



المرحلة: الثانية
 السنة الدراسية: 2017-2018
 اسم التدريسي: أ.م.د علي العذاري

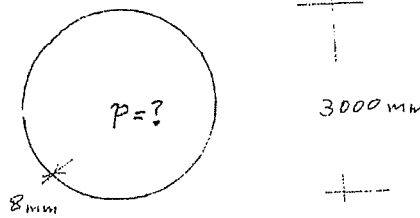
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 > حل المسألة

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 Mechanics of Material
 Pressure Vessel
 خزانات الضغط

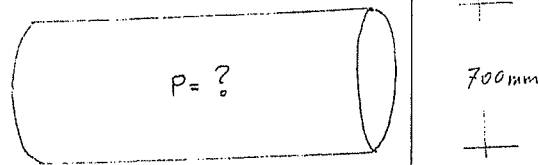
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 مس. ومحلل المواد
 المصنوع الثاني

Q1 - Calculate the safe Gas pressure for the spherical Tank using

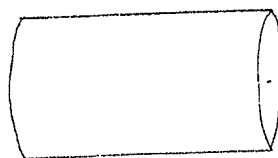
$\sigma_t = 155 \text{ MPa} [\frac{N}{\text{mm}^2}]$, $t = 8 \text{ mm}$, $D = 3000 \text{ mm}$:



Q2 - Calculate the safe pressure for the Cylindrical pressure Vessel using
 $t = 20 \text{ mm}$, $\sigma_{tension} = 200 \frac{N}{\text{mm}^2}$



Q3 for the pressure vessel (cylinder) prove the the stress in a direction is 2x stress in other direction



بين ان الإجهاد في اتجاه هو ضعف الإجهاد في الاتجاه الآخر

$$\frac{\sigma_1}{r_1} + \frac{\sigma_2}{r_2} = \frac{P}{t}$$



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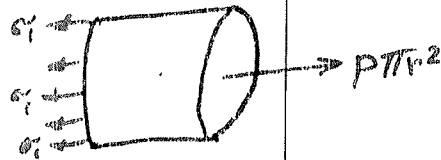
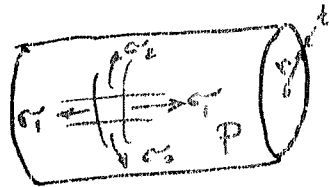
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(5)

Example (2) Calculate the membrane stresses σ_1 and σ_2 for the cylinder with radius r and wall thickness t carries an internal pressure P



Solution: $r_1 = \infty$, $r_2 = r$

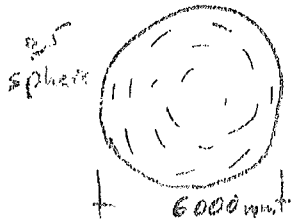
$$\frac{\sigma_1}{r_1} + \frac{\sigma_2}{r_2} = \frac{P}{t}$$

$$\frac{\sigma_1}{\infty} + \frac{\sigma_2}{r} = \frac{P}{t} \implies \sigma_2 = \frac{Pr}{t}$$

$$\sum F_x = 0 \quad \sigma_1 \cdot \pi(2r) \cdot t = P \pi r^2 \quad \sigma_1 = \frac{Pr}{2t}$$

$$\therefore \sigma_2 = 2\sigma_1$$

Example (3): Calculate the safe internal gas pressure P for a spherical pressure vessel made of thin magnesium plate 2.5 mm thick if $D = 6000$ mm and the allowable stress in tension $90 \frac{N}{mm^2}$.



$$\frac{\sigma_1}{r_1} + \frac{\sigma_2}{r_2} = \frac{P}{t}$$

$$\sigma_1 = \sigma_2 = \sigma$$

$$r_1 = r_2 = r$$

$$\frac{2\sigma}{r} = \frac{P}{t}$$

$$\sigma = \frac{Pr}{2t}$$

$$90 = \frac{P \cdot \frac{6000}{2}}{2 \times 2.5}$$

$$P = \frac{90 \times 2 \times 2.5}{3000} = 0.15 \frac{N}{mm^2}$$

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