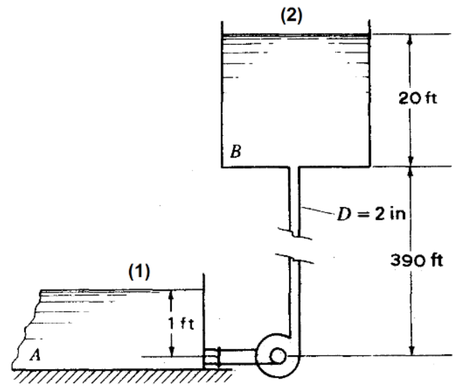
November 20, 2015

NAME

Fluids-ID

Quiz 13. The pump moves 120 gal/min (1 gal = 0.133681 ft^3) of water from tank A to tank B with 390 ft long pipe system as shown in the figure. The pipes are steel (ε = 0.00015 ft). Water is at 60 °F (ρ = 1.938 slugs/ft^3 and μ = 2.344 × 10^{-5} lb·s/ft^2). Neglecting the loss for the short inlet piping and the minor losses, find the (a) the average water velocity V through the pipe, (b) Reynolds number Re = $\rho VD/\mu$, and (c) friction factor f through the 2-in (12in = 1ft) pipe and (d) determine the required pump power $\dot{W}_p$ = ρgQh_p (1 hp = 550 ft-lb/s and g = 32.2 ft^2/s). Assume the flow is turbulent and use the following energy equation and friction factor formula,



$$\frac{p_1}{\gamma} + \alpha_1 \frac{V_1}{2g} + z_1 + h_p = \frac{p_2}{\gamma} + \alpha_2 \frac{V_2}{2g} + z_2 + f \frac{L}{D} \frac{V^2}{2g}$$

$$\frac{1}{\sqrt{f}} = -1.8 \log\left[\left(\frac{\varepsilon/D}{3.7}\right)^{1.1} + \frac{6.9}{Re}\right]$$

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