

BASINLI TÜPEK (İNCE CİDALLI)

SİLİNDİRELER İÇİN

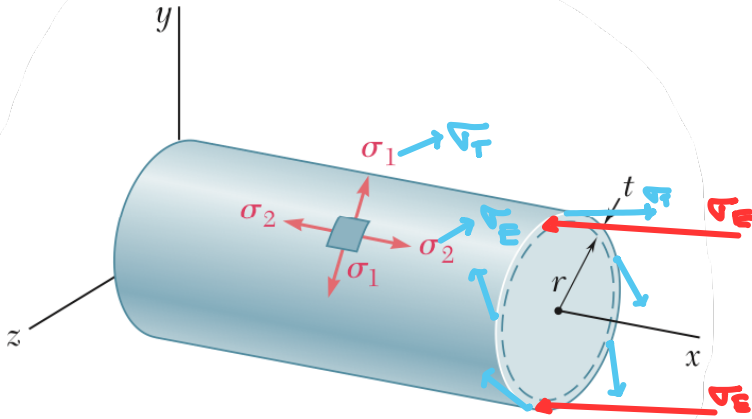


Fig. 7.47 Pressurized cylindrical vessel.

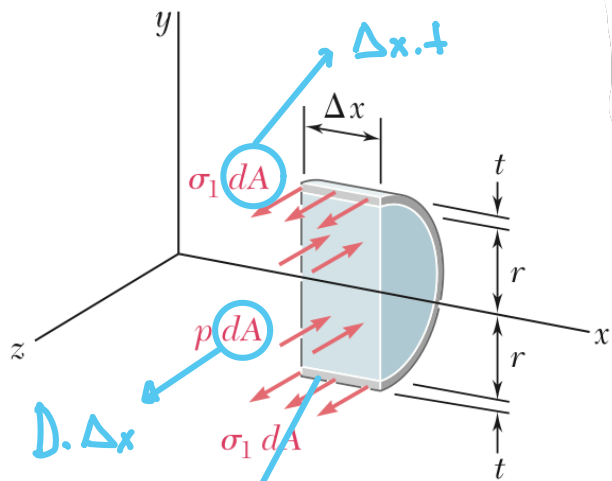


Fig. 7.48 Free body to determine hoop stress.

$$\sum F_x = 0$$

$$\Rightarrow + \sigma_1 \cdot dA - p \cdot dA = 0$$

$$\Rightarrow 2 \cdot \sigma_1 \cdot dA = p \cdot dA$$

$$\Rightarrow 2 \cdot \sigma_1 \cdot \Delta x \cdot t = p \cdot D \cdot \Delta x$$

$$\Rightarrow \sigma_1 = \frac{p \cdot D_0}{2 \cdot t}, \quad D_0 = \frac{D + d}{2}$$

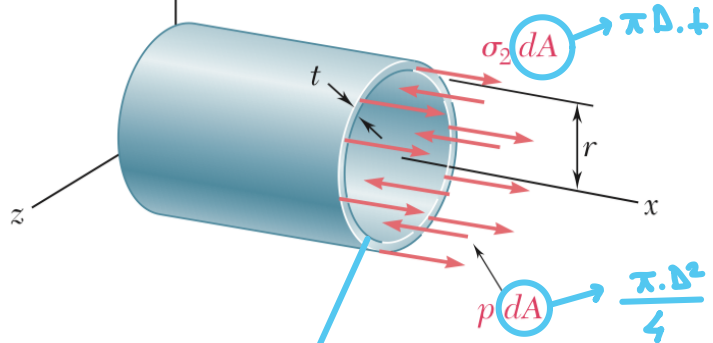


Fig. 7.49 Free body to determine longitudinal stress.



$$\sum F_x = 0$$

$$\Rightarrow + \sigma_2 \cdot dA - P \cdot dA = 0$$

$$\Rightarrow \sigma_E \cdot \pi \cdot D \cdot t = P \cdot \frac{\pi \cdot D^2}{4}$$

$$\Rightarrow \sigma_E = \frac{P \cdot D_0}{4t}$$

$$\sigma_T = 2 \times \sigma_E$$

KÜRZE i4iN

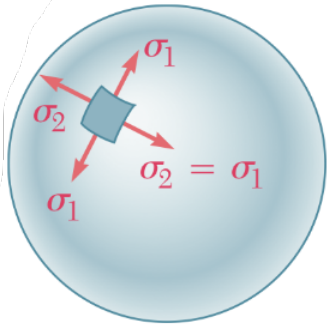


Fig. 7.51 Pressurized spherical vessel.

