

Answer on Question #42654-Physics-Electric Circuits

Two heater coils A and B made of the same material are connected in parallel across the same mains. The length and diameter of the wire used in A are double as that of the wire used in B. If H_1 and H_2 be the quantities of heat liberated per second in A and B respectively, then $H_1 : H_2 =$

A 1 : 4 B 2 : 1 C 1 : 2 D 1 : 1

Solution

The quantity of heat liberated per second in A is

$$H_1 = \frac{V^2}{R_1},$$

where

$$R_1 = \frac{\rho l_1}{A_1} = \frac{\rho l_1}{\frac{\pi d_1^2}{4}}.$$

The quantity of heat liberated per second in B is

$$H_2 = \frac{V^2}{R_2},$$

where

$$R_2 = \frac{\rho l_2}{A_2} = \frac{\rho l_2}{\frac{\pi d_2^2}{4}}.$$

Then

$$\frac{H_1}{H_2} = \frac{\frac{V^2}{R_1}}{\frac{V^2}{R_2}} = \frac{R_2}{R_1} = \frac{\frac{\rho l_2}{\frac{\pi d_2^2}{4}}}{\frac{\rho l_1}{\frac{\pi d_1^2}{4}}} = \frac{l_2}{l_1} \cdot \left(\frac{d_1}{d_2}\right)^2 = \frac{1}{2} \cdot 2^2 = 2.$$

Answer: B 2 : 1.