

This course can be adapted to virtual classroom mode

## Electrical Motors: Technology, Operation & Maintenance

5 days  
Overview

EIMEA-EN-A

### LEVEL

Expert

### PURPOSE

This course focuses on the technical development of industrial electrical motors.

### LEARNING OBJECTIVES

Upon completion of the course, participants will be able to:  
explain the operation and the main failures of electrical motors,  
list the diagnostic tools and monitoring equipment in operation,  
describe main setting rules.

### WAYS AND MEANS

Visit of a motor repair workshop.  
Interactive course.  
Motor disassembly and assembly in case of an available workshop.

### LEARNING ASSESSMENT

Quiz.

### PREREQUISITES

Provide evidence of a professional experience of at least 1 month related to the concerned field.

## Agenda

### OPERATION PRINCIPLE & TECHNOLOGY

2 d

Working principle of induction and synchronous motors.  
Features: power, current, torque and power factors.  
Technology and main parameters.  
Protective modes in regards with external environments: temperature classes, protection class index, hazardous area motors, ATEX protection.  
Electrical and thermal protection of the motor as well as the use of temperature sensors.  
API 541 asynchronous guidelines for refinery and petrochemical motors.  
Efficiency motor's standards IEC 60 034-30/IEEE 112.

### VARIABLE SPEED FEATURES

1 d

Power and HV/LV range, fields of use and typical applications.  
Speed and motor control as well as network consequences. Synchronous motor: torque control and various technologies.  
Induction motor: standard starting methods depending on mechanical load, motor power and network capacity; limiting conditions due to the grid; number of start constraints. Electronic starting method (soft starter).

## INSTALLATION

0.5 d

Main characteristics and constraints for a motor installation.  
Skid and shim. Shaft alignment. Comparison to reference datasheets. Vibration footprint.

## FAILURE DIAGNOSIS IN OPERATION

0.5 d

Bearings: temperature, vibration, lubrication monitoring.  
Mechanical failures.

## CONTROL & REPAIR TECHNIQUES - PRACTICAL WORK

1 d

Part identification in workshop.  
Bearings assembly, housing repair, clearance and concentricity control.  
Electrical insulation and phases balancing control.  
Impact of frequency inverters and harmonics on electrical coils insulation and the bearings.  
Coil insulation repairs: vacuum coils impregnation, technology and quality. Rewinding and coils positioning according to magnetic circuit's notches. Electrical controls (electrical resistance, insulation, polarization...).  
Balancing: quality standards, unload and load tests. Repair specification: specification content as well as work acceptance.  
Visit of a motor repair workshop ( if possible) .