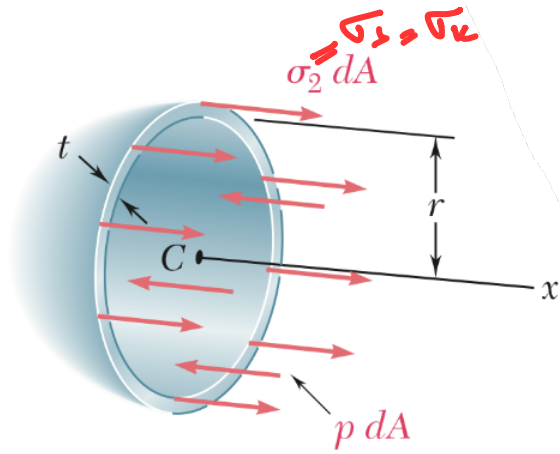


Fig. 7.52 Free body to determine wall stress.

$$\sum F_x = 0$$

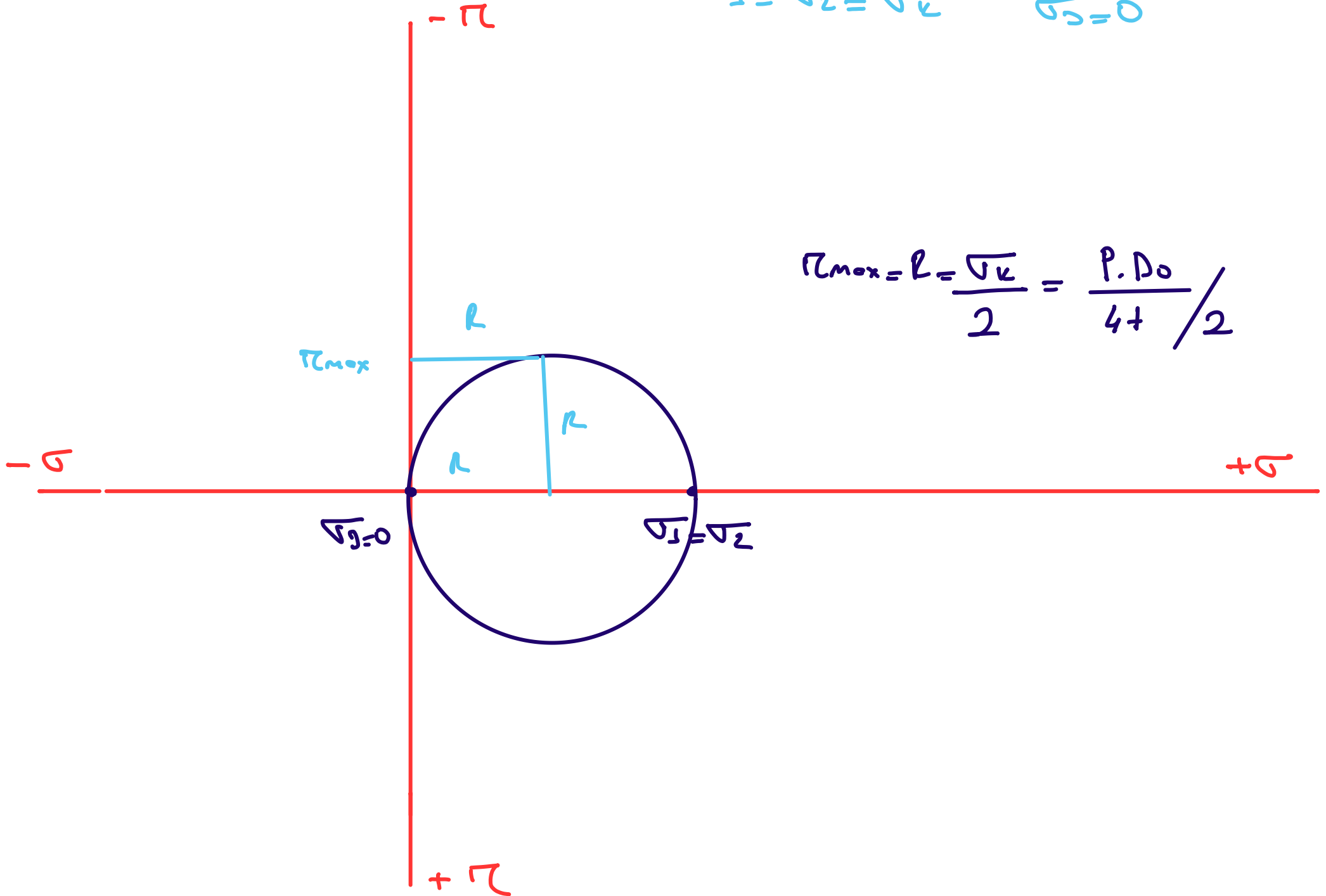
$$\Rightarrow \sigma_1 = \sigma_2 = \sigma_3 = \sigma_E = \frac{p \cdot D_o}{4t}$$

LIKE IGIN MOHR GEMERK!

