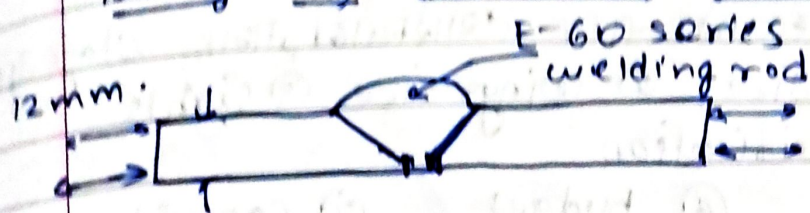


# Design of - Machine - Elements - Lab - 05:



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B22ME055

Load given (-20,000) to (20,000) N  
 $\sigma_{ut} = 420 \text{ MPa}$        $\sigma_{yt} = 340 \text{ MPa}$

Grounded off edges:

→ No stress concentration.

Load-factor  $C_L = 1.0 \rightarrow$  As Axial-Load.

For axial:

$$S_n = S_n' \times C_L \times C_G \times C_s \times C_T \times C_R$$

=  $S_e$  ( $10^6$  cycle)

0.1  
(axial)

$\therefore t = 12 \text{ mm}$   
 $C_G = 1$

s/c factor 0.56  
for  $\sigma_{ut} = 420$   
from fig.

90%  
(assuming)  
(12 = 0.847)

$$\therefore S_n' = 0.5 S_n$$

→ As per approximations.

$$\therefore S_n' = 0.5 \times S_{ut} \times 1 \times 0.56 \times 0.847 \times 1$$

$$S_n = 105.48 \approx S_e$$

In Soderberg - Criterion:

$$\frac{\sigma_a}{S_e} + \frac{\sigma_m}{S_{yt}} = \frac{1}{F.O.S}$$

$\sigma_a = 0$

assuming  
F.O.S. = 2.5

$$\frac{\sigma}{S_e} + 0 = \frac{1}{2.5} \Rightarrow \sigma = \frac{S_e}{2.5}$$

$$\therefore \frac{105.48}{2.5} = \sigma = \underline{\underline{42.192}}$$

$$\therefore \frac{20,000}{12 \times l} = 42.192$$

$$\therefore l = \frac{20,000}{12 \times 42.192} = \frac{20,000}{506.304}$$

$$\therefore \boxed{l = 39.5 \text{ mm}}$$



\* Edges not ground off:

$$\sigma = \frac{S_e}{3} \times 1/1.4$$

stress-concentration

$$\Rightarrow \sigma = \frac{42.192}{1.2} = 35.16.$$

$$35.16 = F/A.$$

$$\therefore 35.16 = \frac{201000}{12 \times l} \Rightarrow l = \frac{201000}{35.16 \times 12}$$

$$\Rightarrow l = \frac{20000}{421.92} = 47.40.$$

$$l = 47.40 \text{ mm}$$