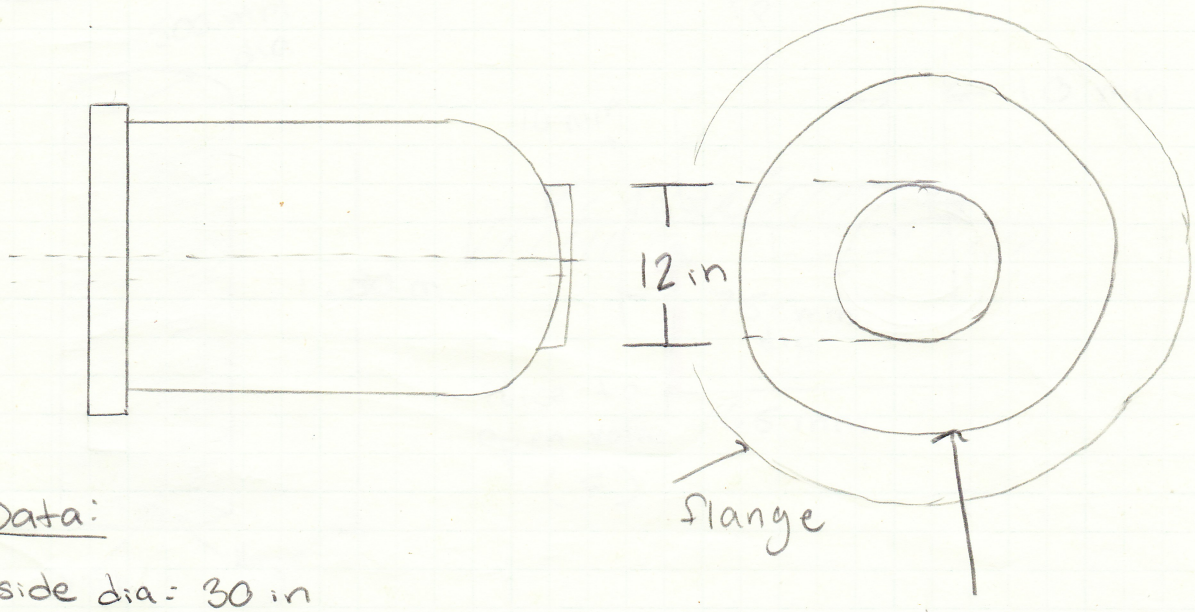
4.2



Data:

inside dia = 30 in

internal pressure = + 14.4 psig

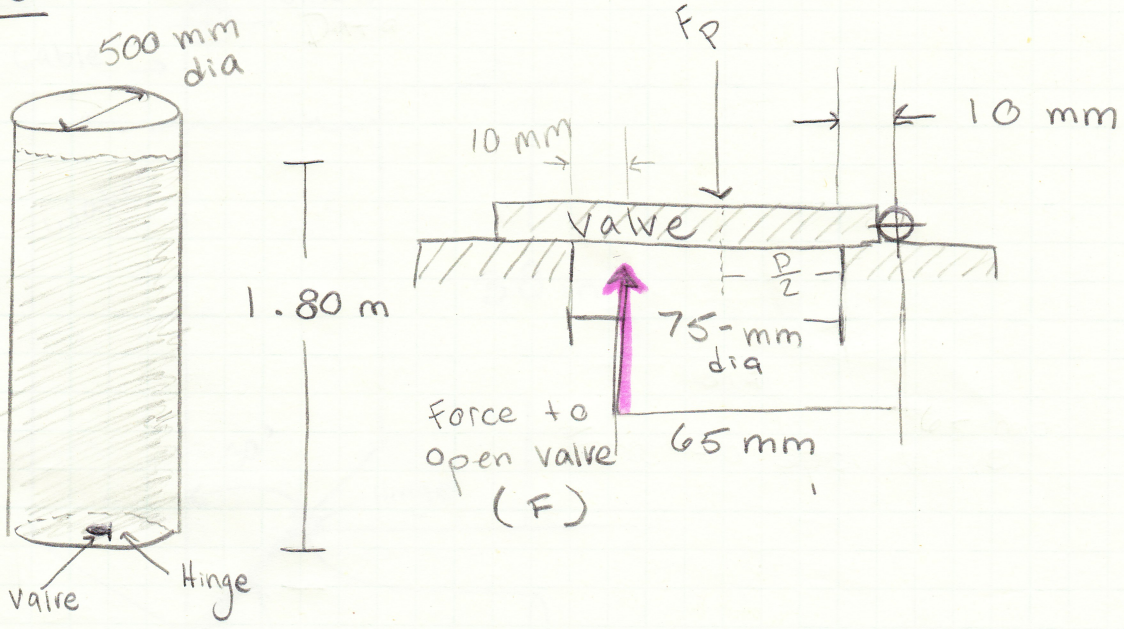
Calc. total force resisted by bolts in flange

$$P = \frac{F}{A} \rightarrow F = P \times A$$

$$(14.4 \text{ psig})\left(\frac{\pi 30^2}{4}\right)$$

$$= 10178.8 \text{ lbf}$$

4.10



Data

Tank dia = 500 mm = 0.5 m

Tank height = 1.8 m

Opening dia = 75 mm = 0.075 m

Calc force required to open valve:

