

# 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

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

### 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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