Atlas Copco

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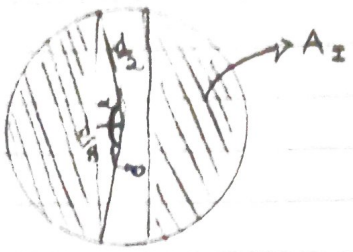
1)



$$\theta = 2\alpha = 2 \cdot \arccos\left(\frac{d/8}{d/2}\right) = 2 \cdot \arccos\left(\frac{1}{4}\right) \cong 151°$$

$$A = 2A_I = 2 \cdot (A_{\text{setor circular}} - A_{\text{triangulo}}) = 2 \cdot \left(\frac{\theta}{360} \cdot \pi \left(\frac{d}{2}\right)^2 - \frac{\left(\frac{d}{2}\right)^2 \cdot \operatorname{sen}\theta}{2}\right)$$

$$= 2 \cdot (527 - 97) = 860\ mm^2$$

$$P = \sigma \cdot A = 7 \cdot 860 = 6020\ Kgf$$

2) $F_c = \frac{F}{S} \Rightarrow F = F_c \cdot S = 1{,}8 \cdot 125 = 225\ tf$

$$\varepsilon = R_{Ext} - R_{Int} \Rightarrow \frac{d}{8} = \frac{d}{2} - R_{Int} \Rightarrow R_{Int} = \frac{3d}{8}$$

$$\sigma = \frac{F}{A} \Rightarrow A = \frac{F}{\sigma} \Rightarrow \pi\left(R_{Ext}^2 - R_{Int}^2\right) = \frac{225 \cdot 10^3}{28}$$

$$\pi\left(\frac{d^2}{4} - \frac{9d^2}{64}\right) = \frac{225 \cdot 10^3}{28}$$

$$\pi \frac{7d^2}{64} = \frac{225 \cdot 10^3}{28}$$

$$d^2 = \frac{15^2 \cdot 4^2}{7^2} \cdot \frac{10^3}{\pi} \Rightarrow d = \frac{15 \cdot 4}{7}\sqrt{\frac{1000}{\pi}} \cong 153\ mm$$

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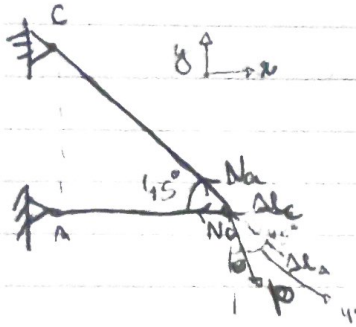
3) $\varepsilon_{transversal} = -\nu \cdot \varepsilon_{Normal}$ $\quad \varepsilon = \frac{\sigma}{E} = \frac{F}{AE}$

$\varepsilon = \frac{\Delta l}{l_0}$

$\frac{\Delta l}{l_0} = -\nu \cdot \varepsilon_{normal}$

$\frac{-2.10^{-3}}{10^2} = -0,3 \cdot \frac{F_c}{A.E} \Rightarrow F_c = \frac{2.10^{-5}}{0,3} \cdot 1400.21000 = 1960 Kgf$

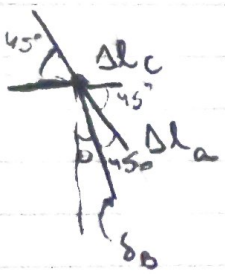
4)



ΣF_x $\quad x: P\sin\theta - N_C - N_A\frac{\sqrt{2}}{2} = 0$ $\quad -①$

$y: P\cos\theta - N_A\frac{\sqrt{2}}{2} = 0$ $\quad -②$

$① / ② \Rightarrow tg\theta = \frac{N_C}{N_A\frac{\sqrt{2}}{2}} + 1$ $\quad -③$



$\cos(45-\theta) = \frac{\Delta l_A}{\delta\theta} \Rightarrow \Delta l_A = \delta\theta\left(\cos\theta\frac{\sqrt{2}}{2} + \sin\theta\frac{\sqrt{2}}{2}\right)$

$\sin\theta = \frac{\Delta lc}{\delta\theta} \Rightarrow \Delta lc = \delta\theta\sin\theta$

$\left(N = \frac{\Delta l.E.A}{L}\right)$ $\quad ③: tg\theta = \frac{\delta\theta\sin\theta.E.A_2}{L} \Big/ \frac{\delta\theta\frac{\sqrt{2}}{2}(\sin\theta+\cos\theta).E.A_1\sqrt{2}}{L\sqrt{2}} + 1 = \frac{4A_2\sin\theta}{\sqrt{2}A_1(\sin\theta+\cos\theta)} + 1$

