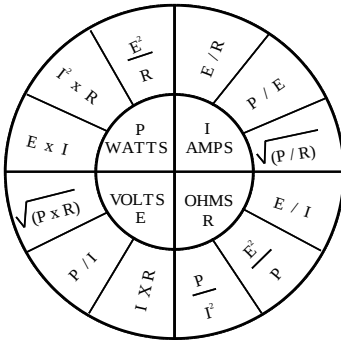


Math Formulas



$$E = I \times R$$

$$R = E / I$$

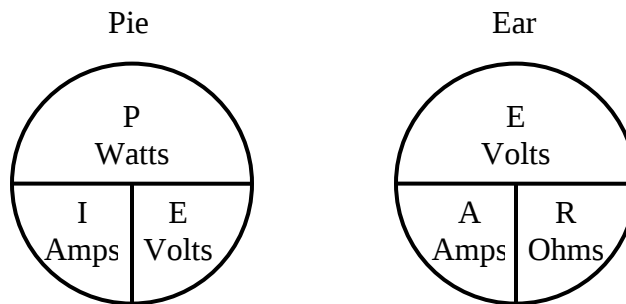
$$I = E / R$$

$$P = I^2 R$$

$$E^2 / R$$

$$\text{Power} = E \times I$$

Pioneer



Series Circuits

Wattage, resistance and voltage are additive

Parallel Circuits

$$R_T = 1 / (1/R_1 + 1/R_2 \dots R_N)$$

If equal parallel: $\frac{\text{Resistance of One Resistor}}{\text{Number of Resistors}}$

Unequal Parallel: $\frac{R_1 \times R_2}{R_1 + R_2}$

$$746 \text{ W} = 1 \text{ HP}$$

$$\text{Efficiency} = \text{Output} / \text{Input}$$

Maximum or Peak Voltage or Amperage = Indicated RMS Voltage / .707
or Indicated RMS Amperage / .707

$$\text{Neutral Current (Wye)} = \sqrt{A^2 + B^2 + C^2 - (A \times B + A \times C + B \times C)}$$

Voltage Drops

Basic Formulas: $VD = \frac{2 \times K \times I \times D}{CM}$

$VD = I \times R$ (Ohm's Law)

Algebraic Transformation gives the following:

$$CM = \frac{2 \times K \times I \times D}{VD}$$

$$D = \frac{CM \times VD}{2 \times K \times I}$$

$$I = \frac{CM \times VD}{2 \times K \times D}$$

VD = Voltage Drop (IN's)

CM = Circular Mils (Table 8)

I = Current in Amps

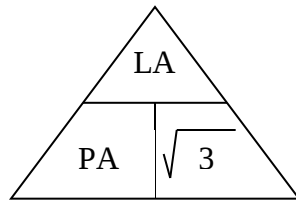
D = Distance in feet ONE WAY

Use the "2" for single-phase

Use 1.732 ($\sqrt{3}$ for 3-phase circuits)

*K = approximate K – 12.9 Cu, 21.2 Al

3 Phase Transformers



Delta Rules

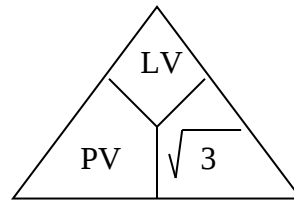
Phase Voltage = Line Voltage

Line Voltage = Voltage between any 2 lines (not neutral line)

Line Amps = Phase Amps x 1.732

Phase Amps = Line Amps / 1.732

In a Delta System, the line Amps will always be larger than the Phase Amps



Wye or Star Rules

Phase Current = Line Current

Line Voltage = Phase Voltage x 1.732

Phase Voltage = Line Voltage / 1.732

Motor Rules

1. FLC Tables 430.247 DC, 430. 248 1ΦAC, 430.250 3ΦAC
2. Thermal "Heater" Overload protection – Standard 430.32(A)(1), Maximum 430.32(C)
3. Branch circuit wire size 430.22 FLC x 125% Ampacity Table 310.15(B)(16)
4. Branch Circuit Short-Circuit and Ground-Fault Protection Table 430.52, Standard OCPD 240.6 Go↑
5. Feeder Conductor Size 430.24, Largest FLC x 125% + all other FLC's on same feeder
6. Feeder OCPD 430.62, Largest OCPD + all other FLC's on same feeder. Go ↓

Dwelling Services (See Annex D)

1. Table 220.12 SF x 3 VA
2. 220.52 Small Appliance Load 2 x 1,500 = 3,000 VA
Laundry Load 1,500 VA
3. Table 220.42 Apply Lighting Load to Steps 1 & 2
4. 220.60 Non-coincident Loads – Compare A/C vs Heating. Use Largest
5. 220.53 75% Demand on 4 or more Fastened-in-Place Appliances
6. 220.54 Dryers 5 KW Minimum 220.18. 220.61 Neutral Demand 70%
7. Table 220.55 Range Calculations. 220.61 Neutral Demand 70%
8. 220.14(C) Add an additional 25% of Largest Motor
9. 310.15(B)(7), 240.6 Size the service entrance conductor. Size the Service
10. Table 250.66 Grounding Electrode Conductor