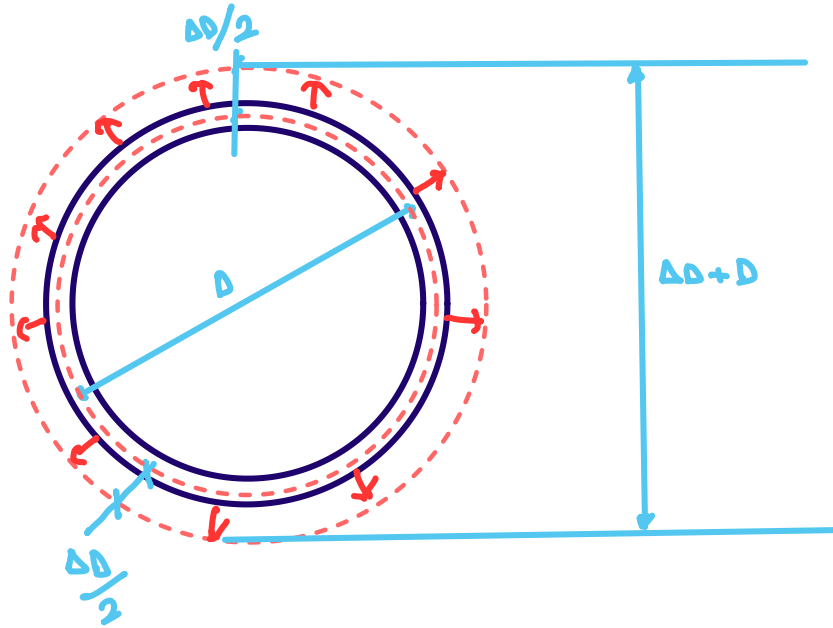
$$\sigma_1 \quad \sigma_2 \quad \sigma_3$$

$$\sigma_1 = \sigma_2 = \sigma_3$$

$$\sigma_3 = 0$$



CİRALDAKİ DEĞİŞİM (SİLİNDİK)



$\pi \cdot (\Delta D + D)$ GENİŞLEMİ



$\pi \cdot D$ DEFAULT



$$\epsilon = \frac{L_{\text{son}} - L_{\text{ilk}}}{L_{\text{ilk}}} = \frac{\Delta \text{GENİLE}}{\text{GENİLE}}$$

$$\epsilon = \frac{[\pi \cdot (\Delta D + D)] - \pi D}{\pi D} = \frac{\Delta D}{D_0}$$

$$\epsilon = \frac{P}{E}$$

$$\Rightarrow \frac{\Delta D}{D_0} = \frac{P \cdot D_0}{2 \cdot E}$$

$$\Rightarrow \Delta D = \frac{P \cdot D_0^2}{2 \cdot E}$$

TERMAL ETİKİ

- Isıtma ve basınç duruşu;

$$\Delta D = \underset{\downarrow}{+} \alpha \Delta T D \underset{\downarrow}{+} \frac{PD^2}{2Et}$$

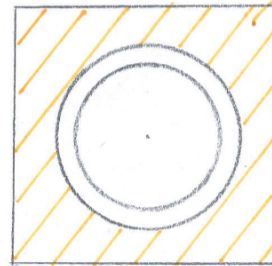
(+) Isıtma

(+) iç basınç

(-) Soğutma

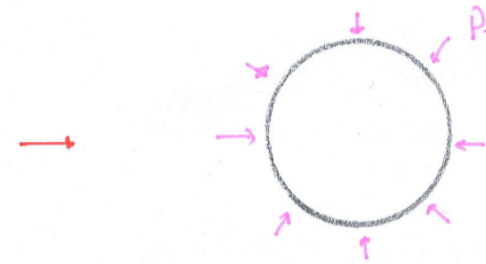
(-) Dış basınç

EĞER;



