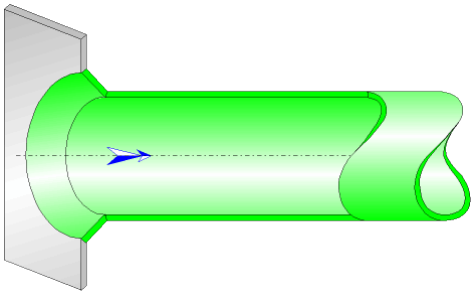
Flush-mounted bevelled entrance
Circular Cross-Section
(MILLER)



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 (m^2):

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

Mean velocity in pipe (m/s):

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

Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

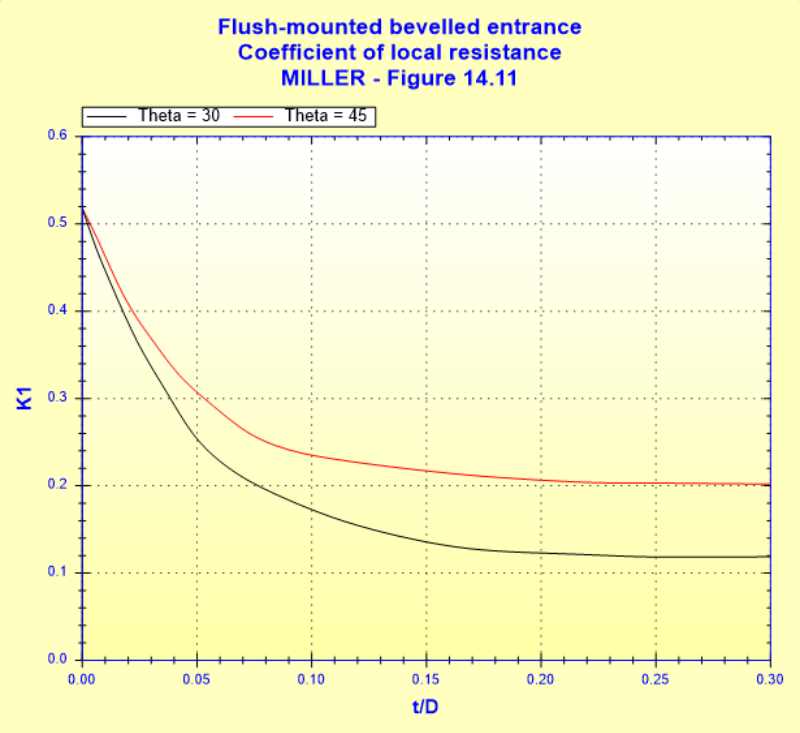
Reynolds number in pipe:

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

Local resistance coefficient:

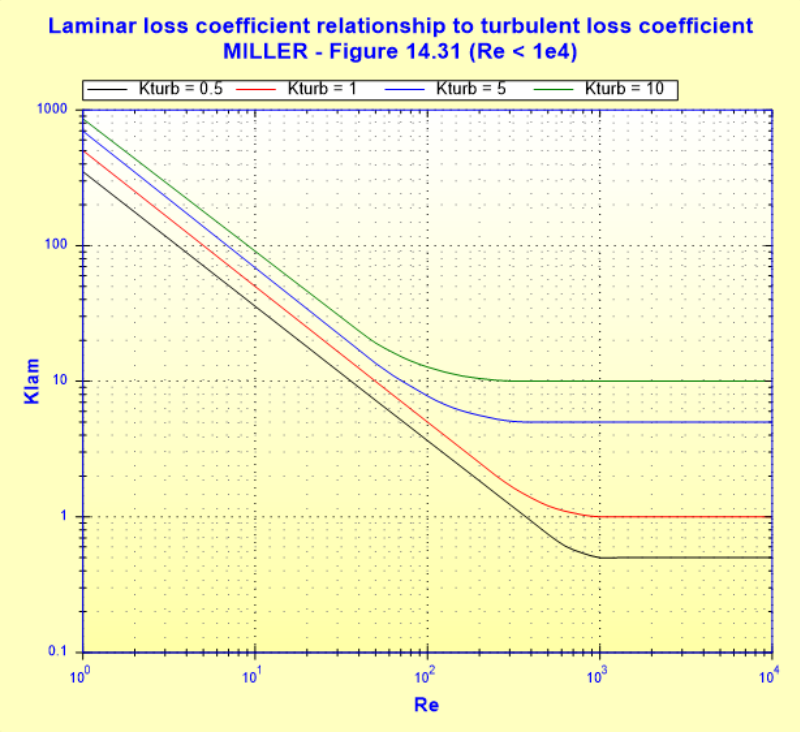
- $Re \geq 10^4$

$$K_1 = f\left(\frac{t}{D}, \theta\right)$$ ([1] figure 14.11)



