

Pipe Pressure Drop Calculation Sheet

$d := 50.0 \cdot \text{cm}, 55 \cdot \text{cm}.. 80 \cdot \text{cm}$ $l := 50 \cdot \text{m}$ $\text{cm_H2O} := 98.07 \cdot \text{Pa}$

$\text{cp} := 0.01 \cdot \text{poise}$

$Q := 1000 \cdot \frac{\text{liter}}{\text{sec}}$

$\rho := 1.0 \cdot \frac{\text{kg}}{\text{liter}}$

$\mu := 1.0 \cdot \text{cp}$

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

$V(d) := \frac{Q}{A(d)}$

$\text{Re}(d) := \frac{\rho \cdot V(d) \cdot d}{\mu}$

$\frac{d}{\text{cm}}$	$\frac{A(d)}{\text{cm}^2}$
50.0	$2.0 \cdot 10^3$
55.0	$2.4 \cdot 10^3$
60.0	$2.8 \cdot 10^3$
65.0	$3.3 \cdot 10^3$
70.0	$3.8 \cdot 10^3$
75.0	$4.4 \cdot 10^3$
80.0	$5.0 \cdot 10^3$

$V(d)$
$5.09 \cdot \text{m} \cdot \text{sec}^{-1}$
$4.21 \cdot \text{m} \cdot \text{sec}^{-1}$
$3.54 \cdot \text{m} \cdot \text{sec}^{-1}$
$3.01 \cdot \text{m} \cdot \text{sec}^{-1}$
$2.60 \cdot \text{m} \cdot \text{sec}^{-1}$
$2.26 \cdot \text{m} \cdot \text{sec}^{-1}$
$1.99 \cdot \text{m} \cdot \text{sec}^{-1}$

$\text{Re}(d)$
$2.5 \cdot 10^6$
$2.3 \cdot 10^6$
$2.1 \cdot 10^6$
$2.0 \cdot 10^6$
$1.8 \cdot 10^6$
$1.7 \cdot 10^6$
$1.6 \cdot 10^6$

$\epsilon := 0.002 \cdot \text{mm}$

Pipe roughness ϵ

$y(d) := -\log\left(\frac{\epsilon}{3.7 \cdot d} - \frac{4.52}{\text{Re}(d)} \cdot \log\left(\frac{7}{\text{Re}(d)} + \frac{\epsilon}{7 \cdot d}\right)\right)$

$f(d) := \begin{cases} \frac{16}{\text{Re}(d)} & \text{if } \text{Re}(d) < 2100 \\ \frac{1}{16 \cdot y(d)^2} & \text{otherwise} \end{cases}$ **Friction factor f**

$f(d)$
0.0025
0.0026
0.0026
0.0026
0.0027
0.0027
0.0027

$q(d) := \frac{1}{2} \cdot \rho \cdot V(d)^2$

Velocity head q

0.0027
0.0027
0.0027

$$\Delta P_f(d) := 4 \cdot f(d) \cdot \frac{1}{d} \cdot q(d)$$

Pipe friction loss ΔP_f

$$K_f := 0.5 + .35 + .35$$

**Entrance (0.5) and turn losses
e.g. 2 turns of 45 deg (0.35) K_f**

$$\Delta P(d) := \Delta P_f(d) + q(d) \cdot K_f$$

Total loss ΔP

d	q(d)	$\Delta P_f(d)$	$\Delta P(d)$
cm	cm_H2O	cm_H2O	cm_H2O
50.0	132.2	134.0	292.7
55.0	90.3	84.3	192.7
60.0	63.8	55.2	131.8
65.0	46.3	37.4	93.0
70.0	34.4	26.1	67.4
75.0	26.1	18.7	50.0
80.0	20.2	13.7	37.9