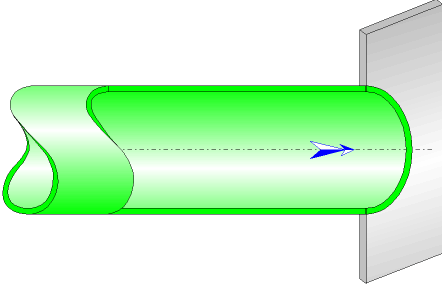




## Flush-mounted sharp-edged discharge Circular Cross-Section (MILLER)



### 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>):

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

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Mean velocity in pipe (m/s):

$$U = \frac{Q}{A}$$

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Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

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Reynolds number in pipe:

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

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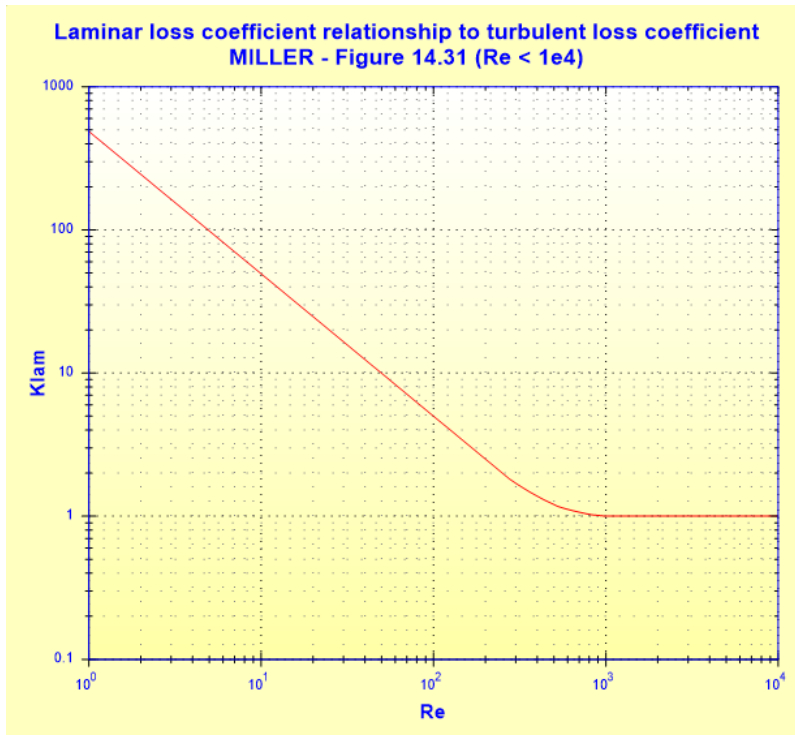
Local resistance coefficient:

■  $Re \geq 10^4$

$$K_s = 1 \quad ([1] \text{ figure 14.15 with } A_1/A_2=0)$$

■  $Re < 10^4$

$$K_{lam} = f(Re) \quad ([1] \text{ figure 14.31 with } K_{turb} = 1)$$



Reynolds Number Correction ( $Re < 10^4$ ):

$$C_{Re} = \frac{K_{lam}}{K_s}$$

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

■ turbulent flow ( $Re \geq 10^4$ ):

$$K = K_s$$

■ laminar flow ( $Re < 10^4$ ):

$$K = K_{lam}$$

Total pressure loss (Pa):

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

Total head loss of fluid (m):

$$\Delta H = K \cdot \frac{U^2}{2 \cdot g}$$

Hydraulic power loss (W):

$$Wh = \Delta P \cdot Q$$

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**Symbols, Definitions, SI Units:**

$D_h$	Hydraulic diameter (m)
$D$	Pipe diameter (m)
$A$	Pipe cross-sectional area ( $m^2$ )
$Q$	Volume flow rate ( $m^3/s$ )
$U$	Mean velocity in pipe (m/s)
$G$	Mass flow rate (kg/s)
$Re$	Reynolds number in pipe ( )
$K_s$	Local resistance coefficient for $Re \geq 10^4$ ( )
$K_{lam}$	Local resistance coefficient for $Re < 10^4$ ( )
$C_{Re}$	Reynolds number correction for $Re < 10^4$ ( )
$K$	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 ( $kg/m^3$ )
$\nu$	Fluid kinematic viscosity ( $m^2/s$ )
$g$	Gravitational acceleration ( $m/s^2$ )

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**Validity range:**

- any flow regime: laminar and turbulent

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**Example of application:**

HydrauCalc 2019b - [Flush-mounted sharp-edged discharge - MILLER (2nd 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 :  $\rho$  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.

Divers **HC**

**Geometrical characteristics**

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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 (Fig. 14.11) (Re > 10000)	Ks	1	
Pressure loss coefficient (based on the mean pipe velocity)	K	1	
Hydraulic power loss	Wh	4.140942	W

## References:

[1] Internal Flow System, Second Edition, D.S. Miller