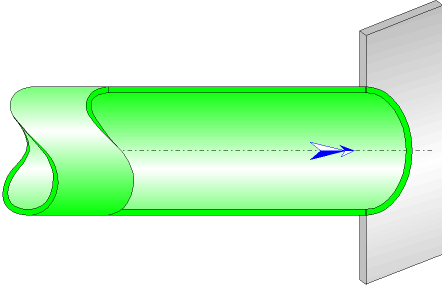




## Flush-mounted sharp-edged discharge Circular Cross-Section (CRANE)



### 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:

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Hydraulic diameter (m):

$$D_h = D$$

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Pipe cross-sectional area (m<sup>2</sup>):

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

---

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):

$$K = K_1$$

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Total pressure loss (Pa):

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

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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 <sup>2</sup> )
$q$	Volume flow rate (m <sup>3</sup> /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) ( )
$\Delta P$	Total pressure loss (Pa)
$\Delta H$	Total head loss of fluid (m)
$Wh$	Hydraulic power loss (W)
$\rho$	Fluid density (kg/m <sup>3</sup> )
$\nu$	Fluid kinematic viscosity (m <sup>2</sup> /s)
$g$	Gravitational acceleration (m/s <sup>2</sup> )

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### Validity range:

- turbulent flow regime in pipe ( $Re \geq 10^4$ )

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### Example of application:

HydrauCalc 2019b - [Flush-mounted sharp-edged discharge - 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 :  $\rho$  998.2061 kg/m<sup>3</sup>  
Dynamic Viscosity :  $\mu$  0.00100159 N.s/m<sup>2</sup>  
Kinematic Viscosity :  $\nu$  1.00340E-06 m<sup>2</sup>/s

Density  Dyn. Visc.  Kn. Visc.

Geometrical characteristics

Calculate

Pressure loss  
 $\Delta P$  0.008281884 bar  
 $\Delta H$  0.0846 m of fluid

Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	Dh	0.0703	m
Pipe cross-section area	A	0.003881508	m <sup>2</sup>
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

Divers

HC

## References:

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