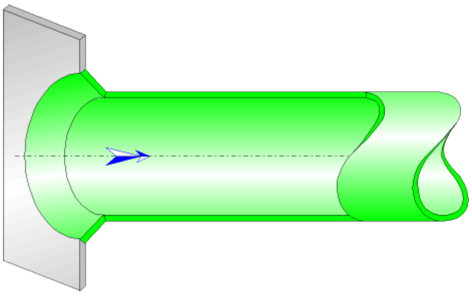
Flush-mounted bevelled entrance
Circular Cross-Section
(Pipe Flow - Guide)



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):

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

Mass flow rate (kg/s):

$$G = Q \cdot \rho_m$$

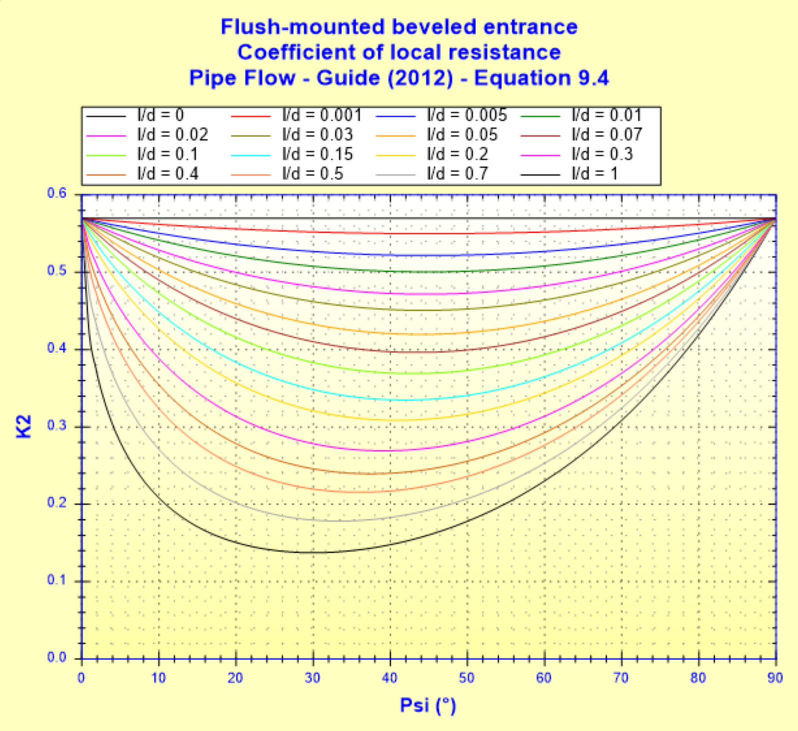
Reynolds number in pipe:

$$N_{Re} = \frac{V \cdot d}{\nu}$$

Local resistance coefficient ($N_{Re} \geq 10^4$):

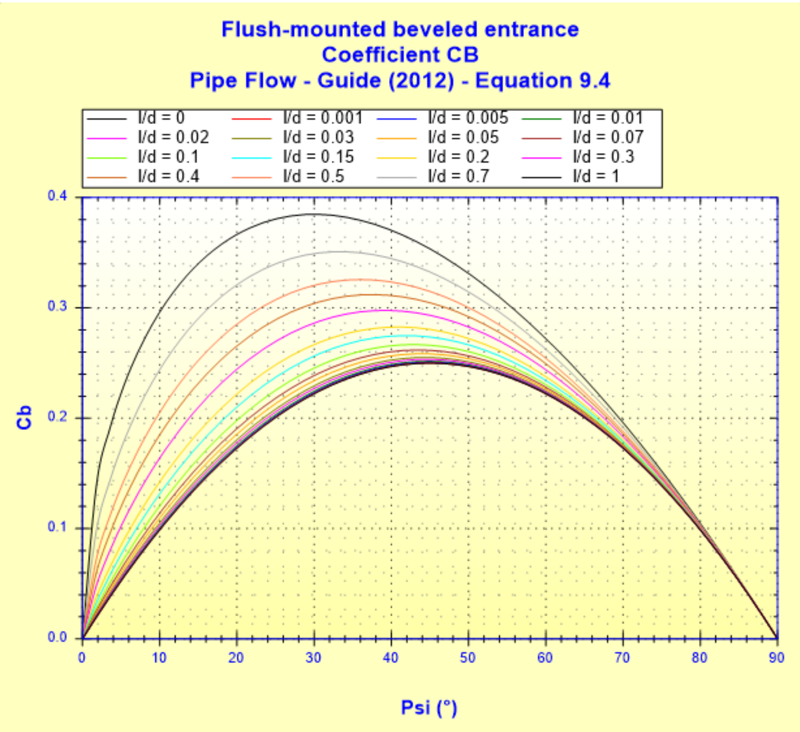
$$K_2 = 0.0696 \cdot \left[1 - C_b \cdot \frac{l}{d}\right] \cdot \lambda^2 + (\lambda - 1)^2$$

