Correction d'Examen

RDM

Exercice N:01 (08 pts)

- Donnés :

• $F_1 = 45KN$ • $F_2 = 450KN$; • $S_1 = 625\ mm^2$

• $S_2 = 2500\ mm^2$ • $S_3 = 1250\ mm^2$

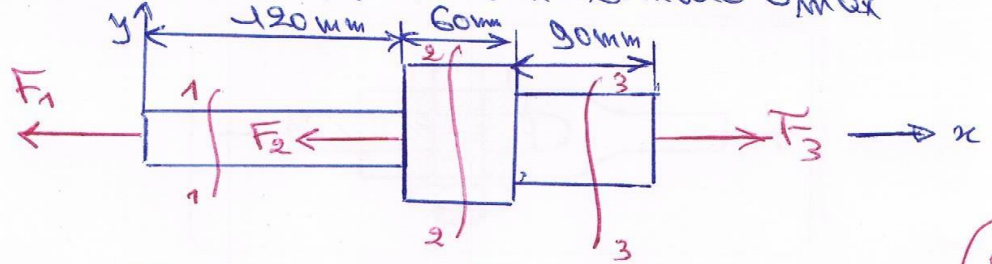
1/- Valeur de F_2

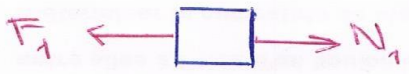
on a :

$\Sigma F = 0 \Rightarrow F_3 - F_2 - F_1 = 0 \Rightarrow F_2 = F_3 - F_1 = 450 - 45$ (a1)

$F_2 = 405\ KN$ (1)

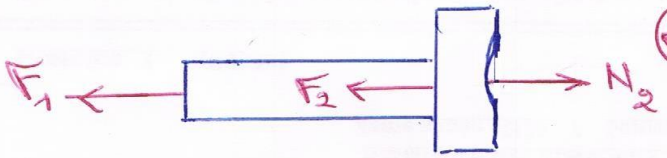
2/- Contrainte normale maximale σ_{max}





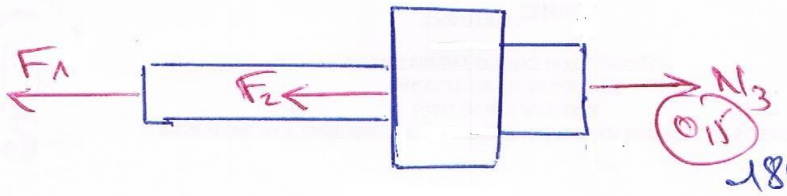
(0,15)

Coupure 1-1 : $0 \leq x \leq 120$ (0,25)



(0,15)

Coupure 2-2 : $120 \leq x \leq 180$ (0,25)



(0,15)

Coupure 3-3 (0,25)

$180 \leq x < 270$

- Coupure 1-1.

on a: $\sum F = 0 \rightarrow N_1 = F_1 = 45\,kN$ (0,5)

$\Rightarrow \sigma_1 = \frac{N_1}{S_1} = \frac{45.10^3\,N}{625\,mm^2} = 72\,\frac{N}{mm^2} \Rightarrow \underline{\sigma_1 = 72\,MPa}$ (0,5)

- Coupure 2-2

on a: $\sum F = 0 \rightarrow +F_1 + F_2 = N_2 \Rightarrow N_2 = 450\,kN$ (0,5)

$\Rightarrow \sigma_2 = \frac{N_2}{S_2} = \frac{450.10^3\,N}{2500\,mm^2} = 180\,N/mm^2 \Rightarrow \underline{\sigma_2 = 180\,MPa}$ (0,5)

- Coupure 3-3

on a: $\sum F = 0 \rightarrow F_1 + F_2 = N_3 \Rightarrow N_3 = 450\,kN$ (0,5)

$\Rightarrow \sigma_3 = \frac{N_3}{S_3} = \frac{450.10^3\,N}{4250} = 360\,\frac{N}{mm^2} \Rightarrow \underline{\sigma_3 = 360\,MPa}$ (0,5)

on constate que $\boxed{\sigma_{max} = 360\,MPa}$ (1)

Exercice N: 02 — 12 pts

- Données:

- $e = 4\,mm$ • $\tau = 200\,MPa$ • $a = 20\,mm$
- $\sigma_{pc} = 240\,MPa$

1/ L'effort minimal F_{min}

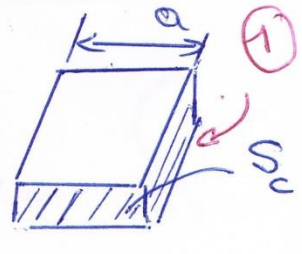
on a: $T = F_{min}$, S_c : surface cisaillée

on sait que: $\tau = \frac{T}{S}$ (1) avec $\begin{cases} T = F \\ S_c = 4ae \end{cases}$ (1)

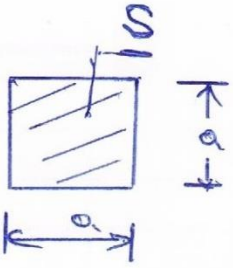
Donc:

$\tau = \frac{F_{min}}{4ae}$ (1) $\Rightarrow F_{min} = 4\tau ae$

$F_{min} = 4 \times 200 \times 20 \times 4 \Rightarrow \boxed{F_{min} = 64000\,N}$ (1)



2/- La contrainte de compression σ :



on a : $\sigma = \frac{N}{S}$ avec : $\begin{cases} N = F \\ S = a \times a = a^2 \end{cases}$ (1)

AN : $\sigma = \frac{F}{a^2} = \frac{64000\,N}{(20)^2\,mm^2}$

$\sigma = 160\,\frac{N}{mm^2} \Rightarrow \boxed{\sigma = 160\,MPa}$ (1)

On remarque que $\sigma < \sigma_{pc}$ (1) c'à'd $160 < 240\,MPa$

Donc :
cette contrainte de compression est satisfaisante (1)

3/- Valeur minimale de a :

Lorsque la contrainte de compression dans le poinçon σ atteint la contrainte pratique σ_{pc} (1) on ne peut plus envisager de poinçonner la tôle.

D'après la cond. de résistance : $\sigma \leq \sigma_{pc}$

$\Rightarrow \frac{F}{a^2} \leq \sigma_{pc}$ (0,5) , ($F = \tau \cdot 4a \cdot e$ (voir Question 1) (0,5))

Donc :

$\frac{\tau\, 4ae}{a^2} \leq \sigma_{pc} \Rightarrow$ (1)

$\Rightarrow a \geq \frac{4\tau e}{\sigma_{pc}} \Rightarrow a \geq \frac{4 \cdot 200 \cdot 4}{240}$

$\boxed{a \geq 13,33\,mm}$ (1)