

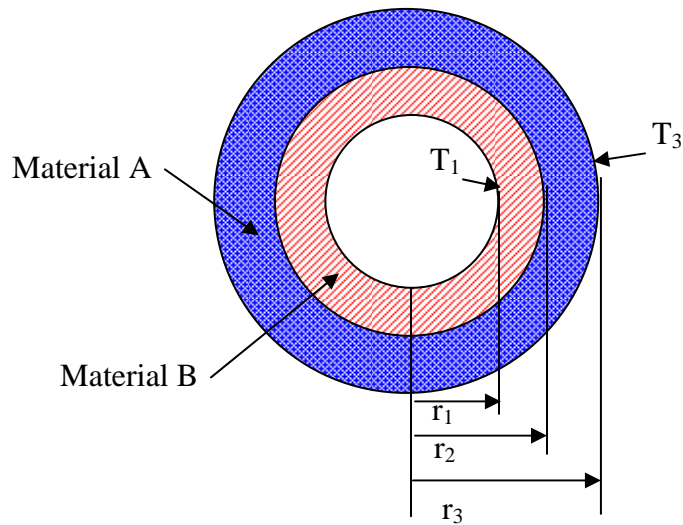
COMPOSITE CYLINDRICAL TUBE

Recall for a single-layer pipe:

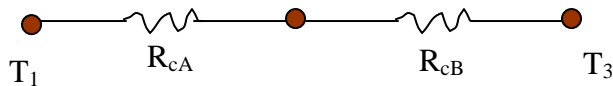
$$q_r = \frac{2\pi Lk(T_i - T_o)}{\ln\left(\frac{r_o}{r_i}\right)}$$

and resistance due to conduction

$$R_c = \frac{\ln\left(\frac{r_o}{r_i}\right)}{2\pi Lk}$$



Thermal resistance diagram:



For the composite pipe shown in the diagram

The individual resistance values are:

$$R_{cB} = \frac{\ln\left(\frac{r_3}{r_2}\right)}{2\pi Lk_B}$$

and, referring to the resistance diagram,

Substituting the resistance terms

$$q_r = \frac{T_1 - T_3}{\frac{\ln \frac{r_2}{r_1}}{2\pi L k_A} + \frac{\ln \frac{r_3}{r_2}}{2\pi L k_B}}$$