

Course No. 1281

Magnetic Particle Testing (MT) Training Course

CORROSION, INSPECTION & NDT
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Magnetic Particle Testing (MT) Training Course provides a comprehensive and practical understanding of magnetic particle testing principles, techniques, equipment, inspection procedures, indication evaluation, and industrial applications. The course is designed to develop the technical capabilities required to detect and evaluate surface and near-surface discontinuities in ferromagnetic materials without damaging the inspected component. It focuses on the practical application of magnetic fields, magnetization techniques, magnetic particles, inspection sensitivity, and interpretation of indications.

Magnetic particle testing is an important non-destructive testing method used extensively for examining welds, forgings, castings, shafts, structural components, pressure equipment, machinery parts, and other ferromagnetic materials. The method is particularly effective for detecting cracks and other discontinuities that may extend to or close to the surface. A strong understanding of magnetic particle testing enables inspection professionals to select appropriate magnetization techniques, prepare components correctly, control examination conditions, and evaluate indications systematically.

The course covers the fundamentals of magnetism, magnetic fields, magnetic flux, ferromagnetic materials, magnetization methods, magnetic particles, suspension systems, inspection equipment, field strength, sensitivity, and demagnetization. Participants will examine both visible and fluorescent magnetic particle testing techniques, direct and indirect magnetization approaches, and practical considerations for detecting discontinuities with different orientations and locations.

The program also emphasizes the integration of magnetic particle testing into inspection, quality assurance, fabrication, maintenance, reliability, and asset integrity programs. Participants will learn how to develop inspection procedures, select appropriate techniques, identify relevant and non-relevant indications, document results, and communicate technical findings. This practical approach supports improved defect detection, stronger quality control, more consistent inspection practices, and better-informed decisions concerning the condition and integrity of industrial components.

Objectives

- Analyze the fundamental principles of magnetism and magnetic particle testing and relate them to the detection of surface and near-surface discontinuities during the course.
- Identify the characteristics of ferromagnetic materials and determine their suitability for magnetic particle testing applications.
- Evaluate magnetic field behavior, magnetic flux, field direction, and flux leakage as they relate to discontinuity detection.
- Apply appropriate magnetization techniques according to component geometry, material characteristics, inspection objectives, and expected discontinuity orientation.
- Evaluate magnetic particle systems, equipment, testing media, lighting conditions, and examination parameters according to inspection requirements.
- Apply visible and fluorescent magnetic particle testing principles to relevant industrial components and weld configurations.
- Interpret magnetic particle indications and distinguish relevant indications from non-relevant or false indications.
- Develop appropriate magnetic particle testing procedures covering surface preparation, magnetization, particle application, inspection, evaluation, and reporting.
- Assess factors affecting inspection sensitivity, including field strength, field direction, particle concentration, surface condition, lighting, and component geometry.
- Improve the quality and traceability of magnetic particle inspection records by documenting examination conditions, indications, results, and technical conclusions.
- Strengthen communication between NDT personnel, inspectors, engineers, quality professionals, maintenance teams, and asset integrity specialists through clear technical reporting.
- Develop a practical magnetic particle testing inspection strategy for a selected industrial component or weld by the end of the course.

Who Should Attend

The Magnetic Particle Testing (MT) Training Course is designed for professionals involved in non-destructive testing, inspection, quality assurance, welding, fabrication, manufacturing, maintenance, engineering, and asset integrity. It is particularly suitable for magnetic particle testing inspectors, NDT technicians, inspection engineers, quality engineers, mechanical engineers, materials engineers, welding engineers, metallurgical engineers, asset integrity engineers, reliability

engineers, and technical professionals responsible for detecting surface and near-surface discontinuities in ferromagnetic materials.

The course is also relevant to NDT supervisors, inspection supervisors, NDT coordinators, quality managers, inspection managers, maintenance managers, engineering managers, fabrication managers, project engineers, technical authorities, and professionals responsible for inspecting welds, shafts, gears, forgings, castings, structural components, pressure equipment, pipelines, and machinery parts.

Managers, project decision makers, quality professionals, and technical specialists who review NDT reports or establish inspection requirements can also benefit from the course. It provides a practical understanding of the capabilities and limitations of magnetic particle testing, method selection, inspection sensitivity, indication interpretation, documentation, and the role of MT results in quality control, maintenance, reliability, and asset integrity decisions.

Learning Outcomes

- Explain the fundamental principles of magnetism, magnetic fields, magnetic flux, and flux leakage used in magnetic particle testing.
- Identify ferromagnetic materials and determine when magnetic particle testing is an appropriate inspection method.
- Explain the relationship between discontinuity orientation, magnetic field direction, and the ability to detect relevant indications.
- Select suitable magnetization techniques based on component geometry, material characteristics, and expected discontinuity orientation.
- Apply principles of visible and fluorescent magnetic particle testing to appropriate industrial inspection applications.
- Identify the functions and operating principles of magnetic particle testing equipment, coils, yokes, prods, magnetic benches, particles, and related accessories.
- Evaluate inspection conditions including field strength, particle concentration, surface condition, lighting, and examination sensitivity.
- Interpret representative magnetic particle indications and distinguish relevant indications from non-relevant and false indications.
- Develop structured magnetic particle testing procedures covering preparation, magnetization,

particle application, examination, evaluation, and reporting.

