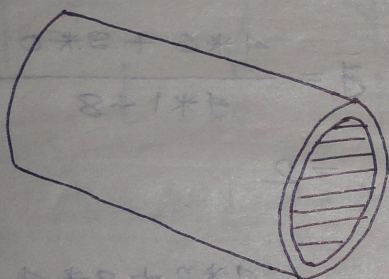
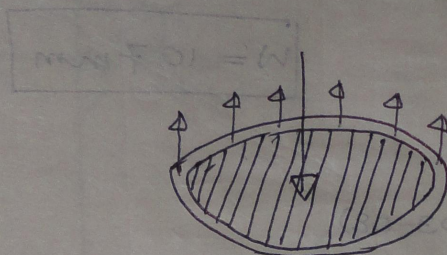
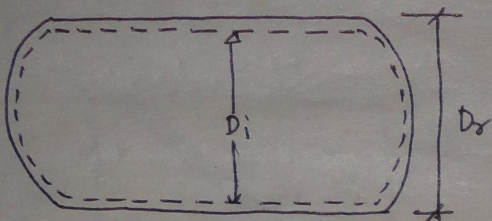


Pressure Vessel



$$F = PA$$

Here, Force on vessel of gas.

$$F = PA$$

$$= P * \frac{\pi}{4} D_i^2$$

Resisting Area, $\frac{\pi}{4} (D_o^2 - D_i^2)$

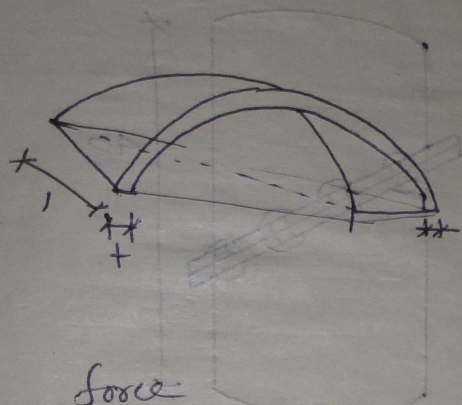
Resisting load, $\sigma_L * \frac{\pi}{4} (D_o^2 - D_i^2)$

$$\text{Now, } P * \frac{\pi}{4} D_i^2 = \sigma_L * \frac{\pi}{4} (D_o^2 - D_i^2)$$

$$\text{So, } P D_i^2 = \sigma_L (D_o - D_i) (D_o + D_i)$$

$$\text{Or, } \sigma_L = \frac{P D_i^2}{2 D_i * 2t}$$

$$\therefore \sigma_L = \frac{P D_i}{4t}$$



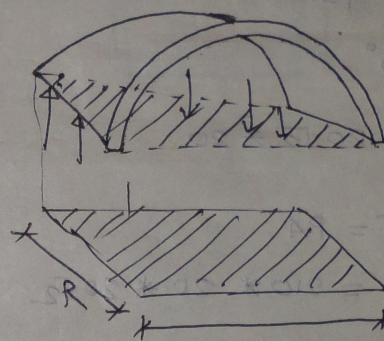
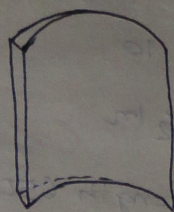
Force Loading Area = $P \cdot D_i \cdot R$

Resisting Area = $2 \cdot t \cdot R$

So, $P \cdot D_i \cdot R = \sigma_t \cdot 2 \cdot t \cdot R$

So, $\sigma_t = \frac{P \cdot D_i}{2t}$

So, $\sigma_t = \frac{P \cdot D_i}{2t}$



Projection area

4.5

No of bolt 10.

Diameter $1\frac{1}{2}$ in

Ultimate strength 65000 psi

Cross section 20×20 .

$$P = 210 \text{ psi}$$

$$\theta = 45^\circ$$

$$A = 20\sqrt{2} \times 20$$

$$\text{Now, } F = PA$$

$$= 210 \times 20 \times 20\sqrt{2}$$

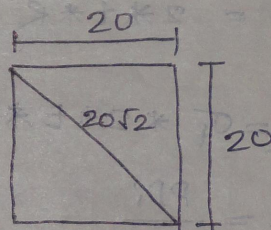
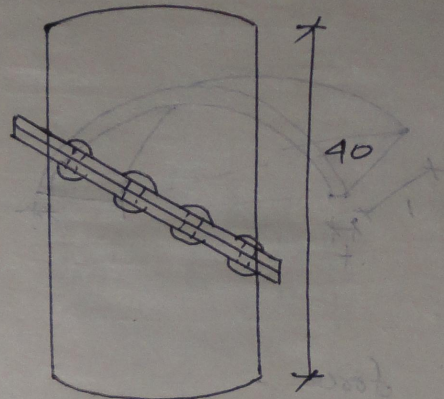
$$\text{Resisting area} = 10 \times \frac{\pi}{4} (1.5)^2$$

$$A_{\text{net}} = 10 \times \frac{\pi}{4} \times 0.7 (1.5)^2$$

$$\text{Force} = 10 \times \frac{\pi}{4} \times 0.7 (1.5)^2 \times 65000$$

$$\text{So, } F_s = \frac{10 \times \frac{\pi}{4} \times 0.7 (1.5)^2 \times 65000}{210 \times 20 \times 20\sqrt{2}}$$

$$F_s = 6.76$$



4.7

inside dia 2 in

drilled hole $\phi = 0.6$ in

$\sigma_{allow} = 1500$ psi

$t = 0.2$ in

Loading Area $\frac{\pi}{4} (2)^2$

Load, $P \times \frac{\pi}{4} (2)^2 = \pi P$.

