PROBLEM NO. 2-4 | MECHANICAL ENGINEERING DEPARTMENT | NAME KOUL

DATE | SECTION

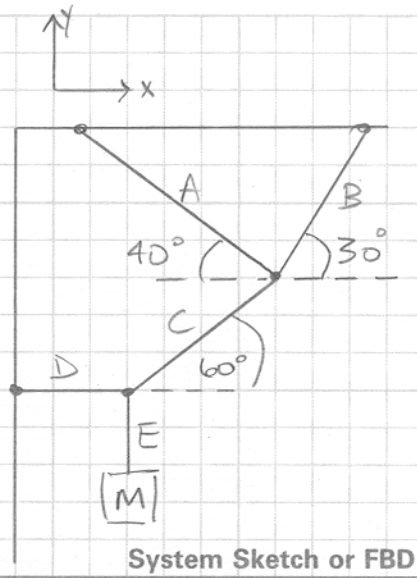
**Given:** $m = 250\ Kg$
$d = 15\ mm$
Fig P2-4

**Find:** normal stresses $\sigma_A, \sigma_B$
$\sigma_C, \sigma_D, \sigma_E$

**Relationships:** $A = \frac{\pi}{4} d^2 = 176.7\ mm^2$

$F = mg$

$\sigma = \frac{F}{A} = \frac{T}{A}$




System Sketch or FBD

**Solution:**

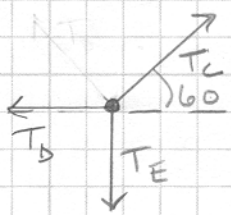
FBD of M

$\Sigma F_x = 0$

$\Sigma F_y = T_E - (9.8)250 = 0$

$T_E = 2450\ N$

FBD of joint CDE



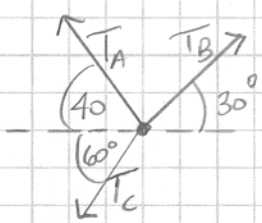

$\Sigma F_x = -T_D + T_C \cos 60° = 0$

$\Sigma F_y = T_C \sin 60° - 2450 = 0$

$T_C = 2829\ N$

$T_D = 1414.5\ N$

FBD of joint ABC




$\Sigma F_x = -T_A \cos 40° + T_B \cos 30° - T_C \cos 60° = 0$

$\Sigma F_y = T_A \sin 40° + T_B \sin 30° - T_C \sin 60° = 0$

$T_B = 2968\ N$

$T_A = 1506\ N$

$\sigma = \frac{T}{A}$

$\sigma_A = 8.52\ MPa$
$\sigma_B = 16.80\ MPa$
$\sigma_C = 16.02\ MPa$
$\sigma_D = 8.01\ MPa$
$\sigma_E = 13.88\ MPa$

PROBLEM NO. 2-8 | MECHANICAL ENGINEERING DEPARTMENT | NAME KOUL

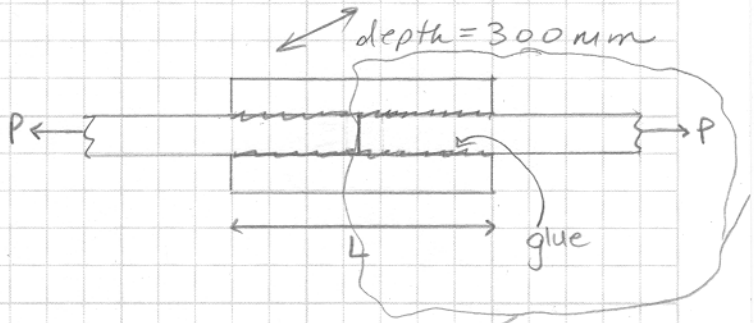
DATE | SECTION

**Given:** Fig P2-8

$\tau \leq 950\,kPa$

$P = 50\,kN$

**Find:** $L$

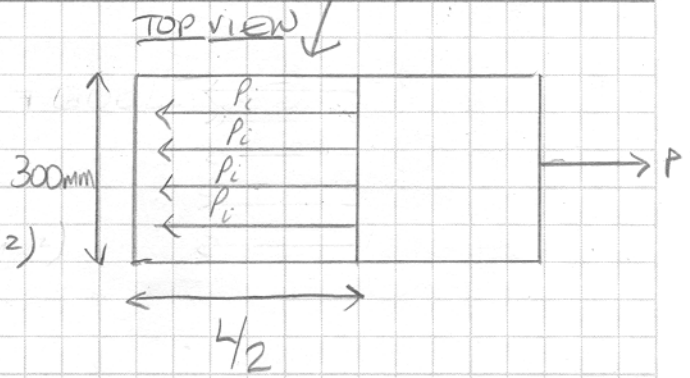



**Relationships:**

$$\tau = \frac{P}{A}$$

Assume gapped area is ignored

**System Sketch or FBD**




**Solution:**

FBD of one half of system

$$\Sigma P_i = P = \tau A$$

$$A = 2(300)\frac{L}{2} = 0.3L\,(m^2)$$

$$P = \tau(0.3L)$$

$$50{,}000 = 950{,}000(0.3L)$$

$$\boxed{L \geq 0.175\,m}$$

PROBLEM NO. 2-14

DATE

MECHANICAL ENGINEERING DEPARTMENT

NAME KOUL

SECTION

**Given:** Fig P2-14

$\tau_{punch} = 75\ MPa$

$\sigma_{bear} = 100\ MPa$

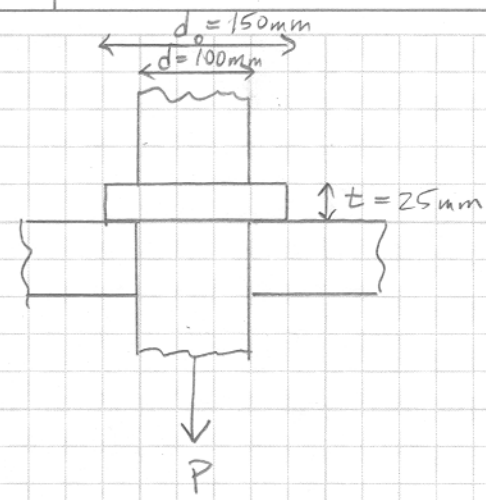
**Find:**

$P$

**Relationships:**

$$\tau_{punch} = \frac{P}{\pi d t}$$

$$\sigma_{bear} = \frac{4P}{(d_o^2 - d)\pi}$$




System Sketch or FBD

**Solution:**

$$\tau_{punch} = \frac{P}{\pi d t}$$

$$75 \times 10^6 = \frac{P}{\pi(0.1)(0.025)}$$

$$P \leq 589\ kN$$

$$\sigma_{bear} = \frac{4P}{(d_o^2 - d)\pi}$$

$$100 \times 10^6 = \frac{4P}{(0.15^2 - 0.10^2)\pi}$$

$$P \leq 982\ kN$$

So P must be limited to 589 kN