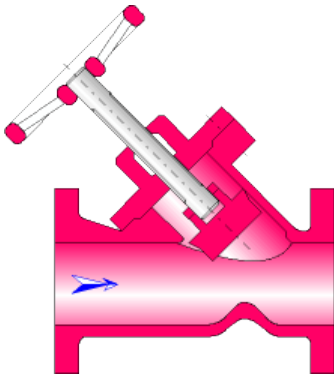




## Y Globe valve (MILLER)



### 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 at valve inlet ( $m^2$ ):

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

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Mean velocity (m/s):

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

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Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

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Reynolds number:

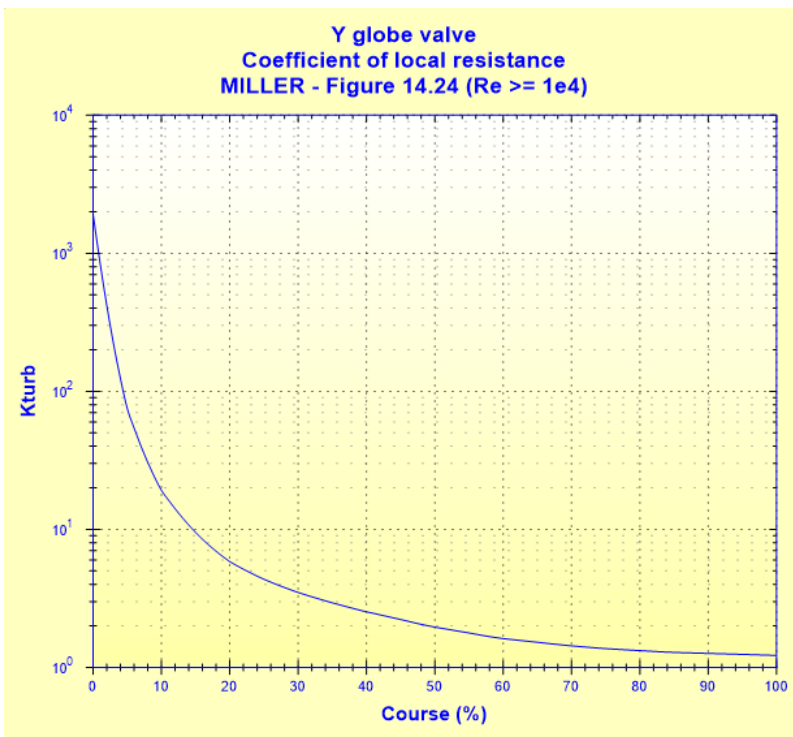
$$Re = \frac{U \cdot D}{\nu}$$

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Local resistance coefficient:

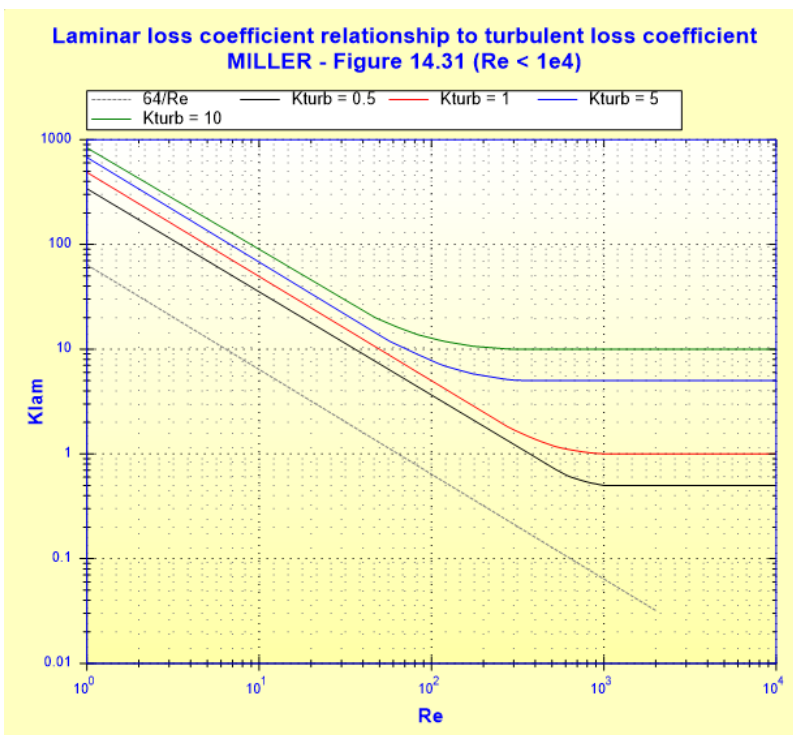
- $Re \geq 10^4$  (turbulent flow)

