



Ohm's Law Formulae with Power and Impedance

A) Power = P

$$P = P_a \cdot \cos \theta$$

$$P = V \cdot I \cdot \cos \theta \cdot \sqrt{\emptyset}$$

$$P = \frac{V^2 \cdot \cos^2 \theta \cdot \sqrt{\emptyset}}{R}$$

$$P = \frac{V^2 \cdot \cos \theta \cdot \sqrt{\emptyset}}{Z}$$

$$P = I^2 \cdot R \cdot \sqrt{\emptyset}$$

$$P = I^2 \cdot Z \cdot \cos \theta \cdot \sqrt{\emptyset}$$

B) Apparent Power = Pa

$$P_a = \frac{P}{\cos \theta}$$

$$P_a = V \cdot I \cdot \sqrt{\emptyset}$$

$$P_a = \frac{V^2 \cdot \cos \theta \cdot \sqrt{\emptyset}}{R}$$

$$P_a = \frac{V^2 \cdot \sqrt{\emptyset}}{Z}$$

$$P_a = \frac{I^2 \cdot R \cdot \sqrt{\emptyset}}{\cos \theta}$$

$$P_a = I^2 \cdot Z \cdot \sqrt{\emptyset}$$

C) Current = I

$$I = \frac{P}{V * \cos\theta * \sqrt{\phi}}$$

$$I = \sqrt{\frac{P}{R * \sqrt{\phi}}}$$

$$I = \sqrt{\frac{P}{Z * \cos\theta}}$$

$$I = \frac{P_2}{V * \sqrt{\phi}}$$

$$I = \sqrt{\frac{P_2 * \cos\theta}{R * \sqrt{\phi}}}$$

$$I = \sqrt{\frac{P_2}{Z}}$$

$$I = \frac{V * \cos\theta}{R}$$

$$I = \frac{V}{Z}$$

D) Voltage = V

$$V = \frac{P}{I \cdot \cos\theta \cdot \sqrt{\phi}}$$

$$V = \sqrt{\frac{P \cdot R}{\sqrt{\phi}}} \cos\theta$$

$$V = \sqrt{P \cdot Z \cdot \cos\theta}$$

$$V = \frac{P_a}{I \cdot \sqrt{\phi}}$$

$$V = \sqrt{\frac{P_a \cdot R \cdot \cos\theta}{\sqrt{\phi}}}$$

$$V = \sqrt{P_a \cdot Z \cdot \cos\theta^2}$$

$$V = I \cdot Z$$

$$V = \frac{R}{\cos\theta}$$

E) Resistance = R

$$R = \frac{V^2 \cdot \cos\theta^2 \cdot \sqrt{\phi}}{P}$$

$$R = \frac{P}{I^2 \cdot \sqrt{\phi}}$$

$$R = Z \cdot \cos\theta$$

$$R = \frac{V^2 \cdot \cos\theta \cdot \sqrt{\phi}}{P_a}$$

$$R = \frac{V \cdot \cos\theta}{I}$$

F) Impedance = Z

$$Z = \frac{V^2 \cdot \cos\theta \cdot \sqrt{\emptyset}}{P}$$

$$Z = \frac{P}{I^2 \cdot \cos\theta \cdot \sqrt{\emptyset}}$$

$$Z = \frac{V^2 \cdot \sqrt{\emptyset}}{P_a}$$

$$Z = \frac{P_a}{I^2 \cdot \sqrt{\emptyset}}$$

$$Z = \frac{V}{I}$$

$$Z = \frac{R}{\cos\theta}$$

Footnote: $\sqrt{\emptyset}$ is a tricky method of compensating for 1 and 3 phase power differences. The square root of 1 is 1 for single phase and 1.73 for three phase. Use 2 in place of $\sqrt{\emptyset}$ for 2 phase 4-wire and 1.414 (sqrt(2)) for 2 phase 3-wire.