

Power Factor Correction Formulas

Nomenclature: C = Capacitance in μf

A = Current

KV = Kilovolts

E = Voltage

PF = Power Factor

A. Capacitors connected in parallel

$$C_{total} = C_1 + C_2 + C_3 + \dots + C_n$$

B. Capacitors Connected in series

$$C_{total} = \frac{C_1 * C_2}{C_1 + C_2}$$

For two capacitors in series

$$C_{total} = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots + \frac{1}{C_n}}$$

For more than two capacitors in series.

C. Reactance - X_c Capacitance

X_L Inductance

$$1. X_c = \frac{1}{(2\pi f)C} \text{ (C is in microfarads (10}^{-6}\text{))}$$

$$2. X_c = \frac{10^6}{(2\pi f)C}$$

$$3. X_c = \frac{KV^2 * 10^3}{KVAR}$$

$$4. X_l = (2\pi f)L$$

$$5. X_c = \frac{KV^2}{MVAR} \quad \text{OR,} \quad X_l = \frac{KV^2}{MVAR}$$

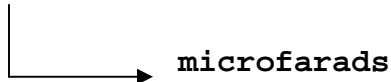
D. Capacitance

$$1. C = \frac{10^6}{(2\pi f)X_c}$$

$$2. C = \frac{KVAR * 10^9}{E^2 * (2\pi f)} \quad \text{or,} \quad C = \frac{KVAR * 10^3}{(2\pi f)(KV^2)}$$

E. Capacitive Kilovars

$$1. KVAR = \frac{E^2 * (2\pi f) * (C * 10^{-6})}{10^3}$$



$$2. KVAR = \frac{(2\pi f)C(KV^2)}{10^3}$$

$$3. KVAR = \frac{10^3(KV^2)}{X_c}$$

F. Miscellaneous

$$1. \text{ Power - Factor} = \text{Cos } f = \frac{KW}{KVA}$$

$$2. \text{ Tan } j = \frac{KVAR}{KW}$$

$$3. \text{ KW} = \frac{\sqrt{3} * E * A * PF}{10^3} \quad (\text{Three phase rating})$$

$$4. \text{ KVA} = \frac{\sqrt{3} * E * A}{10^3} \quad (\text{Three phase rating})$$

$$5. \text{ Line - Current} = \frac{KVA * 10^3}{\sqrt{3} * E} \quad (\text{Three phase rating})$$

$$6. \text{ KVA} = \frac{KW}{PF} \quad (\text{KW Motor input})$$

$$7. \text{ KW (Motor - Input)} = \frac{hp * 0.746}{\text{efficiency}}$$

$$8. \text{ Approximate Motor KVA} = \text{Motor HP (at full load)}$$

G. Additional Data

1. Simplified Voltage Rise

$$\% = \frac{KVAR * \%transformer - reac \tan ce}{KVA(transformer)}$$

2. Losses Reduction

$$\% LR = 100 - 100 \left(\frac{Original(pf)}{improved(pf)} \right)^2$$

3. Operation at other than rated voltage and frequency

$$KVAR(effective) = KVAR(rated) \left(\frac{LineVoltage}{Cap.Voltage} \right)^2$$

$$KVAR(effective) = KVAR(rated) \left(\frac{LineFreq.}{Cap.Freq.} \right)^2$$