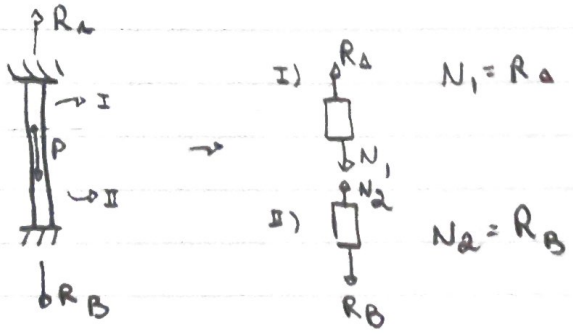
$tg\theta = \frac{4.A_2}{\sqrt{2}A_1}\left(\frac{\sin\theta}{\sin\theta+\cos\theta}\right) + 1 \Rightarrow tg\theta = \frac{4A_2}{\sqrt{2}A_1}\left(\frac{tg\theta}{tg\theta+1}\right) + 1$

$$tg^2\theta + tg\theta = \frac{4A_2}{\sqrt{2}A_1}\cdot tg\theta + tg\theta + 1 \rightarrow tg\theta = \frac{4A_2}{\sqrt{2}A_1} + cotg\theta$$

$$\boxed{cotg\,2\theta = \frac{cotg\theta - tg\theta}{2}}$$

$$cotg\,2\theta = \frac{cotg\theta - \frac{4A_2}{\sqrt{2}A_1} - cotg\theta}{2} = \frac{-2A_2}{\sqrt{2}A_1} = \frac{-\sqrt{2}A_2}{A_1}$$

5)



$N_1 = R_A$

$N_2 = R_B$

$R_A = P + R_B$

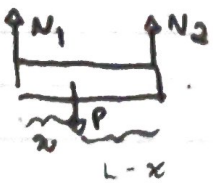
$$\delta_{Total} = 0 \rightarrow \delta_1 + \delta_2 = 0 \Rightarrow \frac{N_1 \cdot a}{E \cdot A} + \frac{N_2 \cdot b}{E \cdot A} = 0 \Rightarrow N_1 = -\frac{N_2 b}{a}$$

$$R_A = -\frac{R_B b}{a}$$

$$R_A = P + R_B \rightarrow -\frac{R_B b}{a} = P + R_B \Rightarrow -R_B\frac{b}{a} - R_B = P \Rightarrow -R_B\left(\frac{a+b}{a}\right) = P \Rightarrow$$

$$\Rightarrow \boxed{R_B = -\frac{Pa}{L}} \qquad \boxed{R_A = -R_B \cdot \frac{b}{a} = \frac{P \cdot b}{L}}$$

6)



$P = N_1 + N_2$

$M_{(P)} = 0 \Rightarrow N_1 \cdot x = N_2 \cdot (L - x) \Rightarrow x = \frac{N_2 L}{N_1 + N_2}$

$\delta_1 = \delta_2$ (Ficar horizontal) $\Rightarrow \frac{N_1 \cdot l}{A \cdot E_1} = \frac{N_2 \cdot l}{A \cdot E_2} \Rightarrow N_1 = \frac{E_1}{E_2} \cdot N_2$

$$x = \frac{N_2 L}{\frac{E_1}{E_2}\cdot N_2 + N_2} = \frac{L}{\left(\frac{E_1}{E_2}+1\right)} = \frac{E_2 L}{E_1 + E_2}$$

7) $\varepsilon_{máx\ concreto} = 4.10^{-3}$ $\left(\frac{\sigma}{E}\right)$ $\varepsilon_{Máx\ caixa} = 5.10^{-3}$

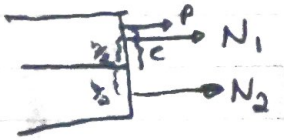
Nosso limite

$A_{caixa} = (250^2 - 200^2) = 50.450 = 22500\ mm^2$

$A_{concreto} = (200^2) = 40000\ mm^2$

$\Delta E_t = E_{caixa}\cdot A_{caixa} + E_{concreto}\cdot A_{concreto} = 840.22500 + 140.40000$
$= 24500000$

$F = \varepsilon . A . E = 98000\ kgf$

8) 

$M_{(P)} = 0 \Rightarrow N_1\cdot(e - \frac{b}{2}) + N_2(e+\frac{b}{2}) = 0$

$N_1(\frac{b}{2} - e) = N_2(\frac{b}{2} + e) \Rightarrow$

$N = \sigma . A = \varepsilon . E . A$

$\Rightarrow \varepsilon . A . E_1 \cdot (\frac{b}{2} - e) = \varepsilon . A . E_2 (\frac{b}{2} + e) \Rightarrow E_1\frac{b}{2} - eE_1 = E_2\frac{b}{2} + eE_2$

$(E_1 - E_2)\frac{b}{2} = e(E_1 + E_2) \Rightarrow$

$\Rightarrow e = \frac{\frac{b}{2}(E_1 - E_2)}{(E_1 + E_2)}$

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4)

$M_{(A)} = 0 \Rightarrow P \cdot 3a = a N_1 + 2a N_2$

$N_1 + 2N_2 = 3P$

$\text{Logo} \quad \frac{\delta_1}{a} = \frac{\delta_2}{2a} \Rightarrow \frac{N_1 \cdot \ell}{E \cdot A \cdot a} = \frac{N_2 \ell}{E \cdot A \cdot 2a} \Rightarrow N_2 = 2N_1$

$N_1 = \frac{3P}{5} \quad N_2 = \frac{6P}{5} \Rightarrow N_1 = 12000\,kgf$

$N_2 = 24000\,kgf$

$\sigma_1 = \frac{N_1}{A} = 6,67\,kgf/mm^2$

$\sigma_2 = \frac{N_2}{A} = 13,33\,kgf/mm^2$