4. Mass flow rate ($\dot{m}$)

$$\dot{m} = C_d A_0 \left[\frac{2\rho\Delta P}{1-\beta^4}\right]^{0.5}$$

$$\frac{\delta\dot{m}}{\dot{m}} = \left[\left(\frac{\delta C_d}{C_d}\right)^2 + \left(\frac{\delta A_0}{A_0}\right)^2 + \frac{1}{4}\left(\frac{\delta\rho}{\rho}\right)^2 + \frac{1}{4}\left(\frac{\delta(\Delta P)}{(\Delta P)}\right)^2 + \frac{1}{4}\left(\frac{\delta\beta}{\beta}\right)^2\right]^{0.5}$$

$$= \left[(0.016)^2 + (0.00526)^2 + \frac{1}{4}(0.0083)^2 + \frac{1}{4}\left(\frac{1}{25}\right)^2 + \frac{1}{4}(0.00121)^2\right]^{0.5}$$

= 0.0437 or 4.37%

5. Useful heat gain (Q_u)

$$Q_u = \dot{m} C_p (T_o - T_i)$$

$$\frac{\delta Q_u}{Q_u} = \left[\left(\frac{\delta\dot{m}}{\dot{m}}\right)^2 + \left(\frac{\delta Cp}{Cp}\right)^2 + \left(\frac{\delta(\Delta T)}{(\Delta T)}\right)^2\right]^{0.5}$$

$=[(0.0437)^2 + (1/1005)^2 + (0.5/15.2)^2]^{0.5}$

= 0.0547 or 5.47%

6. Heat transfer coefficient ($\bar{h}$)

$$\bar{h} = \frac{Q_u}{A_p (T_{pm} - T_{fm})}$$

$$\frac{\delta\bar{h}}{\bar{h}} = \left[\left(\frac{\delta Q_u}{Q_u}\right)^2 + \left(\frac{\delta A_p}{A_p}\right)^2 + \left(\frac{\delta T_{pf}}{T_{pf}}\right)^2\right]^{0.5}$$

$$= \left[(0.0547)^2 + (0.00358)^2 + \left(\frac{1}{12}\right)^2\right]^{0.5}$$

=0.09974 or 9.974%