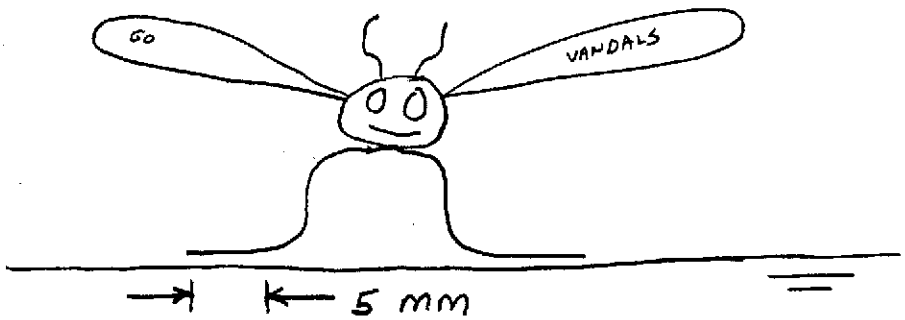
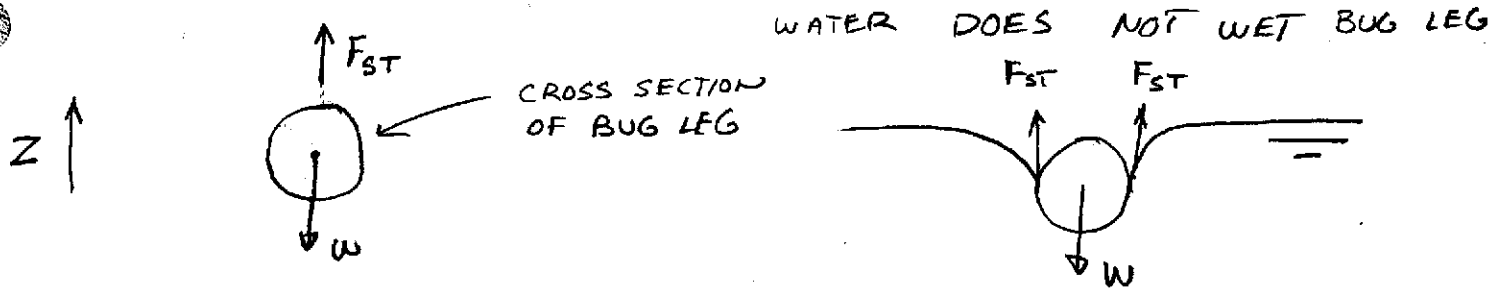
2.49 GIVEN: WATER BUG WITH SIX LEGS SUSPENDED ON SURFACE OF POND. WATER DOES NOT WET THE LEGS.



FIND: MAXIMUM BUG MASS THAT CAN BE SUSPENDED.

SOLUTION: DRAW FREE BODY DIAGRAM



FORCE EQUILLIBRIUM EQUATION FOR Z-DIRECTION:

$$\Sigma F_z = 0 \qquad F_{ST,z} - W = 0$$

DOES NOT WET CASE:

$$2(16)(.005\ m)\left(0.073\ \frac{N}{m}\right) - W = 0$$

2 ← 2 CONTACT LINES; 16 ← SIX LEGS; σ ← FOR CLEAN WATER

$W = 0.00438\ N \qquad m = W/g \qquad m = 0.000447\ kg$

$$\boxed{m = 0.45\ g}$$

2.58

GIVEN: WATER VAPOUR PRESSURE @ 100°C IS $p_v = 101\ kN/m^2$. V_ϕ DECREASES LINEARLY AT $\alpha = 3.1\ kN/m^2\text{-}°C$

FIND: BOILING TEMP. OF WATER @ $69\ kN/m^2$.

SOLUTION: $p_v = 69\ kN/m^2 \quad T = ?$

$$p_v = 101\ kN/m^2 - 3.1\ kN/m^2\text{-}°C\ (100°C - T)$$

INVERT EQN.

$$T = \frac{p_v - 101\ kN/m^2}{3.1\ kN/m^2\text{-}°C} + 100°C$$

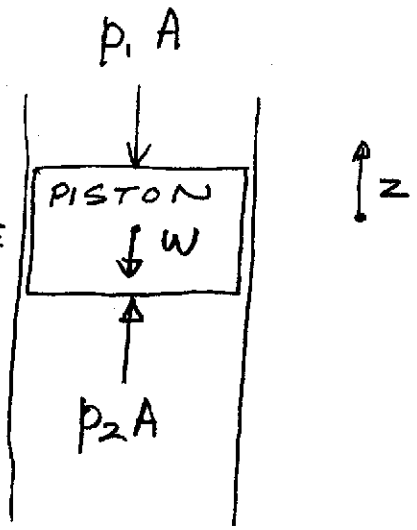
$$T = \frac{(69 - 101)\ kN/m^2}{3.1\ kN/m^2\text{-}°C} + 100°C$$

$$\boxed{T = 89.8°C}$$

3.1 GIVEN: DEAD WEIGHT TESTER WITH 30 mm DIAMETER PISTON. PISTON AND WEIGHTS ARE SET TO 140 N. GAGE BEING TESTED INDICATES 200 kPa.

