

Hoop Stress:

Hoop stress will always be worse than axial stress so we only care about the hoop stress

$$\sigma_h = \frac{P \times r}{t} = \frac{(662 \frac{\text{lb}}{\text{in}^2})(2 \text{ in})}{(0.125 \text{ in})} = 10592 \text{ psi}$$
$$FoS = \frac{40000}{10592} = 3.78$$

tensile yield strength of Aluminum 6061: 40000 psi

Bolt Shear:

$$\sigma = \left(\frac{\pi}{4} D_{\text{casing}}^2 \times \text{MEOP} \right) / \left(N \times \frac{\pi}{4} d_{\text{bolt, minor}}^2 \right)$$
$$= \left(\frac{\pi}{4} (3.75 \text{ in})^2 \times 662 \frac{\text{lb}}{\text{in}^2} \right) / \left(8 \times \frac{\pi}{4} (.267 \text{ in})^2 \right)$$
$$\sigma = 8161.65 \text{ psi}$$
$$FoS = \frac{0.75 \times 120000 \text{ psi}}{8161.65 \text{ psi}} = 11.03$$

Bolt Tear Out Stress:

$$F_{\text{bolt}} = \frac{\pi/4 D_{\text{casing}}^2 \times \text{MEOP}}{N} = \frac{\pi/4 (3.75 \text{ in})^2 (662 \text{ psi})}{8} = 913.95 \text{ lb}$$
$$\sigma_{\text{tear out}} = \frac{F_{\text{bolt}}}{E_{\text{min}} \times 2t}$$
$$E_{\text{min}} = 0.336 \text{ in}$$
$$\sigma_{\text{tear out}} = \frac{913.95 \text{ lb}}{(0.336 \text{ in})(2)(0.125 \text{ in})} = 10880.3 \text{ psi}$$
$$FoS = \frac{30000 \text{ psi}}{10880.3 \text{ psi}} = 2.757$$

Casing Tensile Stress:

$$\sigma_{\text{tensile}} = \frac{\pi/4 (3.75 \text{ in})^2 \times (662 \text{ psi})}{((4 \text{ in} - 0.125 \text{ in})\pi - 8(0.313 \text{ in})) \times 0.125 \text{ in}} = 6049.07 \text{ psi}$$
$$FoS = \frac{90000 \text{ psi}}{6049.07 \text{ psi}} = 14.88$$

Bearing Stress:

$$\sigma_{\text{bearing}} = \frac{F_{\text{bolt}}}{d_{\text{bolt, major}} \times t} = \frac{913.95 \text{ lb}}{(0.313 \text{ in}) \times (0.125 \text{ in})} = 23359.74 \text{ psi}$$
$$FoS = \frac{BYS}{\sigma_{\text{bearing}}} = \frac{56000 \text{ psi}}{23359.74 \text{ psi}} = 2.397$$