CONTROLLING SYSTEM VOLTAGE

Without capacitors, the voltage drop across a system is calculated as:

$$Vd = \frac{kVA}{10(kV)^2}\,(R\cos\theta + X\sin\theta)$$

or

$$\%V_d = (\%R\cos\theta + \%X\sin\theta)\,kVA_{pu}$$

V_d = voltage drop across system leading to the load

kVA = 3-phase load kVA

kV = phase to phase voltage at load

cos theta = cosine of the power factor angle

R = resistance of system leading up to the load (ohms)

X = inductive reactance of the system leading up to the load (ohms)

The percent voltage rises at a load due to the addition of a capacitor bank is:

V_r = % voltage rise at load

kVAR = 3-phase capacitive kilovar

kV = phase to phase kilovolts

X = inductive reactance of the system

KVA_{sc} = 3-phase short circuit kVA

The percent voltage rises from primary to secondary of a transformer is:

$$V_r = \frac{(kVAr)}{kVA_t}$$

Where:

Vr = the percent voltage rises at the transformer

kVAR = 3-phase kilovar applied

kVA_t = 3-phase kVA of the transformer

X_t = transformer reactance in percent