6.8 This problem asks us to compute the diameter of a cylindrical specimen of steel in order to allow an elongation of 0.38 mm. Employing Equations 6.1, 6.2, and 6.5, assuming that deformation is entirely elastic

$$\sigma = \frac{F}{A_0} = \frac{F}{\pi\left(\dfrac{d_0^2}{4}\right)} = E\frac{\Delta l}{l_0}$$

Or, solving for d_0

$$d_0 = \sqrt{\frac{4\,l_0 F}{\pi\,E\,\Delta l}}$$

$$= \sqrt{\frac{(4)(500 \text{ x } 10^{-3}\,\text{m})\,(11,100\ \text{N})}{(\pi)(207\text{ x }10^9\ \text{N}/\text{m}^2)(0.38\text{ x }10^{-3}\,\text{m})}}$$

$$= 9.5 \text{ x } 10^{-3}\ \text{m} = 9.5 \text{ mm}\ \ (0.376\text{ in.})$$