

Course No. 1659

Advanced Non-Destructive Testing & Inspection Training Course

**MATERIALS, WELDING & FABRICATION ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS**

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Advanced Non-Destructive Testing & Inspection Training Course provides a comprehensive and practical framework for professionals responsible for inspecting materials, equipment, welds, structures, and critical industrial assets without compromising their serviceability. The course focuses on advanced non-destructive testing methods, inspection planning, interpretation of examination results, defect evaluation, and the integration of inspection findings into maintenance, reliability, and asset integrity decisions.

Non-destructive testing is a critical component of asset integrity management across oil and gas, petrochemical, power generation, manufacturing, heavy industry, infrastructure, and engineering organizations. Effective inspection programs help identify defects, corrosion, cracks, weld discontinuities, material degradation, and other forms of damage at appropriate stages, enabling organizations to make informed decisions regarding continued operation, repair, maintenance, or replacement.

The program explores major non-destructive testing techniques, including ultrasonic testing, radiographic testing, magnetic particle testing, liquid penetrant testing, visual inspection, and thickness measurement. It also introduces advanced techniques such as phased array ultrasonic testing, time-of-flight diffraction, eddy current testing, and other advanced inspection approaches. Particular attention is given to selecting the most appropriate technique based on material properties, defect characteristics, component geometry, accessibility, and operating conditions.

A strong emphasis is placed on the interpretation and evaluation of inspection results. Participants examine how to distinguish relevant indications from non-relevant signals, understand detection limitations, evaluate measurement reliability, recognize common sources of error, and assess the significance of identified discontinuities. The course also addresses inspection procedures, acceptance criteria, documentation, reporting, and the role of quality assurance in maintaining reliable inspection outcomes.

Through practical exercises, technical case studies, inspection scenarios, and application-based workshops, participants will strengthen their ability to develop inspection programs, select appropriate testing techniques, interpret examination results, evaluate defects, and prepare technically sound inspection reports. The course is designed to connect advanced non-destructive testing with engineering inspection, asset integrity, maintenance, reliability, and operational risk

management.

Objectives

- Analyze advanced non-destructive testing principles and determine the appropriate application of major inspection techniques within the course.
- Evaluate material characteristics, component geometry, damage mechanisms, and defect types to select suitable inspection methods.
- Apply ultrasonic testing principles to identify, locate, and evaluate internal discontinuities in industrial components.
- Evaluate the appropriate use of radiographic testing, magnetic particle testing, liquid penetrant testing, and visual inspection according to material and equipment requirements.
- Apply advanced ultrasonic techniques, including phased array ultrasonic testing and time-of-flight diffraction, to suitable inspection applications.
- Analyze non-destructive testing results and distinguish relevant indications from non-relevant or misleading signals.
- Evaluate inspection accuracy, detection capability, measurement limitations, and sources of uncertainty affecting examination reliability.
- Design risk-based non-destructive testing and inspection programs aligned with equipment criticality, operating conditions, and asset integrity requirements.
- Assess detected defects and relate inspection findings to applicable damage mechanisms and engineering evaluation requirements.
- Improve technical documentation, inspection records, and reporting practices to support traceability and engineering decision-making.
- Analyze inspection data to support maintenance planning, reliability improvement, asset integrity management, and equipment life-cycle decisions.
- Develop an actionable framework for improving advanced non-destructive testing and inspection capabilities within the organization by the end of the course.

Who Should Attend

This training course is designed for engineers, inspectors, technicians, and specialists involved in non-destructive testing, engineering inspection, asset integrity, maintenance, reliability, mechanical engineering, materials engineering, welding, and industrial quality management. It is particularly relevant to inspection engineers, non-destructive testing personnel, reliability engineers,

maintenance engineers, welding engineers, materials engineers, asset integrity engineers, inspection supervisors, and professionals responsible for evaluating the condition of industrial equipment and structures.

The course is also suitable for managers and supervisors responsible for inspection programs, equipment integrity, maintenance, technical risk management, and operational reliability within oil and gas, petrochemical, power generation, manufacturing, heavy industry, utilities, infrastructure, and engineering organizations. It is especially valuable for professionals involved in periodic inspection planning, critical equipment assessment, failure investigation, maintenance prioritization, repair decisions, and asset integrity programs.

