December 3, 2014

NAME

Fluids-ID

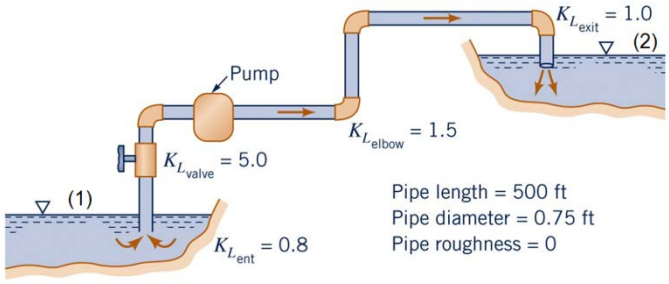
Quiz 12. The pump shown in Figure delivers a head of 250 ft to the water. The differene in elevation of the two ponds is 200 ft. ($P = \rho g Q h_p$; ρ = 1.94 slugs/ft^3; $\mu = 2.34\times10^{-5}$ lb·s/ft^2; g = 32.2 ft/s^2; 1 hp = 550 ft·lbf/s; Reynolds number, $Re = \rho VD/\mu$)

Energy Equation

$$\frac{p_1}{\rho g}+\frac{V_1^2}{2g}+z_1+h_p=\frac{p_2}{\rho g}+\frac{V_2^2}{2g}+z_2+\frac{V^2}{2g}\left(\frac{f\ell}{d}+\sum K_L\right)$$

Friction Factor Equation (The Haaland eq.)

$$\frac{1}{\sqrt{f}}=-1.8\log\left[\left(\frac{\varepsilon/d}{3.7}\right)^{1.11}+\frac{6.9}{Re}\right]$$



Note: Attendance (+2 points), format (+1 point)

a) Simplify energy equation using the given conditions and determine velocity, *V*, as a function of friction factor, *f*.
b) Use the given conditions and determine Reynolds number, *Re*, as a function of velocity, *V*.
c) Determine velocity *V* by following the steps listed below
    1) Assume *f* = 0.02 as your first guess and find *V* using the equation from (a)
    2) Find *Re* using the equation from (b) and the *V* from the previous step
    3) Find a new *f* using the Haaland equation and *Re* from step 2)
    4) Find a new *V* using the *f* from step 3) and the equation from (a)
    5) Repeat the steps 2) through 4) until *f* is converged to the thousandth decimal point
d) Determine the power *P* that pump adds to the water.