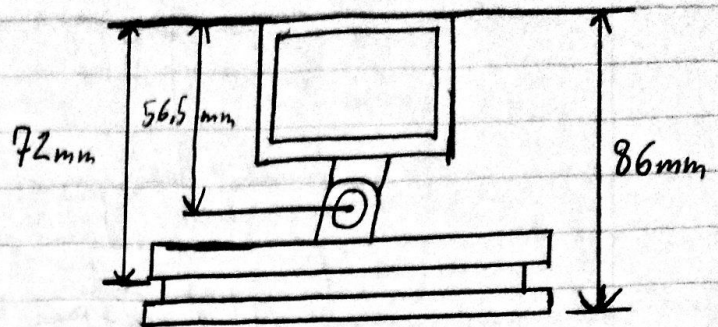


Components Analysis

Analysis Assumptions

- Hinge undergoes 5.5G load, with a safety factor of 2.
- Power necessary to rotate tightened hinge?



Calculation



Mass of camera $\rightarrow m = 0.074 \text{ kg}$

acceleration $\rightarrow 5.5 G \cdot SF$

accel. of gravity $\rightarrow G = 9.81 \text{ m/s}^2$

safety factor $\rightarrow SF = 2$

$$F_1 = (0.074) (5.5 (9.81) \cdot 2)$$

$$F_1 = 7.99$$

$$\sum M_A = 0$$

$$\sum M_A = F_1 (56.5 \text{ mm}) = 0$$

$$M_1 = 951.94 \text{ N}\cdot\text{mm} = \boxed{0.951 \text{ N}\cdot\text{m}} \leftarrow \text{necessary moment needed}$$

Power to rotate fully tightened hinge

Turning camera 90° over 1 sec elapsed time.

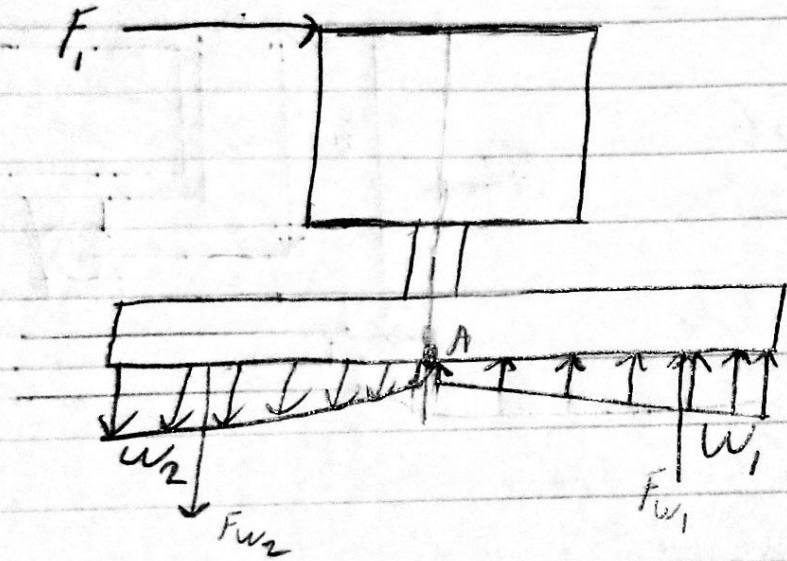
$$\left(\frac{\pi}{2}\right) \text{ rad/sec}$$

$$P = T \omega$$

$$= (0.951 \text{ N}\cdot\text{m}) \left(\frac{\pi}{2} \text{ rad/sec}\right)$$

$$\boxed{P = 0.709 \text{ W}}$$

Assignment #5: Components



$W_1 = \text{foam pushing up}$
 $W_2 = \text{foam pulling down}$

$$W_1 = W_2$$

$$F_1 = 3.99 \text{ N}$$

$$E_{\text{foam}} = 0.90 \text{ MPa}$$

$$M_1 = F_{W1} (21.333)$$

$$M_2 = F_{W2} (21.333)$$

$$M_1 = M_2$$

$$\sum M_A = 0$$

$$\sum M_A = M_1 + M_2 - F_1 (72 \text{ mm}) = 0$$

$$M_1 + M_2 = F_1 (72 \text{ mm})$$

$$M_1 + M_2 = 3.99 (72 \text{ mm})$$

$$M_1 + M_2 = 287.28$$

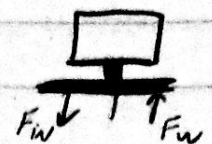
$$M_1 = M_2 = 143.64 \text{ N}\cdot\text{m}$$

Stress analysis

$$\sigma = \frac{F}{A}$$
$$= \frac{26.97 \text{ N}}{0.029 \text{ m}^2}$$

$$\sigma = 930 \text{ Pa}$$

1/2 base plate


$$A = (64 \times 32) \text{ mm}^2 = 2048 \text{ mm}^2 = 0.002048 \text{ m}^2$$
$$F_w = 26.97 \text{ N}$$

Shear stress @ hinge

$$\tau = \frac{T r}{J}$$

$$J = \frac{\pi}{32} (5 \text{ mm})^4 = 61.36 \text{ mm}^4$$

$$= \frac{(0.575 \text{ N}\cdot\text{m})(5 \text{ mm})}{61.36 \text{ mm}^4} = \frac{0.002875 \text{ N}\cdot\text{m}^2}{6.136 \times 10^{-11} \text{ m}^4} \frac{\text{kg}\cdot\text{m}^2}{\text{m}^4} = 46859628.92 \frac{\text{kg}}{\text{m}^2}$$

$$\tau = 46859628.92 \frac{\text{kg}}{\text{m}^2} = 459.97 \text{ MPa}$$