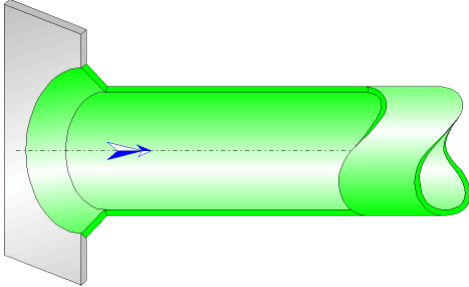




Flush-mounted bevelled entrance Circular Cross-Section (MILLER)



Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a flush-mounted bevelled entrance of piping.

The head loss by friction in the piping is not taken into account in this component.

Model formulation:

Hydraulic diameter (m):

$$D_h = D$$

Pipe cross-sectional area (m²):

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

Mean velocity in pipe (m/s):

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

Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

Reynolds number in pipe:

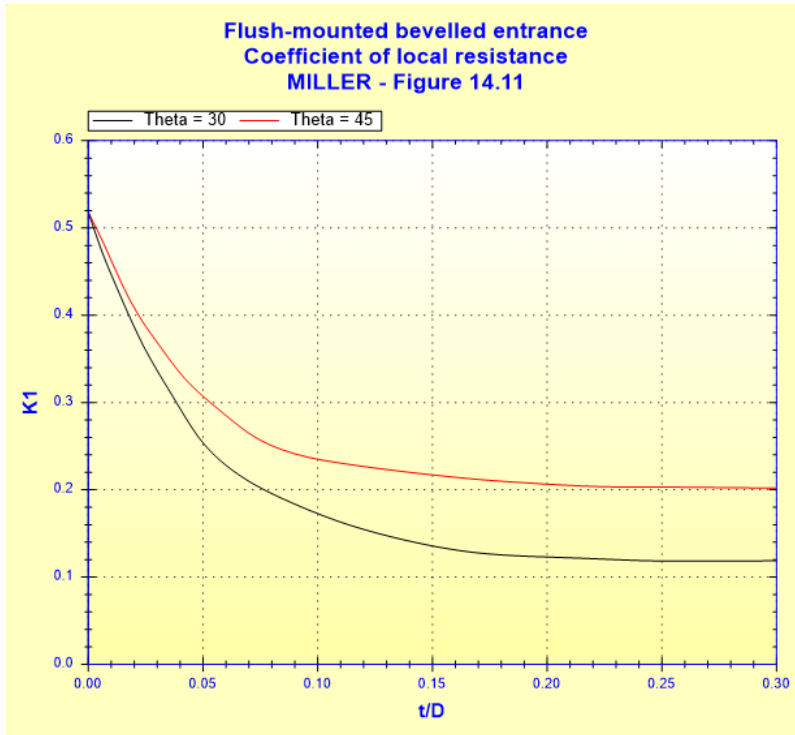
$$Re = \frac{U \cdot D}{\nu}$$

Local resistance coefficient:

■ $Re \geq 10^4$

$$K_1 = f\left(\frac{t}{D}, \theta\right)$$

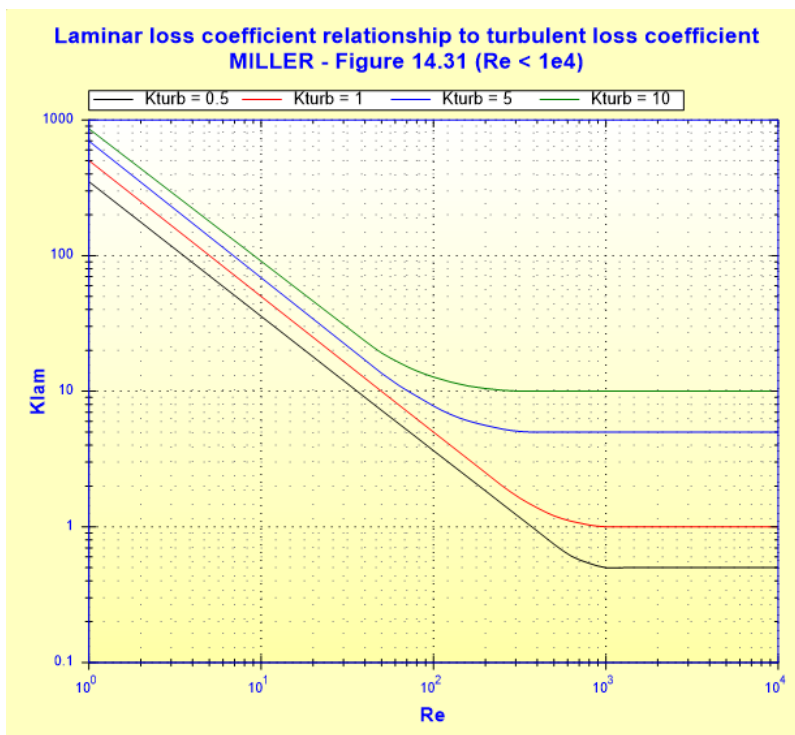
([1] figure 14.11)



■ $Re < 10^4$

$$K_{lam} = f(Re, K_{turb})$$

([1] figure 14.31 with $K_{turb} = K_1$)



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

$$C_{Re} = \frac{K_{lam}}{K_1}$$

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

- turbulent flow ($Re \geq 10^4$):

$$K = K_1$$

- 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):

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

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 ()
α	Bevel angle ($^\circ$)
t	Bevel height (m)
K_1	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) ()
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:

- any flow regime: laminar and turbulent
- relative height of bevel (t/D_h) equal to or lower than 0.3
note: for relative height of bevel greater than 0.3, the local resistance coefficient is extrapolated

Example of application:

HydrauCalc 2019b - [Flush-mounted bevelled entrance - 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 : ρ 998.2061 kg/m³
Dynamic Viscosity : μ 0.00100159 N.s/m²
Kinematic Viscosity : ν 1.00340E-06 m²/s

Density Dyn. Visc. Kin. Visc.

Divers HC

Geometrical characteristics

Pressure loss
 ΔP 0.001816634 bar
 ΔH 0.0186 m of fluid

45
0.01
0.0903 m
1.288 m/s (Turbulent)
0.0703 m
4.9910 kg/s
0.005 m³/s

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Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	Dh	0.0703	m
Pipe cross-section area	A	0.003881508	m ²
Relative length of the bevel	t/D	0.1422475	
Reynolds number	Re	90251	
Top angle of cone	2- θ	90	°
<input checked="" type="checkbox"/> Coefficient of local resistance (Fig. 14.11)	Kl	0.2193503	
Pressure loss coefficient (based on the mean pipe velocity)	K	0.2193503	
Hydraulic power loss	Wh	0.9083171	W

References:

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