

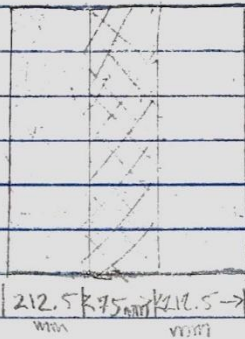


Etanah

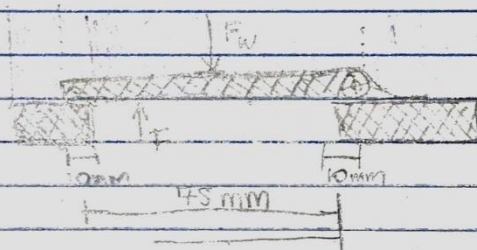
4.10

 water on valve
 water



Tank

1800 mm



Valve

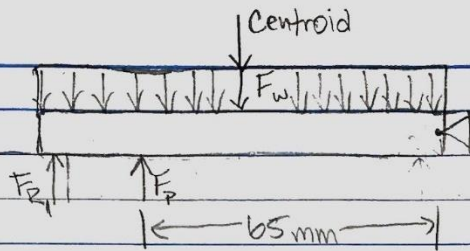
Considerations

- Fluid is water
- Incompressible
- Isothermal

Procedure

1. I will calculate the Forces to sum them.
2. I will calculate the moments to sum them.
3. The Force required to open it is any force larger than the force holding it, so this is what I will solve for.

Calculations



$$\sum F = 0 \rightarrow F_P - F_w + F_R = 0$$

$$\sum M = 0 \rightarrow F_P \cdot 65 \text{ mm} - F_w \cdot 47.5 \text{ mm} + F_R \cdot 75 \text{ mm} = 0$$

$$P = \frac{F}{A} \rightarrow F = p \cdot A \rightarrow p = \rho g h = 1000 \frac{\text{kg}}{\text{m}^3} \cdot 9.81 \text{ m/s}^2 \cdot 1.8 \text{ m}$$

$$p = 17658 \frac{\text{kg}}{\text{m} \cdot \text{s}^2}$$
$$= 17.658 \frac{\text{kg}}{\text{mm} \cdot \text{s}^2}$$

$$F_w = 17.658 \frac{\text{kg}}{\text{mm} \cdot \text{s}^2} \cdot A \rightarrow A = \pi \cdot 34.5^2 = 4417.9 \text{ mm}^2$$

$$F_w = 78.01 \cdot 10^4 \frac{\text{kg} \cdot \text{mm}}{\text{s}^2} = 78.01 \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$$

$$F_P - 78.01 + F_R = 0$$

$$0.065 \text{ m} \cdot F_P + (78.01 \cdot 0.0475 \text{ m}) + F_R \cdot 0.095 \text{ m} = 0$$

↓

$$F_P = -78.01 - F_R \rightarrow 0.065(-78.01 - F_R) + F_R \cdot 0.095 \text{ m} = 0$$

$$F_R = 169.022 \text{ N } \text{ plug and chug}$$

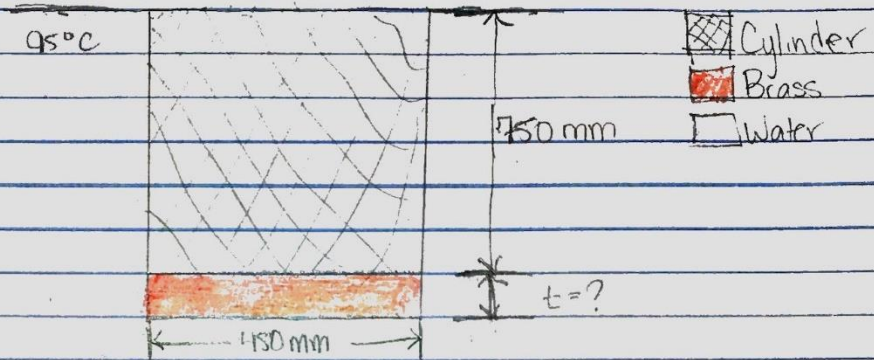
$$F_P = -247.032 \text{ N}$$

Any Force $> 247.032 \text{ N}$ will open the valve.

S.24

Exam

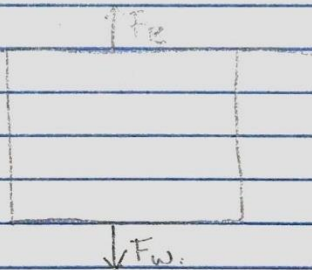
Diagram



Procedure

1. Free body diagram of the forces involved.
2. Find required thickness through statics.
- 3.

Free-Body Diagram



$$F_B - F_w = 0$$

$$F_B = \gamma_w \cdot V_c \rightarrow \gamma_w = 9.4329 \text{ kN/m}^3$$

$$\gamma_w V_c - F_w = 0 \rightarrow V_c = \pi r^2 \cdot h \rightarrow h = 750 + t \text{ [mm]}$$

$$\rightarrow r = 225 \text{ [mm]}$$

$$V_c = \pi \cdot 225^2 \cdot 750 + \pi \cdot 225^2 \cdot t$$

$$9.4329 \text{ [kN/m}^3] \cdot (225^2 \pi \cdot 750 + \pi \cdot 225^2 \cdot t) - F_w = 0$$

$$F_w = w_c + w_B \rightarrow w_B = \gamma_B \cdot \pi \cdot 225^2 \cdot t = 13.36t \text{ kN}$$

$$= w_c + 13.36t$$

$$2.655t - w_c + 13.36t = 0 \rightarrow w_c - 10.705t = 0$$