South Valley University
Faculty of Engineering
Mechanical Power Engineering Dep.

Flow-Network Design
MPEP 425X
Year: 2019/2020
Class: 4th year MPE.

الأسبوع الأول من تعليق الدراسة 16/3/2020

Sheet No. 3

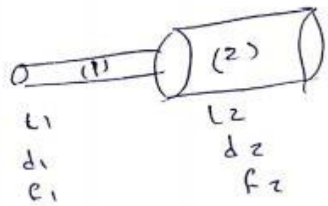
1- A piping system involves two pipes of different diameters (but of identical length, material, and roughness) connected in series. How would you compare the (a) flow rates and (b) pressure drops in these two pipes?

Solution

Solution

$L_1 = L_2$

$d_1 \neq d_2$



In Series Connection

① the flowrate in the two pipe are identical

② Pressure drop will be different

$$h_L = f\frac{L}{d}\frac{V^2}{2g}$$

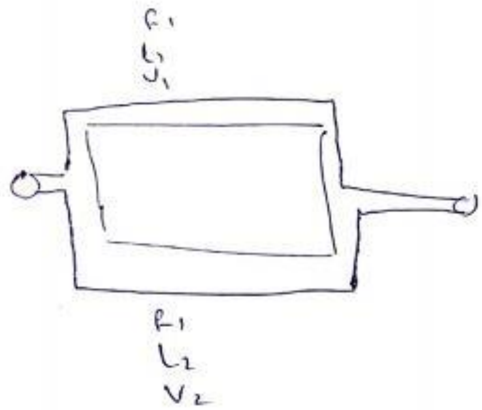
in high diameter the pressure drop will be the lowe

2- A piping system involves two pipes of different diameters (but of identical length, material, and roughness) connected in parallel. How would you compare the (a) flow rates and (b) pressure drops in these two pipes?

Solution

in Parllel Connection

① the Pressure drop ~~[illegible]~~ in two Pipes are identical



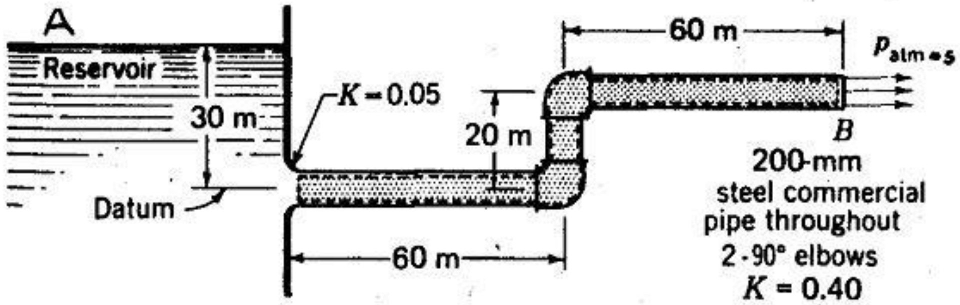
② the flow rate increase due to "p"

$D\uparrow \rightarrow Q\uparrow$

$D\downarrow \rightarrow Q\downarrow$

the flowrate will be high in a higher diameter

3- Pipe system carries water from reservoir and discharges it as free jet. Calculate the expected discharge through 200 mm steel commercial pipe with the fittings shown.



$\nu = .0113 \times 10^{-4}\ m^2/s$
$\rho = 999\ kg/m^3$

solution

$$\cancel{\frac{P_1}{\gamma}} + \cancel{\frac{V_1^2}{2g}} + Z_1 = \cancel{\frac{P_2}{\gamma}} + \frac{V_2^2}{2g} + Z_2 + h_{losses}$$

$$\frac{V_2^2}{2g} = \overset{30\,m}{Z_1} - \overset{20\,m}{Z_2} - h_{losses}$$

$$h_{losses} = \frac{V_2^2}{2g}\left(f\frac{L}{D} + \Sigma K\right)$$

$$\frac{V_2^2}{2g} = 10 - \frac{V_2^2}{2g}\left(f * \frac{140}{200*10^{-3}} + (0.05 + 0.4*2)\right)$$

$$V_2 = \sqrt{\frac{10}{(35.69f + 0.09432)}}$$

assume (try 1) $f = 0.014$

$$V_2 = \sqrt{\frac{10}{35.69*0.014 + 0.09432}} = 4.103\ m/sec$$

$$Re = \frac{VD}{\nu} = \frac{200*10^{-3} * 4.103}{0.0113*10^{-4}} = 7.26*10^{5}$$

$$\varepsilon/D = 0.00023$$

from mody chart $f = 0.0152$

(1)

try (2)

$f = 0.0152$

$$V_2 = \sqrt{\frac{10}{35.69*0.0152 + 0.09432}} = 3.963\ m/sec$$

$$Re = \frac{DV}{\nu} = \frac{200*10^{-3} * 3.963}{0.0113*10^{-4}} = 7.01*10^{5}$$

from mody chart $f = 0.0152$ (ok)

$$Q = AV = \frac{\pi}{4}(200*10^{-3})^2 * 3.963$$

$$= 0.125\ m^3/sec$$