Non-Destructive Testing (NDT) Methods: VT, PT, MT, UT, RT and Eddy Current

10 – 21 January 2027
Dammam - Eastern Province five-star



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Introduction:

Non-destructive testing NDT is how plants, fabricators and asset owners find cracks, laminations, porosity and wall loss without cutting the part, yet results are only as sound as the method chosen, the calibration behind it and the person reading the indication. This Core Concept course works through each NDT method in turn: visual, liquid penetrant, magnetic particle, ultrasonic, radiographic and eddy current testing, with phased array and TOFD at overview. Participants write an NDT Procedure and Technique Sheet for a component from their own work.

Course Objectives:

- Explain the role of NDT in fabrication quality assurance and in-service integrity, and the Level 1, 2 and 3 responsibilities that ISO 9712 and SNT-TC-1A describe
- Carry out and record visual, liquid penetrant and magnetic particle examinations with correct system checks and indication evaluation
- Calibrate ultrasonic equipment on reference blocks and perform thickness gauging and weld flaw detection with documented sensitivity
- Evaluate radiographs, film or digital, for image quality and discontinuity type while observing radiation safety controls
- Select an NDT method or combination for welds, castings, forgings and in-service corrosion based on flaw type, material and access
- Write an NDT procedure and technique sheet with acceptance criteria and a reporting format that a reviewer can approve

Target Audience:

- QA/QC inspection staff responsible for witnessing, performing and accepting NDT on fabricated items
- Integrity engineering staff responsible for corrosion monitoring and in-service inspection data
- Inspection engineering staff responsible for inspection and test plans and NDT scope on plant equipment
- NDT technicians responsible for running examinations and moving from routine testing to procedure work
- Vendor surveillance staff responsible for reviewing supplier NDT reports and personnel records

Course Outline:

Day 1: NDT in Quality Assurance and Asset Integrity

- NDT Versus Destructive Testing: Role in Fabrication QA and In-Service Integrity Programmes
- Discontinuity, Indication and Defect Terminology and the Probability of Detection Concept
- Inherent, Processing and Service-Induced Discontinuities in Welds, Castings and Forgings
- ISO 9712 and SNT-TC-1A Schemes: Level 1, Level 2 and Level 3 Responsibilities
- Codes, Standards, Written Procedures and Technique Sheets: The NDT Document Hierarchy

Day 2: Visual Testing and Liquid Penetrant Testing

- Direct and Remote Visual Testing: Lighting, Viewing Angle, Borescopes and Weld Gauges
- Penetrant Process Steps: Pre-Cleaning, Dwell Time, Excess Removal, Developer and Inspection
- Visible Dye Versus Fluorescent Penetrant Systems and Removal Method Selection
- PT System Performance Checks With Reference Panels and UV-A Intensity Measurement
- Linear and Rounded Indications: PT Evaluation and Examination Record Sheet

Day 3: Magnetic Particle Testing

- Magnetisation Principles: Flux Leakage, Permeability and Field Direction Relative to Flaws
- Yokes, Prods, Coils and Central Conductors: Magnetisation Technique Selection
- Wet and Dry, Visible and Fluorescent Particles and Contrast Paint Application
- Field Adequacy Verification With Field Indicators and Yoke Lifting Power Checks
- Relevant, Non-Relevant and False MT Indications and Demagnetisation Requirements

Day 4: Ultrasonic Testing: Thickness Gauging and Flaw Detection

- Pulse-Echo and Through-Transmission Principles, Frequency and Probe Selection
- Digital Thickness Gauges Under ISO 16809: Dual-Element Probes, Velocity Setting and Grid Surveys
- Flaw Detector Calibration With ISO 2400 and ISO 7963 Reference Blocks
- Straight-Beam Lamination Checks and Angle-Beam Weld Scanning Patterns
- DAC Curves, Reference Sensitivity, Echo Sizing and UT Indication Reporting

