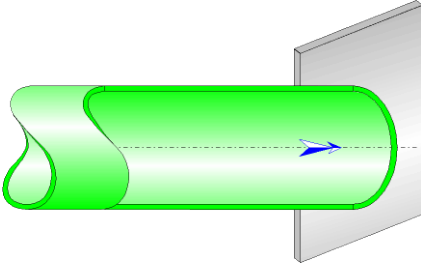




Sharp-edged discharge mounted at a distance Circular Cross-Section (CRANE)



Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a sharp-edged discharge 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):

$$G = q \cdot \rho$$

Reynolds number in pipe:

$$Re = \frac{v \cdot D}{\nu}$$

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

$$K_1 = 1 \quad ([1] \text{ Appendix A-29})$$

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

$$K = K_1$$

Total pressure loss (Pa):

$$\Delta P = K \cdot \frac{\rho \cdot v^2}{2}$$

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)
Re	Reynolds number in pipe ()
K_1	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	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 ($Re \geq 10^4$)

Example of application:

HydrauCalc 2019b - [Sharp-edged discharge mounted at a distance - CRANE (1999)]

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Fluid characteristics

Fluid: Water @ 1 atm [HC]
Ref.: IAPWS IF97

Temperature: T 20 °C
Pressure: P 1.013 bar

Density: ρ 998.2061 kg/m³
Dynamic Viscosity: μ 0.00100159 N.s/m²
Kinematic Viscosity: ν 1.00340E-06 m²/s

Density Dyn. Visc. Kn. Visc.

Density (kg/m³) vs Temperature (°C)

logY

Geometrical characteristics

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Pressure loss
 ΔP 0.008281884 bar
 ΔH 0.0846 m of fluid

4.9910 kg/s
0.005 m³/s
1.288 m/s (Turbulent)
0.0703 m

Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	dh	0.0703	m
Pipe cross-section area	A	0.003881508	m ²
Reynolds number	Re	90251	
Coefficient of local resistance (Appendix A-29)	K1	1	
Pressure loss coefficient (based on the mean pipe velocity)	K	1	
Hydraulic power loss	Wh	4.140942	W

References:

[1] CRANE - Flow of Fluids Through Valves, Fitting and Pipe - Technical Paper No. 410 - Edition 1999