Resisting area $\pi * 2 * 1.2$

Resisting load $2\pi * 1.2 * 1500$.

So, $p = 2 * 1.2 * 1500$

$$p = 3600 \text{ psi}$$

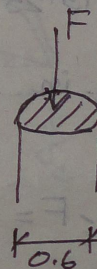
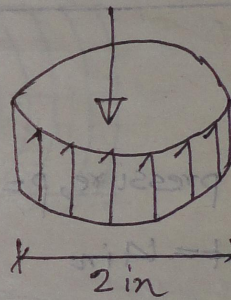
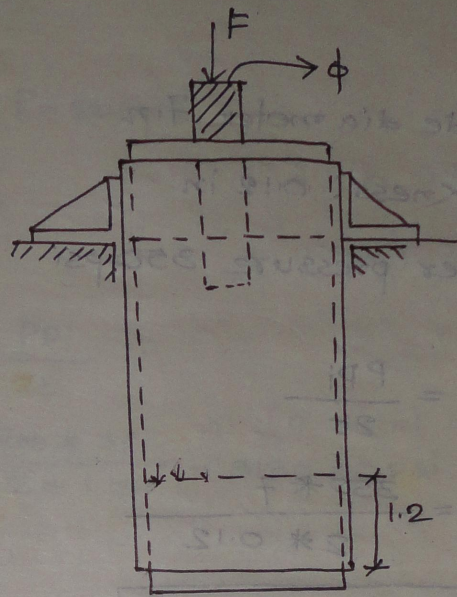
$$F = pA$$

$$= 3600 * \frac{\pi}{4} (0.6)^2$$

$$F = 1017.88$$

$$\text{Now, } \sigma_t = \frac{pD_i}{2t} = \frac{3600 * 2}{2 * 0.2} = 18000 \text{ psi}$$

$$\sigma_L = \frac{pD_i}{4t} = 9000 \text{ psi}$$



4.1

Inside diameter 7 in

Thickness 0.12 in

Water pressure 350 psi

$$\sigma_t = \frac{P D_i}{2t}$$

$$= \frac{350 * 7}{2 * 0.12}$$

$$\sigma_t = 10208.33 \text{ psi}$$

4.2

Hydraulic pressure, $p = 600 \text{ psi}$

$D_{out} = 14 \text{ in}$

$D_{in} = 13.25 \text{ in}$

$\phi = 1 \frac{3}{8} \text{ in} = \frac{11}{8} \text{ in}$

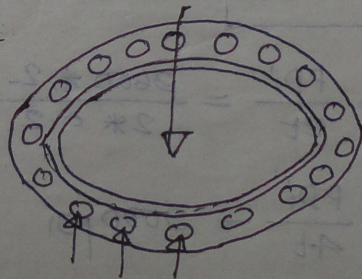
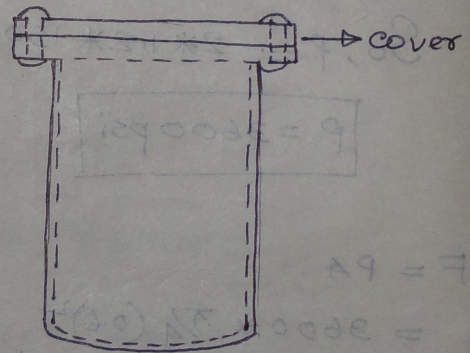
Brusting furnace, $F = PA$

$$= 600 * \pi/4 (13.25)^2$$

$$\text{Resisting force} = 0.7 * 20 * \pi/4 \left(\frac{11}{8}\right)^2 * \sigma$$

$$\text{So, } \sigma = \frac{600 * (13.25)^2}{0.7 * 20 * \pi/4 \left(\frac{11}{8}\right)^2}$$

$$= 3979.69 \text{ psi}$$



4.3

Hydrostatic pressure, $P = 200 \text{ psi}$

$$t = 1.15 \text{ in}$$

$$D_i = 36 \text{ in}$$

$$\begin{aligned} \text{Circumferential stress} &= \frac{PD_i}{2t} \\ &= \frac{200 * 36}{2 * 1.15} = 3130.43 \text{ psi} \end{aligned}$$

