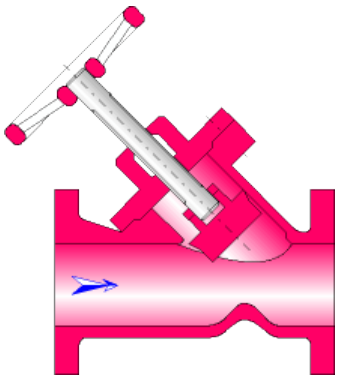
# Y Globe Valve
# (IDELCHIK)



**Model description:**

This model of component calculates the minor head loss (pressure drop) generated by the flow in a Y Globe valve installed in a straight pipe.

**Model formulation:**

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Cross-sectional area ($m^2$):

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

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Mean velocity (m/s):

$$w = \frac{Q}{F}$$

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Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

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Reynolds number:

$$\mathrm{Re} = \frac{w \cdot D}{\nu}$$

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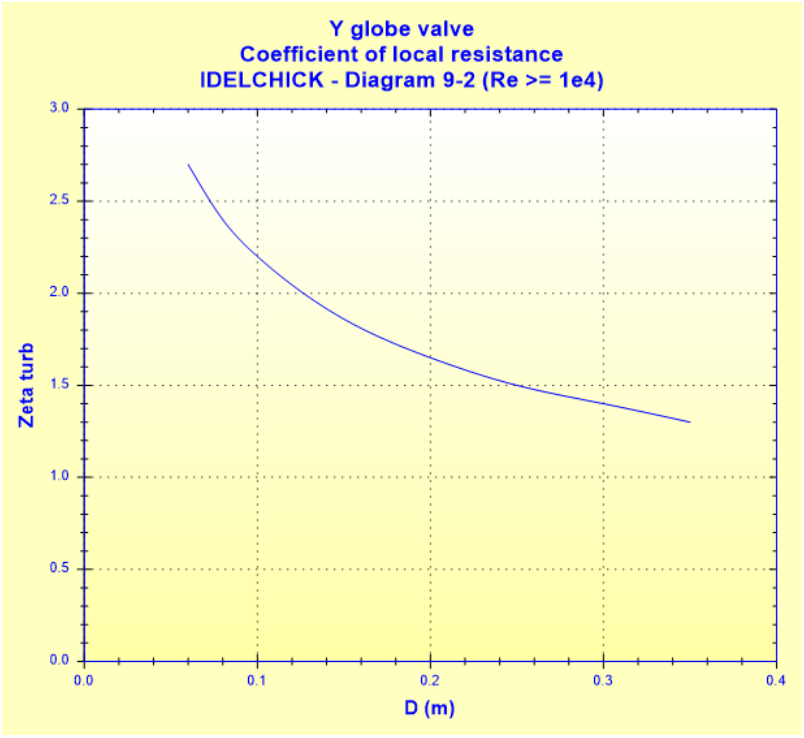
Local resistance coefficient:

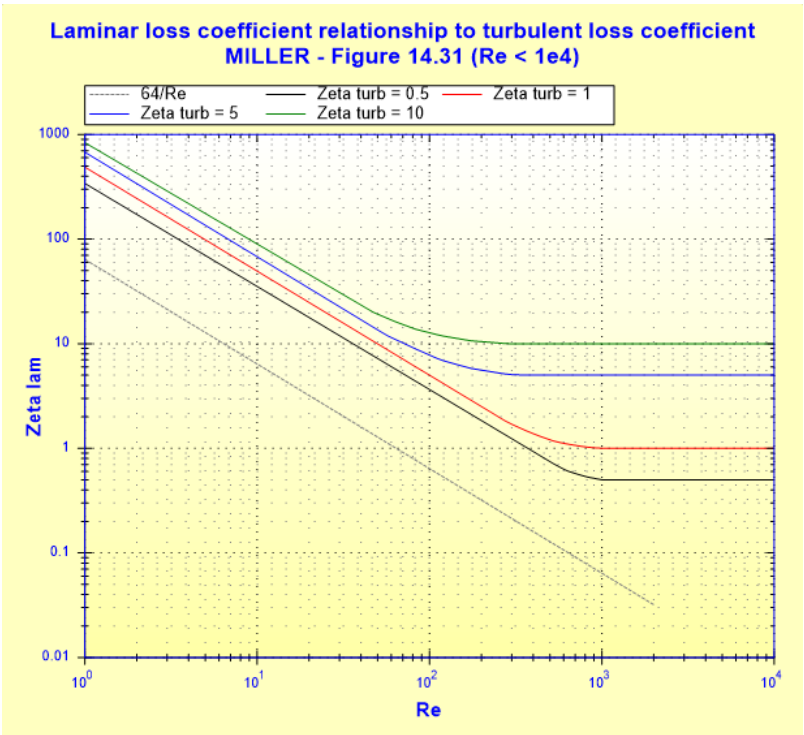
- $\mathrm{Re} \geq 10^4$ (turbulent flow)

  $$\zeta_{turb} = f(D)$$ ([1] diagram 9-2)




- $Re < 10^4$ (laminar flow)

$$\zeta_{lam} = f(\zeta_{turb}, Re)$$ ([2] figure 14.31)

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

$$C_{Re} = \frac{\zeta_{lam}}{\zeta_{turb}}$$

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Total pressure loss coefficient (based on mean velocity):

- turbulent flow ($Re \geq 10^4$):

$$\zeta = \zeta_{turb}$$

- laminar flow ($Re < 10^4$):

$$\zeta = \zeta_{lam}$$

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Total pressure loss (Pa):

