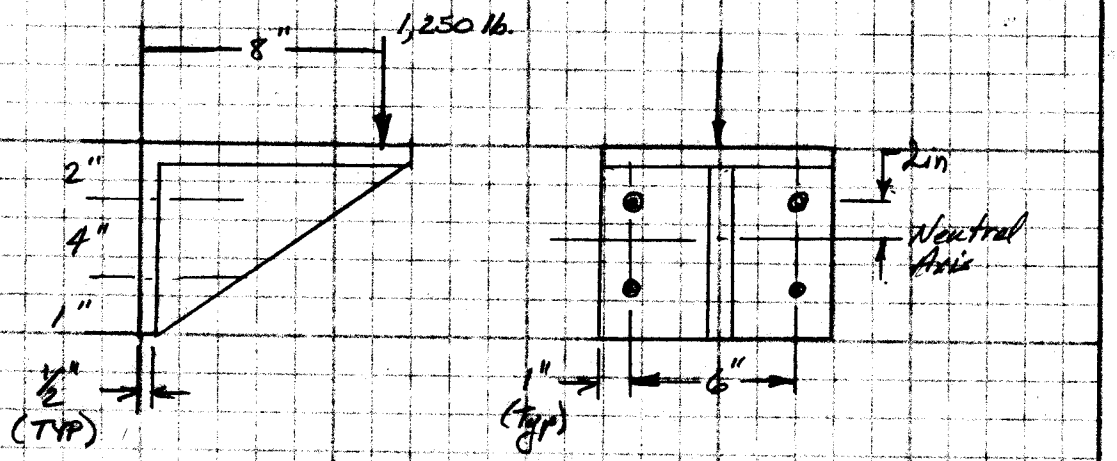
Given:



Fasteners = ⅜-16UNC-2A SAE Grade 5

C = Joint Constant = 0.173

Find: (a) Maximum tension stress in the bolts,

(b) Location of bolt having largest tension force,

(c) Factor of safety for combined tension and shear.

Solution:

The force to be carried by a fastener above the neutral axis of the bolt pattern is given by

$$f_i = \frac{Mc_i}{I}$$

$$I = 4(2)^2 = 16\ in^4$$

$$c = 2\ in$$

$$M = (1{,}250\ lb)(8\ in) = 10\ kip\text{-}in$$

$f = 1.25$ kip (for either of the bolts in the top row)

The total tension force in the fastener is

$$f_t = f_i + CF$$

$$f_i = 0.9(85\,ksi)(0.0775\,in^2)$$

$$= 5.93\,kip$$

$$\Rightarrow f_t = 5.93 + 0.173(1.25) = 6.14\,kip \Rightarrow \sigma = \frac{6.14\,kip}{0.0775\,in^2} = 79.2\,ksi$$

$$f_v = \frac{1,250\,lb}{4} = 312.1b = 0.3\,kip \Rightarrow \tau = \frac{0.3\,kip}{0.0678\,in^2} = 4.42\,ksi$$

$$\sigma_{all} = 85\,ksi \qquad \tau_{all} = 0.5\,\sigma_{all} = 42.5\,ksi$$

$$\left(\frac{\tau}{\tau_{all}}\right)^2 + \left(\frac{\sigma}{\sigma_{all}}\right)^2 = \frac{1}{N_{fs}}$$

$$\Rightarrow \frac{1}{N_{fs}} = \left(\frac{79.2}{85.0}\right)^2 + \left(\frac{4.42}{42.5}\right)^2 = 0.879$$

$$\boxed{\Rightarrow N_{fs} = 1.14}$$