

# Basic Electrical Engineering Formulas And Equations

## Electrical Formulas

These are the Basic Electrical Formulas Related to Ohm's Law.

Variables used in these formulas are as follows:

V = Voltage in Volts

I = Current in Amperes

R = Resistance in Ohms

Power = In Watts

### Voltage Formulas

$$V=IR, \quad V=PI, \quad V= \sqrt{P \times R}$$

### Current Formulas

$$I = V/R, \quad I=PV, \quad I= \sqrt{P/R}$$

### Resistance Formulas

$$R=V/I, \quad R=P/I^2, \quad R=V/I^2$$

### Power Formulas

$$P=VI, \quad P=I^2R, \quad P=V^2/R$$

Following are several additional formulas, which are useful for calculating Current, Horsepower, kW, and kVA for both Single Phase & Three Phase AC Current.

HP= Horsepower

EFE = Efficiency Factor ( Use 0.9 when not mentioned)

PF=Power Factor ( Use 0.8 when not mentioned)

## AC = Alternating Current

| To Find:                         | Single-Phase                                   | Three Phase  |
|----------------------------------|--|--|
| Current, when Motor Hp is known  | $\frac{HP \times 746}{V \times EFE \times PF}$ | $\frac{HP \times 746}{V \times EFE \times PF \times 1.73}$ |
| Ampers, when kW is known         | $\frac{kW \times 1000}{V \times PF}$           | $\frac{kW \times 1000}{V \times PF \times 1.73}$           |
| Current, when kVA is Known       | $\frac{kVA \times 1000}{V}$                    | $\frac{kVA \times 1000}{V \times 1.73}$                    |
| kIowatts (kW)                    | $\frac{V \times I \times PF}{1000}$            | $\frac{V \times I \times PF \times 1.73}{1000}$            |
| kW input, when Motor HP is Known | $\frac{HP \times 0.746}{EFE}$                  | $\frac{HP \times 0.746}{EFE}$                              |
| kilovolt-Amperes (kVA)           | $\frac{V \times I}{1000}$                      | $\frac{V \times I \times 1.73}{1000}$                      |
| Horsepower (HP)                  | $\frac{V \times I \times EFE \times PF}{746}$  | $\frac{V \times I \times EFE \times PF \times 1.73}{746}$  |

## Useful Electrical Formulas

| To Obtain  | Single Phase   | Three Phase   |
|--|--|---|
| kIowatts   | $\frac{V \times L \times PF}{1000}$                            | $\frac{1.732 \times V \times L \times PF}{1000}$                            |
| kV-A   | $\frac{V \times L}{1000}$                                      | $\frac{1.732 \times V \times L}{1000}$                                      |
| Horsepower required when generator kW unknown (if generator efficiency is unknown, use 0.93) | $\frac{kW}{0.746 \times \text{Efficiency (Generator)}}$        | $\frac{kW}{0.746 \times \text{Efficiency (Generator)}}$                     |
| kW input when motor hp known (if motor efficiency is unknown, use 0.85 x hp)                 | $\frac{HP \times 0.746}{\text{Efficiency (Motor)}}$            | $\frac{HP \times 0.746}{\text{Efficiency (Motor)}}$                         |
| Ampers when motor hp is known  | $\frac{HP \times 0.746}{V \times PF \times \text{Efficiency}}$ | $\frac{HP \times 0.746}{1.732 \times V \times PF \times \text{Efficiency}}$ |
| Ampers when kW is known  | $\frac{kW \times 1000}{V \times PF}$                           | $\frac{kW \times 1000}{1.732 \times V \times PF}$                           |
| Ampers when kV-A is known  | $\frac{kV-A \times 1000}{V}$                                   | $\frac{kV-A \times 1000}{1.732 \times V}$                                   |

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