P2

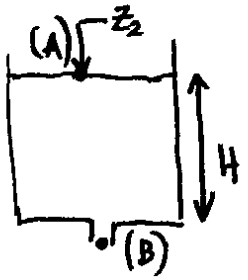
a) $B_1 = B_2 + \sum \Delta_s + \Delta_f$

$B_1 = z_1$
$B_2 = z_2$

$\Delta_f = \frac{f_1 L_1}{D_1} \frac{V_1^2}{2g}$

$z_1 = z_2 + \left(k_e + k_{c_1} + k_s\right) \frac{V_1^2}{2g} + \frac{f_1 L_1}{D_1} \frac{V_1^2}{2g}$

$\Rightarrow V_1 = \frac{\sqrt{2g\left(z_1 - z_2\right)}}{\sqrt{k_e + k_{c_1} + k_s + \frac{f_1 L_1}{D_1}}} \Rightarrow Q_1 = \frac{\pi D_1^2}{4} V_1$



$B_A = z_2$

$B_B = \left(z_2 - H\right) + \frac{V_B^2}{2g}$

$B_A = B_B \Rightarrow V_B = \sqrt{2gH}$

$q = \frac{\pi d^2}{4} V_B = \frac{\pi d^2}{4} \sqrt{2gH}$

$Q_2 = Q_1 - q$ por continuidad

b) Bernoulli entre (2) y (3)

$B_2 = z_2$

$B_3 = z_3 + \frac{V_3^2}{2g}$

$B_2 = B_3 + \sum \Delta_s + \Delta_f - \Delta B_{bomba}$

$z_2 = z_3 + \frac{V_3^2}{2g} + \left(k_{ch} + k_{c_2} + \frac{f_2 L_2}{D_2}\right) \frac{V_2^2}{2g} - \Delta B_{bomba}$

$V_3 = V_2 = \frac{4 Q_2}{\pi D_2^2}$

$$\Rightarrow \Delta B_{bomba} = z_3 - z_2 + \left(1 + k_{ch} + k_{c2} + \frac{f_2 L_2}{D_2}\right) \frac{8 Q_2^2}{g \pi^2 D_2^4}$$

$$\text{Potencia} = \gamma Q_2 \Delta B_{bomba}$$

c)