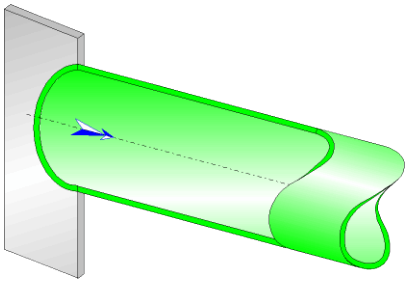
Flush-mounted sharp-edged entrance mounted at an angle
Circular Cross-Section
(IDELCHIK)



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):

$$D_h = D_0$$

Pipe cross-sectional area (m^2):

$$F_0 = \pi \cdot \frac{D_0^2}{4}$$

Mean velocity in pipe (m/s):

$$w_0 = \frac{Q}{F_0}$$

Mass flow rate (kg/s):

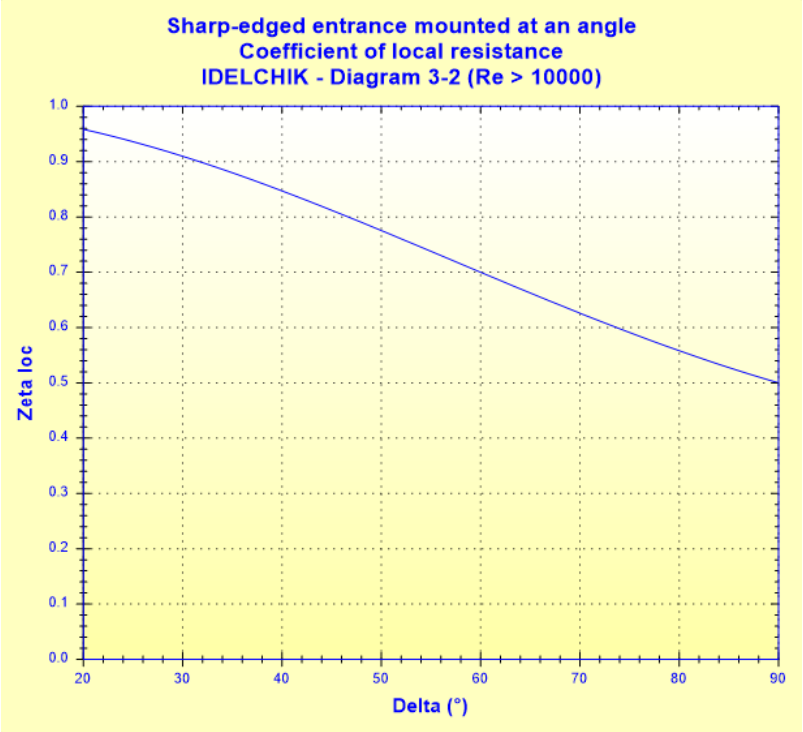
$$G = Q \cdot \rho$$

Reynolds number in pipe:

$$\mathrm{Re} = \frac{w_0 \cdot D_0}{\nu}$$

Local resistance coefficient:

$$\zeta_{loc} = 0.5 + 0.3 \cdot \cos(\delta) + 0.2 \cdot \cos^2(\delta)$$ ([1] diagram 3.2)



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

$$\zeta = \zeta_{loc}$$

Total pressure loss (Pa):

$$\Delta P = \zeta \cdot \frac{\rho \cdot w_0^{\,2}}{2}$$

Total head loss of fluid (m):

$$\Delta H = \zeta \cdot \frac{w_0^{\,2}}{2 \cdot g}$$

Hydraulic power loss (W):

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

Symbols, Definitions, SI Units:

