



Electrical Concepts

Course Description:

This course explores the fundamentals of energy units and electricity. With energy demand rising and greenhouse gas emissions in sharp focus around the world, the time has come for everyone to take action to economize on energy use by the intelligent application of technology to bring about energy efficiency.

Understanding these units and concepts is the foundation to managing and controlling energy – and the key to reducing both consumption and emissions.

Course Outline:

Learning Objectives

At the completion of this course, you will be able to:

- Describe major electrical units
- Explore concepts of single and three phase power supply
- Explain Ohms Law for resistance and power
- Distinguish between real and reactive power
- Define load factor for a building
- Calculate motor input and output power using the electric motor efficiency formula

Course Content

- 1) Introduction
- 2) Energy versus power
 - a. Energy – the ability to do work
 - b. Power – how fast work gets done; the rate at which energy is consumed
- 3) Energy is comprised of WAGES
 - a. Water
 - Domestic potable water
 - Domestic hot water
 - Heating hot water
 - Chilled water
 - Waste water
 - b. Air
 - Compressed air
 - c. Gas
 - Natural gas = primary source
 - Coal, oil, gasoline, and ethanol
 - O, Ar, CO₂ and N
 - d. Electricity

- Joules
- kWh and kVARh
- e. Steam
 - Therms
 - Steam
 - Condensate
- 4) Energy units
 - a. Voltage
 - b. Current
 - c. Resistance
- 5) Ohm's Law
 - a. Relationship between voltage, current and resistance
- 6) The power equation
 - a. $\text{Watts} = \text{Volts} \times \text{Amps}$
- 7) Power distribution
 - a. Single-phase
 - b. Three-phase
- 8) Utility charges
 - a. Consumption
 - b. Peak demand
- 9) Real and reactive power
 - a. Kvars
 - b. The power triangle
- 10) Power Factor
 - a. Causes of low power factor
 - i. Inductive loads
 - ii. Capacitive loads
 - iii. Lagging kvars
 - iv. Leading kvars
 - b. Two types
 - i. Displacement
 - ii. Total (true)
- 11) Calculating power usage
 - a. Single-phase power
 - b. Three-phase power
- 12) Electric motor efficiency
- 13) Degree days
 - a. Absolute value difference of the daily mean temperature from a base temperature value
- 14) Managing units during calculations
 - a. Power factor example
 - b. Running cost example
- 15) Summary