



## Training Program:

### Electric Motors Protection In Non-Hazardous & Hazardous Environments

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## Introduction:

This course is designed to provide participants with the skills to understand how electric motors and their associated motor protection and control systems are applied in industrial process plants in both non-hazardous and hazardous environments (oil & gas, mining and minerals processing and heavy industries). The electric motors and motor protection program is interactive and encourages delegates to participate through questions and answers, along with opportunities to discuss with the presenter specific issues which may result in appropriate solutions. Participants will learn:

- The types of electric motors used in these industries
- How motors are started and controlled, including variable speed drives
- The various classifications types of motors used in hazardous areas
- The importance of selecting and installing the correct motor bearings
- Lubrication programs to ensure the maximum motor life
- The importance utilizing the correct motor protection
- The use of intelligent motor control and motor managers
- Effective motor maintenance, on line and off line diagnostics
- A repair program for faulty electric motors

## Who Should Attend?

Electrical Engineers, Electrical Technicians, Electrical Inspectors, Electrical Professionals & Supervisors, Instrumentation and Design Engineers, Maintenance Engineers, Supervisors & Technicians, Energy Management Consultants, Control Engineers & Technicians, Automation & Process Engineers, Chemical & Mechanical

Engineers, Consulting Engineers, Field Technicians, Graduate Engineers, Project and Production Managers, Project Engineers, Electronic Technicians, Plant Managers, Process Control Engineers, System Engineers, System Integrators, Testing Engineers & Technicians, Power System Engineers, Power System Technicians, Utility Engineers, Managers & Team Leaders of Engineering Departments, Safety Professionals, Plant Electricians, Facilities Engineers, Operations & Maintenance Engineers, Supervisors & Technicians, Project Engineers, Commissioning & Testing Engineers, Consulting Engineers, Electrical Technologists, Facility & Plant Managers

## Course Objectives:

**By the end of this course delegates will be able to:**

- Undertake a detailed review the different types of electric motors available
- Learn the different starting and control methods used
- Understand the requirements for electric motors in hazardous areas
- Learn the importance of selecting correct bearings and lubrication systems
- Understand the types of motor protection required for different motor types
- Understand the terms Intelligent Motor Control and Motor Manager
- How they are used to control and automate many motor control functions
- Learn about comprehensive electric motor maintenance programs
- Evaluate whether a motor can be repairs or requires replacement

# Course Outline

## Fundamentals of Electric Motors

- Introduction to electrical motors, basic theory and operation
- Types of electric motors
- DC
- AC Synchronous
- AC Asynchronous
- Commonly used electric motors in industry
- Cast or rotor
- Wound rotor and slipring
- Speed torque curves and motor starting considerations
- High voltage electric motors

## Electric Motor Control and Hazardous Area Requirements

- Motor control methods and techniques
- DOL
- Reduced voltage start
- Variable speed drives
- Hazardous area requirements
- Types of hazardous area classifications
- Motors classified for use in hazardous areas

### **Electric Motor Bearings, Efficiency and Harmonics**

- Motor bearings, design and types, plain, roller and sleeve, lubrication
- Motor shaft currents and insulation of bearings
- Factors that limit or extend motor life
- Energy efficiency of motors
- Harmonics in motors from VSDs or other sources

### **Electric Motor Protection**

- Motor protection requirements
- Motor thermal model including overload, locked rotor, often or prolonged acceleration and duty cycle requirements
- Motor stall, acceleration and running thermal limit curves
- Motor thermal capacity and how it is evaluated in motor protection devices
- Motor managers and intelligent motor control

### **Electric Motor Maintenance and Repair**

- Preventative maintenance, corrective maintenance and maintenance planning
- On-line testing of motors using current signature analysis can detect
- Rotor defects
- Stator problems
- Bearing problems
- Air gap problems
- Off-line static testing to evaluate

- Stator condition
- Rotor health
- Air gap anomalies
- Power circuit faults
- Motor insulation health
- Predictive maintenance
- Vibration analysis, thermography and laser alignment
- Repair or replacement decisions, motor repair