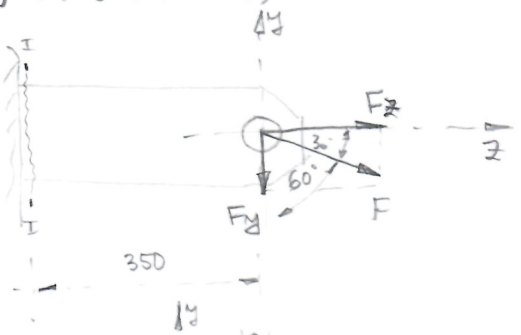
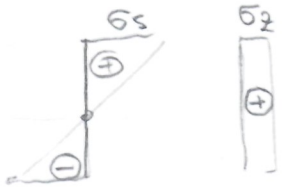
6.1 S235 (Č0370)

$F_z = F \cdot \sin 60° = 40\,000 \cdot \sin 60° = 34640\,N$

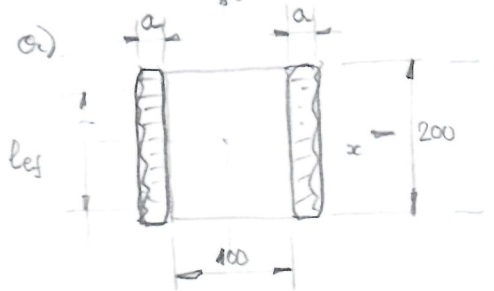
$F_y = F \cdot \cos 60° = 40\,000 \cdot \cos 60° = 20\,000\,N$



Č0370 → $\sigma_{D(-1)_S} = 170\ \frac{N}{mm^2}$ $\sigma_{D(-1)_Z} = 120\ \frac{N}{mm^2}$



a)

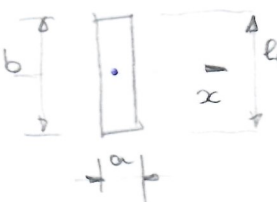


$l_{ef} = b - 2a = 200 - 2 \cdot 15 = 170\,mm$

$W = 2 \cdot \frac{a \cdot l_{ef}^2}{6} = 2 \cdot \frac{15 \cdot 170^2}{6} = 144500\,mm^3$

$A = 2 \cdot a \cdot l_{ef} = 2 \cdot 15 \cdot 170 = 5100\,mm^2$

$\sigma_S = \frac{M}{W} = \frac{F_y \cdot l}{W} = \frac{20\,000 \cdot 350}{144500} = 48,45\ \frac{N}{mm^2}$



$W = \frac{a \cdot b^2}{6}$

$\sigma_Z = \frac{F_z}{A} = \frac{34640}{5100} = 6,80\ \frac{N}{mm^2}$

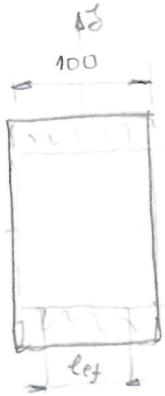
$\tau_S = \frac{F_S}{A} = \frac{F_y}{A} = \frac{20\,000}{5100} = 3,92\ \frac{N}{mm^2}$ ×

$S_S = \frac{[S]}{\sigma} = \frac{\sigma_{DM_S}}{\sigma_S} = \frac{85}{48,45} = 1,75\ (1.69)$ $S_Z = \frac{[S]}{\sigma_Z} = \frac{\sigma_{DM_Z}}{\sigma} = \frac{60}{6180} = 8,82\ (7)$

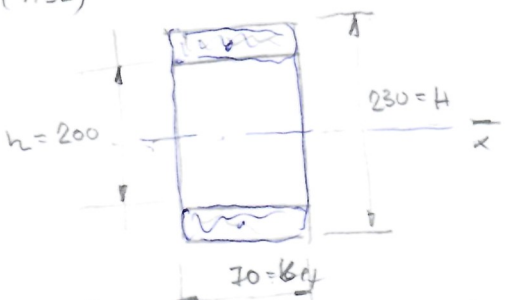
$\sigma_{DM_S} = \frac{\sigma_{D(-1)_S}}{K_D} = \frac{170}{2} = 85\ \frac{N}{mm^2}\ (79.8)$ $\sigma_{DM_Z} = \frac{\sigma_{D(-1)_Z}}{K_D} = \frac{120}{2} = 60\ \frac{N}{mm^2}\ (48)$

$S = \frac{S_S \cdot S_Z}{S_S + S_Z} = \frac{1,75 \cdot 8,82}{1,75 + 8,82} = \boxed{1,46}\ (1.32)$

б)



$l_{ef} = x - 2a = 100 - 2 \cdot 15 = 70\,mm$



$W_x = \frac{bH^3 - bh^3}{6H} = \frac{b(H^3 - h^3)}{6H} = \frac{70 \cdot (230^3 - 200^3)}{6 \cdot 230} = 211370\,mm^3$

$\sigma_S = \frac{M}{W} = \frac{F_y \cdot l}{W} = \frac{20\,000 \cdot 350}{211370} = 33,12\ \frac{N}{mm^2}$

