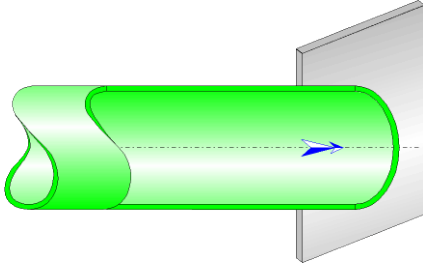




Sharp-edged discharge mounted at a distance Circular Cross-Section (Pipe Flow - Guide)



Model description:

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

$$G = Q \cdot \rho_m$$

Reynolds number in pipe:

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

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

$$K_2 = 1 \quad ([1] \text{ §12.1})$$

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)
G	Mass flow rate (kg/s)
V	Mean velocity in pipe (m/s)
N_{Re}	Reynolds number in pipe ()
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 ($N_{Re} \geq 10^4$)

Example of application:

HydrauCalc 2019b - [Sharp-edged discharge mounted at a distance - Pipe Flow - Guide (2012)]

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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.

Divers HC

Geometrical characteristics

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Pressure loss
 ΔP 0.008281884 bar
 ΔH 0.0846 m of fluid

4.9910 kg/s
Q 0.005 m³/s
1.288 m/s (Turbulent)
v

0.0703 m
dh

Complementary results

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 (§9.1.1)	K2	1	
Pressure loss coefficient (based on the mean pipe velocity)	K	1	
Hydraulic power loss	Wh	4.140942	W

References:

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