Formel nach L umstellen

1 Wärmestrom Dampf

$$\dot{Q} = \frac{2\pi \cdot L}{\frac{1}{\alpha_A \cdot r_1} + \sum_{i=1}^{n} \frac{1}{\lambda_i} \ln\left(\frac{r_{i+1}}{r_i}\right) + \frac{1}{\alpha_B \cdot r_{n+1}}} \cdot \Delta T_{ln}$$

$$\dot{Q}_D = \frac{2\pi \cdot L}{\frac{1}{\alpha_{A_1} \cdot r_1} + \frac{1}{\lambda_2} \ln\left(\frac{r_2}{r_1}\right) + \frac{1}{\alpha_{B_1} \cdot r_2}} \cdot \Delta T_{ln}$$

$$\alpha_{A_1} = \frac{Nu_d \cdot \lambda_2}{d}$$

$$\dot{Q}_D = \frac{2\pi \cdot L}{\frac{1}{\frac{Nu_d \cdot \lambda_1}{d} \cdot r_1} + \frac{1}{\lambda_2} \ln\left(\frac{r_2}{r_1}\right) + \frac{1}{\alpha_{B_1} \cdot r_2}} \cdot \Delta T_{ln}$$

$$Nu_d = \frac{\frac{\xi}{8} \cdot Re_{d_i} \cdot Pr}{1 + 12{,}7 \cdot \sqrt{\frac{\xi}{8}} \cdot \left(Pr^{\frac{2}{3}} - 1\right)} \cdot f_1 \cdot f_2$$

$$\dot{Q}_D = \frac{2\pi \cdot L}{\frac{1}{\frac{\frac{\xi}{8} \cdot Re_{d_i} \cdot Pr}{1 + 12{,}7 \cdot \sqrt{\frac{\xi}{8}} \cdot \left(Pr^{\frac{2}{3}} - 1\right)} \cdot f_1 \cdot f_2 \cdot \lambda_1}{d} \cdot r_1} + \frac{1}{\lambda_2} \ln\left(\frac{r_2}{r_1}\right) + \frac{1}{\alpha_{B_1} \cdot r_2}} \cdot \Delta T_{ln}$$

$$f_1 = 1 + \left(\frac{d_i}{L}\right)^{\frac{2}{3}}$$

$$\dot{Q}_D = \frac{2\pi \cdot L}{\frac{1}{\frac{\frac{\xi}{8} \cdot Re_{d_i} \cdot Pr}{1 + 12{,}7 \cdot \sqrt{\frac{\xi}{8}} \cdot \left(Pr^{\frac{2}{3}} - 1\right)} \cdot \left(1 + \left(\frac{d_i}{L}\right)^{\frac{2}{3}}\right) \cdot f_2 \cdot \lambda_1}{d} \cdot r_1} + \underbrace{\frac{1}{\lambda_2} \ln\left(\frac{r_2}{r_1}\right) + \frac{1}{\alpha_{B_1} \cdot r_2}}_{E}} \cdot \Delta T_{ln}$$

$$A = 2\pi \cdot \Delta T_{ln}$$

$$B = \frac{\frac{\xi}{8} Re_{d_i} \cdot Pr}{1 + 12{,}7 \cdot \sqrt{\frac{\xi}{8}} \left(Pr^{2/3} - 1\right)} \cdot f_2 \cdot \lambda_1$$

$$D = \frac{r_1}{d}$$

$$E = \frac{1}{\lambda_2} \ln\left(\frac{r_2}{r_1}\right) + \frac{1}{\alpha_{B_1} \cdot r_2}$$

Falls dieses Terms konstant sind:

$$Q = \frac{A \cdot L}{\frac{1}{\frac{B\left(1 + \left(\frac{D}{L}\right)^{2/3}\right)}{D}} + E}$$