Day 5: Week-One Walkthrough: Examining a Fabricated Pressure Component

- Case Brief: Butt-Welded Nozzle Assembly and Its Inspection and Test Plan
- Choosing VT, PT, MT and UT Coverage by Material, Surface Condition and Joint Geometry
- Reviewing Case PT and MT Record Sheets for Missing Parameters and Coverage Gaps
- Interpreting Case UT Data: Thickness Readings and Weld Indication Plots
- Week-One Findings Summary: Accept, Reject or Re-Examine Decisions

Day 6: Radiographic Testing: Film, Digital and Radiation Safety

- X-Ray and Gamma Sources, Source-to-Film Distance and Geometric Unsharpness
- Exposure Arrangements for Plate and Pipe: Single-Wall and Double-Wall Views
- Image Quality Indicators, Film Density and Radiograph Viewing Conditions
- Computed and Digital Radiography: Imaging Plates, Detector Arrays and Image Processing
- Radiation Safety at Overview: Time, Distance, Shielding, Controlled Areas and Dosimetry

Day 7: Radiograph Interpretation, Acceptance Concepts and NDT Reliability

- Radiographic Images of Porosity, Slag, Lack of Fusion, Cracks and Casting Shrinkage
- Acceptance Criteria Concepts: Workmanship Levels Versus Fitness-for-Purpose Limits
- Sizing Uncertainty, False Calls and Missed Flaws in Inspection Decisions
- Technique Qualification and Performance Demonstration for NDT Methods
- NDT Quality Audit: Calibration Certificates, Consumable Batch Control and Personnel Records

Day 8: Eddy Current, PAUT and TOFD at Overview

- Eddy Current Principles: Coil Impedance, Test Frequency and Standard Depth of Penetration
- Eddy Current Uses: Surface Crack Detection, Heat Exchanger Tubes and Coating Thickness
- Phased Array UT: Focal Laws, Sectorial Scans and Encoded Weld Scanning
- TOFD Under ISO 10863: Diffracted Tip Signals, Dead Zones and Flaw Height Sizing
- Complementary Methods at Overview: Acoustic Emission, Thermography and Magnetic Flux Leakage

Day 9: Method Selection, Reporting to Stakeholders and NDT Performance

- NDT Method Selection Matrix: Flaw Type, Orientation, Material, Thickness and Access
- Castings and Forgings: Volumetric and Surface Examination Sequence and Timing
- In-Service Corrosion: Condition Monitoring Locations and Wall Loss Trending
- NDT Report Content for Integrity Engineers, Operations and Client Reviewers
- NDT Performance Measures: Weld Repair Rates, Rejection Trends and Re-Inspection Findings

Day 10: Capstone: NDT Procedure and Technique Sheet

- NDT Procedure Structure: Scope, Personnel, Equipment, Calibration, Technique and Acceptance
- Technique Sheet Drafting: Probe or Source, Scan Plan, Sensitivity and Coverage for a Chosen Component
- Indication Record and Examination Report Template for the Chosen Method
- Procedure Peer Review Against a Level 3 Review Checklist
- NDT Procedure and Technique Sheet Presentation and Improvement Actions

Skills You Will Gain:

- Discontinuity Classification
- Penetrant System Control
- Magnetisation Technique Selection
- Ultrasonic Calibration
- Radiograph Image Quality Review
- NDT Method Selection
- NDT Procedure Writing
- Inspection Report Review

Why Attend This Course:

- Leave with an NDT Procedure and Technique Sheet written for a component from your own work
- Spot weak calibration, poor coverage and unsupported acceptance decisions in contractor NDT reports
- Understand what each qualification level may do, so the right person signs each examination
- Compare inspection practice with peers from oil and gas, power, fabrication and process plants

Conclusion:

Reliable NDT depends on matching the method to the flaw, proving the system works before testing and recording indications so that another inspector can repeat the result. Week one builds hands-on capability in visual, penetrant, magnetic particle and ultrasonic testing and applies it to a fabricated component. Week two adds radiography, interpretation, reliability, eddy current, phased array and TOFD, then method selection and reporting. The final day turns this into an NDT Procedure and Technique Sheet ready for review.