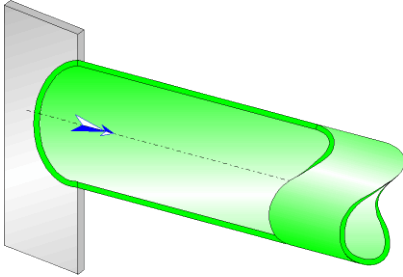




Flush-mounted sharp-edged entrance mounted at an angle Circular Cross-Section (Pipe Flow - Guide)



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 an angle.

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):

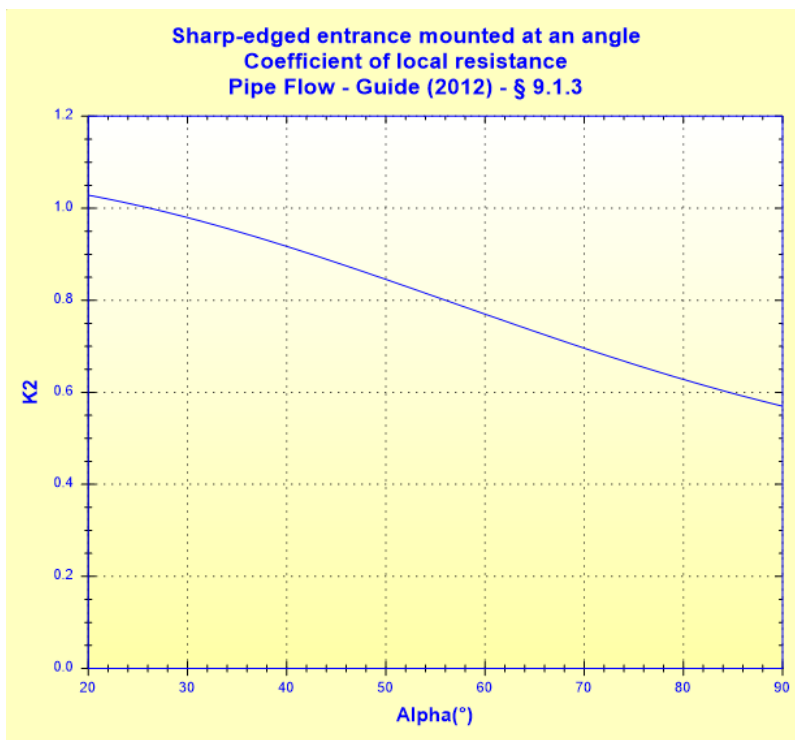
$$G = Q \cdot \rho_m$$

Reynolds number in pipe:

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

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

$$K_2 = 0.57 + 0.3 \cdot \cos(\alpha) + 0.2 \cdot \cos^2(\alpha) \quad ([1] \text{ § 9.1.3})$$



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 ()
α	Angle of inclination (°)
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 the pipe ($Re \geq 10^4$)
- angle of inclination (α) between 20° and 90°

Example of application:

The screenshot displays the HydraulCalc software interface. The main window is titled "HydraulCalc 2019b - [Sharp-edged entrance mounted at an angle - Pipe Flow - Guide (2012)]". The interface is divided into several sections:

- Fluid characteristics:** Shows fluid properties for "Water @ 1 atm [HC]". Parameters include Temperature (20 °C), Pressure (1.013 bar), Density (998.2061 kg/m^3), Dynamic Viscosity (0.00100159 N.s/m^2), and Kinematic Viscosity (1.00340E-06 m^2/s). A graph shows Density (kg/m^3) vs. Temperature ($^\circ\text{C}$).
- Geometrical characteristics:** Shows a 3D model of a pipe with a sharp-edged entrance. Parameters include Pressure loss (ΔP : 0.007305716 bar, ΔH : 0.0746 m of fluid), Mass flow rate (4.9910 kg/s), Volume flow rate (0.005 m^3/s), Mean velocity (1.288 m/s (Turbulent)), Hydraulic diameter (0.0703 m), and Angle of inclination (α : 45°).
- Complementary results:** A table listing various parameters and their values.

Designation	Symbol	Value	Unit
Hydraulic diameter	dh	0.0703	m
Pipe cross-section area	A	0.003881508	m^2
Reynolds number	NRe	90251	
Coefficient of local resistance (§ 9.1.3)	K2	0.8821321	
Pressure loss coefficient (based on the mean pipe velocity)	K	0.8821321	
Hydraulic power loss	Wh	3.652858	W

References:

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