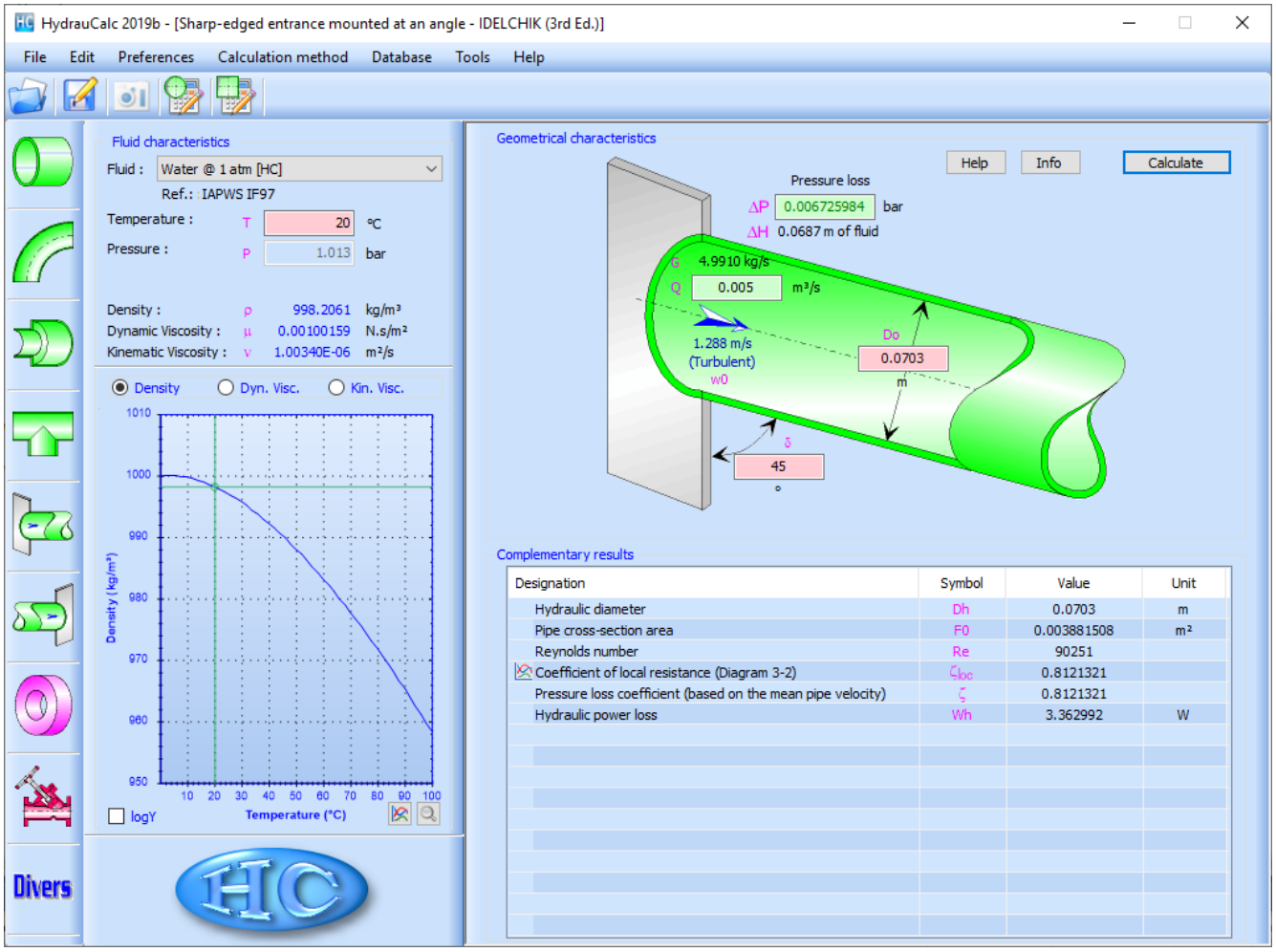
D_h	Hydraulic diameter (m)
D_0	Pipe diameter (m)
F_0	Pipe cross-sectional area (m^2)
Q	Volume flow rate (m^3/s)
w_0	Mean velocity in pipe (m/s)
G	Mass flow rate (kg/s)
Re	Reynolds number in pipe ()
δ	Angle of inclination (°)
ζ_{loc}	Local resistance coefficient ()
ζ	Total pressure loss coefficient (based 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:

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

Example of application:



References:

[1] Handbook of Hydraulic Resistance, 3rd Edition, I.E. Idelchik