

ELECTRICAL MOTORS (REF:OTSEM001)

Course Introduction

This training course covers the basic AC and DC electric motor theory and characteristics followed by a look at how to maintain, test and protect electrical motors.

The cost of maintaining electrical motors can be a significant amount in the budget item of manufacturing industries. This course gives a thorough understanding of electrical motor's working, maintenance and failure modes and gives you the tools to maintain and troubleshoot electrical motors.

This course gives a fundamental understanding of the installation, operation and troubleshooting of electric motors. Typical applications of electric motors in manufacturing, materials handling, process control are covered in detail. It gives the basic steps in specifying, installing, wiring and commissioning motors. The concluding section of the course gives the fundamental tools in troubleshooting motors confidently and effectively, Using Motor, Electric Traction & Electrical Control Trainer simulator.

Course Objectives

By the end of this course, the trainee will be able to:

- List the typical motor components and component function.
- List the types of motors typically used in the petrochemical industry.
- List the yearly operating checks required. State why these checks are necessary.
- List in writing the data required to specify a new motor.
- Show where the data can be found.
- Explain the contents of motor specifications.
- Explain a factory acceptance procedure for a large new motor including the necessary safety reviews, data requirements, drawings, performance curves and procedures. Explain the requirements and expected results.
- Explain the requirements of a design data sheet for a motor starter.
- Explain the basic theory that applies to the design of this equipment.
- Explain the selection criteria for different applications.
- Explain the different cooling systems used for motors.
- Explain the different mounting methods.
- Explain the FAT or site performance test of a large motor.
- Explain the criticality of this equipment, how the maintenance frequencies are set and the essential requirements to prepare the equipment for maintenance.
- Explain how to prepare a requisition and how to analyze the technical bids.
- Perform the sizing calculations for the motor starter and explain the required data input and results.
- Prepare a data sheet for motors and motor starters and explain the requirements.
- Prepare a specification and design data sheet for the purchase of this equipment. Explain the type and material selection requirements included in this specification.
- Prepare a factory acceptance procedure for a large new motor including the necessary safety reviews, data requirements, drawings, performance curves and procedures. Explain the requirements and expected results.
- Write a report detailing test parameters and explain the results and recommendations.
- Perform an analysis of problems and faults with this equipment used on the site. Prepare a short summary report detailing the results of this analysis with recommendations of ways to eliminate the losses. Explain the conclusions and discuss recommendations for performance improvement of this equipment. Also, define the operating conditions that caused the main problems encountered.



Course Outline

DAY 1

1. Introduction

- Function
- Advantages of Electric Motors VS Mechanical Drives
- Disadvantages of Electric Motors VS Mechanical Drives
- Electric Motors Types
- Applications in Oil & Gas Plants

2. DC – Motors Features Explanation, Selection & Applications

- Old design
- Shunt/Series excitation
- Variable speed
- High starting torque
- Lot of maintenance recruitment
- Bigger size / KW

3. AC Motors Features / Explanation, Selection & Application

- Synchronous motors
- Induction motors
- Constant speed
- Smaller size / Kw
- Less maintenance requirements
- Simpler control (starting)

4. Basic components & practical aspects of AC motors

- Rotor - stator - bearings – housing
- Practical aspects of the single-phase induction motor
- Split-phase starting techniques for induction motors
- Types of single-phase AC motors
- The synchronous motor
- Shaded-pole motors
- The hysteresis motor
- The reluctance motor
- The wound-rotor induction motor
- The double squirrel-cage induction motor
- Speed selection by pole modification
- The universal motor
- Rotation reversal in AC motors
- Non-sinusoidal waveforms applied to AC motors
- Power input and power factor in three-phase induction motors
- Unusual motor behavior

DAY 2

5. Basic terminology & Testing:

- Insulation classes
- Resistively & Dielectric
- Dielectric coefficient
- Dielectric breakdown strength
- Dielectric constant
- Dielectric resistively
- Dielectric power factor
- Rotor & excites test
- Enclosures: TE - FC and TENV
- IP Code: Definitions/examples



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DAY 3

6. Starting Methods

- Starting current VS full load current
- Starting KVA (SKVA) code letter
- Full voltage starting
- Reducing voltage starting
- Star/delta
- Auto transformer
- Electronic
- Electrolyte

7. Installation

- Foundation
- Concrete
- Skid
- Resilient “shock” mounting
- Resonance
- Alignment
- Bearing alignment
- Coupling alignment
- Vibration
- Ventilation
- Hazardous Location

8. Variable Speed Drives

- Eddy current couplings
- Variable frequency suppliers

DAY 4

9. Maintenance & Inspection of Typical Motors Used in Oil & Gas Fields Plants

LV/MV/HV Electric Motors

- Basic Parts and Operation
- Bearings and Lubrication
- Failing Bearings
- Disconnecting Power Supply and Motor Leads
- Disconnecting the Motor
- Pre-disassembly Readings
- Motor Disassembly
- Removing the Rotor
- Installing a Split Bearing Puller
- Removing Bearings and Inspecting Bearing Surfaces
- Measuring Bearing Seating Surfaces
- Inspecting the Rotor and Stator
- Preparing Bearings for Installation and Cleaning the Rotor and Stator.
- Replacing Bearings
- Motor Reassembly
- Reconnecting the Motor



- Wound Rotor Induction Motors
- Brush Assemblies
- Brush Assembly Maintenance
- Slip Ring Maintenance
- Rotor Winding Maintenance and Variable Resistor Inspection
- Contact Assembly
- Verifying Change in Rotor Resistance
- Split-phase Motors
- Centrifugal Switches
- Capacitor Start-induction Run Motors
- DC Motor Operation
- Commentators
- Commentator Inspection
- Removing Brush Rigging
- Undercutting Mica
- Reinstalling Brush Rigging
- Installing Brushes
- Seating Brushes
- Completing Maintenance
- Introduction to Troubleshooting
- Questioning the Operator
- Evaluation and Power Supply Check
- Control Circuit Checks
- Mechanical Checks
- Electrical Checks
- Operational Checks
- Program Review

DAY 5

10. Control Equipment

- Introduction to troubleshooting
- Ruling out problems
- Troubleshooting circuit switches
- Introduction to removing and replacing parts
- Checking a circuit dead
- Checking for continuity
- Removing and installing parts
- Poles and throws

11. Limit Switches

- Introduction to Limit Switches
- Finding the Cause of the Problem
- Replacing the Contact Block and Testing the Switch
- Introduction to Torque Switches
- Adjustment and Testing of a Torque Switch
- Setting the Open Rotor on the Geared Limit Switch
- Setting the Close Rotor
- Using Motor, Electric Traction & Electrical Control Trainer simulator.