- Identify common sources of inspection error and recommend measures to improve magnetic particle testing reliability.
- Prepare professional magnetic particle inspection reports containing examination conditions, indication details, evaluation results, and technical conclusions.
- Integrate magnetic particle testing results into quality assurance, inspection, maintenance, reliability, and asset integrity decision-making.

Course Outline

DAY 01

Fundamentals of Magnetism and Magnetic Particle Testing

- Introduction to magnetic particle testing and its role in non-destructive examination.
- Fundamental principles of magnetism and magnetic fields.
- Magnetic poles, magnetic flux, magnetic flux density, and magnetic field strength.
- Ferromagnetic, paramagnetic, and non-magnetic materials.
- Magnetic properties of industrial materials.
- Magnetic flux leakage and its relationship to discontinuity detection.
- Surface and near-surface discontinuities suitable for magnetic particle testing.
- Advantages, limitations, capabilities, and applications of magnetic particle testing.
- Factors influencing magnetic particle inspection sensitivity.
- Introduction to magnetic particle testing equipment and examination procedures.

PRACTICAL APPLICATION

Analyze different industrial components and determine their suitability for magnetic particle testing.

DAY 02

Magnetization Techniques, Equipment, and Testing Media

- Principles of component magnetization.
- Direct and indirect magnetization techniques.

DAY 02 — CONTINUED

- Circular and longitudinal magnetization.
- Magnetic particle testing using portable yokes and prods.
- Magnetic benches, coils, and electromagnetic equipment.
- Selection of magnetization techniques according to component geometry.
- Magnetic field direction and discontinuity orientation.
- Importance of applying magnetic fields in appropriate directions.
- Visible and fluorescent magnetic particles.
- Dry powder and wet suspension techniques.
- Particle concentration, application methods, and inspection conditions.

PRACTICAL APPLICATION

Select appropriate equipment and magnetization techniques for different industrial components and potential discontinuity orientations.

DAY 03

Inspection Procedures and Indication Detection

- Surface preparation and cleaning requirements.
- Establishing appropriate examination conditions.
- Equipment verification and field strength considerations.
- Magnetization and magnetic particle application procedures.
- Dry particle and wet particle examination techniques.
- Visible magnetic particle inspection principles.
- Fluorescent magnetic particle inspection principles.
- Lighting requirements and examination environment considerations.
- Detection of cracks, laps, seams, inclusions, lack of fusion, and other discontinuities.
- Identification of discontinuity orientation and location.

PRACTICAL APPLICATION

Develop an inspection sequence for selected components and evaluate representative magnetic particle indications.

DAY 04

Indication Interpretation, Evaluation, and Inspection Quality

- Principles of magnetic particle indication formation and interpretation.
- Relevant, non-relevant, and false indications.
- Characteristics of crack-like and other relevant indications.
- Evaluation of indication location, size, shape, orientation, and distribution.
- Common sources of non-relevant indications.
- Influence of geometry, surface condition, edges, keyways, threads, and material structure.
- Factors affecting inspection sensitivity and reliability.
- Common inspection errors and methods for reducing examination uncertainty.
- Documentation and traceability of magnetic particle inspection results.
- Review of representative inspection cases and technical findings.

PRACTICAL APPLICATION

Interpret sample magnetic particle testing results, classify indications, and develop appropriate technical conclusions.

DAY 05

Magnetic Particle Testing Procedures, Reporting, and Asset Integrity

- Developing effective magnetic particle testing inspection procedures.
- Selecting magnetization methods according to inspection objectives and discontinuity mechanisms.
- Defining inspection areas, examination coverage, testing sequence, and equipment requirements.
- Establishing surface preparation, particle application, lighting, and examination requirements.
- Evaluating indications and determining when additional examination is required.
- Demagnetization principles and requirements following magnetic particle testing.
- Post-inspection cleaning and restoration considerations.
- Inspection documentation, reporting, traceability, and technical communication.

DAY 05 — CONTINUED

- Integrating magnetic particle testing results with quality assurance, maintenance, reliability, and asset integrity programs.
- Communicating findings to engineering, quality, fabrication, maintenance, and inspection management teams.
- Improving the consistency and reliability of magnetic particle testing programs.

FINAL WORKSHOP

Develop a comprehensive Magnetic Particle Testing inspection strategy for a selected industrial component or weld, including material assessment, potential discontinuities, magnetization method, equipment selection, particle application, examination conditions, indication evaluation, reporting requirements, demagnetization, and recommended follow-up actions.

Register or Request More Information

Course page: <https://quest-training.com/courses/magnetic-particle-testing-mt-training-course>

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