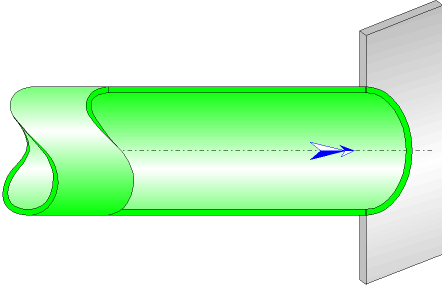




Flush-mounted sharp-edged discharge Circular Cross-Section (IDELCHIK)



Model description:

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

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

Local resistance coefficient:

$$\zeta_{loc} = 1$$

([1] diagram 11.1 - Uniform velocity distributions)

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 ()
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 ($Re \geq 10^4$)
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Example of application:

HydrauCalc 2019b - [Flush-mounted sharp-edged discharge - IDELCHIK (3rd Ed.)]

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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.

Geometrical characteristics

Calculate

Pressure loss
 ΔP 0.008281884 bar
 ΔH 0.0846 m of fluid

S 4.9910 kg/s
 Q 0.005 m³/s
 w 1.288 m/s (Turbulent)
 D_h 0.0703 m

Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	D_h	0.0703	m
Pipe cross-section area	F_0	0.003881508	m ²
Reynolds number	Re	90251	
Coefficient of local resistance (Diagram 3-1)	ζ_{loc}	1	
Pressure loss coefficient (based on the mean pipe velocity)	ζ	1	
Hydraulic power loss	W_h	4.140942	W

Divers HC

References:

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