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COURSE BROCHURE

# Advanced AC Motors and Drives Troubleshooting and Protection Training Course

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Registered in the United Kingdom and Saudi Arabia

# Advanced AC Motors and Drives Troubleshooting and Protection Training Course

AC Motors and Drives Troubleshooting and Protection is a 2-week training course for electrical maintenance engineers, motor technicians and reliability engineers who keep induction motors, synchronous machines and variable frequency drives running in pumping stations, compressors, conveyors and process plants, and who leave with a Motor and Drive Care Plan for one critical fleet. Drive-fed motors now dominate plant loads, so a single failure can halt production. Jupiter Prime Training delivers this course on AC motors and drives troubleshooting and protection.

## Why AC Motors and Drives Troubleshooting and Protection Matters Now

Three forces shape AC motors and drives troubleshooting and protection today. Variable frequency drives have spread across pumps, fans and compressors, bringing bearing currents, insulation stress and harmonic distortion that older maintenance routines never addressed. Experienced motor specialists are retiring while drive firmware, parameters and fault codes multiply. Operations managers expect higher availability from fewer spares and shorter shutdowns. A site that diagnoses motor and drive faults correctly avoids repeat burnouts and unplanned stops; one that does not swaps parts blindly and pays for rewinds that could have been prevented. The course rests on established electrical machine theory, drive control principles and recognised condition monitoring practice.

## Who Gains Most from AC Motors and Drives Troubleshooting and Protection

- Maintenance engineers responsible for low and medium voltage motor fleets in plants and utilities
- Drive technicians who commission, parameterise and fault-find variable frequency drives
- Reliability engineers who run vibration, thermography and current signature programmes
- Protection staff who set motor relays, thermal models and earth fault elements
- Workshop supervisors who decide between rewind, repair and replacement

A plant electrical section in water, oil and gas or manufacturing gains most when its motor technicians, drive specialists and reliability engineers attend together.

## AC Motors and Drives Troubleshooting and Protection Capabilities

Participants connect machine theory, drive behaviour and field symptoms so that each trip or failure leads to a confirmed cause and a lasting fix.

- Assess induction and synchronous motor performance from nameplate, load and test data — duty and replacement decisions
- Specify drive control modes for torque, speed and process needs — commissioning engineers and process owners
- Calculate harmonic distortion and select filters or multi-pulse front ends — power quality at the plant supply
- Design motor protection with thermal models, stall and unbalance elements — relay setting approval
- Apply structured troubleshooting to drive fault codes and motor symptoms — restoration of production
- Build condition monitoring routes and alarm limits — reliability and maintenance planning

## Key AC Motors and Drives Troubleshooting and Protection Terms

- Slip — the difference between synchronous speed and actual rotor speed in an induction motor, rising with load.
- Pulse width modulation — the switching method a drive inverter uses to build a variable voltage and frequency output.
- Vector control — a drive control method that regulates motor flux and torque separately for precise speed and torque response.
- Thermal model protection — a relay function estimating winding temperature from current history to trip before insulation damage.
- Bearing currents — circulating or discharge currents caused by drive common-mode voltage that pit and flute motor bearings.
- Total harmonic distortion — the ratio of harmonic content to the fundamental, used to judge drive impact on the supply.

## AC Motors and Drives Troubleshooting and Protection Day by Day

### Day 1: Motor Fleet Context and Failure Patterns

- Motor Fleet Criticality Ranking — Spares and Attention Priorities
- Typical Failure Statistics by Component — Bearings, Windings and Rotors
- Drive Adoption Effects on Motor Life — New Stress Mechanisms
- Operating Duty Classes — Starts per Hour and Load Profile Matching
- Failure History Records — Learning from Past Rewinds and Trips

### Day 2: Induction Motor Theory in Practice

- Equivalent Circuit Parameters — Losses, Efficiency and Power Factor
- Torque-Speed Curves — Starting, Pull-Up and Breakdown Torque
- Starting Methods Compared — Direct-on-Line, Star-Delta and Soft Starters
- Voltage Unbalance and Derating — Supply Quality Effects on Heating
- Squirrel Cage and Wound Rotor Designs — Application Selection

## Day 3: Synchronous Motors and Special Machines

- Synchronous Motor Excitation Control — Power Factor Correction Use
- Pull-Out Torque and Loss of Synchronism — Load Disturbance Limits
- Permanent Magnet Motors — Efficiency Gains and Demagnetisation Risk
- Brushless Excitation Systems — Rotating Diode Fault Detection
- Large Motor Starting Studies — Voltage Dip on the Plant Network

