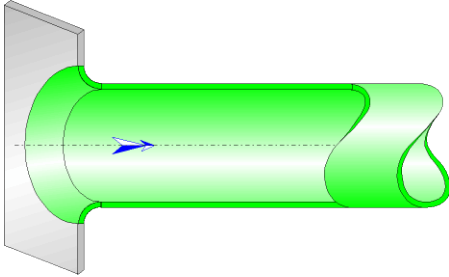




## Flush-mounted rounded entrance Circular Cross-Section (Pipe Flow - Guide)



### Model description:

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

$$d_h = d$$

---

Pipe cross-sectional area (m<sup>2</sup>):

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

---

Mean velocity in pipe (m/s):

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

---

Mass flow rate (kg/s):

$$G = Q \cdot \rho_m$$

---

Reynolds number in pipe:

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

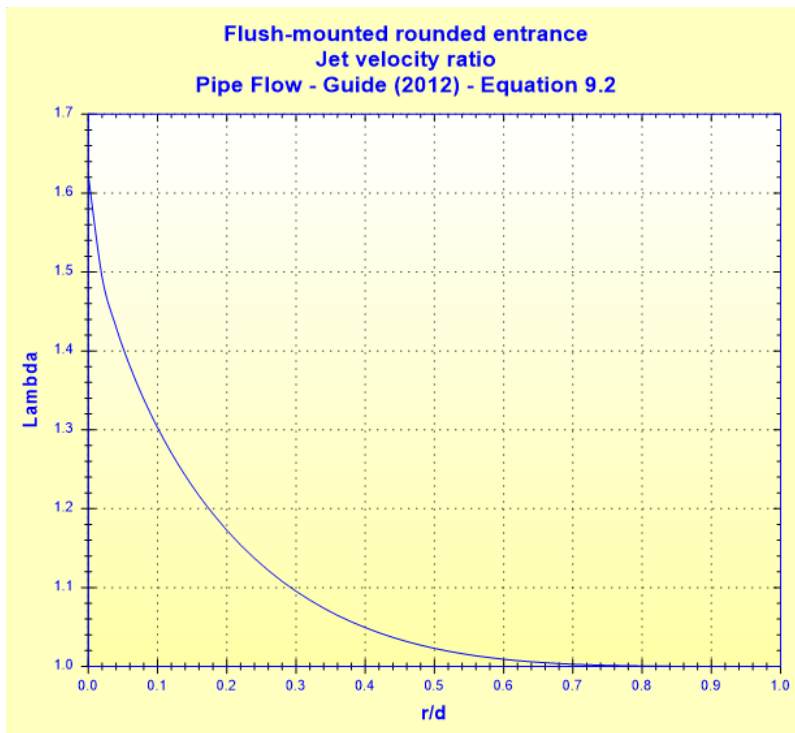
---

Jet velocity ratio:

■  $r/d < 1$

$$\lambda = 1 + 0.622 \cdot \left[ 1 - 0.3 \cdot \sqrt{\frac{r}{d}} - 0.7 \cdot \frac{r}{d} \right]^4$$

([1] equation 9.2)



■  $r/d \geq 1$

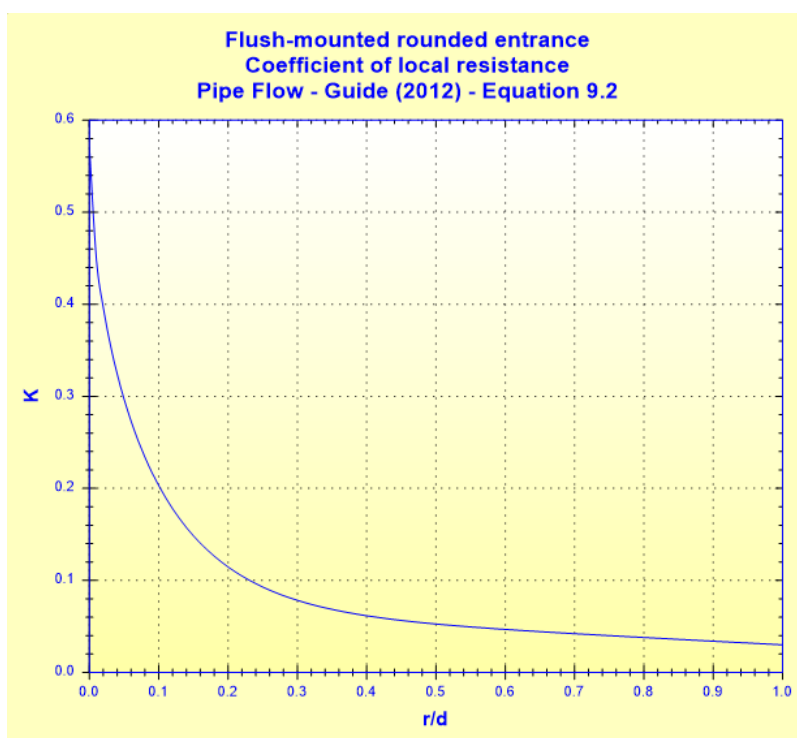
$$\lambda = 1 \quad ([1] \text{ § 9.2})$$

Coefficient of local resistance ( $N_{Re} \geq 10^4$ ):

■  $r/d < 1$

$$K_e = 0.0696 \cdot \left( 1 - 0.569 \cdot \frac{r}{d} \right) \cdot \lambda^2 + (\lambda - 1)^2$$

([1] equation 9.2)



■  $r/d \geq 1$

$$K_e = 0.03 \quad ([1] \text{ § 9.2})$$

---

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

$$K = K_e$$

---

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 <sup>2</sup> )
$Q$	Volume flow rate (m <sup>3</sup> /s)
$v$	Mean velocity in pipe (m/s)
$G$	Mass flow rate (kg/s)
$N_{Re}$	Reynolds number in pipe ( )
$r$	Radius of the round (m)
$\lambda$	Jet velocity ratio ( )
$K_e$	Local resistance coefficient ( )
$K$	Total pressure loss coefficient (based on mean velocity in pipe) ( )
$\Delta P$	Total pressure loss (Pa)
$\Delta H$	Total head loss of fluid (m)
$Wh$	Hydraulic power loss (W)
$\rho_m$	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:**

- turbulent flow regime in pipe ( $N_{Re} \geq 10^4$ )

---

**Example of application:**

HydrauCalc 2019b - [Flush-mounted rounded entrance - Pipe Flow - Guide (2012)]

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.  Kn. Visc.

Geometrical characteristics

Pressure loss  
 $\Delta P$  0.00207164 bar  
 $\Delta H$  0.0212 m of fluid

Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	dh	0.0703	m
Pipe cross-section area	A	0.003881508	m <sup>2</sup>
Relative radius of the round	r/d	0.07112376	
Reynolds number	NRe	90251	
<input checked="" type="checkbox"/> Jet velocity ratio (Equation 9.2)	$\lambda$	1.35668	
<input checked="" type="checkbox"/> Coefficient of local resistance (Equation 9.2)	Ke	0.2501411	
Pressure loss coefficient (based on the mean pipe velocity)	K	0.2501411	
Hydraulic power loss	Wh	1.03582	W

## References:

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