

Course No. 1290

Advanced Ultrasonic Testing (AUT) Training Course

CORROSION, INSPECTION & NDT
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Advanced Ultrasonic Testing (AUT) Training Course provides a comprehensive and practical framework for professionals who require advanced knowledge of ultrasonic inspection techniques, data interpretation, inspection planning, and defect evaluation. The course builds upon fundamental ultrasonic testing principles and focuses on advanced applications used to assess the integrity of industrial components, welds, pipelines, pressure equipment, and other critical assets.

Advanced Ultrasonic Testing provides enhanced inspection capability for detecting and characterizing internal and subsurface discontinuities that may not be identifiable through conventional visual examination. By applying advanced ultrasonic techniques, organizations can obtain detailed information about defect location, dimensions, orientation, and distribution while supporting condition assessment, maintenance planning, asset integrity, and reliability decisions.

The course examines advanced ultrasonic testing principles, equipment configuration, probe selection, calibration, scanning strategies, signal interpretation, data acquisition, imaging, and defect characterization. Participants will explore advanced techniques including phased array ultrasonic testing, time-of-flight diffraction, encoded scanning, sectorial scanning, electronic beam steering, and advanced data analysis. The emphasis is placed on understanding how inspection parameters influence detection capability and result reliability.

The program also addresses practical challenges associated with complex weld geometries, difficult inspection areas, material variations, surface conditions, and interpretation of complex ultrasonic indications. Participants will develop structured approaches for inspection planning, calibration verification, data evaluation, reporting, and technical decision-making. The course supports organizations seeking to strengthen advanced non-destructive testing capabilities and improve the quality of integrity assessments for critical equipment and infrastructure.

Objectives

- Analyze advanced ultrasonic testing principles and their application to industrial inspection and asset integrity within the course.
- Evaluate the operating principles and applications of advanced ultrasonic inspection technologies, including phased array and time-of-flight diffraction techniques.

- Select appropriate probes, frequencies, wedges, scanning configurations, and inspection parameters for different materials and component geometries.
- Apply advanced calibration and verification procedures to establish reliable ultrasonic inspection conditions.
- Develop inspection strategies for welds, pipelines, pressure vessels, structural components, and other critical industrial assets.
- Interpret advanced ultrasonic signals, scans, images, and data sets to distinguish relevant indications from non-relevant responses.
- Evaluate the location, size, orientation, and characteristics of detected discontinuities using appropriate ultrasonic data analysis techniques.
- Apply electronic beam steering, focusing, sectorial scanning, and encoded scanning principles to improve inspection coverage and data quality.
- Assess the limitations, uncertainties, and sources of error associated with advanced ultrasonic testing results.
- Strengthen inspection reporting through accurate documentation of equipment settings, calibration information, scan coverage, indications, evaluations, and conclusions.
- Develop systematic approaches for reviewing advanced ultrasonic inspection data and determining when additional examination is required.
- Prepare a complete advanced ultrasonic testing inspection strategy for a selected industrial application by the end of the course.

Who Should Attend

The Advanced Ultrasonic Testing (AUT) Training Course is designed for experienced non-destructive testing professionals, inspection engineers, asset integrity specialists, and technical personnel involved in advanced ultrasonic examination and evaluation of industrial assets. It is particularly suitable for ultrasonic testing technicians, NDT inspectors, inspection engineers, mechanical engineers, welding inspectors, corrosion engineers, materials engineers, pipeline integrity specialists, reliability engineers, and asset integrity engineers who require advanced ultrasonic inspection capabilities.

The course is also relevant to inspection supervisors and managers, NDT coordinators, quality assurance and quality control professionals, engineering managers, maintenance managers, pipeline integrity teams, and technical authorities responsible for defining inspection requirements and evaluating advanced NDT results. Professionals involved in weld inspection, pipeline inspection,

pressure equipment assessment, fabrication, construction, maintenance, shutdowns, and integrity management will benefit from the advanced technical content.

The program is particularly valuable for organizations where reliable detection and characterization of internal discontinuities are important for equipment integrity and operational decision-making. It supports multidisciplinary teams by improving their ability to understand advanced ultrasonic inspection results, assess technical findings, communicate inspection requirements, and integrate NDT information into broader maintenance, reliability, and asset integrity programs.

Learning Outcomes

- Explain advanced ultrasonic testing principles and their relationship to conventional ultrasonic inspection methods.
- Describe the operating principles and practical applications of phased array ultrasonic testing and time-of-flight diffraction.
- Select appropriate probes, frequencies, wedges, beam configurations, and scanning techniques for specific inspection applications.
- Configure and verify advanced ultrasonic testing equipment according to defined inspection requirements.
- Establish appropriate calibration and reference conditions for advanced ultrasonic examinations.
- Develop inspection coverage strategies for welds, pipelines, pressure vessels, and complex industrial components.
- Interpret sectorial scans, encoded scans, ultrasonic images, A-scans, and other advanced inspection data.
- Characterize relevant indications according to their location, dimensions, orientation, morphology, and ultrasonic response.
- Distinguish relevant indications from geometric echoes, surface effects, structural noise, and other non-relevant responses.
- Evaluate inspection limitations, measurement uncertainty, scan coverage, and factors affecting result reliability.
- Prepare comprehensive advanced ultrasonic testing reports containing inspection parameters, calibration information, coverage, findings, evaluations, and conclusions.
- Determine when additional inspection, alternative NDT methods, or engineering assessment is required based on advanced ultrasonic findings.

