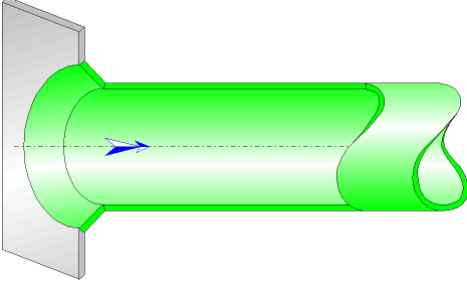




Flush-mounted bevelled entrance Circular Cross-Section (IDELCHIK)



Model description:

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

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):

$$G = Q \cdot \rho$$

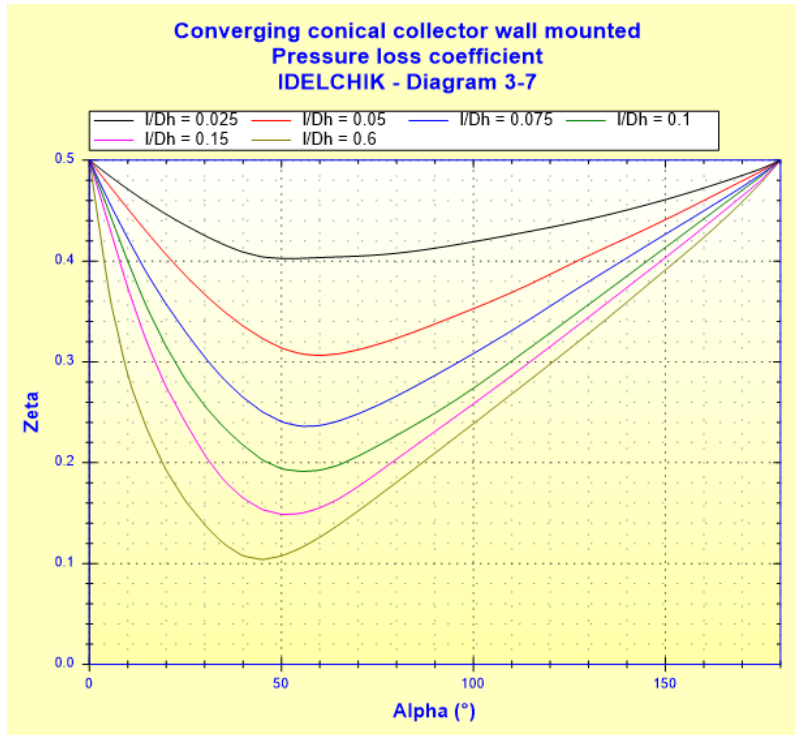
Reynolds number in pipe:

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

Local resistance coefficient ($Re \geq 10^4$):

$$\zeta_{loc} = f(\alpha, l/D_h)$$

([1] diagram 3.7)



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 ()
α	Top angle of cone (2 x bevel angle) (°)
l	Bevel length (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 in pipe ($Re \geq 10^4$)
- relative length of bevel (l/D_h) equal to or lower than 0.6

Example of application:

The screenshot shows the HydraulCalc 2019b software interface. The window title is "HydrauCalc 2019b - [Flush-mounted bevelled entrance - IDELCHIK (3rd Ed.)]". The interface is divided into several sections:

- Fluid characteristics:**
 - Fluid: Water @ 1 atm [HC]
 - Ref.: IAPWS IF97
 - Temperature: T = 20 °C
 - Pressure: P = 1.013 bar
 - Density: $\rho = 998.2061$ kg/m³
 - Dynamic Viscosity: $\mu = 0.00100159$ N.s/m²
 - Kinematic Viscosity: $\nu = 1.00340E-06$ m²/s
 - Selected: Density (radio button)
 - Graph: Density (kg/m³) vs Temperature (°C) showing a curve from 1000 at 0°C to approximately 950 at 100°C.
- Geometrical characteristics:**
 - Diagram: A 3D perspective view of a pipe with a bevelled entrance. The bevel angle is $\alpha/2 = 45^\circ$. The pipe diameter is $D_h = 0.0703$ m. The bevel length is $l = 0.01$ m. The flow velocity is $v = 1.288$ m/s (Turbulent). The mass flow rate is $Q = 0.005$ m³/s. The pressure loss is $\Delta P = 0.001936416$ bar and $\Delta H = 0.0198$ m of fluid.
- Complementary results:**

Designation	Symbol	Value	Unit
Hydraulic diameter	D_h	0.0703	m
Pipe cross-section area	F_0	0.003881508	m ²
Relative length of the bevel	l/D_h	0.1422475	
Reynolds number	Re	90251	
Top angle of cone	α	90	°
<input checked="" type="checkbox"/> Coefficient of local resistance (Diagram 3-7)	ζ_{loc}	0.2338134	
Pressure loss coefficient (based on the mean pipe velocity)	ζ	0.2338134	
Hydraulic power loss	Wh	0.968208	W

References:

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