



# **AC Electrical Motors & Drives: Troubleshooting, Maintenance & Protection**

3 – 7 May 2027  
Barcelona (Spain)



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**Ref:** 6054\_280598 **Date:** 3 - 7 May 2027 **Location:** Barcelona (Spain) **Fees:** 6200 Euro

### Introduction

AC motors are the backbone of industry in a myriad of applications, efficiently converting more than half of the world's energy consumption into mechanical work governed by intelligent drives. The intersection of AC motors and their corresponding drives with a plant's SCADA system demands an adept understanding of maintenance and troubleshooting for optimizing uptime and enhancing productivity.

Additionally, the essential protection of these substantial investments secures the equipment and ensures the safety of personnel. This AC motor and drive maintenance troubleshooting and protection course covers comprehensive approaches to the maintenance, troubleshooting, and security of AC motors and drives.

### Enhancing Electric Motor Maintenance and Troubleshooting Knowledge

Electric motor drives serve as critical components in modern industrial environments. Understanding the intricacies of electric motor maintenance training, employing the right electric motor maintenance tools, and mastering the arts of troubleshooting electric motors and electric motor protection can dramatically influence operational efficiency.

This AC motor and drive maintenance troubleshooting and protection course is tailored to empower professionals with the competencies to maintain and troubleshoot AC electric motors and electrical AC drives, ensuring prolonged operational life and system reliability. Whether you are installing a new electric motor drive system or maintaining existing electric motor drives, this AC drive training course stands as an essential stepping stone for technicians who strive for excellence in the field.

### Targeted Groups

- Electricians.
- Electrical supervisors.
- Plant electricians.
- Operations and maintenance engineers, supervisors, and technicians.
- Maintenance technicians.

## Course Objectives

Upon AC motor and drive maintenance troubleshooting and protection course completion, participants should be able to:

- Explain the operation and construction of AC electric motors and electrical drives, ensuring their compatibility with various loads.
- Implement maintenance procedures for electric motors and drives according to industrial standards.
- Apply troubleshooting methodologies to diagnose and resolve issues with motors and drives, drastically reducing downtime.
- Utilize documentation such as single-line drawings for effective commissioning, maintenance, and troubleshooting.
- Recognize the principle operations of AC electric motors and electrical drives informed by contemporary electronic technology.
- Instill confidence in maintaining motors and drives following industrial best practices.

## Targeted Competencies

At the end of this AC motor and drive maintenance troubleshooting and protection course, the target competencies will be able to:

- Understand comprehension of AC motor types and start-up methods.
- Operate principles of variable speed drives and electric motor drive systems.
- Understand and identify the variable speed drive types.
- Learn about troubleshooting and maintenance skills for variable speed drives and electric drive maintenance.
- Understand protection strategies for motors and drives.

## Course Content

### Unit 1: AC Motors

- Overview to introduction to magnetics and the basic principles of excitation in electric motor maintenance and troubleshooting.
- Learn about a comprehensive discussion on rotating machines theory, AC motor construction, slip, operation principles, and performance metrics, including torque-speed characteristics and efficiency.
- Overview of types, construction, and applications of single-phase and three-phase AC motors with an emphasis on split-phase and capacitor motors.
- Learn about techniques for starting and controlling acceleration in induction motors and their applications.
- Understand the necessity of speed control and compatibility with varying loads for AC motors.

### Unit 2: Drives

- What are the basic principles of AC Variable-Speed Drives VSDs, constant torque region, constant power extended speed region, and four-quadrant operation?
- Power semiconductors, diode, thyristor SCR, IGBT, MOSFET, GTO, and others.
- Inverters, voltage-source, and current-source, pulse width modulated PWM inverters.
- Two-level pulse width modulated inverter, DC link energy and capacitor sizing, regeneration or dynamic slowdown, dynamic braking, regeneration.
- PWM waveforms and analysis, effects of PWM on motor bearings and insulation and life expectancy, volts/Hertz control, start-up and operation, dynamics, PWM rectifier inverter systems.
- Switch transients, harmonics, and power factor.
- AC driveline power factor, the effect of AC input on drive operation, switching transients, insulation voltage stress, motor winding voltage distribution, radiated and conducted electromagnetic interferences EMI, and EMI filtering.

### Unit 3: Troubleshooting and Maintenance of Motors

- Study of motor characteristics, enclosure types, cooling methods, and its impact on maintenance.
- Understand methods for predicting and identifying failures in three-phase stator windings.
- Understand Routine and advanced electric motor maintenance and troubleshooting practices, focusing on cleanliness, lubrication, temperature management, noise, and vibration control.
- Learn about strategies for addressing common issues such as slow acceleration, overheating, and bearing failures.
- Understand standards for motor maintenance and the relevance of testing in the electric motor repair training course.

## **Unit 4: Troubleshooting and Maintenance of Drives**

- Identify and resolve converter failures and understand standard failure modes and fault current limitations.
- What are Troubleshooting techniques for reversing circuits in single-phase and three-phase motors?
- Understand preventative maintenance frameworks, including dynamic and static inspections, phase imbalance detection, and maintenance scheduling.
- Learn about the examination of drive-related symptoms, their causes, and remedies.

## **Unit 5: Protection of Motors and Drives**

- What are the requirements and methods for AC motor protection with an emphasis on overload protection and the behavior of motors under stress?
- Learn about the in-depth study of various protection devices like fuses, circuit breakers, and state-of-the-art relays designed for motor protection.
- Understand motor protection curves and the importance of backup protection.
- Understand protection schemes for inverters and electronic converters operating motors.
- Learn about systems selection and design considerations, aiming for optimal protection.