FIND: % ERROR OF INDICATED PRESSURE

SOLUTION: DRAW FBD AND WRITE FORCE EQUATION.



$$\Sigma F_z = 0, \quad p_2 A - p_1 A - W = 0$$

WORK IN TERMS OF GAGE PRESSURE

$$p_1 = 0$$

$$p_2 A - W = 0$$

$$p_2 = \frac{W}{A} = \frac{140\ N}{\frac{\pi}{4}(.03\ m)^2}$$

$$p_2 = 198,100\ \frac{N}{m^2} \rightarrow \text{ACTUAL PRESSURE}$$

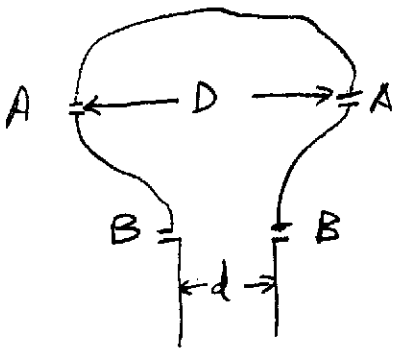
$$\%\ \text{ERROR} = \frac{\text{INDICATED} - \text{ACTUAL}}{\text{ACTUAL}} \times 100\%$$

$$= \frac{200,000 - 198,100}{198,100} \times 100\%$$

$$= 0.980\ \%$$

3.4

GIVEN:



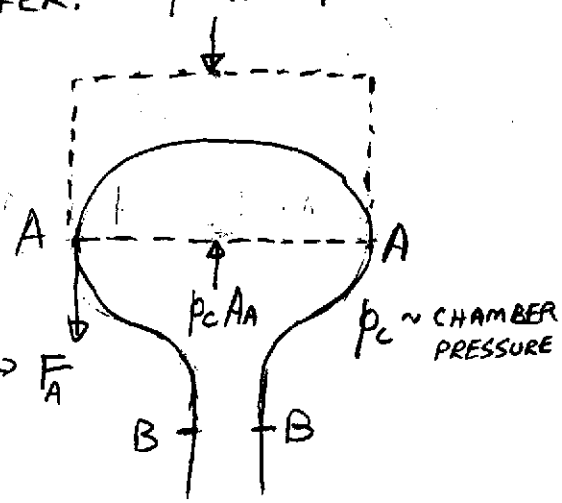
20 BOLTS TO HOLD CHAMBER TO GETHER AT FLANGE A-A.

$D = 50$ cm , $d = 25$ cm

FIND: NUMBER OF BOLT TO HOLD FLANGE B-B TOGETHER.

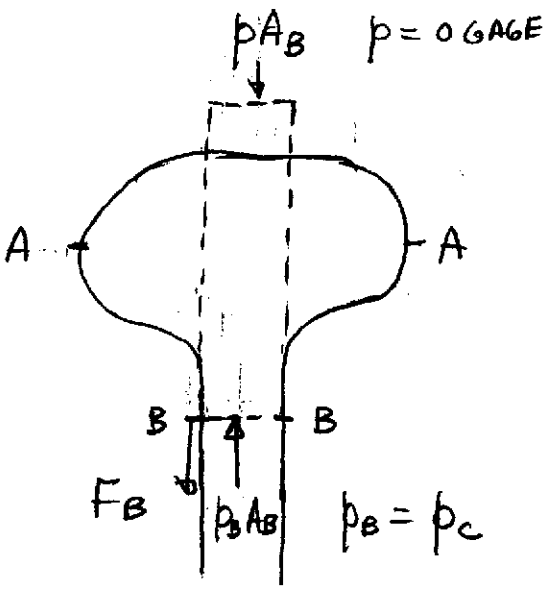
SOLUTION: FORCE HELD BY 20 BOLTS IS:

$$F_A = p_c A_A$$



FORCE HELD BY N BOLTS IS:

$$F_B = p_c A_B$$



$$\frac{F_B}{F_A} = \frac{A_B}{A_A} = \frac{d^2}{D^2} = \frac{1}{4}$$

$$F_B = \frac{1}{4} F_A$$

NEED 5 BOLTS AT FLANGE B-B.