6.17 This problem asks that we compute the original length of a cylindrical specimen that is stressed in compression. It is first convenient to compute the lateral strain ε_x as

$$\varepsilon_x = \frac{\Delta d}{d_0} = \frac{30.04 \text{ mm} - 30.00 \text{ mm}}{30.00 \text{ mm}} = 1.33 \times 10^{-3}$$

In order to determine the longitudinal strain ε_z we need Poisson's ratio, which may be computed using Equation 6.9; solving for ν yields

$$\nu = \frac{E}{2G} - 1 = \frac{65.5 \times 10^3 \text{ MPa}}{(2)(25.4 \times 10^3 \text{ MPa})} - 1 = 0.289$$

Now ε_z may be computed from Equation 6.8 as

$$\varepsilon_z = -\frac{\varepsilon_x}{\nu} = -\frac{1.33 \times 10^{-3}}{0.289} = -4.60 \times 10^{-3}$$

Now solving for l_0 using Equation 6.2

$$l_0 = \frac{l_i}{1 + \varepsilon_z}$$

$$= \frac{105.20 \text{ mm}}{1 - 4.60 \times 10^{-3}} = 105.69 \text{ mm}$$