

# Pipe Pressure Drop Calculation Sheet

$d := 30.0\text{-cm}, 35\text{-cm}.. 60\text{-cm}$      $l := 50\text{-m}$      $\text{cm\_H2O} := 98.07\text{-Pa}$

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

$Q := 100 \cdot \frac{\text{liter}}{\text{sec}}$

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

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

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

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

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

$\frac{d}{\text{cm}}$	$\frac{A(d)}{\text{cm}^2}$
30.0	706.9
35.0	962.1
40.0	$1.3 \cdot 10^3$
45.0	$1.6 \cdot 10^3$
50.0	$2.0 \cdot 10^3$
55.0	$2.4 \cdot 10^3$
60.0	$2.8 \cdot 10^3$

$V(d)$
$1.41 \cdot \text{m} \cdot \text{sec}^{-1}$
$1.04 \cdot \text{m} \cdot \text{sec}^{-1}$
$0.80 \cdot \text{m} \cdot \text{sec}^{-1}$
$0.63 \cdot \text{m} \cdot \text{sec}^{-1}$
$0.51 \cdot \text{m} \cdot \text{sec}^{-1}$
$0.42 \cdot \text{m} \cdot \text{sec}^{-1}$
$0.35 \cdot \text{m} \cdot \text{sec}^{-1}$

$\text{Re}(d)$
$4.2 \cdot 10^5$
$3.6 \cdot 10^5$
$3.2 \cdot 10^5$
$2.8 \cdot 10^5$
$2.5 \cdot 10^5$
$2.3 \cdot 10^5$
$2.1 \cdot 10^5$

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

## Pipe roughness $\epsilon$

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

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

$f(d)$
0.0034
0.0035
0.0036
0.0037
0.0037
0.0038
0.0039

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

## Velocity head q

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

### Pipe friction loss $\Delta P_f$

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

### 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 $\Delta P$

d	q(d)	$\Delta P_f(d)$	$\Delta P(d)$
cm	cm_H2O	cm_H2O	cm_H2O
30.0	10.2	23.2	35.5
35.0	5.5	11.0	17.6
40.0	3.2	5.8	9.7
45.0	2.0	3.3	5.7
50.0	1.3	2.0	3.6
55.0	0.9	1.3	2.3
60.0	0.6	0.8	1.6