Power Factor & Harmonics Course Outline

Course Description

Low power factor and harmonics are a frustration for electrical installations. They can cause power losses and reduced energy reliability. In the context of increasing concern about energy efficiency and energy management, power factor and harmonics are important issues to consider for the management of electrical installations. This course will explore power factor and harmonics and will explain how power factor correction and harmonic mitigation provide immediate benefit in terms of reduced power losses, reduced electricity bill, and the possibility to use the total system capacity.

Course Outline

Course Objectives

- List examples of power factor and harmonics phenomena, the common causes and the common negative physical and financial impacts
- List methods of preventing or mitigating power factor and harmonics problems and describe their suitability for particular situations
- Perform power triangle calculations, and size the required power factor correction solution for a given level of correction
- List possible locations of mitigation solutions within an electrical network, and identify the pros and cons associated with each location

Course Content or Material

1) Introduction

2) Power Quality Problems
   a) Low power factor and harmonics are a frustration for electrical installations
      i) Power losses
      ii) Reduced energy reliability
   b) Voltage fluctuation
      i) Systematic variation of the voltage waveform or a series of random voltage changes of small dimensions

3) Power Factor Phenomena
   a) The active power P (kW) is the real power transmitted to loads such as motors, lamps, heaters and computers
   b) The apparent power S (kVA) is the product: Vrms x Irms
   c) The Power Factor (λ) is the ratio of the active power P (kW) to the apparent power S (kVA)

4) The Power Triangle
   a) Some power triangle calculations
      i) kVA2 = kW2 + kvar2
      ii) kvar2 = kVA2 – kW2
      iii) kvar = √(kVA2 – kW2)
   b) Example 1
   c) Example 2

5) Energy Efficiency
   a) Reduced overloading on the electrical system, thereby releasing useable capacity
   b) Reduced system losses and demand power
   c) Reduced risks of outage
   d) Extended equipment lifetime

6) Benefits of PFC & Harmonic Mitigation
   a) Reduced electricity bill
   b) Reduced power losses
   c) Reduced cable size
   d) Improved process quality
   e) Improved business performance

7) Mitigating Power Problems
   a) Monitoring is the best solution
      i) Capacitor Banks
      ii) Active Filters
      iii) Hybrid Filters
      iv) Electronic Compensators

8) Mitigating VSD Power Problems
   a) Capacitor-less (C-less) technology
   b) AC-Line or DC-link reactors
   c) Multi-pulse arrangement
   d) Active Front End

9) Design Affects Energy Efficiency

10) Summary

Course Assessment: Test Your Knowledge

Course Survey: We Value Your Opinion