Electric bulb rated for 500 watts at 100 V is used in the circuit having 200 V supply. What is the resistance that must be put in series with the bulb so that the bulb will draw 500 watts?

Solution: If the bulb has a nominal power 500 W, we can calculate the resistance of this bulb: $P = \frac{V_n^2}{R_b}$, where P is the nominal power, W; V_n is the nominal voltage, V; R_b is the resistance of the bulb, Ω. $R_b = \frac{V_n^{\,2}}{P} = \frac{100^2}{500} = 20\ \Omega$. Nominal current through the bulb should be $I_n = \frac{V_n}{R_b} = \frac{100}{20} = 5$ A.

Then, total resistance at 200 V should correspond to the nominal current: $R_\Sigma = \frac{V}{I_n} = \frac{200}{5} = 40\ \Omega$.

As you know, total resistance of resistors in series is equal to the sum of their individual resistances: $R_\Sigma = R_b + R'$, where R' is the additional resistance. Then, $R' = R_\Sigma - R_b = 40 - 20 = 20\ \Omega$.

Answer: 20 Ω.