4.4

Water pressure 50 psi

Brusting force

$$= 66 * 6 * 50$$

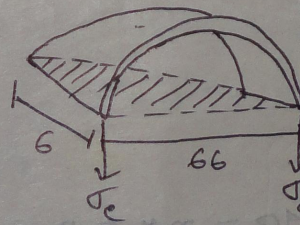
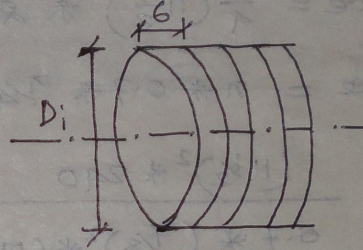
Resisting Force

$$= 2 * \sigma_c * 0.7 A.$$

$$= 2 * \sigma_c * 0.7 * \pi A (1)^2$$

$$\text{So, } \sigma_c = \frac{66 * 6 * 50}{2 * 0.7 * \pi A}$$

$$= 18007.24 \text{ psi}$$



4.6

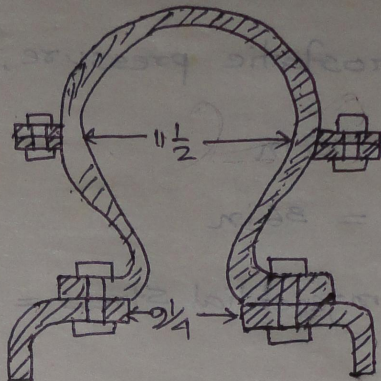
Pressure, $p = 240 \text{ psi}$

$\sigma_c = 6000 \text{ psi}$

$\phi = 7/8 \text{ in}$

at A Dia = $11\frac{1}{2} \text{ in}$

at B " = $9\frac{1}{4} \text{ in}$



$$\text{Bursting force} = \frac{\pi}{4} (11\frac{1}{2})^2 * 240$$

$$\text{Resisting force} = n * 0.7 * \frac{\pi}{4} * (\frac{7}{8})^2 * 6000$$

$$\text{So, } n = \frac{(11\frac{1}{2})^2 * 240}{0.7 * (\frac{7}{8})^2 * 6000} = 9.87$$

$$n \approx 10$$

At B-B

$$\frac{\pi}{4} (9\frac{1}{4})^2 * 240 = n * 0.7 * \frac{\pi}{4} * (\frac{7}{8})^2 * 6000$$

$$\therefore n = 6.39 \approx 7$$

Ans.

4.8

$$D_i = 11 \text{ in}$$

$$P = 450 \text{ psi}$$

$$\sigma = 5000 \text{ psi}$$

$$\phi = 1\frac{1}{4} \text{ in} = \frac{5}{4} \text{ in}$$

$$\text{Bursting Force} = P * \pi/4 (11)^2$$

$$\text{Resisting " } = 5000 * n * 0.7 * \pi/4 (\frac{5}{4})^2$$

$$\text{So, } n = \frac{450 * \pi/4 (11)^2}{5000 * 0.7 * \pi/4 (\frac{5}{4})^2}$$

$$= 9.95$$

$$\boxed{n \approx 10}$$

Ans

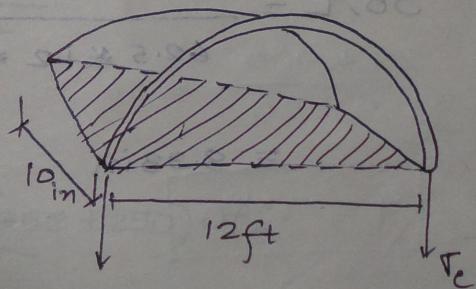
4.9

$$\text{Diameter of tank} = 12 \text{ ft}$$

$$\text{height} = 18 \text{ ft}$$

$$\text{Hoops } 2 * \frac{3}{8}$$

$$h = 18 - \frac{10}{12}$$



$$\text{Bursting force} = \text{water pressure} * \text{Area}$$

$$= 62.5 (18 - \frac{10}{12}) * 12 * \frac{10}{12}$$

$$= 10729.167$$

$$\text{Resisting force} = 2 * \sigma_c * \frac{2}{12} * \frac{3}{8 * 12}$$

$$= \frac{1}{2} \sigma_c \frac{3}{2}$$

$$\text{So, } \frac{1}{8} \sigma_c = 10729.167$$

$$\therefore \sigma_c = 85833.336$$

$$\text{So, } \sigma_c = \frac{10729 * 2}{3}$$

$$\sigma_c = 7152.78 \text{ psi}$$

Ans.

b) for brine

$$\text{Brusting force} = 62.5 * 1.2 * 17 \frac{1}{6} * 12 * L$$

$$\text{Resisting load} = 2 * \sigma_c * 2 * \frac{3}{8}$$

$$\text{So, } L = \frac{2 * 7152.78 * 2 * \frac{3}{8}}{62.5 * 1.2 * 17 \frac{1}{6} * 12}$$

$$= 8.33 \text{ in}$$