$\sigma_Z = \frac{F}{A} = \frac{F_z}{A} = \frac{34640}{2100} = 16,50\ \frac{N}{mm^2}$

$A = 2 \cdot a \cdot l_{ef} = 2 \cdot 15 \cdot 70$

$A = 2100\,mm^2$

$S_S = \frac{[S]}{\sigma} = \frac{\sigma_{DM_S}}{\sigma_S} = \frac{85}{33,12} = 2,56\ (2.41)$

$S_Z = \frac{[S]}{\sigma} = \frac{\sigma_{DM_Z}}{\sigma_Z} = \frac{60}{16,50} = 3,63\ (2.91)$

$S = \frac{S_S \cdot S_Z}{S_S + S_Z}$ (1.32)

$S = \frac{2,56 \cdot 3,63}{2,56 + 3,63} = \boxed{1,50}$

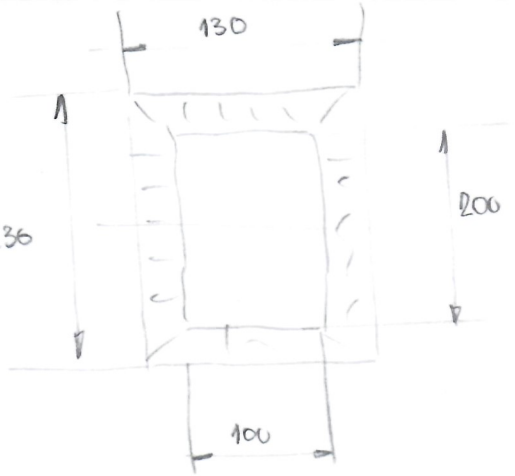
а) $K_{D_1} = \frac{1}{\beta_{1_1} \beta_2}$ $\beta_{1_1} = 0,67 \Rightarrow K_{D_1} = \frac{1}{0,67 \cdot 0,7} = 2.13$

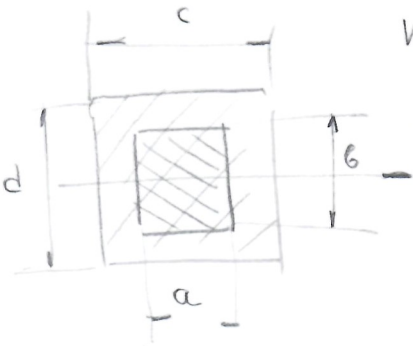
$K_{D_2} = \frac{1}{\beta_{1_2} \cdot \beta_2}$ $\beta_{1_2} = 0,57 \Rightarrow K_{D_2} = \frac{1}{0,57 \cdot 0,7} = 2.50$

$\beta_2 = f$ (квалитет на обработка) → средна квалитет (диаметър нормално)

$\beta_2 = 0,65 - 0,75 = 0,7$

6)





$$W = \frac{cd^3}{6} - \frac{ab^3}{6}$$

$$W = \frac{130 \cdot 230^3 - 100 \cdot 200^3}{6}$$

$$W = 479500\ mm^3$$

$$A = c \cdot d - a \cdot b$$

$$A = 230 \cdot 130 - 200 \cdot 100$$

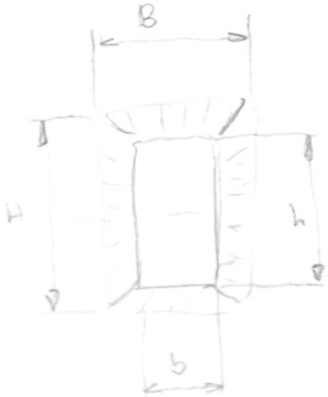
$$A = 9900\ mm^2$$

$$\sigma_S = \frac{M}{W} = \frac{F_S \cdot e}{W} = \frac{20000 \cdot 350}{479500} = 14{,}60\ \frac{N}{mm^2}$$

$$\sigma_Z = \frac{F}{A} = \frac{F_Z}{A} = \frac{34640}{9900} = 3{,}50\ \frac{N}{mm^2}$$

$$\left.\begin{aligned} S_S &= \frac{[\sigma]}{\sigma} = \frac{\sigma_{DM_S}}{\sigma_S} = \frac{85}{14{,}60} = 5{,}82 \\ S_Z &= \frac{[\sigma]}{\sigma} = \frac{\sigma_{DM_Z}}{\sigma_Z} = \frac{60}{3{,}50} = 17{,}15 \end{aligned}\right\} \quad \boxed{S_z = \frac{S_S \cdot S_Z}{S_S + S_Z} = \frac{5{,}82 \cdot 17{,}15}{5{,}82 + 17{,}15} = 4{,}34}$$

$$\left.\begin{aligned} S_S &= 5{,}46 \\ S_Z &= 13{,}72 \end{aligned}\right\} \quad S = 3{,}91 > S_{min}\ (2)$$



$$W = \frac{BH^3 - bh^3}{6} = 479500\ mm^3$$

$$B = b + 2a_Z = 130$$

$$H = h + 2a_Z = 230$$