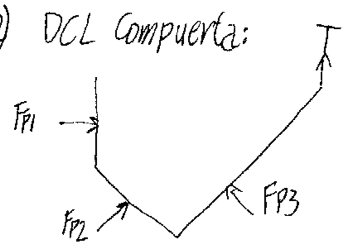
P1 a) DCL Compuerta:

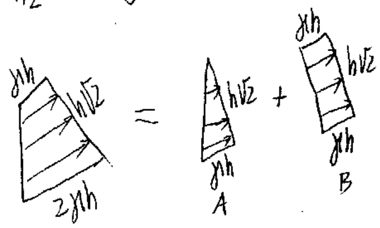


$\sum \vec{T}=0 \Leftrightarrow F_{P1}\cdot r_1 + F_{P2}\cdot r_2 = F_{P3}\cdot r_3 + T\cdot 2h$ (1)

F_{P1}:

$F_{P1}=\frac{1}{2}\gamma h\cdot h\cdot b = \frac{\gamma h^2 b}{2}$; $r_1 = CG + h = \frac{h}{3}+h=\frac{4h}{3}$

F_{P2}:



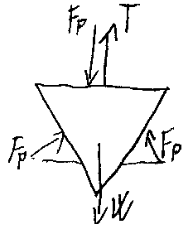
$\Rightarrow F_{P2A} = \frac{1}{2}\gamma h\cdot h\sqrt{2}\cdot b = \frac{\gamma h^2 b\sqrt{2}}{2}$; $r_{2A}=\frac{h\sqrt{2}}{3}$

$F_{P2B} = \gamma h\cdot h\sqrt{2}\cdot b = \gamma h^2 b\sqrt{2}$; $r_{2B}=\frac{h\sqrt{2}}{2}$

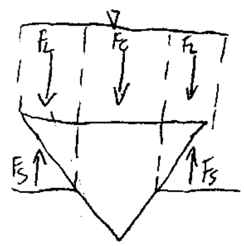
F_{P3}:

$\Rightarrow F_{P3}=\frac{1}{2}\gamma h\cdot h\sqrt{2}\cdot b=\frac{\gamma h^2 b\sqrt{2}}{2}$; $r_3=\frac{h\sqrt{2}}{3}$

DCL Tapón

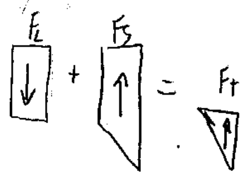


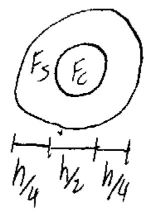
Veamos las presiones:



(las horizontales se anulan)

$F_C = \gamma\cdot\frac{3}{2} h\cdot A = \gamma\cdot\frac{3}{2} h\cdot\frac{\pi}{4}\left(\frac{h}{2}\right)^2 = \frac{3}{32}\gamma h^3\pi$





(F_S actúa en el anillo exterior)

F_T:

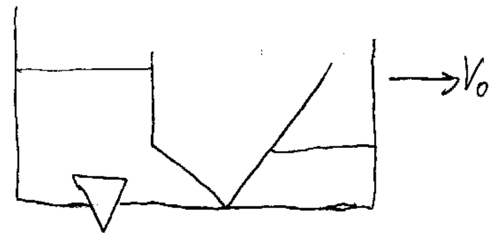
$\Rightarrow F_T=\frac{1}{2}\frac{\gamma h}{2}\cdot\frac{\pi}{4}\left(h^2-\left(\frac{h}{2}\right)^2\right)=\frac{3\gamma\pi h^3}{64}$

$\therefore T = W + F_C - F_T = W+\frac{3}{32}\gamma h^3\pi - \frac{3\gamma h^3\pi}{64} = W+\frac{3\gamma\pi h^3}{64}$

Reemplazando en (1): $\frac{\gamma h^2 b}{2}\cdot\frac{4h}{3} + \cancel{\frac{\gamma h^2 b\sqrt{2}}{2}\cdot\frac{h\sqrt{2}}{3}} + \gamma h^2 b\sqrt{2}\cdot\frac{h\sqrt{2}}{2} = \cancel{\frac{\gamma h^2 b\sqrt{2}}{2}\cdot\frac{h\sqrt{2}}{3}} + \left(W+\frac{3\gamma\pi h^3}{64}\right)\cdot 2h$

$\frac{2}{3}\gamma h^3 b + \gamma h^3 b = 2hW + \frac{3}{32}\gamma\pi h^4 \Leftrightarrow 2hW = \frac{5}{3}\gamma h^3 b - \frac{3}{32}\gamma\pi h^4 \Leftrightarrow W = h^2\gamma\left(\frac{5}{6} b - \frac{3}{32}\pi h\right) = 34{,}85[N]$

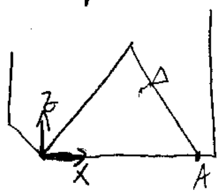
b)



De Cinemática: $\cancel{V_f^2}^{\,0} - V_0^2 = 2ad$

$\Rightarrow a_0 = -\frac{V_0^2}{2d} = -4{,}82$ [m/seg]

Compartimento derecho: $P - P_0 = -\rho a_x (X - X_0) - \rho g (z - z_0)$



condición crítica: $P_0 = 0$ en $z_0 = 2h$, $X_0 = 2h$

$\Rightarrow P = -\rho a_x (X - 2h) - \rho g (z - 2h)$ (1)

En el pto. A, tb. estamos en una isóbara ($P=0$), sabemos que ahí $z=0$, pero ¿x?

Conservación de volumen: $\forall_0 = \forall_f$; $\forall_0 = b\cdot h(D-h) + \frac{1}{2}h^2 b$; $\forall_f = \frac{x\cdot 2h}{2} b$

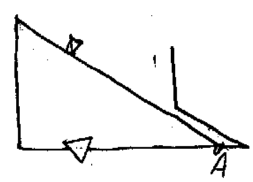
$\Rightarrow \cancel{bh}\left(D - \frac{h}{2}\right) = x\cancel{hb} \Rightarrow x = D - \frac{h}{2} < D$ (coherente con el dibujo)

(1): $0 = -\rho a_x \left(D - \frac{h}{2} - 2h\right) - \rho g (0 - 2h) \Leftrightarrow a_x = \frac{2gh}{\left(D - \frac{5}{2}h\right)} = 5{,}6$ [m/seg²]

$\Rightarrow$ Con a_0 no hay derrame

Compartimento Izquierdo: Condición crítica: $P_0 = 0$ en $z_0 = H$, $X_0 = 0$

$\Rightarrow P = -\rho a_x (X - 0) - \rho g (z - H)$ (2)



Isóbara en pto. A: $P=0$; $z=0$; ¿x?

$\forall_0 = 2h\cdot b(L-h) + \frac{h^2 b}{2}$; $\forall_f = \frac{Hxb}{2}$; $\forall_0 = \forall_f \Leftrightarrow h\cancel{b}\left(2L - \frac{3h}{2}\right) = \frac{Hx\cancel{b}}{2}$

$\Rightarrow x = \frac{2h}{H}\left(2L - \frac{3h}{2}\right) = 0{,}93 < L$ (coherente con el dibujo)

(2): $0 = -\rho a_x \left(\frac{2h}{H}\left(2L - \frac{3h}{2}\right)\right) - \rho g (0 - H) \Leftrightarrow a_x = \frac{H^2 g}{2h}\cdot\frac{1}{\left(2L - \frac{3h}{2}\right)} = 4{,}23$ [m/seg²]

$\Rightarrow$ Para salvar al perro, debe haber derrame del compartimento.