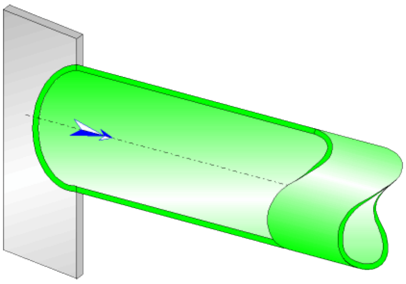
Flush-mounted sharp-edged entrance mounted at an angle
Circular Cross-Section
(Pipe Flow - Guide)



Model description:

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

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):

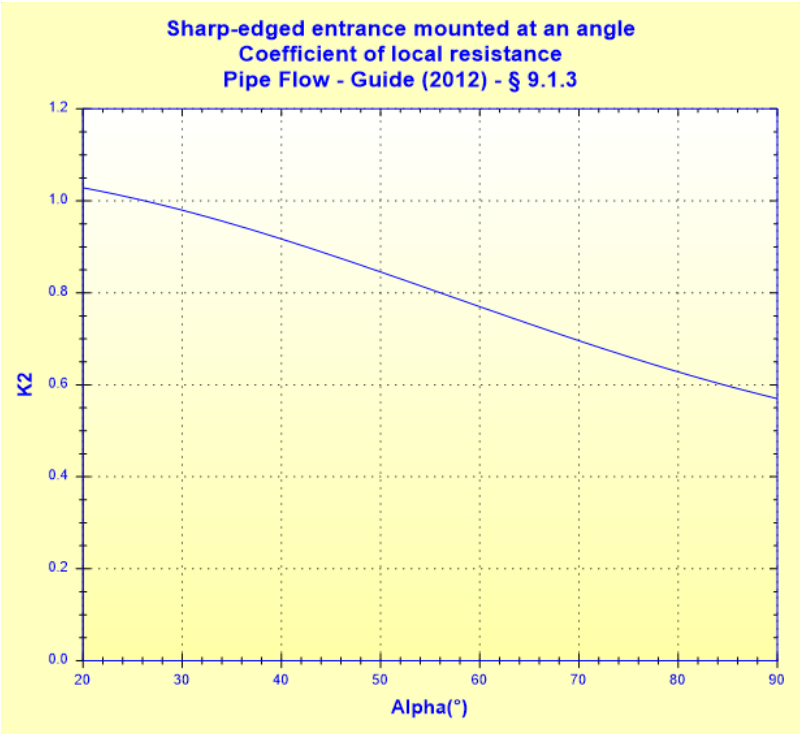
$$G = Q \cdot \rho_m$$

Reynolds number in pipe:

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

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

$$K_2 = 0.57 + 0.3 \cdot \cos(\alpha) + 0.2 \cdot \cos^2(\alpha)$$ ([1] § 9.1.3)



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

$$K = K_2$$

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:

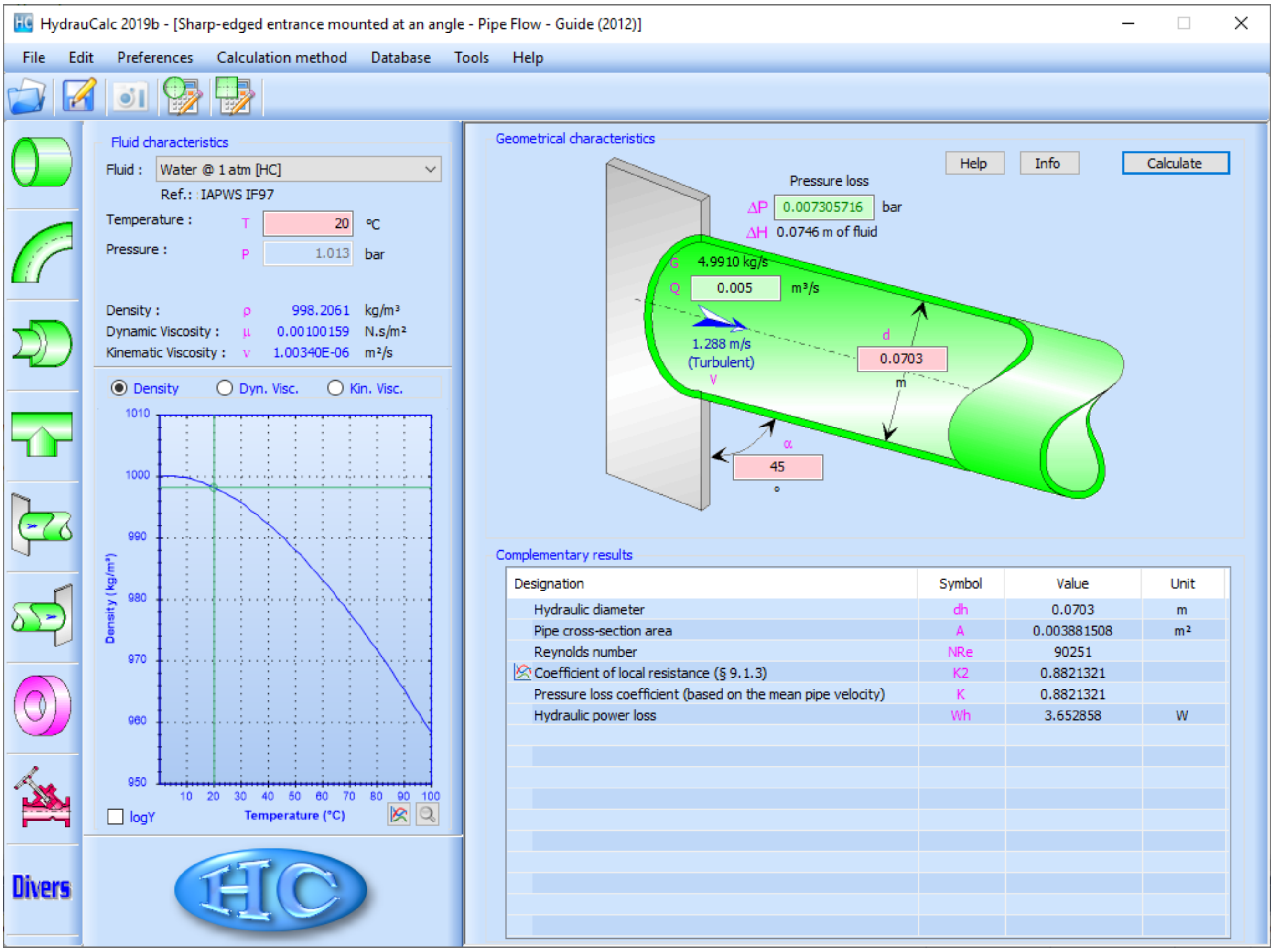
d_h	Hydraulic diameter (m)
d	Pipe diameter (m)
A	Pipe cross-sectional area (m^2)
Q	Volume flow rate (m^3/s)
V	Mean velocity in pipe (m/s)
G	Mass flow rate (kg/s)
N_{Re}	Reynolds number in pipe ()
α	Angle of inclination (°)
K_2	Local resistance coefficient ()
K	Total pressure loss coefficient (based on 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/m^3)
ν	Fluid kinematic viscosity (m^2/s)
g	Gravitational acceleration (m/s^2)

Validity range:

- turbulent flow regime in the pipe ($Re \geq 10^4$)
- angle of inclination (α) between 20° and 90°

Example of application:



References:

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