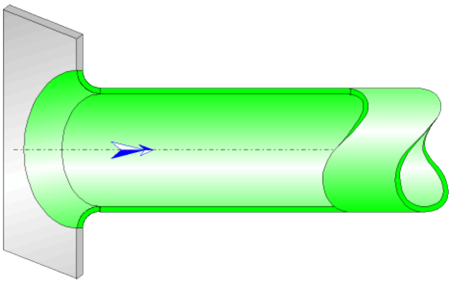
Flush-mounted rounded entrance
Circular Cross-Section
(IDELCHIK)



Model description:

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

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

Model formulation:

Hydraulic diameter (m):

$$\boxed{D_h = D_0}$$

Pipe cross-sectional area (m²):

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

Mean velocity in pipe (m/s):

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

Mass flow rate (kg/s):

$$\boxed{G = Q \cdot \rho}$$

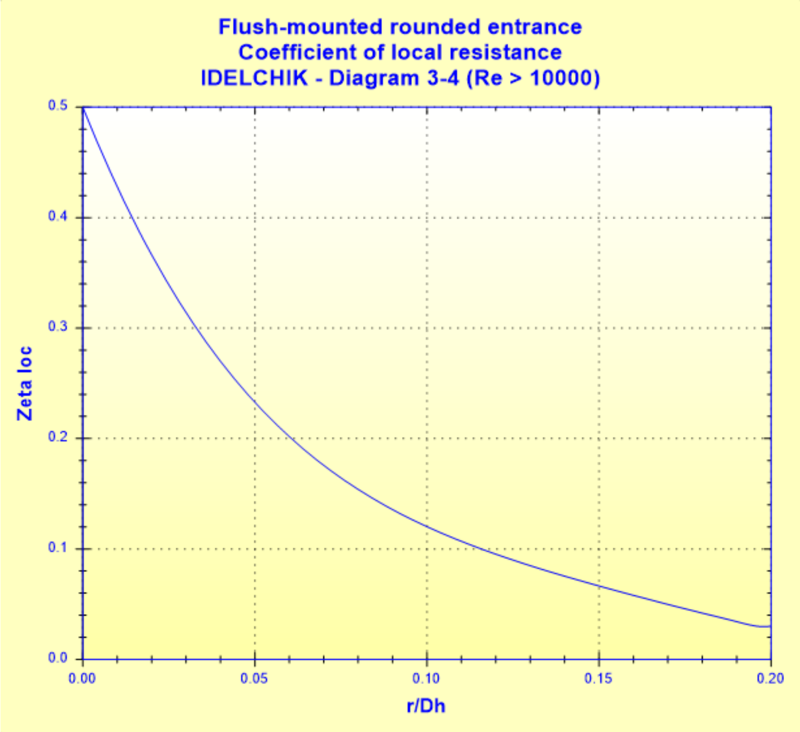
Reynolds number in pipe:

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

Local resistance coefficient:

- $r/D_h \le 0.2$

$$\zeta_{loc} = f\left(r/D_h\right)$$ ([1] diagram 3.4)



- $r/D_h > 0.2$

$$\zeta_{loc} = 0.03$$ ([1] diagram 3.4)

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:

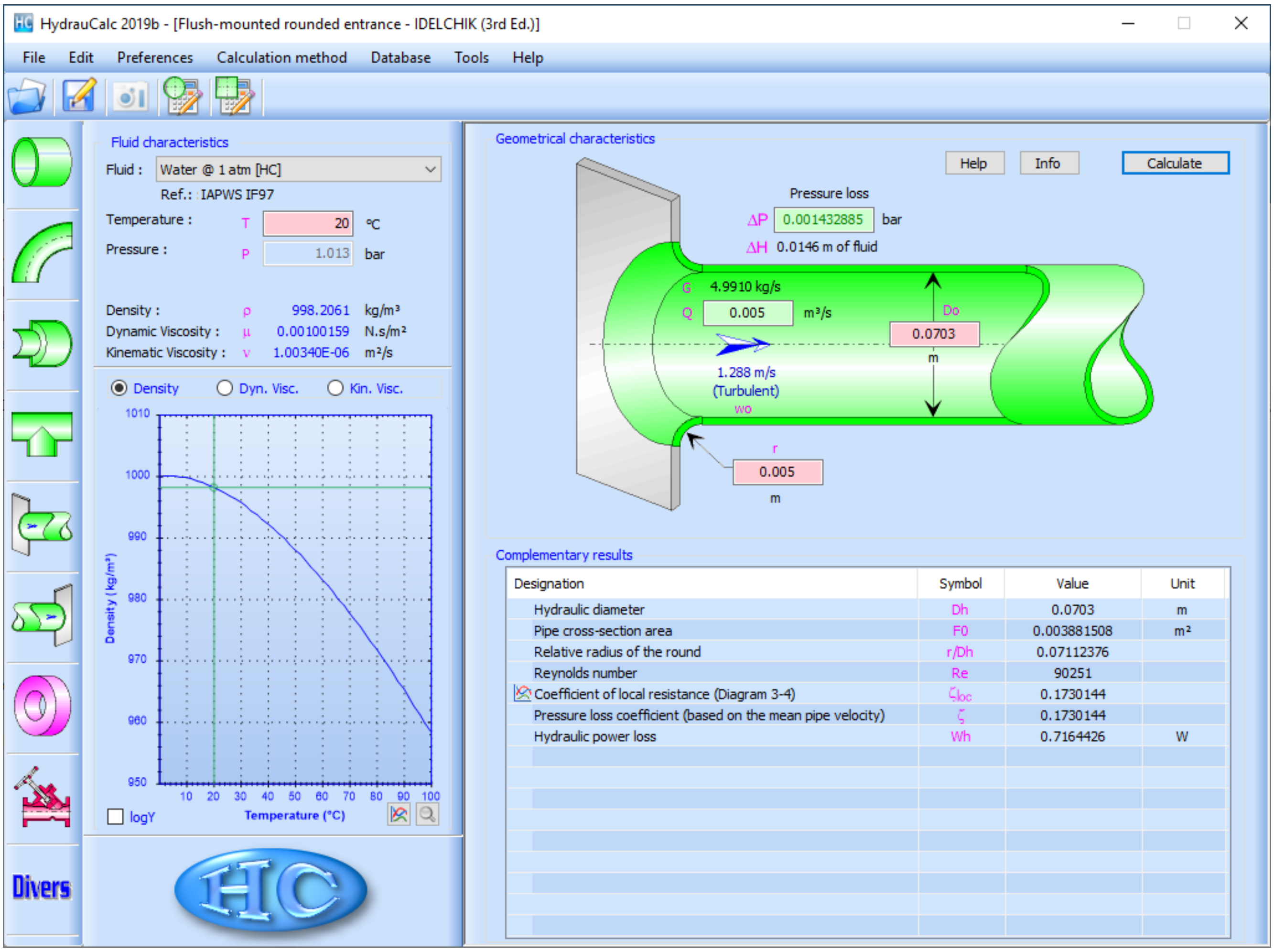
D_h	Hydraulic diameter (m)
D_0	Pipe diameter (m)
F_0	Pipe cross-sectional area (m^2)
Q	Volume flow rate (m^3/s)
w_0	Mean velocity in pipe (m/s)
G	Mass flow rate (kg/s)

Re	Reynolds number in pipe ()
r	Radius of the round (m)
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 ($Re \geq 10^4$)

Example of application:



References:

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