Tüp ısıtılır

Rijit Engel



$P_T \rightarrow P_T$ dış basıncı oluşturur

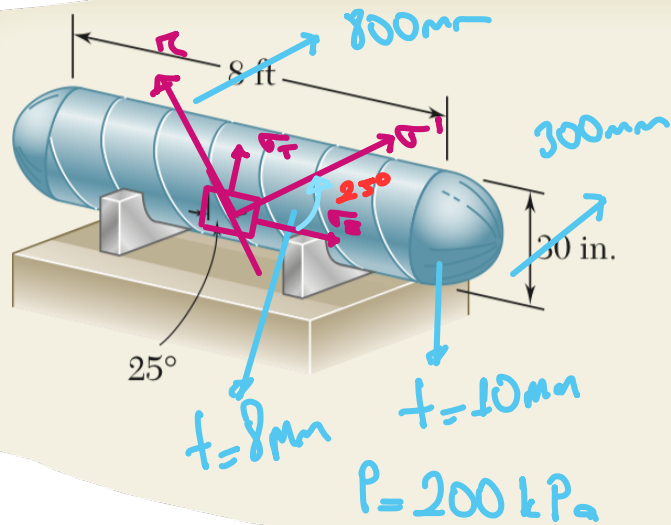
$$\Rightarrow \Delta D = \alpha \Delta T D - \frac{P_T \cdot D^2}{2Et} = 0$$

$$\Rightarrow - P_T = \frac{2E\alpha + D}{D} \Delta T$$

$\Delta D = 0$

$$\cdot \sigma_{T+} = \frac{PD}{2t} = \frac{2E\alpha + D}{D2t} \cdot \Delta T = \alpha \Delta T E$$

SAMPLE PROBLEM 7.5

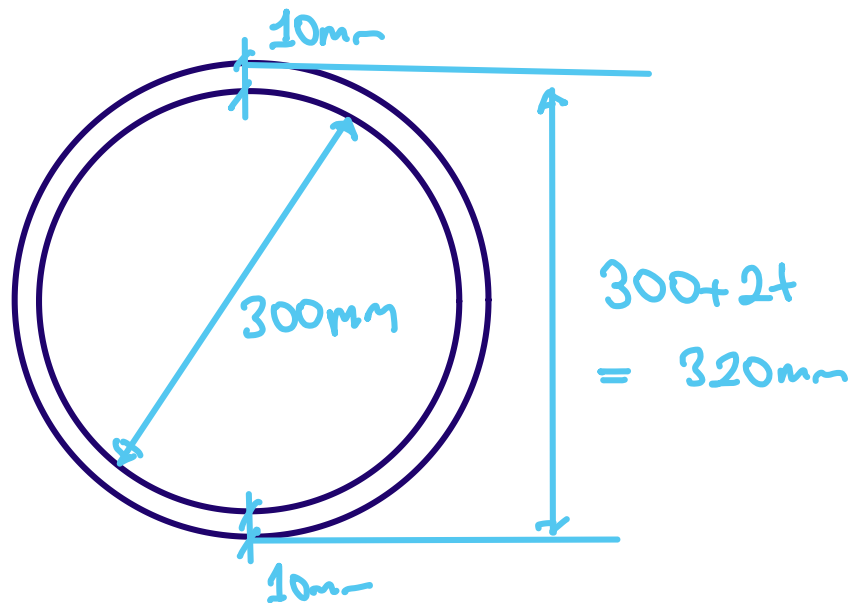


A compressed-air tank is supported by two cradles as shown; one of the cradles is designed so that it does not exert any longitudinal force on the tank. The cylindrical body of the tank has a 30-in. outer diameter and is fabricated from a $\frac{3}{8}$ -in. steel plate by butt welding along a helix that forms an angle of 25° with a transverse plane. The end caps are spherical and have a uniform wall thickness of $\frac{5}{16}$ in. For an internal gage pressure of 180 psi, determine

- the normal stress and the maximum shearing stress in the spherical caps.
- the stresses in directions perpendicular and parallel to the helical weld.

$$a.) \quad \sigma_k = \frac{P \cdot D_o}{4t}$$

$$D_o = \frac{D + d}{2} = \frac{320 + 300}{2} = 310 \text{ mm}$$



$$\sigma_k = \frac{0.2 \cdot 310}{4 \cdot 10} = 1.55 \text{ MPa}$$

$$\tau_{\max} = \frac{\sigma_k}{2} = 0.775 \text{ MPa}$$

b.)

$$\sigma_T = 2 \times \sigma_E$$

$$\sigma_E = \frac{P \cdot D_o}{4t}$$

$$D_o = \frac{(300 + 8 + 8) + 300}{2}$$
$$= 308 \text{ mm}$$

$$\sigma_E = \frac{0.2 \cdot 308}{4 \cdot 8} = 1.925 \text{ MPa}$$

$$\sigma_T = 2 \times \sigma_E = 3.85 \text{ MPa}$$

