, I.E. Idelchik