

Lab 4.

9/10/2018

# TENSILE TESTING

## Engineering stress + strain

$$\text{stress} \rightarrow S = \frac{F_0 \leftarrow \text{Force}}{A_0 \leftarrow \text{original area.}}$$

$$\text{Eng strain} = \frac{\Delta l \leftarrow \text{change in length}}{l_0 \leftarrow \text{original length}}$$

How much does a load cell cost?

It is about this amount \$23,000

- Never overload a cell

The cell capacity - 100,000 lbs

60,000 lbs

1,000 lbs

100 lbs

Now look at the lubs:

7075-0

7075-T6

0 = annealed

T6 = peak aged

If you take a look at the book

| UTS | $\gamma_s$ | % EL |
|-----|------------|------|
|-----|------------|------|

|    |    |    |
|----|----|----|
| 33 | 15 | 16 |
|----|----|----|

|    |    |    |
|----|----|----|
| 83 | 73 | 11 |
|----|----|----|

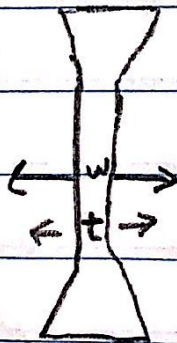
↑  
This is  
a stress

how do we estimate the load?

So,  $S = 83,000 \text{ lbs}$

$$S = \frac{F}{A_0} \rightarrow F = SA_0$$

original area  $A_0 = w \cdot t$  thickness  
width

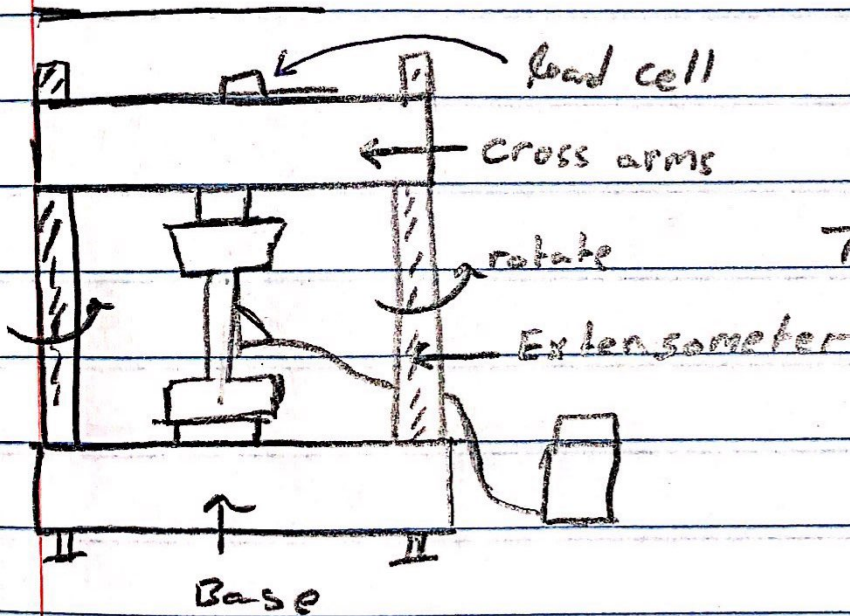
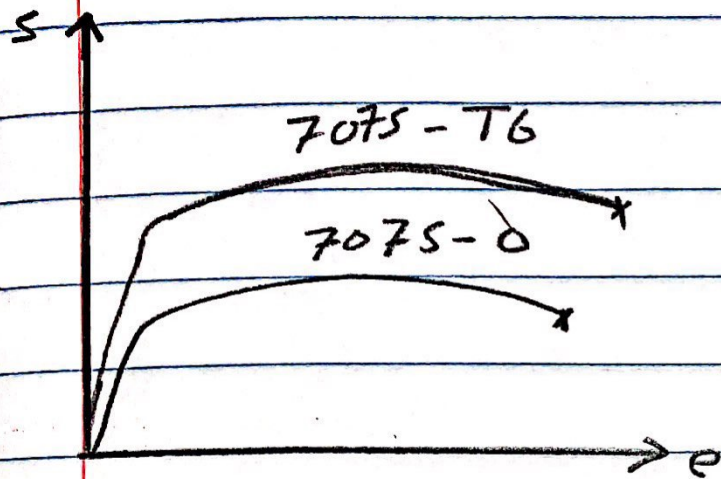


$$A_0 = 0.534 \cdot 0.123$$
$$= 0.0656 \text{ in}^2$$

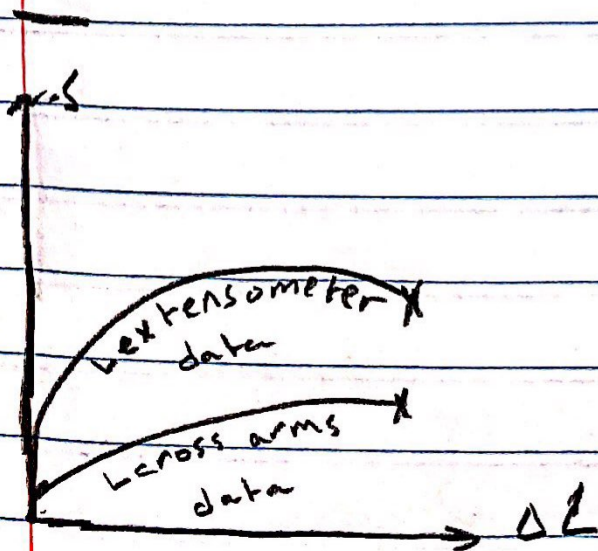
$$F = 83,000 \frac{\text{lb}}{\text{in}^2} \cdot 0.0656 \text{ in}^2$$
$$= 5451 \text{ lbs}$$

$\therefore$  Our normal 10,000 lbs capacity  
load cell will not be damaged.

# Tensile Curves:



Electromechanical  
Testing Frame



Cross arms data tends  
to over estimate strain



caused by machine flex  
Some errors

For cross arm

$$\Delta L = D_m + D_e$$

machine displacement      material displacement

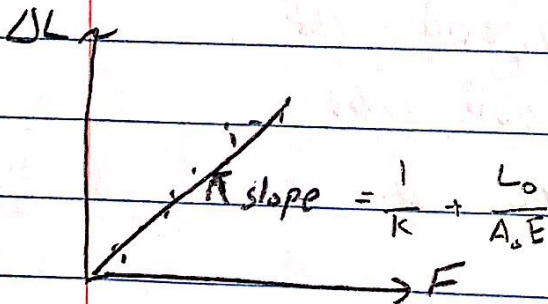
$$D_e = \frac{SL_0}{E} = \frac{FL_0}{A_0 E}$$

$$D_m = F/k \leftarrow \text{machine stiffness}$$

$$\therefore \Delta L = \frac{F}{k} + \frac{FL_0}{A_0 E}$$

$$\therefore \Delta L = F \left( \frac{1}{k} + \frac{L_0}{A_0 E} \right)$$

if you plot  $\Delta L$  with  $F$  we get a linear relationship



Now we can use the slope of that plot to find  $k$ .

Why Do I Care?

- If you use a Young's modulus based on cross arm, your  $Y_s$  will be off.
- a change in  $k$  means a problem w/ the machine.