Quality assurance and quality control professionals, technical contractors, inspection service providers, and engineering specialists will also benefit from the program, particularly those seeking to strengthen their understanding of advanced non-destructive testing techniques, inspection data interpretation, defect evaluation, and the relationship between inspection results and engineering decisions.

Learning Outcomes

- Identify appropriate non-destructive testing techniques based on material type, component geometry, accessibility, and expected damage mechanisms.
- Explain the operating principles, applications, strengths, and limitations of major non-destructive testing methods.
- Interpret ultrasonic testing results and evaluate indications associated with internal discontinuities.
- Apply appropriate inspection methods to welds, metallic components, pressure equipment, structures, and industrial assets.
- Compare the capabilities and limitations of radiographic, ultrasonic, magnetic particle, liquid penetrant, and visual inspection methods.
- Evaluate the application of phased array ultrasonic testing and time-of-flight diffraction for complex inspection requirements.
- Identify sources of error, uncertainty, and variability that can affect the accuracy and reliability of inspection results.
- Assess inspection indications and relate identified defects to applicable damage mechanisms and operating conditions.

- Develop an inspection plan for a critical industrial asset based on equipment importance, risk, damage mechanisms, and inspection objectives.
- Prepare clear and traceable technical inspection reports containing examination results, relevant indications, defect information, and recommendations.
- Use non-destructive testing results to support maintenance, repair, replacement, reliability, and asset integrity decisions.
- Develop improvement measures for strengthening non-destructive testing quality, inspection effectiveness, data management, and technical reporting.

Course Outline

DAY 01

Advanced Non-Destructive Testing Principles & Damage Mechanisms

- Principles and industrial applications of non-destructive testing and inspection
- Classification of defects and common material degradation mechanisms
- Relationship between material properties, defect characteristics, and inspection techniques
- Inspection method selection based on asset criticality, risk, geometry, and operating conditions

PRACTICAL APPLICATION

Analyze an industrial equipment case and identify potential damage mechanisms and appropriate non-destructive testing methods

DAY 02

Advanced Ultrasonic Testing & Inspection Techniques

- Principles and industrial applications of ultrasonic testing
- Thickness measurement and detection of internal discontinuities
- Defect location, sizing, characterization, and interpretation of ultrasonic indications
- Phased array ultrasonic testing and time-of-flight diffraction applications

DAY 02 — CONTINUED

PRACTICAL APPLICATION

Analyze ultrasonic inspection results, identify relevant indications, and evaluate data quality and inspection reliability

DAY 03

Radiographic, Magnetic, Surface & Visual Inspection

- Principles and applications of radiographic testing for welds and industrial components
- Magnetic particle testing for surface and near-surface discontinuities
- Liquid penetrant testing for surface-breaking defects
- Advanced visual inspection and remote inspection techniques

PRACTICAL APPLICATION

Compare inspection methods and select the most appropriate technique according to defect type, material, component geometry, and inspection requirements

DAY 04

Inspection Results, Defect Evaluation & Asset Integrity

- Interpretation of non-destructive testing indications and evaluation of inspection reliability
- Assessment of cracks, corrosion, weld discontinuities, material degradation, and other defects
- Detection limitations, measurement uncertainty, and common sources of inspection error
- Integration of inspection results with asset integrity, maintenance, reliability, and engineering assessment

PRACTICAL APPLICATION

Evaluate inspection results from a critical industrial asset and determine the significance of identified indications and appropriate technical actions

DAY 05

Inspection Program Development, Data Management & Continuous Improvement

- Developing advanced non-destructive testing and inspection programs for critical assets
- Establishing inspection priorities based on risk, criticality, and damage mechanisms
- Inspection documentation, technical reporting, traceability, and quality control
- Using inspection data to support maintenance, reliability, asset integrity, and life-cycle management

FINAL WORKSHOP

Develop an advanced inspection program for a selected industrial asset covering damage mechanisms, testing techniques, inspection scope, inspection frequency, result evaluation, reporting, recommendations, and improvement actions

Register or Request More Information

Course page: <https://quest-training.com/courses/advanced-non-destructive-testing-inspection-training-course>

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