Course Outline

DAY 01

Advanced Ultrasonic Testing Principles and Inspection Technology

- Review of ultrasonic testing fundamentals and advanced inspection concepts.
- Wave propagation, reflection, refraction, attenuation, scattering, and acoustic impedance.
- Advanced ultrasonic equipment architecture and signal processing.
- Probe characteristics, frequency selection, bandwidth, sensitivity, and resolution.
- Wedges, couplants, beam angles, and beam behavior in different materials.
- Advanced calibration principles and reference standards.
- Inspection sensitivity, resolution, signal-to-noise ratio, and detection capability.
- Introduction to phased array ultrasonic testing and electronic beam control.
- Introduction to time-of-flight diffraction and advanced defect detection principles.
- Selection of advanced ultrasonic techniques according to component geometry and inspection objectives.

PRACTICAL APPLICATION

Develop an advanced ultrasonic inspection configuration for a representative industrial component and determine the required equipment and inspection parameters.

DAY 02

Phased Array Ultrasonic Testing and Advanced Scanning

- Principles of phased array technology and multi-element transducers.
- Electronic beam steering and beam focusing.
- Sectorial scanning and linear scanning configurations.
- Probe selection and wedge configuration for different applications.
- Focal laws and their influence on inspection coverage.
- Scan planning for welds and complex geometries.
- Encoded scanning and position tracking.
- Data acquisition and digital ultrasonic imaging.

DAY 02 — CONTINUED

- Detection of planar and volumetric discontinuities using phased array techniques.
- Interpretation of sectorial and encoded scan results.
- Common phased array inspection challenges and troubleshooting.

PRACTICAL APPLICATION

Develop a phased array inspection plan for a welded component, including probe selection, scanning range, focal configuration, coverage, and data acquisition requirements.

DAY 03

Time-of-Flight Diffraction and Advanced Defect Characterization

- Fundamentals of time-of-flight diffraction.
- Diffraction behavior at crack tips and discontinuity boundaries.
- Probe positioning and inspection geometry.
- Time-of-flight measurements and signal interpretation.
- Detection and sizing of planar defects.
- Application of time-of-flight diffraction to weld inspection.
- Integration of time-of-flight diffraction with conventional ultrasonic testing.
- Defect height, length, depth, and location assessment.
- Interpretation of advanced ultrasonic indications.
- Comparison of phased array and time-of-flight diffraction applications.
- Limitations and sources of uncertainty in advanced ultrasonic sizing.

PRACTICAL APPLICATION

Analyze representative advanced ultrasonic data and determine defect location, dimensions, orientation, and relevance.

DAY 04

Data Interpretation, Evaluation, and Inspection Reliability

- Advanced interpretation of A-scans, sectorial scans, encoded data, and ultrasonic images.
- Identification of relevant and non-relevant indications.
- Geometric echoes and complex component responses.
- Evaluation of weld geometry and structural noise.
- Assessment of scan coverage and inspection completeness.
- Factors affecting ultrasonic sensitivity and defect detectability.
- Material characteristics and their influence on ultrasonic response.
- Surface condition, access limitations, curvature, and component geometry.
- Measurement uncertainty and sizing accuracy.
- Verification of indications using alternative scan configurations.
- Determining requirements for additional inspection or complementary NDT methods.

PRACTICAL APPLICATION

Review a complex ultrasonic inspection data set, identify significant indications, evaluate their reliability, and develop recommendations for additional examination where required.

DAY 05

Advanced AUT Inspection Planning, Reporting, and Asset Integrity

- Developing advanced ultrasonic testing procedures and inspection plans.
- Defining inspection objectives, coverage requirements, equipment, probes, and scanning strategies.
- Establishing calibration, verification, and data quality requirements.
- Documentation of inspection parameters and equipment settings.
- Recording scan coverage, indications, measurements, and evaluation results.
- Advanced ultrasonic testing reporting and technical documentation.
- Integration of AUT findings with welding inspection and asset integrity assessments.
- Using advanced ultrasonic data to support maintenance and integrity decisions.
- Managing inspection limitations, uncertainties, and technical assumptions.

DAY 05 — CONTINUED

- Quality assurance and review of advanced ultrasonic inspection results.
- Roles of NDT specialists, inspection engineers, engineering authorities, and asset integrity teams.

FINAL WORKSHOP

Develop and present a complete Advanced Ultrasonic Testing inspection strategy for a selected industrial asset, including inspection objectives, technique selection, equipment configuration, calibration requirements, scanning methodology, data acquisition, defect characterization, result evaluation, reporting, quality verification, and recommendations for further assessment or corrective action.

Register or Request More Information

Course page: <https://quest-training.com/courses/advanced-ultrasonic-testing-aut-training-course>

Website: <https://quest-training.com>

Email: info@quest-training.com

Phone: +905016771440