How to calculate the power of capacitors

BASED ON ELECTRICITY BILLS

Calculation

To calculate the capacitor banks to be installed, use the following method:
- Select the month in which the bill is highest (kVArh to be billed)
- Assess the number of hours the installation operates each month
- Calculate the capacitor power Qc to be installed

$$Qc = \frac{\text{kVArh to be billed (monthly)}}{\text{No. of hours' operation (monthly)}}$$

Example

For the subscriber:
- Highest reactive energy bill: December
- Number of kVArh to be billed: 70,000
- Monthly operating times:

high-load + peak times = 350 hours

$$Qc \text{ (bank to be installed)} = \frac{70{,}000}{350} = 200 \text{ kVAr}$$

BASED ON MEASUREMENTS TAKEN ON THE HV/LV TRANSFORMER SECONDARY: PkW-cos φ

Example

An establishment supplied from an 800 KVA HV/LV subscriber station wanting to change the power factor of its installation to:

- Cos φ = 0.928 (tg φ = 0.4) at the primary
- I.e. Cos φ = 0.955 (tg φ = 0.31) at the secondary, with the following readings:
  - Voltage: 400 V 3-phase 50 HZ
  - PkW = 475
  - Cos (secondary) = 0.75 (i.e. tg φ = 0.88)

Qc (bank to be installed) =
PkW x (tg φ measured - tg φ to be obtained)
Qc = 475 x (0.88 - 0.31) = 270 kVAr

CALCULATION FOR FUTURE INSTALLATIONS

In the context of future installations, compensation is frequently required right from the engineering stage. In this case, it is not possible to calculate the capacitor bank using conventional methods (electricity bill). For this type of installation, it is advisable to install at least a capacitor bank equal to approximately 25% of **the nominal power of the corresponding HV/LV transformer.**

Example

1000 kva transformer, Q capacitor = 250 kVAr

Note: This type of ratio corresponds to the following operating conditions:

- 1000 kVA transformer
- Actual transformer load = 75%
- Cos φ of the load = 0.80 } k = 0.421
- Cos φ to be obtained = 0.95 } (see table on page 12)

Qc = 1000 x 75% x 0.80 x 0.421 = 250 kVAr