$$K_{turb} = f(\alpha) \quad ([1] \text{ figure 14.24})$$



■  $Re < 10^4$  (laminar flow)

$$K_{lam} = f(K_{turb}, Re) \quad ([1] \text{ figure 14.31})$$



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

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

Total pressure loss coefficient (based on mean velocity):

■ turbulent flow ( $Re \geq 10^4$ ):

$$K = K_{turb}$$

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

$$K = K_{lam}$$

Total pressure loss (Pa):

$$\Delta P = K \cdot \frac{\rho \cdot U^2}{2}$$

Total head loss of fluid (m):

$$\Delta H = K \cdot \frac{U^2}{2 \cdot g}$$

Hydraulic power loss (W):

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

### Symbols, Definitions, SI Units:

D	Internal diameter (m)
A	Cross-sectional area (m <sup>2</sup> )
Q	Volume flow rate (m <sup>3</sup> /s)
G	Mass flow rate (kg/s)
U	Mean velocity (m/s)
Re	Reynolds number ( )
st	Opening stroke of the valve (%)
K <sub>turb</sub>	Local resistance coefficient for $Re \geq 10^4$ ( )
K <sub>lam</sub>	Local resistance coefficient for $Re < 10^4$ ( )
C <sub>Re</sub>	Reynolds number correction for $Re < 10^4$ ( )
K	Total pressure loss coefficient (based on 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 <sup>3</sup> )
$\nu$	Fluid kinematic viscosity (m <sup>2</sup> /s)
g	Gravitational acceleration (m/s <sup>2</sup> )

### Validity range:

- any flow regime: laminar and turbulent

note: for laminar flow regime ( $Re < 10^4$ ), the pressure loss coefficient "K<sub>lam</sub>" is estimated

### Example of application:

HydrauCalc 2020b - [Y globe valve - MILLER (2nd Ed.)]

File Edit Preferences Calculation method Database Tools Help

Fluid characteristics

Fluid : Water @ 1 atm [HC]  
Ref.: IAPWS IF97

Temperature : T 20 °C  
Pressure : P 1.013 bar

Density :  $\rho$  998.2061 kg/m<sup>3</sup>  
Dynamic Viscosity :  $\mu$  0.00100159 N.s/m<sup>2</sup>  
Kinematic Viscosity :  $\nu$  1.00340E-06 m<sup>2</sup>/s

Density  Dyn. Visc.  Kin. Visc.

Density (kg/m<sup>3</sup>)

Temperature (°C)

logY

Geometrical characteristics

Calculate  
Help  
Info

Pressure loss  $\Delta P$  0.01012378 bar  
 $\Delta H$  0.1034 m of fluid

G 4.9910 kg/s  
Q 0.005 m<sup>3</sup>/s  
1.288 m/s (Turbulent) U

D 0.0703 m

100 % Stroke

Complementary results

Designation	Symbol	Value	Unit
Pipe cross-section area	A	0.003881508	m <sup>2</sup>
Reynolds number	Re	90251	
<input checked="" type="checkbox"/> Coefficient of local resistance (Figure 14.24)	K <sub>turb</sub>	1.2224	
Pressure loss coefficient (based on the mean valve velocity)	K	1.2224	
Hydraulic power loss	Wh	5.061887	W

Divers HC

## References:

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