

Answer on Question #59667-Engineering-Chemical Engineering

A mixture of isomeric Diphenyl and Dichloro Tetrachloroethane is used as a Thermic fluid in a liquid phase heating system. The thermic fluid enters an indirect fired heater at a temperature of 450 K and leaves the heater at a temperature of 550 K. Calculate the supply of heat to the heater per kg of the liquid heated. The heat capacity of the fluid is given by the equation:

$$C_p = 1.435 + 2.19 \cdot 10^{-3}T, \frac{kJ}{kg \ K}$$

Solution

$$Q = m \int_{T_1}^{T_2} C dT = m \int_{T_1}^{T_2} (1.435 + 2.19 \cdot 10^{-3}T) dT = m \left[1.435 (T_2 - T_1) + \frac{2.19 \cdot 10^{-3}}{2} (T_2^2 - T_1^2) \right].$$

Where $m = 1 \ kg$, $T_1 = 450 \ K$, $T_2 = 550 \ K$.

$$Q = 1 \left[1.435 (550 - 450) + \frac{2.19 \cdot 10^{-3}}{2} (550^2 - 450^2) \right] = 253 \frac{kJ}{kg}.$$