49. ***REASONING AND SOLUTION***

a. Equation 20.14 gives

$$I = \frac{V}{R} = \frac{120\ \text{V}}{240\ \Omega} = \boxed{0.50\ \text{A}}$$

b. Since there is no inductor, Equations 23.6 and 23.7 apply with $X_\text{L} = 0\ \Omega$. Therefore, the current is $I = V/Z = V/\sqrt{R^2 + X_\text{C}^2}$. Using Equation 23.2 for X_C, we find

$$I = \frac{V}{\sqrt{R^2 + \left(\dfrac{1}{2\pi f C}\right)^2}} = \frac{120\ \text{V}}{\sqrt{(240\ \Omega)^2 + \left[\dfrac{1}{2\pi(60.0\ \text{Hz})(10.0 \times 10^{-6}\ \text{F})}\right]^2}} = \boxed{0.34\ \text{A}}$$

c. When an inductor is present, Equations 23.6 and 23.7 give the current as $I = V/Z = V/\sqrt{R^2 + (X_\text{L} - X_\text{C})^2}$. This expression reduces to $I = V/R$ when $X_\text{L} = X_\text{C}$. Using Equations 23.2 and 23.4 for the reactances, we find that

$$2\pi f L = \frac{1}{2\pi f C} \quad \text{or} \quad L = \frac{1}{4\pi^2 f^2 C} = \frac{1}{4\pi^2 (60.0\ \text{Hz})^2 (10.0 \times 10^{-6}\ \text{F})} = \boxed{0.704\ \text{H}}$$

$\boxed{\text{Yes,}}$ it is possible to return the current to the value calculated in part (a).