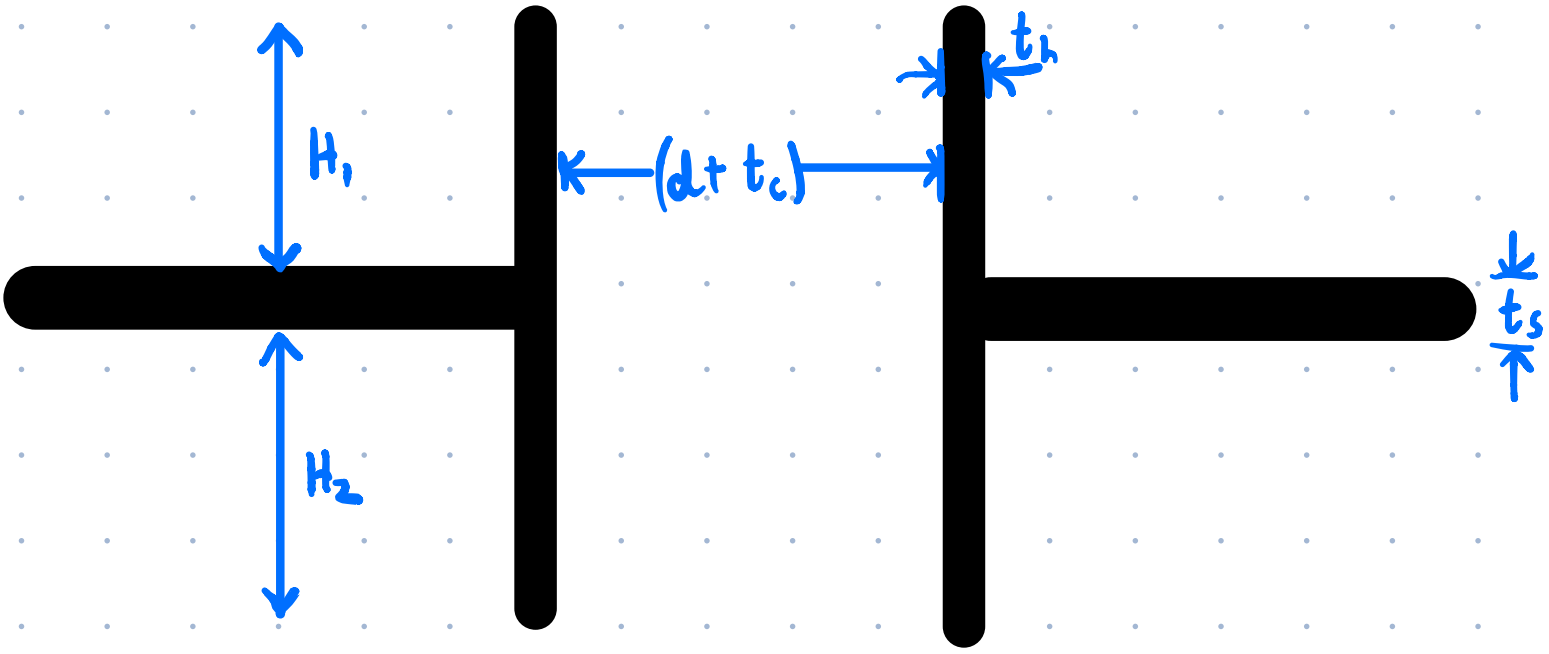

Given:

O.D. of vessel = 1.2 m = D_o

Max working Press. = 1000 kPa

f = 120 MPa

J = 0.85

d_i = Nozzle O.D. = 0.25

H_1 = 0.1 m

t_c = 2 mm

design Press. = $P = 1.05 \times 10^6$ Pa

Vessel Thickness

$$t_r = \frac{P D_o}{2fJ + P} = \frac{1.05 \times 10^6 \times 1.2}{2 \times 120 \times 10^6 \times .85 + 10^6}$$

$$= \frac{1.2}{(2 \times 120 \times .85) + 1} \approx \underline{6.14 \text{ mm} = t_r}$$

$\therefore t = t_r + t_c = 8.146 \text{ mm}$

$t_s = 9 \text{ mm}$

Nozzle Thickness

$d_o = 0.25$

$\therefore t_r' = \dfrac{1.05 \times 10^6 \times 0.25}{2 \times 120 \times 10^6 \times .85 + 10^6}$

$= \dfrac{0.25 \times 1.05}{240 \times .85 + 1} \approx 1.28 \text{ mm} = t_r'$

$t = t_r' + t_c$

$= 3.28 \text{ mm}$

$\therefore t_n = 5 \text{ mm}$

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

$= (0.25 - 0.01) = 0.24 \text{ m} = d$

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

$$= (0.24 + 2 \times 0.002)(0.006146)$$

$$= 1.4996 \times 10^{-3}\ m^2$$

Area available from shell for reinforcement

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

$$= (0.24 + 2 \times 0.002)(0.009 - 0.006146 - 0.002)$$

$$= 2.084 \times 10^{-4}\ m^2$$

Area available from nozzle for reinforcement

$$A_n = A_0 \text{ (no inside protrusion)}$$

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

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

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

$= 0.027\ m$

which is > actual length of nozzle above surface

$\therefore A_n = 2 \times 0.027 (0.005 - 0.00128 - 0.002)$

$= 9.288 \times 10^{-5}\ m^2$

$A_s + A_n = 0.3013 \times 10^{-3}\ m^2$

Area left to be compensented

$A - (A_s + A_n) = 1.2967 \times 10^{-3}\ m^2$

$\therefore$ $\boxed{A_r \geq 1.1983 \times 10^{-3}\ m^2}$

$= \{2(d + 2t_c) - (d + 2t_c + 2t_r')\}\ t_p$

$= \{2(0.24 + 0.004) - (0.24 + 0.004 + 0.00256)\}\ t_p$

$\Rightarrow 0.2414\ t_p \geq 1.1983 \times 10^{-3}\ m^2$

$\Rightarrow \quad t_p \geq 4.964 \text{ mm}$

$\Rightarrow t_p = 4.964 \text{ mm}$

$t_p + t_c = 6.964 \text{ mm}$

$\therefore$ Thickness (Standard) = 7 mm

$\therefore$ **Ring Pad Dimensions**

Inner Diameter = d_o = 0.25 m
Outer Diameter = $2(d + 2t_c)$ = 0.484 m
Thickness = 7 mm