IMPORTANT ELECTRICAL EQUATIONS

Capacitors

Capacitive Reactance in Ohms = $X_C = 1/(2 \times 3.14 \times f \times C)$

Parallel Impedance in Ohms = $Z = X_{C1} + X_{C2} + X_{C3}...$

Series Impedance in Ohms = $Z = 1/(1/X_{C1}) + (1/X_{C2})...$

Current, Amperes (I)

Single-Phase = $I = P/E$ Three-Phase = $I = P/(E_{L\text{-}L} \times 1.732)$

Efficiency

Efficiency = Output/Input   Input = Output/Efficiency

Output = Input × Efficiency

Inductors

Inductive Reactance in Ohms = $X_L = 2 \times 3.14 \times f \times L$

Parallel Impedance in Ohms = $Z = 1/(1/X_{L1}) + (1/X_{L2}) + (1/X_{L3})$

Series Impedance in Ohms = $Z = X_{L1} + X_{L2} + X_{L3}$

Impedance (Z)

Impedance in Ohms = $Z = \sqrt{R^2 + (X_L^2 - X_C^2)}$

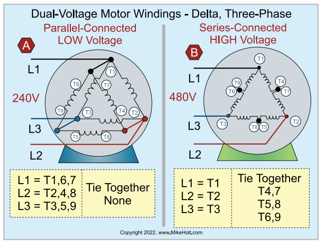
Motor FLA/Watts

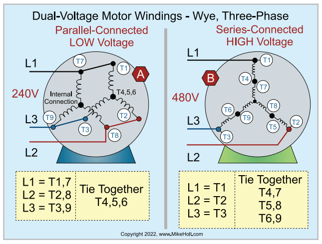
FLA, Single-Phase = (hp × 746W)/(E × Eff × PF)

FLA, Three-Phase = (hp × 746W)/(E × 1.732 × Eff × PF)

Watts = Horsepower × 746W

Motors, Dual-Voltage





Neutral Current

Single-Phase, 120/240V System: $I_{Neutral}$ = Line 1 – Line 2

Three-Phase, 120/208V, 4-wire Wye Connected System:

$I_{Neutral} = \sqrt{(I_{L1}^2 + I_{L2}^2 + I_{L3}^2) - (I_{L1} \times I_{L2}) - (I_{L2} \times I_{L3}) - (I_{L1} \times I_{L3})}$

Parallel Circuit Resistance

R_T = Resistance/Number of Resistors $R_T = (R_1 \times R_2)/(R_1 + R_2)$

$R_T = 1/(1/R_1 + 1/R_2 + 1/R_3)$

Power Factor

PF = W/VA   VA = W/PF   W = VA × PF

Series Circuit Resistance

$R_T = R_1 + R_2 + R_3...$ $E_T = E_1 + E_2 + E_3...$

Short-Circuit Calculation

Short-Circuit Current = Secondary Amperes/Transformer Z%

Temperature Conversions

C° = 5/9 × (Temp F° – 32°)   F° = (9/5 × Temp C°) + 32°

Transformers, Single-Phase

$I_{Primary}$ = Transformer VA/$E_{L\text{-}L}$ $I_{Secondary}$ = Transformer VA/$E_{L\text{-}L}$

Transformer VA = $E_{L\text{-}L} \times I_{Secondary}$

Transformers, Three-Phase

$I_{Primary}$ = Transformer VA/($E_{L\text{-}L}$ × 1.732)

$I_{Secondary}$ = Transformer VA/($E_{L\text{-}L}$ × 1.732)

Transformer VA = ($E_{L\text{-}L}$ × 1.732) × $I_{Secondary}$

Turns Ratio

Turns Ratio = Primary Volts:Secondary Volts

Secondary Volts = Primary Volts/Turns Ratio

Primary Volts = Secondary Volts × Turns Ratio

Volt-Amperes

Single-Phase = VA = E × I

Three-Phase = VA = ($E_{L\text{-}L}$ × 1.732) × I

Voltages

Peak Voltage = Effective (RMS) Voltage × 1.414

Effective (RMS) Voltage = Peak Voltage × 0.707

High-Leg Voltage = $V_{L\text{-}to\text{-}N}$ × 1.732

Voltage Drop, Single-Phase

Voltage Drop = (2 × K × I × D)/Cmil

Wire Size = (2 × K × I × D)/VD

Distance = (Cmil × VD)/(2 × K × I)

K = Cu, 12.90Ω – Al, 21.20Ω

Voltage Drop, Three-Phase

Voltage Drop = (1.732 × K × I × D)/Cmil

Wire Size = (1.732 × K × I × D)/VD

Distance = (Cmil × VD)/(1.732 × K × I)

K = Cu, 12.90Ω – Al, 21.20Ω