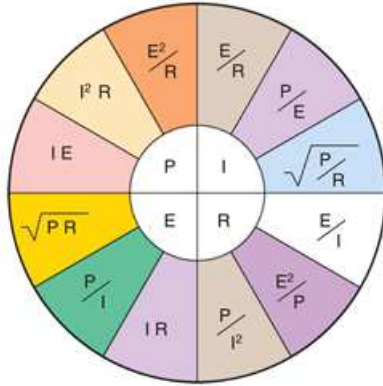


Instrumentation Formulas

For use with the following assessments:

- Instrumentation Fitter V4
- Instrumentation Technician V4

Power Formulas



Resistance Formulas

$$TR = R1 + R2 + R3...$$

$$TR = \frac{1}{(1/R1) + (1/R2) + (1/R3)}$$

Temperature Formulas

$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$$

Pressure Formulas

$$\text{PSI} = 2.77 \text{ 'H}_2\text{O}$$

$$\text{PSIA} = \text{PSIG} + 14.7 \text{ PSI}$$

Absolute pressure = Barometric pressure – gauge

Updated: 4/14/21

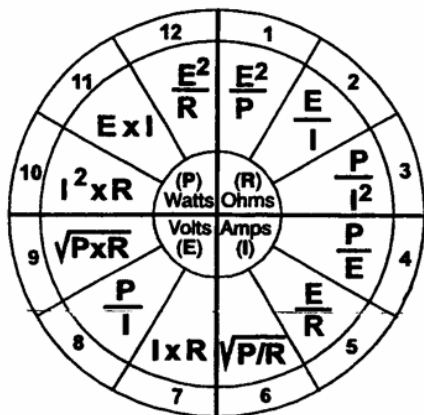
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Electrical Formulas

General Formulas

The following formula wheel can be used for all direct current circuits and alternating current circuits with unity power factor.



Voltage Drop Formulas

$$\text{Voltage Drop (1}\varnothing\text{)} = \frac{2 \times L \times K \times I}{\text{CM}}$$

$$\text{Voltage Drop (3}\varnothing\text{)} = \frac{1.732 \times L \times K \times I}{\text{CM}}$$

K = direct current resistance for a 1,000 circular mil conductor 1,000 feet long operating at 75°C..

K = 12.9 ohms for copper

K = 21.2 ohms for aluminum

(From NEC - Chapter 9, Table 8)

L = One way length of circuit in feet

I = Current in conductor in amperes

$$\text{Voltage Drop (1}\varnothing\text{)} = R \times I$$

R = Resistance of both conductors

$$\text{Voltage Drop (3}\varnothing\text{)} = R \times I \times 1.732$$

R = Resistance of one conductor

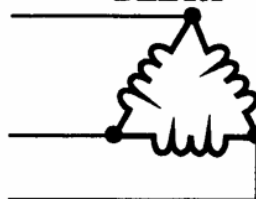
Note 1 - Use copper conductors for all problems, unless otherwise specified.

Note 2 - One horse power is equal to 746 watts.

Note 3 - Power factor (P.F.) = $\cos \theta = R/Z$, Z = Impedance.

Note 4 - Efficiency = Output/Input

DELTA



$$V_L = V \text{ Line} = \text{Source Voltage}$$

$$V_P = V \text{ Phase} = \text{Phase Voltage}$$

$$V_L = V_P$$

$$I_L = I \text{ Line} = \text{Line Current}$$

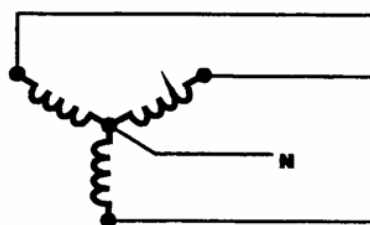
$$I_P = I \text{ Phase} = \text{Phase Current}$$

$$I_L = I_P \times 1.732$$

$$I_P = I_L / 1.732$$

$$\begin{aligned} \text{Power} = W &= \sqrt{3} \times V_L I_L \cos \theta \\ &= 3 I_P^2 R \\ &= 3 V_P I_P \cos \theta \end{aligned}$$

WYE



$$V_L = V \text{ Line} = \text{Source Voltage}$$

$$V_P = V \text{ Phase} = \text{Phase Voltage}$$

$$V_L = V_P \times 1.732$$

$$I_L = I \text{ Line} = \text{Line Current}$$

$$I_P = I \text{ Phase} = \text{Phase Current}$$

$$I_L = I_P$$

$$\begin{aligned} \text{Power} = W &= \sqrt{3} \times V_L I_L \cos \theta \\ &= 3 I_P^2 R \\ &= 3 V_P I_P \cos \theta \end{aligned}$$

$$\text{Power Factor} = \frac{\text{True Power}}{\text{Apparent Power}}$$