# Formulas

## Measurement unit abbreviations

| | |
|---|---|
| E | voltage |
| hp | horsepower |
| I | current |
| P | power |
| PF | power factor |
| R | resistance |
| RMS | root mean square |
| VA | apparent power |
| W | watts |

## Constants

| | |
|---|---|
| $\sqrt{2}$ | 1.41 |
| $\sqrt{3}$ | 1.73 |
| π | 3.14 |

## Formulas

| Descriptions | Full | Abbreviated |
|---|---|---|
| Area of circle | pi × radius squared | $\pi r^2$ |
| Current | $\frac{\text{voltage}}{\text{resistance}}$ | $\frac{E}{R}$ |
| $\text{Current}_{(\text{average})}$ (full wave) | $\text{current}_{(\text{maximum})} \times 0.6365$ | $I_{(max)} \times 0.6365$ |
| $\text{Current}_{(\text{root meansquare})}$ | $\text{current}_{(\text{maximum})} \times 0.7071$ | $I_{(max)} \times 0.7071$ |
| Force | area × pressure | |

**Formulas (continued)**

| | | |
|---|---|---|
| Frequency | $\frac{\text{poles} \times \text{speed}}{120}$ | |
| Line current ($I_{line}$) | $\frac{\text{apparent power}}{(\text{line voltage} \times \sqrt{3})}$ | $\frac{\text{VA}}{(E_{line} \times \sqrt{3})}$ |
| Line current ($I_{line}$) (delta) | phase current $\times \sqrt{3}$ | $I_{phase} \times \sqrt{3}$ |
| Line voltage ($E_{line}$) (wye) | phase voltage $\times \sqrt{3}$ | $E_{phase} \times \sqrt{3}$ |
| Peak | root mean square $\times \sqrt{2}$ | RMS $\times \sqrt{2}$ |
| Power | current squared $\times$ resistance | $I^2 \times R$ |
| Power | horsepower $\times$ 746 watts | hp $\times$ 746 W |
| Power | voltage $\times$ current $\times$ power factor | $E \times I \times PF$ |
| Power | $\frac{\text{voltage squared}}{\text{resistance}}$ | $\frac{E^2}{R}$ |
| Power factor | cosine $\times$ angle | cos $\times$ angle |
| Power factor | $\frac{\text{true power}}{\text{apparent power}}$ | $\frac{P}{VA}$ |
| Resistance | $\frac{\text{voltage squared}}{\text{power}}$ | $\frac{E^2}{P}$ |
| Short circuit current ($I_{short\text{-}circuit}$) | $\frac{\text{secondary current}}{\text{impedance}}$ | $\frac{I_{secondary}}{\%Z}$ |
| Total power ($P_{total}$) | line voltage $\times$ line current $\times$ power factor $\times \sqrt{3}$ | $E_{line} \times I_{line} \times PF \times \sqrt{3}$ |
| Total power ($P_{total}$) | phase voltage $\times$ phase current $\times$ power factor $\times$ 3 | $E_{phase} \times I_{phase} \times PF \times 3$ |

**Formulas (continued)**

| | | |
|---|---|---|
| Tum ratio | $\frac{\text{number of primary turns}}{\text{number of secondary turns}} = \frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{current in the secondary}}{\text{current in the primary}}$ | $\frac{N_p}{N_s} = \frac{E_p}{E_s} = \frac{I_s}{I_p}$ |
| Volt - amperes | line voltage $\times$ line current $\times \sqrt{3}$ | $E_{line} \times I_{line} \times \sqrt{3}$ |
| Volt - amperes | phase voltage $\times$ phase current $\times$ 3 | $E_{phase} \times I_{phase} \times 3$ |