

Homework 2.1

FLUID MECHANICS

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4.2/4.10

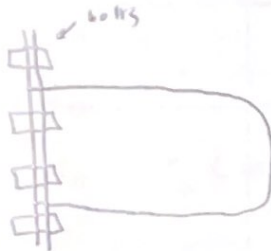
Given:

$$I.D. = 30''$$

$$P = 14.4 \text{ psi}$$

$$Find: F_{Bolt}$$

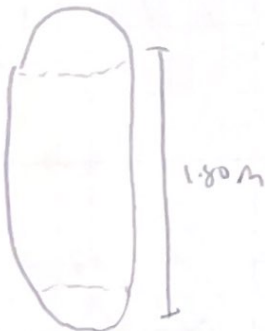
F.B.D



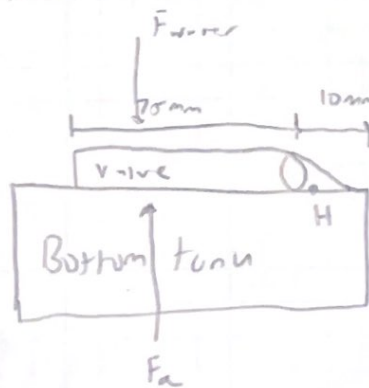
$$F_{Bolt} = P \times A$$

$$F_{Bolt} = \left(14.4 \frac{lb}{in^2} \right) \left(\frac{\pi (30'')^2}{4} \right) = 10,178 \text{ lb}$$

4.10
FBD



$$\frac{9.20 \text{ m}}{500 \text{ mm}} = 18.4$$



$$P_B = \left(9.81 \frac{\text{N}}{\text{m}^3} \right) (1.50 \text{ m}) = 17.658 \text{ N/m}^2$$

$$A_W = \frac{\pi (.075 \text{ m})^2}{4} = .00441788 \text{ m}^2$$

$$F_{\text{water}} = (A_W)(17.658 \text{ N/m}^2) = .0780 \text{ N}$$

$$\sum M_H = 0$$

$$\sum M_H = -F_A (.065 \text{ m}) + F_W (.085 \text{ m}) = 0$$

$$-F_A (.065) = -F_W (.085)$$

$$F_A = \frac{(F_{\text{water}})(.085 \text{ m})}{(.065 \text{ m})} = \underline{\underline{.102 \text{ N}}}$$

4.17 Using ex Problem 4.5 in book for reference

given:

$$S_{\text{oil}} = (.86) \left(9.81 \frac{\text{N}}{\text{m}^3} \right)$$

$$\gamma_{\text{oil}} = 8.4366$$

F.O.D



$$F_R = \gamma \left(\frac{h}{2} \right) (A)$$

$$= (8.1366) \left(\frac{1.4 \text{ m}}{2} \right) (1.979 \text{ m}) (1.4 \text{ m}) = \boxed{16.31 \text{ kN}}$$

$$L = \frac{h}{\sin \theta} = \frac{1.4 \text{ m}}{\sin(150^\circ)} = 1.479 \text{ m}$$

Center of Pressure

$$L - L_3$$

$$1.479 \text{ m} - \frac{1.479 \text{ m}}{3} = \boxed{1.32 \text{ m}}$$