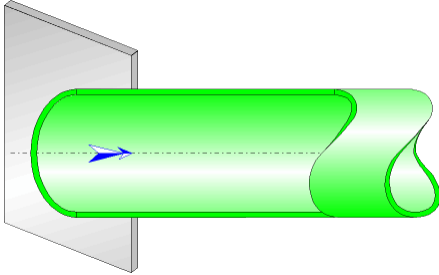




Flush-mounted sharp-edged entrance mounted at a distance Circular Cross-Section (Pipe Flow - Guide)



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):

$$d_h = d$$

Pipe cross-sectional area (m²):

$$A = \pi \cdot \frac{d^2}{4}$$

Mean velocity in pipe (m/s):

$$V = \frac{Q}{A}$$

Mass flow rate (kg/s):

$$G = Q \cdot \rho_m$$

Reynolds number in pipe:

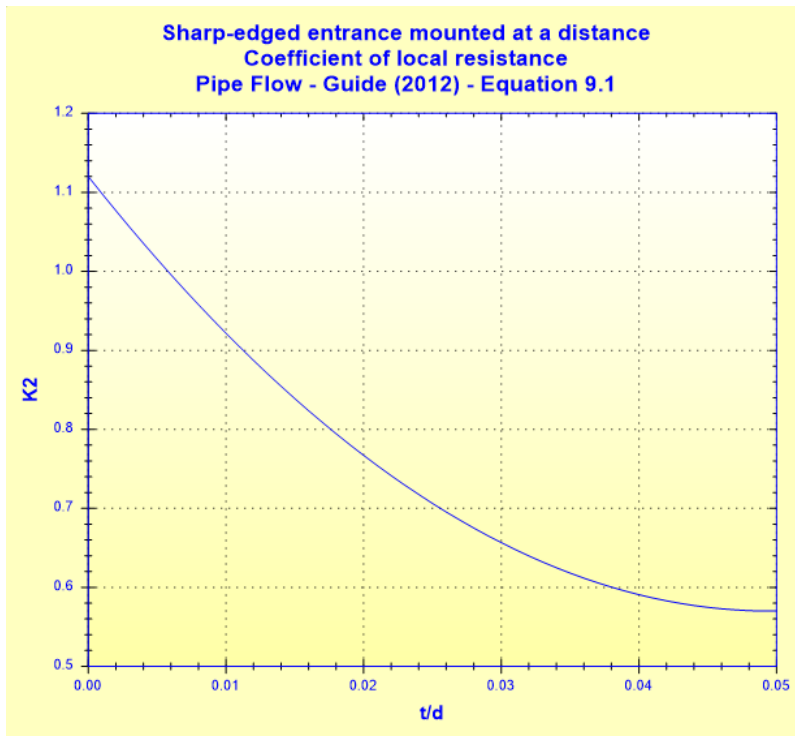
$$N_{Re} = \frac{V \cdot d}{\nu}$$

Local resistance coefficient ($N_{Re} \geq 10^4$ and $l/d \geq 0.5$):

■ $t/d \leq 0.05$

$$K_2 = 1.12 - 22 \cdot \frac{t}{d} + 216 \cdot \left(\frac{t}{d}\right)^2 + 80 \cdot \left(\frac{t}{d}\right)^3$$

([1] equation 9.1)



■ $t/d > 0.05$

$$K_2 = 0.57$$

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

$$K = K_2$$

Total pressure loss (Pa):

$$\Delta P = K \cdot \frac{\rho_m \cdot V^2}{2}$$

Total head loss of fluid (m):

$$\Delta H = K \cdot \frac{V^2}{2 \cdot g}$$

Hydraulic power loss (W):

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

Symbols, Definitions, SI Units:

d_h	Hydraulic diameter (m)
d	Pipe diameter (m)
A	Pipe cross-sectional area (m ²)
Q	Volume flow rate (m ³ /s)
V	Mean velocity in pipe (m/s)
G	Mass flow rate (kg/s)

N_{Re} Reynolds number in pipe ()
 t Pipe thickness (m)
 l Distance from the wall (m)
 K_2 Local resistance coefficient ()
 K 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_m 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 ($N_{Re} \geq 10^4$)
- relative distance (l/d) equal to or greater than 0.5

Example of application:

The screenshot shows the HydraulCalc 2019b software interface. The main window is titled "HydrauCalc 2019b - [Sharp-edged entrance mounted at a distance - Pipe Flow - Guide (2012)]". 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: $\rho = 998.2061 \text{ kg/m}^3$
 - Dynamic Viscosity: $\mu = 0.00100159 \text{ N.s/m}^2$
 - Kinematic Viscosity: $\nu = 1.00340E-06 \text{ m}^2/\text{s}$
 - Selected: Density
- Geometrical characteristics:**
 - Pressure loss: $\Delta P = 0.005555305 \text{ bar}$
 - $\Delta H = 0.0568 \text{ m of fluid}$
 - Pipe thickness: $t = 0.002 \text{ m}$
 - Hydraulic diameter: $d_h = 0.0703 \text{ m}$
 - Distance from wall: $l = 0.1 \text{ m}$
 - Mass flow rate: $\dot{m} = 4.9910 \text{ kg/s}$
 - Volume flow rate: $Q = 0.005 \text{ m}^3/\text{s}$
 - Mean velocity: $v = 1.288 \text{ m/s}$ (Turbulent)
- Density Graph:** A graph showing Density (kg/m^3) vs Temperature ($^{\circ}\text{C}$) for water. The density decreases from approximately 998.2 kg/m^3 at 20 $^{\circ}\text{C}$ to about 950 kg/m^3 at 100 $^{\circ}\text{C}$.
- Complementary results:**

Designation	Symbol	Value	Unit
Hydraulic diameter	d_h	0.0703	m
Pipe cross-section area	A	0.003881508	m^2
Relative thickness	t/d	0.0284495	
Relative distance	l/d	1.422475	
Reynolds number	N_{Re}	90251	
<input checked="" type="checkbox"/> Coefficient of local resistance (Equation 9.1)	K_2	0.6707779	
Pressure loss coefficient (based on the mean pipe velocity)	K	0.6707779	
Hydraulic power loss	Wh	2.777652	W

References:

[1] Pipe Flow: A Practical and Comprehensive Guide. Donald C. Rennels and Hobart M. Hudson. (2012)