$$F_P = \gamma_w \times h_c \times A$$

$$F_P = \left[(\gamma_w)(h)\right] \times \left[\frac{\pi (0.075)^2}{4}\right]$$

$$F_P = 9.81 \frac{kN}{m^3} \times 1.80\,m \times \frac{\pi (0.075^2\,m)}{4}$$

$$F_P = 0.078\ kN/m$$

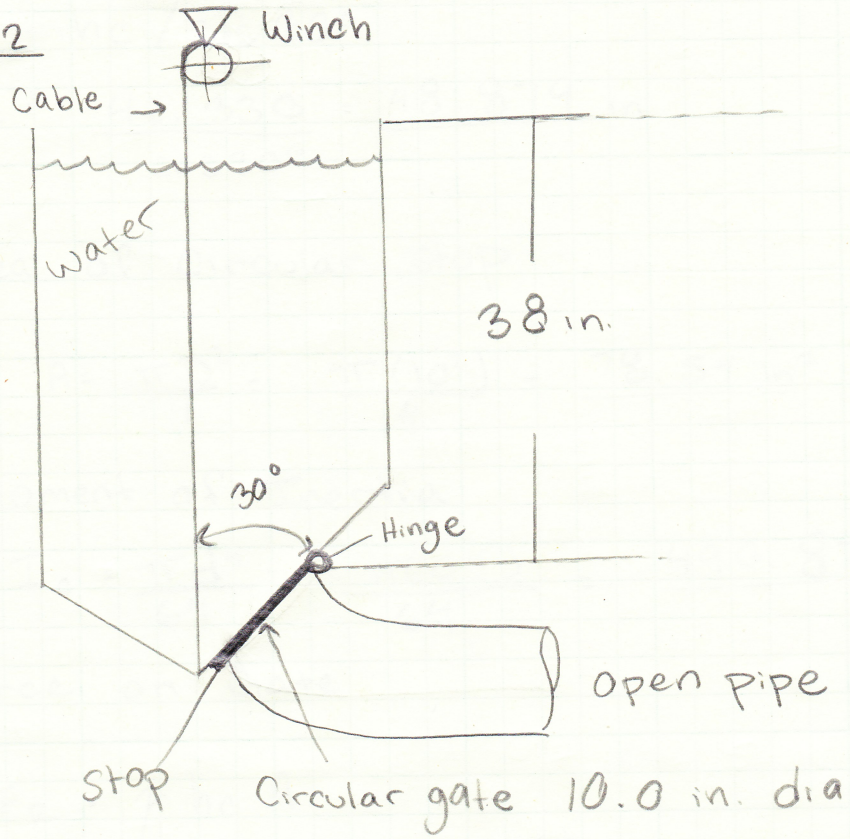
Moment about hinge

$$\Sigma M = (0.078)(0.0475) - F(0.065) = 0$$

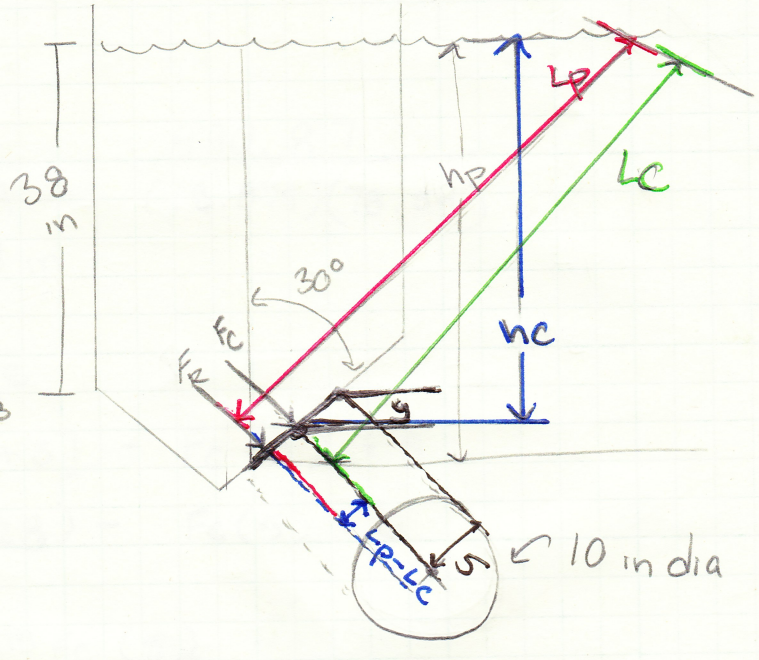
(F_P; $\frac{D}{2} + 10\,mm$)

$$F = 0.057\ kN$$

4.42



Compute force the winch + cable must exert to open the gate



Data

∢ cable = 30°

gate dia. = 10 in.

Water $\gamma = 62.4 \frac{lb}{ft^3}$

$h_c = 38\text{ in} + y$

$h_c = 38 + 5\cos 30°$

$= 42.3301$

$L_c = h_c / \cos 30°$

$L_c = \frac{42.330}{\cos 30°} = 48.879 \text{ in}$

Area of Circular stop

$A = \frac{\pi D^2}{4} = \frac{\pi (10^2)}{4} = 78.54 \text{ in}^2$

Moment of Inertia

$I_c = \frac{\pi d^4}{64} = \frac{\pi (10^4)}{64} = 490.87 \text{ in}^4$

Force on Gate

$F_R = \gamma h_c A$

$\left[62.4 \frac{\text{lb}}{\cancel{\text{ft}^3}} \times \frac{1 \cancel{\text{ft}^3}}{1728 \text{ in}}\right] \times 42.33 \times 78.54$

$F = 120.06 \text{ lb}$

$\rightarrow \quad L_p - L_c = \frac{I_c}{L_c A} = \frac{490.87}{(48.879)(78.54)}$

$L_p - L_c = 0.128 \text{ in}$

Moment about hinge

$\Sigma M: \quad F_R [(L_p - L_c) + 5] - F_c (5) = 0$

$= (120.06)(5.128) - F_c (5) = 0$

$\hookrightarrow \frac{615.668 \text{ lb.in}}{5 \text{ in}} \quad \frac{F_c (5)}{5 \text{ in}}$

Force Required (F_c) = **123.13 lb**