Assigment - 2

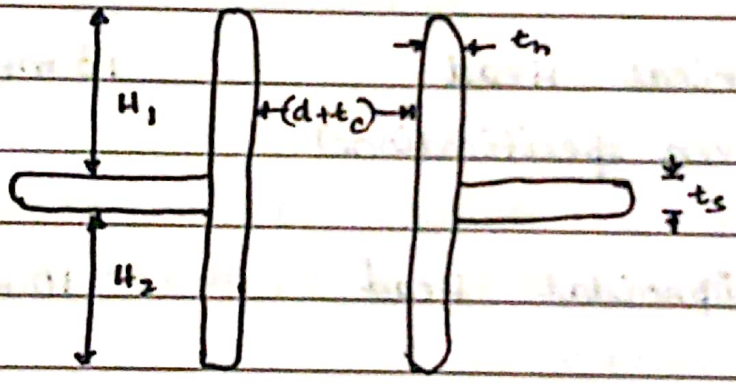
Q) For the vessel in assignment - 1, Find out the ring pad dimensions (I.D / O.D and thickness)

Nozzle O.D = 0.25m

Inside protrusion of nozzle : Not Desired

Length of nozzle above surface : 0.12 m

A)



O.D of vessel = 1.5 m

Max. working pressure = 800 kPa

f = 120 MPa

J = 0.85

d_o = Nozzle O.D = 0.25

H_1 = 0.12m

t_c = 2mm t_c = 1mm

Design Pressure = P = 840 kPa

Inside protrution isn't there, so no compensation from H_2

Vessel Thickness

$$t_r = \frac{PD_o}{2fJ + P_w} = \frac{840 \times 10^3 \times 1.5}{(2 \times 120 \times 0.85 \times 10^6) + 840 \times 10^3}$$

$$= 6.151 \times 10^{-3} \text{ m}$$

$$= 6.151 \text{ mm}$$

$$t = t_r + t_c = (6.151 + 2) \text{ mm}$$

$$= 8.151 \text{ mm}$$

$\therefore t_s = 9 \text{ mm}$

↳ Standard Thickness aviable (near nighest)

Nozzle Thickness

$d_o = 0.25$

$$t_r' = \frac{840 \times 10^3 \times 0.25}{2 \times 120 \times 10^6 \times 0.85 + 840 \times 10^3}$$

$$= 1.0252 \times 10^{-3} \text{ m}$$

$$= 1.0252 \text{ mm}$$

$$t = t_r' + c = 1.025 + 2$$

$$= 3.025 \text{ mm}$$

Standard thickness near highest available = 5mm

$t_n = 5mm$

$d = d_o - 2t_n$

$d = (0.25 - 2 \times 0.005)$

$= 0.25 - 0.01$

$\therefore d = 0.24m$

$A = (d + 2t_c)\, t_r$

$= (0.24 + 2 \times 0.002)\ (0.006152)$

$= 1.5011 \times 10^{-3}\ m^2$

Area available from shell for reinforcement

$A_s = (d + 2c)\ (t_s - t_r - c)$

$= (0.244)(0.009 - 0.006152 - 0.002)$

$= 2.06912 \times 10^{-4}\ m^2$

Area available from nozzle for reinforcement

A_n = A_o (no inside protrusion)

$= 2H_1 (t_n - t_r' - c)$

$H_1 = \sqrt{(d + 2c)(t_n - t_c)}$

$= \sqrt{(0.24 + 2 \times 0.002)(0.005 - 0.002)}$

$= 0.027\ m$

H_1 > actual length of nozzle above surface

$\therefore A_n = 2 \times 0.027 (0.005 - 0.001025 - 0.002)$

$= 1.0665 \times 10^{-4}\ m^2$

$A_s + A_n = (2.06912 + 1.0665) \times 10^{-4}$

$= 3.136 \times 10^{-4} m^2$

$= 0.3136 \times 10^{-3}\ m^2$

Area left to be compensated

$$A - (A_s + A_n) = (1.5011 - 0.3136) \times 10^{-3}\ m^2$$
$$= 1.1875 \times 10^{-3}\ m^2$$

$$A_r \geq A - (A_s + A_n)$$

$$\therefore A_r \geq 1.1875 \times 10^{-3}\ m^2$$

$$A_r = \{2(d + 2 \cdot \epsilon) - (d + 2 \cdot \epsilon + 2t_r')\} t_p$$
$$= \{2(0.244) - (0.24 + 0.004 + 0.00205)\} t_p$$
$$= 0.24195\, t_p$$

$$(0.24195)\, t_p \geq 1.1875 \times 10^{-3}$$

$$\therefore t_p \geq \frac{1.1875 \times 10^{-3}}{0.24195}$$

$$t_p \geq 4.908\ mm$$

$$t_p + t_c = 4.908 + .1$$
$$= 5.908\ mm$$

t_c ↑ Corrosion Allowance

Standard Thickness (near highest) available is 6mm

Thickness = 6mm

∴ Ringpad Dimensions

Inner diameter = d_o = 0.25 m

Outer diameter = 2 (d + 2tc)

= 2 (0.24 + 0.004)

= 0.488 m ≈ 0.500m

Thickness = 6 mm

Ring Pad Dimensions

Area left to be compensated = 1.1875×10^{-3} m^2

Inner diameter = 0.25 m

Outer diameter = 0.500 m

Thickness = 6 mm

→ Outer diameter is taken as 0.5 m, as we can't get an accuracy of 0.488 m.