([1] equation 9.4)



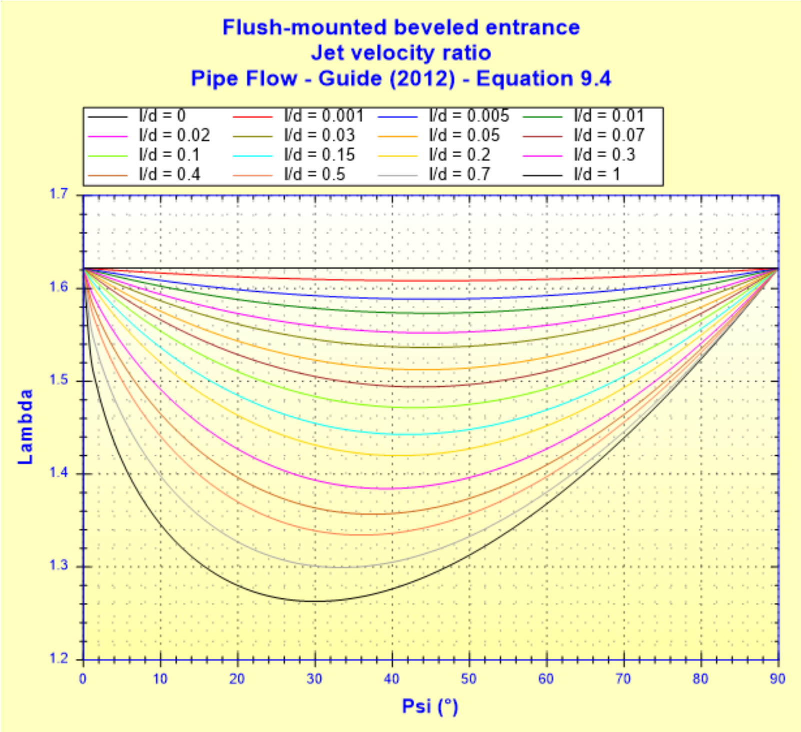
With:

$$C_b = \left(1 - \frac{\Psi}{90}\right) \cdot \left(\frac{\Psi}{90}\right)^{\frac{1}{1+l/d}}$$



And:

$$\lambda = 1 + 0.622 \cdot \left[1 - 1.5 \cdot C_b \cdot \left(\frac{l}{d}\right)^{\frac{1 - \sqrt[4]{l/d}}{2}}\right]$$



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

$$K = K_2$$

Total pressure loss (Pa):

$$\Delta P = K \cdot \frac{\rho_m \cdot V^2}{2}$$

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:

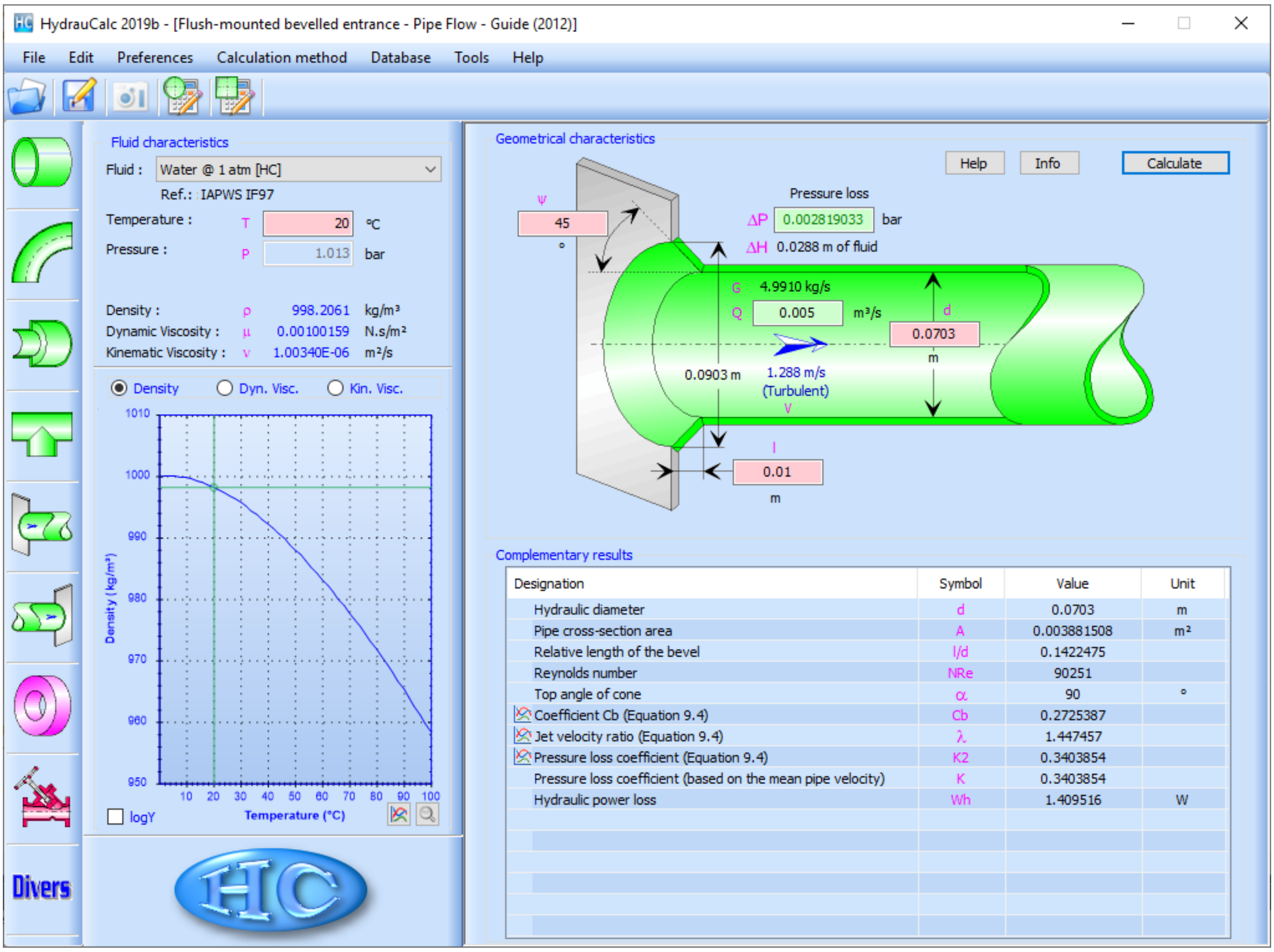
d_h	Hydraulic diameter (m)
d	Pipe diameter (m)
A	Pipe cross-sectional area (m^2)
Q	Volume flow rate (m^3/s)
G	Mass flow rate (kg/s)
V	Mean velocity in pipe (m/s)
N_{Re}	Reynolds number in pipe ()
ψ	Bevel angle (°)
l	Bevel length ()
K_2	Local resistance coefficient ()
K	Total pressure loss coefficient (based on mean velocity in pipe) ()
ΔP	Total pressure loss (Pa)
ΔH	Total head loss of fluid (m)

Wh	Hydraulic power loss (W)
ρ_m	Fluid density (kg/m³)
ν	Fluid kinematic viscosity (m²/s)
g	Gravitational acceleration (m/s²)

Validity range:

- turbulent flow regime in pipe ($N_{Re} \geq 10^4$)
- relative length of bevel (l/d) equal to or lower than 1

Example of application:



References:

[1] Pipe Flow: A Practical and Comprehensive Guide. Donald C. Rennels and Hobart M. Hudson. (2012)