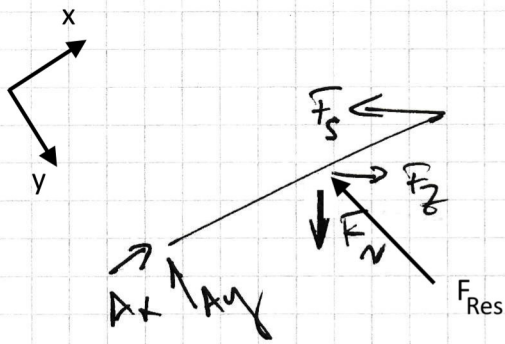


B6-4 a) $F_N = F_2 = 20 \text{ kN}$



$$F_N = F_2$$

$$\sum F_x = 0 = A_x - \frac{\sqrt{2}}{2} F_N + \frac{\sqrt{2}}{2} F_2 - \frac{\sqrt{2}}{2} F_S$$

$$\sum F_y = 0 = A_y - \frac{\sqrt{2}}{2} F_N - \frac{\sqrt{2}}{2} F_2 + \frac{\sqrt{2}}{2} F_S$$

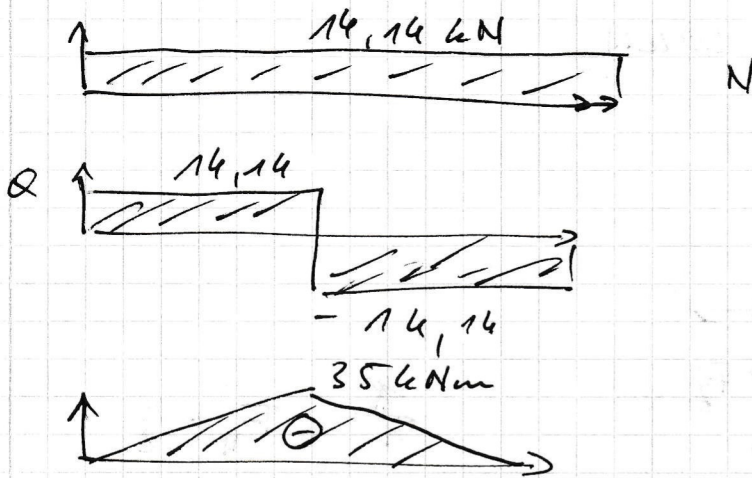
$$\sum M_A = 0 = -\frac{\sqrt{2}}{2} F_N \cdot 2,748 \text{ m} + \frac{\sqrt{2}}{2} F_S \cdot 4,9 \text{ m} - \frac{\sqrt{2}}{2} F_2 \cdot 2,748 \text{ m}$$

$$\Rightarrow F_S = \frac{1}{2} F_N + \frac{1}{2} F_2 = 20 \text{ kN}$$

$$\Rightarrow \sum F_x = 0: A_x = \frac{\sqrt{2}}{2} F_N - \frac{\sqrt{2}}{2} F_2 + \frac{\sqrt{2}}{2} F_S = 14,14 \text{ kN}$$

$$\sum F_y = 0: A_y = \frac{\sqrt{2}}{2} F_N + \frac{\sqrt{2}}{2} F_2 - \frac{\sqrt{2}}{2} F_S = 14,14 \text{ kN}$$

$$\Rightarrow F_A = \sqrt{A_x^2 + A_y^2} = \sqrt{400} = 20 \text{ kN}$$



a) $F_S = 20 \text{ kN}$

$$\Rightarrow \sigma_{zul} = 260 \frac{\text{N}}{\text{mm}^2} \geq \frac{F_S}{A} \quad \text{mit } A = n \cdot \frac{\pi d_B^2}{4}$$

$$\Rightarrow n \cdot \frac{\pi d_B^2}{4} = \frac{F_S}{\sigma_{zul}} \quad (\Rightarrow) \quad n = \frac{4 F_S}{\pi \cdot d_B^2 \cdot \sigma_{zul}}$$

$$= 43,53 \Rightarrow 44 \text{ Dr.}$$

$$e) \sigma_{b\text{zul}} \geq \frac{M_b}{W_b}$$

$$W_b = \frac{\pi}{32} \left(\frac{D^4 - d^4}{D} \right)$$

$$\frac{D}{d} = \frac{1}{0,9} \Rightarrow D = \frac{1}{0,9} d \Leftrightarrow 0,9D = d$$

$$\Rightarrow W_b = \frac{\pi}{32} \left(\frac{D^4 - (0,9D)^4}{D} \right)$$

$$\Rightarrow \frac{M_{b\text{max}}}{\sigma_{b\text{zul}}} = W_b = \frac{\pi}{32} \cdot 0,3439 D^3$$

$$\Leftrightarrow \frac{32 \cdot 35.000.000 \text{ N}\cdot\text{mm}}{250 \frac{\text{N}}{\text{mm}^2} \cdot \pi} = 0,3439 D^3$$

$$\Rightarrow \sqrt[3]{\frac{32 \cdot 35.000.000 \text{ N}\cdot\text{mm}}{0,3439 \cdot \pi \cdot 250 \frac{\text{N}}{\text{mm}^2}}} = 160,657 \text{ mm} = D$$

$$\Rightarrow d = 0,9D = 144,591 \text{ mm}$$

$$\sigma_{z10} \text{ konst. : } \frac{F_{\text{Nor}}}{A} = \sigma_{z10} = \frac{14,14 \text{ kN}}{3851,682 \text{ mm}^2}$$

$$\text{mit } A = \frac{\pi}{4} (D^2 - d^2) = 3851,682 \text{ mm}^2$$

$$\Rightarrow \sigma_{z10} = 3,671 \frac{\text{N}}{\text{mm}^2}$$

$$\sigma_{b\text{max}} = \frac{M_b}{W_b} = \sigma_{b\text{zul}} \Rightarrow \sigma_N = 253,671 \frac{\text{N}}{\text{mm}^2}$$

$$g) \Delta l = \frac{F \cdot l}{E \cdot A} = \frac{20.000 \text{ N} \cdot 3500 \text{ mm}}{210000 \frac{\text{N}}{\text{mm}^2} \cdot 77,75 \text{ mm}^2}$$

$$= 4,287 \text{ mm}$$

$$b) \quad f = \frac{28,28 \text{ kN} \cdot (4950 \text{ mm})^3}{210.000 \frac{\text{N}}{\text{mm}^2} \cdot \frac{\pi}{64} (160,657^4 - 144,591^4) \cdot 48}$$

$$= 30,257 \text{ mm}$$