Foster Grubbs

HW 2.4

12.4)

$Q = 1350$ gal/min

Q_1 = V. flow rate in 6 in pipe

Q_2 = V. flow rate in 2 in pipe

$Q = Q_1 + Q_2$

$Q = A + V$

$\Rightarrow Q \propto A$

$$\frac{Q_1}{Q_2} = \frac{A_1}{A_2} = \frac{D_1^2}{D_2^2}$$

$$\frac{Q_1}{Q_2} = \frac{6^2}{2^2} = \frac{36}{4} = 9$$

$$\frac{Q_1}{Q_2} = 9 \qquad Q_1 = 9 \times Q_2$$

$Q_1 = Q - Q_2$

$9 \times Q_2 = 1350 - Q_2$

$10 \times Q_2 = 1350$

$\boxed{Q_2 = 135\ G/min}$ $Q = Q_1 + Q_2$

$1350 = Q_1 + 135$

$\boxed{Q_1 = 1215\ G/min}$

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Hw 2.4

12.5

$Q_1 = 600\ L/min$

$\Rightarrow Q_1 = \frac{600}{1} \times \frac{1\times10^{-3}}{1} \times \frac{1}{60} = 0.01\ m^3/sec$

$d_1 = 100_{mm}$ $d_2 = 50_{mm}$

$Q = A_1 V_1 = A_2 V_2$

$V_1 = \frac{Q}{A_1} = \frac{4Q}{\pi d_1^2} = \frac{4(0.01)}{\pi(0.1)^2} = 1.2727\ m/s$

$V_2 = \frac{4Q}{\pi d_2^2} = \frac{4(0.01)}{\pi(0.05)^2} = 5.09\ m/s$

@ 10°C, water has a kinematic viscosity of $1.397\times10^{-6}\ m^2/s$

$Re_1 = \frac{V_1 d_1}{\nu} = \frac{1.2727(0.1)}{1.397\times10^{-6}} = 91102.36$

friction factor $(f) = 0.184\ R_e^{-0.2}$

$f_1 = 0.184(91102.36)^{-0.2} = 0.0187$

$(R_{ep})_2 = \frac{V_2 d_2}{\nu} = \frac{5.09\times0.05}{1.397\times10^{-6}} = 182180.83$

Both are turbulent

$f_2 = 0.184 \times R_{ep}^{-0.2}$

$f_2 = 0.0163$

$$\frac{f_1 L v_1^2}{2g\,d_1} + k\,\frac{v_1^2}{2g} = \frac{f_2 v_2^2 L}{2g\,d_2}$$

$$k = \frac{L}{v_1^2}\left[\frac{f_2 v_2^2}{d_2} - \frac{f_1 v_1^2}{d_1}\right]$$

$$= \frac{30}{12.727^2}\left[\frac{0.0163 \times 5.09^2}{0.05} - \frac{0.0187 \times 12.727^2}{0.1}\right]$$

$$\boxed{k = 150.87}$$

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HW2.4 on Test 1

Q1) One thing I learned from the first problem is that it's always easiest to start with what you have given to you. For the second part of the problem, I forgot to account for the mercury moving up on the right side. Sometimes you need to take a step back and ask if it actually makes sense

Q2) For this problem, I used one of the examples from the book to help solve this problem, Using the problem, I worked backwards to find a solution

Q3) Initially, I had trouble finding an answer that proved that the rotated position was more stable, After realizing my simple mistake, I came to an answer. Always check where your numbers go.