K. Dennehy Ch. 3, Pgs. 115-116: 3-25, 3-29, 3-33 HW

(3-25) change in length

$$\sigma = E\varepsilon \rightarrow \varepsilon = \frac{\sigma}{E} \rightarrow \frac{\delta}{L} = \frac{\sigma}{E} \rightarrow \delta = \frac{\sigma L}{E} \rightarrow \delta = \frac{P}{A}\frac{L}{E}$$

(or $P = \frac{AE}{L}\delta$ compare to equ. for spring $P = kx \rightarrow k = \frac{AE}{L}$)

$$\delta = \frac{0.300\,kN}{\pi\left(\frac{0.015m}{2}\right)^2}\frac{(200\,mm)}{\left(2{,}700{,}000\,\frac{kN}{m^2}\right)} = \boxed{0.126\,mm}$$

change in diameter

$$\nu = -\frac{\varepsilon_{lat}}{\varepsilon_{long}} \rightarrow \varepsilon_{lat} = -\nu\,\varepsilon_{long} = -\nu\frac{\sigma}{E} = -\nu\frac{P}{AE}$$

$$\varepsilon_{lat} = \frac{\delta}{D}$$

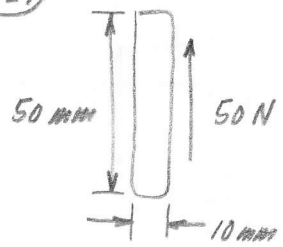
$$\delta = -\nu\frac{P}{AE}D$$

$$= -(0.4)\left(\frac{0.300\,kN}{\left(\pi\left(\frac{0.015m}{2}\right)^2\right)\left(2{,}700{,}000\,\frac{kN}{m^2}\right)}\right)(15\,mm)$$

$$= -0.00377\,mm$$

or $\boxed{\text{contracts } 0.00377\,mm}$

(3-29)



$$\frac{\tau}{\gamma} = G \rightarrow \gamma = \frac{\tau}{G} = \frac{\frac{V}{A}}{G} = \frac{\frac{50\,N}{(0.050\,m)(0.020\,m)}}{\left(0.20\times10^6\,\frac{N}{m^2}\right)} = \boxed{0.250\,rad}$$

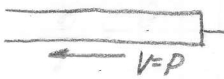
(3-33) $\tau_y = 50\,ksi$, $\nu = 0.3$

$$G = \frac{50\,ksi}{0.004} = 12{,}500\,ksi$$

$$G = \frac{E}{2(1+\nu)} \rightarrow E = 2(1+\nu)G$$

$$E = 2(1+0.3)(12{,}500\,ksi)$$

$$= 32{,}500\,ksi \text{ or } \boxed{32.5\,msi}$$



$$\frac{\tau}{\gamma} = G \rightarrow \tau = G\gamma \rightarrow \frac{V}{A} = G\gamma$$

$$\frac{P}{\frac{\pi}{4}(0.25in)^2} = \left(12{,}500\,\frac{kip}{in^2}\right)(0.004\,rad)$$

$$P = \boxed{2.45\,kip}$$