## Day 4: Variable Frequency Drive Fundamentals

- Rectifier, DC Link and Inverter Stages — Component Roles and Failures
- Pulse Width Modulation Switching — Output Waveform and Carrier Frequency
- Scalar Voltage-per-Hertz Control — Pump and Fan Applications
- Sensorless and Closed-Loop Vector Control — High-Torque Process Loads
- Regenerative and Braking Options — Cranes, Hoists and Decelerating Loads

## Day 5: Drive Installation and Power Quality

- Harmonic Current Spectrum of Drives — Supply Transformer Heating
- Line Reactors, Passive Filters and Active Filters — Mitigation Choice
- Multi-Pulse and Active Front End Drives — Low-Harmonic Designs
- Cable Length, Reflected Wave and dv/dt Filters — Winding Insulation Protection
- Earthing, Shielding and Electromagnetic Compatibility — Interference Prevention

## Day 6: Motor Protection Schemes

- Thermal Overload Models — Hot and Cold Curve Settings
- Stall, Locked Rotor and Jam Protection — Mechanical Fault Response
- Negative Sequence and Phase Loss Protection — Unbalanced Supply Defence
- Motor Earth Fault and Differential Protection — Large Machine Coverage
- Drive Built-In Protections — Coordination with Upstream Relays

## Day 7: Troubleshooting Motors and Drives

- Structured Fault-Finding Method — Symptom, Hypothesis and Test Sequence
- Drive Fault Code Interpretation — Overcurrent, Overvoltage and Earth Leakage
- Winding Resistance, Insulation and Surge Comparison Tests — Motor Verdicts
- Bearing Current Diagnosis — Shaft Grounding and Insulated Bearing Fixes
- Parameter Backup and Restore — Fast Drive Replacement

## Day 8: Condition Monitoring and Diagnostics

- Vibration Spectrum Analysis — Imbalance, Misalignment and Bearing Defects
- Motor Current Signature Analysis — Broken Rotor Bars and Eccentricity
- Infrared Thermography of Motors and Drive Panels — Hot Spot Ranking
- Online Partial Discharge for Medium Voltage Motors — Stator Insulation Trend
- Alarm Limits and Trending — From Data to Work Orders

## Day 9: Maintenance Strategy and Lifecycle Decisions

- Preventive and Predictive Task Selection — Interval and Condition Triggers
- Rewind Quality Specification — Efficiency Retention After Repair
- Repair, Rewind or Replace Economics — Lifecycle Cost Comparison
- Critical Spares Strategy — Motors, Drive Modules and Capacitors
- Drive Obsolescence Planning — Firmware, Parts and Migration Paths

## Day 10: Practising the Motor and Drive Care Plan

- Applying Criticality Ranking — Selected Motor Fleet Prioritisation
- Applying Protection Settings Review — Relay and Drive Coordination for the Case
- Applying Troubleshooting Sequence — Simulated Drive Trip Resolution
- Applying Monitoring Routes — Tasks and Alarm Limits for the Fleet
- Motor and Drive Care Plan — Maintenance and Protection Schedule for Peer Review

## Applying AC Motors and Drives Troubleshooting and Protection After the Course

- Rank one plant area's motors by criticality and confirm that each critical drive has a parameter backup and spare module.
- Review thermal model and earth fault settings on three critical motors against their nameplate and starting duty.

## AC Motors and Drives Troubleshooting and Protection Questions FAQ

### What is AC motors and drives troubleshooting and protection, and why does it matter now?

AC motors and drives troubleshooting and protection is the practice of diagnosing, protecting and maintaining induction motors, synchronous machines and variable frequency drives. It matters now because drive-fed motors dominate plant loads and introduce new failure mechanisms.

### Which roles gain most from AC motors and drives troubleshooting and protection training?

Maintenance engineers, drive technicians, reliability engineers and protection staff gain most. You benefit if you commission drives, fault-find motor trips, set motor relays or decide between rewinding and replacing machines.

### How does AC motors and drives troubleshooting and protection differ from a general electrical maintenance course?

A general electrical maintenance course spreads across switchgear, cables, lighting and panels. This course concentrates on rotating machines and drives, covering machine theory, drive control, harmonics, motor protection settings, fault codes and condition monitoring in depth.

## What do you bring back from AC motors and drives troubleshooting and protection training?

You bring back a care plan for a critical motor and drive fleet, covering criticality ranking, protection settings, troubleshooting steps and monitoring routes. It gives your section a ready schedule to reduce repeat failures.

## AC Motors and Drives Troubleshooting and Protection: The Way Forward

The Motor and Drive Care Plan first informs which motors receive condition monitoring and spare drive modules in the next maintenance budget. Maintenance engineers and reliability engineers use it to schedule tasks and review protection. After its first use, revisit harmonic and bearing current findings, since new drives added to the network change supply quality and failure patterns.