

$$\nu = -\frac{\varepsilon_x}{\varepsilon_z} = -\frac{\frac{\Delta d}{d_0}}{\frac{\sigma}{E}}$$

which leads to the following:

$$-\frac{\Delta d}{d_0} = \frac{\nu \sigma}{E}$$

Using values for  $\nu$  and  $E$  found in Table 6.1 for the six metal alloys that satisfy the criterion for part (a), and for  $\sigma = 50$  MPa, we are able to compute a  $-\frac{\Delta d}{d_0}$  for each alloy as follows:

$$-\frac{\Delta d}{d_0} (\text{brass}) = \frac{(0.34)(50 \times 10^6 \text{ N/m}^2)}{97 \times 10^9 \text{ N/m}^2} = 1.75 \times 10^{-4}$$

$$-\frac{\Delta d}{d_0} (\text{copper}) = \frac{(0.34)(50 \times 10^6 \text{ N/m}^2)}{110 \times 10^9 \text{ N/m}^2} = 1.55 \times 10^{-4}$$

$$-\frac{\Delta d}{d_0} (\text{titanium}) = \frac{(0.34)(50 \times 10^6 \text{ N/m}^2)}{107 \times 10^9 \text{ N/m}^2} = 1.59 \times 10^{-4}$$

$$-\frac{\Delta d}{d_0} (\text{nickel}) = \frac{(0.31)(50 \times 10^6 \text{ N/m}^2)}{207 \times 10^9 \text{ N/m}^2} = 7.49 \times 10^{-5}$$

$$-\frac{\Delta d}{d_0} (\text{steel}) = \frac{(0.30)(50 \times 10^6 \text{ N/m}^2)}{207 \times 10^9 \text{ N/m}^2} = 7.25 \times 10^{-5}$$

$$-\frac{\Delta d}{d_0} (\text{tungsten}) = \frac{(0.28)(50 \times 10^6 \text{ N/m}^2)}{407 \times 10^9 \text{ N/m}^2} = 3.44 \times 10^{-5}$$

Thus, the brass, copper, and titanium alloys will experience a negative transverse strain greater than  $1.53 \times 10^{-4}$ . This means that the following alloys satisfy the criteria for both parts (a) and (b) of this problem: nickel, steel, and tungsten.