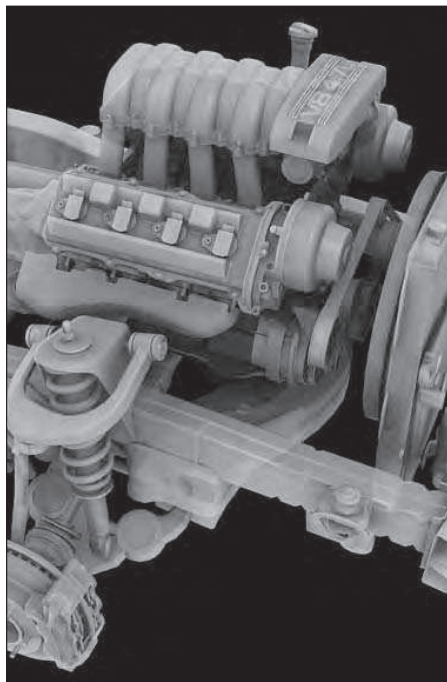

MEDIUM VOLTAGE AC MOTORS FOR THE POWER INDUSTRY

WORKING PRINCIPLES, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING



YOU WILL LEARN HOW TO:

- Understand AC motor operation and construction
- Specify, select and install motors
- Specify protection requirements for motors
- Specify speed control requirements for motors
- Install and commission motors
- Fix faults on motors
- Interpret motor performance curves
- Interface control circuits of motors with PLC's/DCS's
- Reduce downtime on electrical motors
- Improve plant safety
- Improve plant throughput
- Reduce your spares usage and requirements

WHO SHOULD ATTEND:

Anyone associated with the use of electrical motors in the industrial or automation environment. The workshop will also benefit those working in system design as well as site commissioning, maintenance and troubleshooting. Typical personnel who would benefit are:

- Plant Engineers
- Instrument Technicians
- Operations personnel
- Electrical Maintenance Technicians
- Instrument and Control Engineers
- Process control Engineers
- Mechanical Engineers
- Service Technicians
- Maintenance Personnel
- Electrical Maintenance Supervisors

The Workshop

It is estimated that electrical drives and other rotating equipment consume about 50% of the total electrical energy consumed in the world today. The cost of maintaining electrical motors can be a significant amount in the budget item of manufacturing and mining industries. This course gives you a thorough understanding of electrical motor's working, maintenance and failure modes and gives you the tools to maintain and troubleshoot electrical motors.

You will gain a fundamental understanding of the installation, operation and troubleshooting of electric motors. Typical applications of electric motors in mining, manufacturing, materials handling, process control are covered in detail. You will learn the basic steps in specifying, installing, wiring and commissioning motors. The concluding section of the course gives you the fundamental tools in troubleshooting motors confidently and effectively.

The Program

FUNDAMENTALS OF MOTOR TECHNOLOGY

- Basic principles of rotating electric machines
- Fundamental principles of speed control
- Efficiency, torque, inertia, horsepower/ power factor
- Torque-speed curves
- How the motor produces torque
- Standardisation and the meaning of frame size
- Types of motors and their characteristics
 - Cage motors
 - Slip ring motors
 - Synchronous motors
- Relative merits of the above types and reasons for preferring cage type motors
- Relationship between output of motor and the voltage of operation-some pointers
- Medium voltage motors (3.3kv, 6.6 kv and 11 kv) and features

THREE PHASE AC INDUCTION MOTORS

- Components
- Theory of operation
- Induction motor design
- Duty cycles
- Insulation and Cooling requirements
- Starting methods
- Selecting motors

AC MOTOR CONSTRUCTION AND MAINTENANCE

- Basic construction and physical configuration, windings
- Mechanical components and their role
- Bearings and lubrication system
- Types of enclosure, cooling arrangements and temperature supervision
- Embedded temperature sensors for winding and bearings
- Special constructional features of medium voltage motors

DETERMINATION OF LOSSES AND EFFICIENCY OF THREE PHASE AC INDUCTION MOTORS

- Standards
- Types of losses
- Tests for measurement and computation of losses and efficiency
- Dynamometers
- Principles of load application by braking
- Torque measurement basics
- Types of practical dynamometers
- Eddy current dynamometer and its characteristics
- DC and AC dynamometers and their working principles
- Testing of larger motors-Back-to-back test approach

PROTECTION OF AC MOTORS

- Protective devices
 - Thermal overload
 - Over current / overload
 - Under-voltage / over-voltage
 - Under frequency
 - Current unbalance or negative phase sequence
 - Earth fault protection
 - Pole slip / out of step
 - Loss of excitation
 - Inadvertent energisation
 - Over fluxing
 - Stall protection / acceleration time / Start up supervision (time between starts / starts per hour)
 - Voltage controlled or restrained over current
 - Protection settings

MEDIUM VOLTAGE MOTORS IN POWER INDUSTRY

- Overview of a typical power generation plant using steam turbines
- Important drives and their requirements
- Considerations for selection and deployment of electric motors for these applications
 - High inertia fan drives, pump drives, mill drives, need for immunity from electrical voltage disturbances, critical auxiliary systems
- Selection of motors for these applications

SPEED CONTROL OF AC MOTORS

- Introduction to Variable Speed Drives or Power Electronic Converters
- Types, and designs of Variable Speed Drives
- Control theory of VSDs explained

INSTALLATION, COMMISSIONING, PERIODIC MAINTENANCE AND TROUBLESHOOTING OF MEDIUM VOLTAGE MOTORS

- General installation and environmental requirements
- Electrical connections and earthing requirements
- Commissioning tests
- Maintenance of AC machines and periodic checks/tests
- Condition monitoring and record keeping for optimum maintenance
- Bearing and lubrication system and their monitoring
- Types of faults, fault finding and testing of ac machines
- Failure mechanism in AC motors
- Identifying the underlying causes
 - Extended starting, harmonic related failures, single-phasing and consequential failures, insulation overheating and accelerated aging
- Testing instrumentation
- New technologies and developments

SUMMARY, OPEN FORUM AND CLOSING