

1.3.2 simple shear stress

الضغط البسيط

د - محاري

The force per unit area, acting tangent to the small area ΔA . It is denoted by Greek symbol τ (tau). This is independent of sign. This may be:-

a - Direct shear stress.

الضغط

b - Punching

"

الضغط

c - Flexural

" (V)

الضغط الانحناء

d - Torsional

" (ut)

الضغط الالتواء

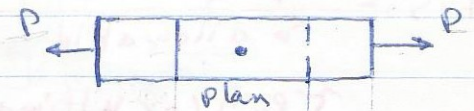
a - Direct shear stress

i - Single shear stress:-

which acts in one region

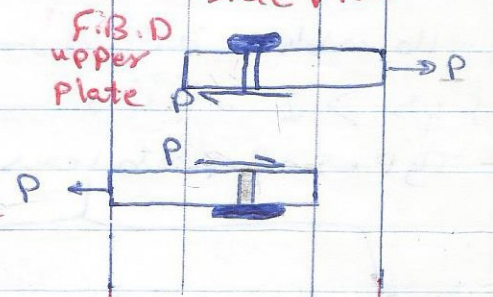
$$\tau = \frac{\text{force}}{\text{area}} = \frac{P}{\frac{\pi}{4} d^2}$$

where:- d:- diameter of bolt or (rivet)



F.B.D upper plate

F.B.D lower plate



ii - Double shear stress which acts in two regions.

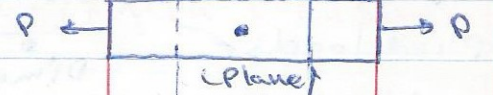
$$\tau = \frac{P}{2(\text{area of bolt})}$$

$$= \frac{P}{2 \times \frac{\pi}{4} d^2}$$

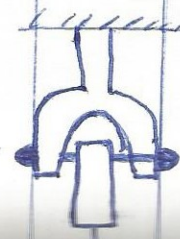
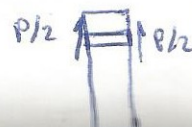
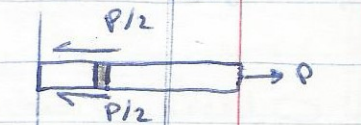
OR

$$\tau = \frac{P/2}{\frac{\pi}{4} d^2}$$

الضغط

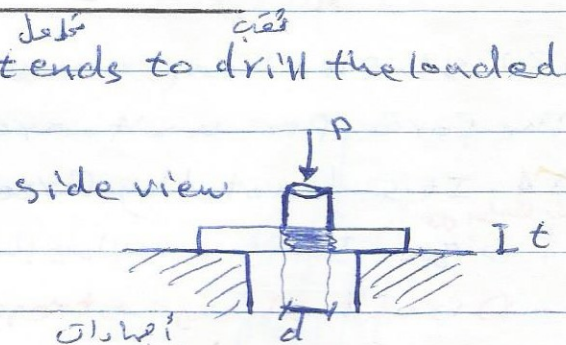


F.B.D of middle plate



b - punching shear stress The force tends to drill the loaded plate.

$$\tau = \frac{P}{\pi \cdot d \cdot t}$$



Notes:-

(cover) سلك

1- we calculate average of stress!!

2- Factor of safety (F.S.)

الحد الأقصى (الحد الأقصى) الحد الأدنى

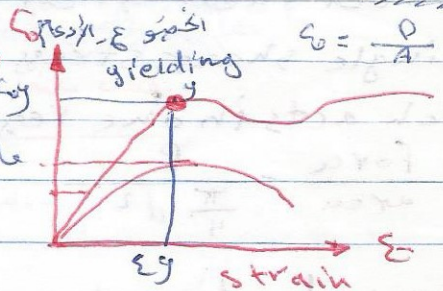
$$F.S. = \frac{\sigma_{fail} \text{ (or ultimate)}}{\sigma_{allowable}}$$

$$\text{or } = \frac{\tau_{fail} \text{ (or ultimate)}}{\tau_{allowable}}$$

نطاق (1-4)
(1-2) →
(3-4) →

stress

الحد الأقصى
الحد الأدنى



failure: fail.
ultimate: ult.

allowable: all.

$$F.S. > 1$$

Steel $\sigma_{y, 200 \text{ MPa}}$

$\sigma_{allowable} = 160 \text{ MPa}$

3- Types of problems:

Design problems

Applied loads

Allowable stresses

Dimensions?

Analytical problems

Dimensions -
allowable stresses -
applied loads?

loads -
Dimensions -
stresses?

4- In general, materials fails under effect of shear stress equals (0.5 - 0.6) times that of normal stress.

Torsion

$$\sigma_{ult} = 300 \text{ MPa}$$

$$\tau_{ult} = (0.5 - 0.6) \times 300$$