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

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Total head loss of fluid (m):

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

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Hydraulic power loss (W):

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

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**Symbols, Definitions, SI Units:**

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|---|---|
| D | Internal diameter (m) |
| F | Cross-sectional area ($m^2$) |
| Q | Volume flow rate ($m^3/s$) |
| G | Mass flow rate (kg/s) |
| w | Mean velocity (m/s) |
| Re | Reynolds number () |
| $\zeta_{turb}$ | Local resistance coefficient for $Re \geq 10^4$ () |
| $\zeta_{lam}$ | Local resistance coefficient for $Re < 10^4$ () |
| $C_{Re}$ | Reynolds number correction for $Re < 10^4$ () |
| $\zeta$ | Pressure loss coefficient (based on the mean velocity) () |
| $\Delta P$ | Total pressure loss (Pa) |
| $\Delta H$ | Total head loss of fluid (m) |
| Wh | Hydraulic power loss (W) |
| | |
| $\rho$ | Fluid density ($kg/m^3$) |
| $\nu$ | Fluid kinematic viscosity ($m^2/s$) |
| g | Gravitational acceleration ($m/s^2$) |

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**Validity range:**

- diameter D between 0.06 m and 0.35 m
- full opening of the valve
- any flow regime: laminar and turbulent

  note: for laminar flow regime ($Re < 10^4$), the pressure loss coefficient "$\zeta_{lam}$" is estimated

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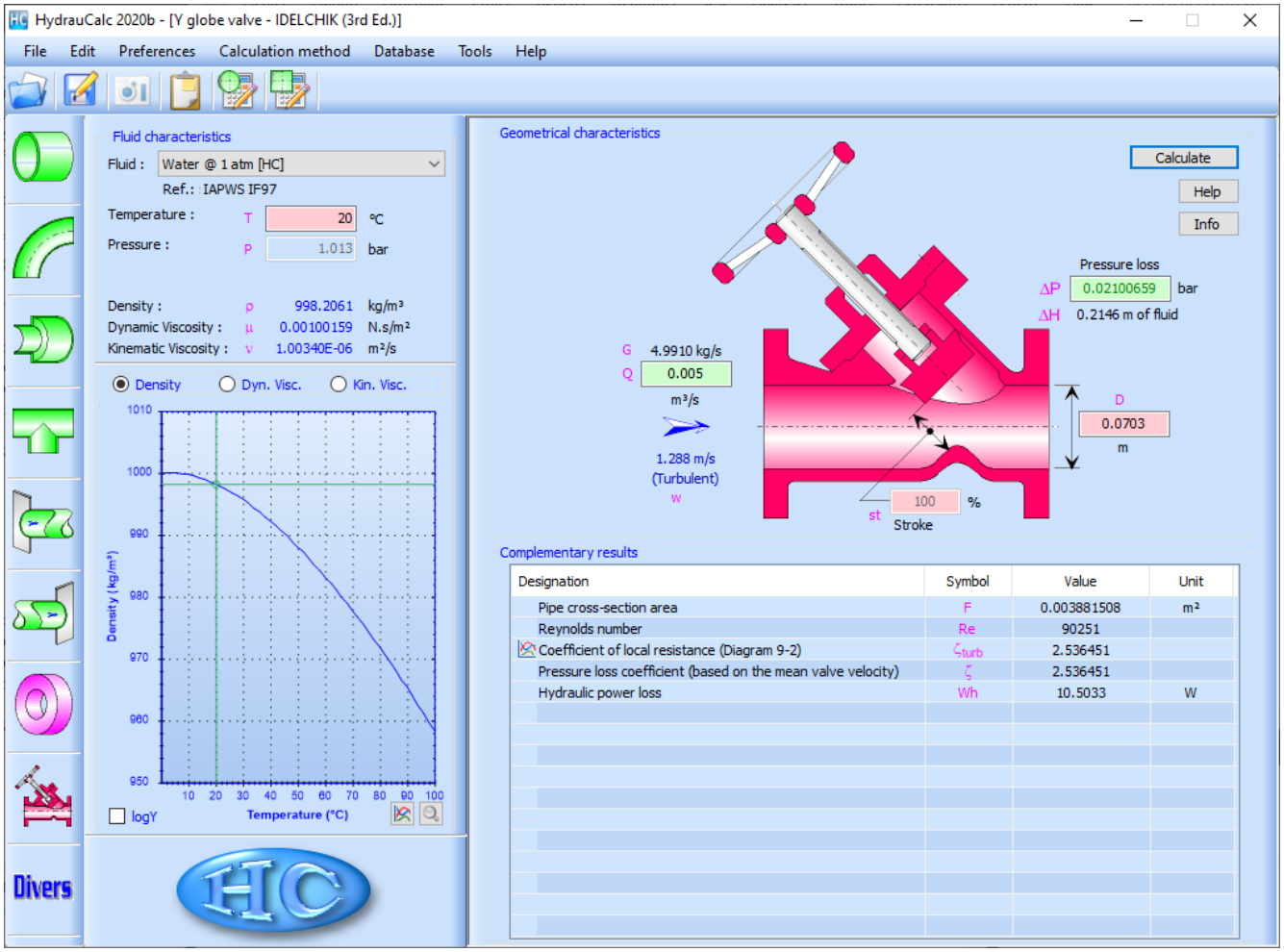
**Example of application:**




## References:


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

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