

# Electrical Formulas For Finding Amperes, Horsepowers, Kilowatts and kVA

To Find	Single-Phase	Alternating Current Two-Phase <sup>1)</sup> , Four-Wire	Three-Phase	Direct Current
Kilowatts	$\frac{I \times E \times pf}{1000}$	$\frac{I \times E \times 2 \times pf}{1000}$	$\frac{I \times E \times 1.73 \times pf}{1000}$	$\frac{I \times E}{1000}$
kVA	$\frac{I \times E}{1000}$	$\frac{I \times E \times 2}{1000}$	$\frac{I \times E \times 1.73}{1000}$	—
Horsepower (Output)	$\frac{I \times E \times \% \text{ EFF} \times pf}{746}$	$\frac{I \times E \times 2 \times \% \text{ EFF} \times pf}{746}$	$\frac{I \times E \times 1.73 \times \% \text{ EFF} \times pf}{746}$	$\frac{I \times E \times \% \text{ EFF}}{746}$
Amperes when Horsepower is Known	$\frac{HP \times 746}{E \times \% \text{ EFF} \times pf}$	$\frac{HP \times 746}{2 \times E \times \% \text{ EFF} \times pf}$	$\frac{HP \times 746}{1.73 \times E \times \% \text{ EFF} \times pf}$	$\frac{HP \times 746}{E \times \% \text{ EFF}}$
Amperes when Kilowatts is Known	$\frac{KW \times 1000}{E \times pf}$	$\frac{KW \times 1000}{2 \times E \times pf}$	$\frac{KW \times 1000}{1.73 \times E \times pf}$	$\frac{KW \times 1000}{E}$
Amperes when kVA is Known	$\frac{kVA \times 1000}{E}$	$\frac{kVA \times 1000}{2 \times E}$	$\frac{kVA \times 1000}{1.73 \times E}$	—

## Average Efficiency and Power Factor Values of Motors

When the actual efficiencies and power factors of the motors to be controlled are not known, the following approximations may be used.

### Efficiencies<sup>2)</sup>

Type	Power Factor
DC motors, 35 horsepower and less	80% to 85%
DC motors, above 35 horsepower	85% to 90%
Synchronous motors (at 100% power factor)	92% to 95%
"Apparent" Efficiencies (= Efficiency × Power Factor); Three-phase induction motors, 25 horsepower and less	70%
Three-phase induction motors above 25 horsepower	80%

## Fault-Current Calculation on Low-Voltage AC Systems

In order to determine the maximum interrupting rate of the circuit breakers in a distribution system, it is necessary to calculate the current which could flow under a three-phase bolted short circuit condition. For a three-phase system the maximum available fault current at the secondary side of the transformer can be obtained by use of the formula:

$$I_{sc} = \frac{kVA \times 100}{KV \times \sqrt{3} \times \% Z}$$

where:

$I_{sc}$  = Symmetrical RMS amperes of fault current.

kVA = Kilovolt-ampere rating of transformers.

KV = Secondary voltage in kilovolts.

% Z = Percent impedance of primary line and transformer.

1) In three-wire, two-phase circuits the current in the common conductor is 1.41 times that in either other conductor.

E = Volts I = Amperes

% EFF = Percent Efficiency pf = Power Factor

2) These figures may be decreased slightly for single-phase and two-phase induction motors.

<http://waterheatertimer.org/Figure-Volts-Amps-Watts-for-water-heater.html>