- $Re < 10^4$

$$K_{lam} = f(\mathrm{Re}, K_{turb})$$ ([1] figure 14.31 with Kturb = K_1)



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

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

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):

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

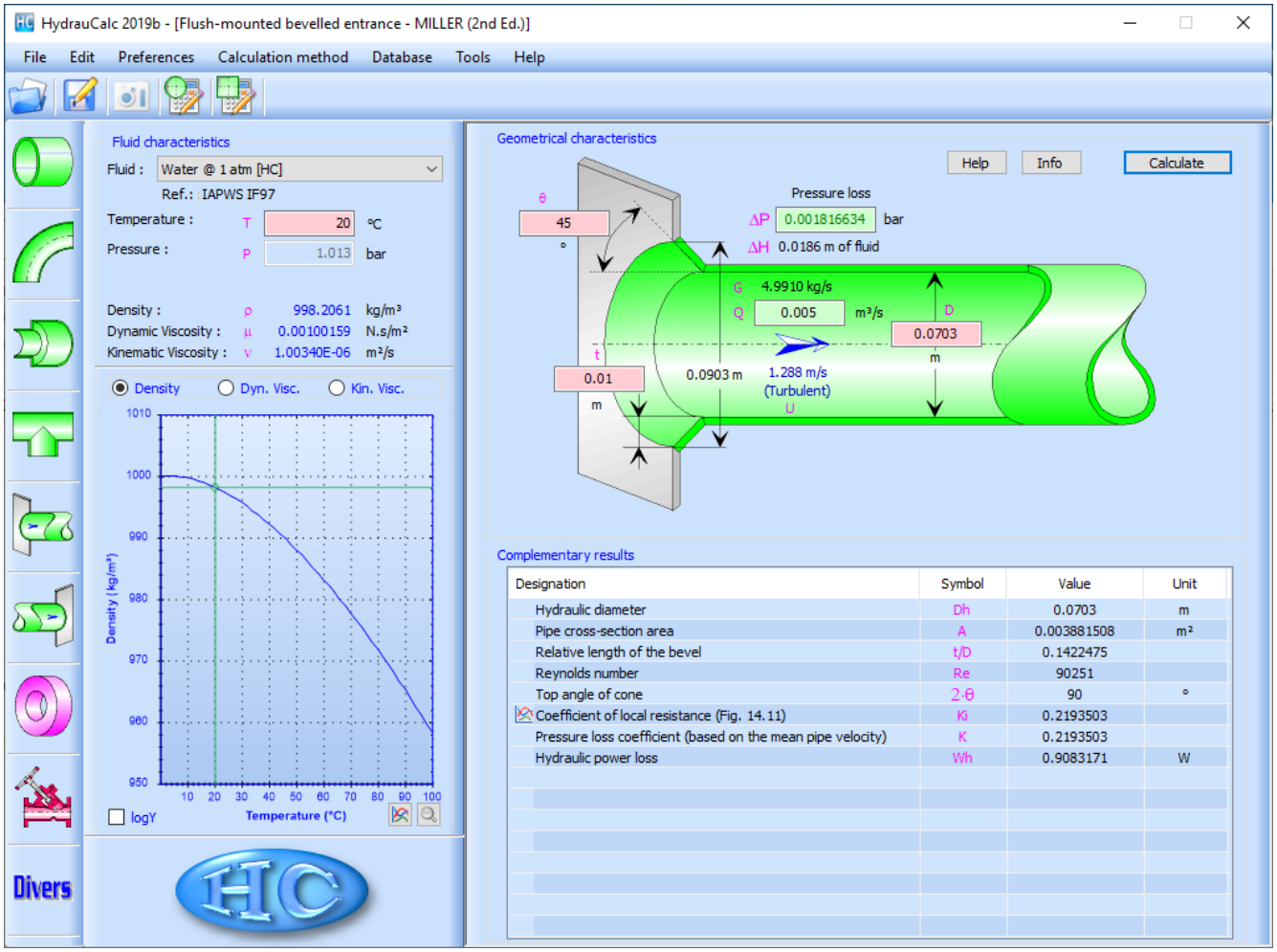
Symbols, Definitions, SI Units:

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 (°)
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 (l/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:



References:

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