

## Inspection and Validation Techniques for Welded Joints

### Recommended Duration: 3–4 Days

#### COURSE OVERVIEW

This training focuses on inspection method selection and application before, during, and after ultrasonic peening (HFMI) treatments for welded joints. It addresses offshore-specific challenges including coated surfaces, needle-gunned steel, and corrosion conditions. Recommended course duration: 3–4 days depending on the level of hands-on inspection practice required.

#### TARGET AUDIENCE

This course is intended for professionals involved in inspection, validation, and integrity management of welded structures before and after ultrasonic peening (HFMI), including:

- Inspection engineers and NDT specialists
- Structural and fatigue engineers
- Asset integrity and maintenance engineers
- Offshore, marine, and energy-sector engineers
- Quality, verification, and certification personnel
- Engineers and supervisors responsible for HFMI execution and acceptance

#### REQUIRED QUALIFICATIONS / BACKGROUND

Participants are expected to have:

- A technical or engineering background (structural, mechanical, materials, or inspection disciplines)
- Basic familiarity with welded joints and common NDT methods
- Understanding of fatigue, cracking mechanisms, or asset integrity principles is beneficial

The course is suitable for both experienced inspectors seeking deeper understanding of HFMI-related validation and engineers responsible for specifying or accepting inspection programs.

#### COURSE DURATION & FORMAT

Recommended duration: 3–4 days

Format:

- Instructor-led training (classroom or virtual)
- Technical lectures combined with real-world offshore case studies
- Optional hands-on inspection and validation exercises
- Group discussions and method-selection exercises

The duration can be adjusted depending on the level of practical inspection training required.



## DAY 1 — Fundamentals of Weld Integrity & Pre-Peening Inspection

1. Introduction to Welded Joint Integrity
  - Fatigue-critical weld details
  - Importance of accurate inspection prior to HFMI
  - Offshore constraints and safety considerations
2. Pre-Peening Inspection Methods
  - Visual Testing (VT)
  - Magnetic Particle Testing (MT)
  - Dye Penetrant Testing (PT)
  - Ultrasonic Testing (UT & PAUT)
  - Radiographic Testing (RT)
  - Surface Profilometry / 3D Scanning
3. Limitations for Offshore Coated or Corroded Structures
  - Effect of coatings on MT/PT/UT
  - Inspection after needle gunning
  - Corrosion masking effects
  - Recommended cleaning practices

## DAY 2 — In-Process Inspection & Monitoring During Peening

1. In-Process Monitoring Techniques
  - Visual coverage verification
  - Imprint/indentation depth checks
  - Tool parameter monitoring (frequency, amplitude)
  - Temperature monitoring for sensitive materials
2. Documentation & Traceability
  - Parameter logging
  - Peening coverage mapping
  - Operator qualification requirements
3. Practical Session (Optional)
  - Hands-on demonstration of in-process verification
  - Identification of under- and over-treated welds

## DAY 3 — Post-Peening & Recurrent Inspection Methods

1. Post-Peening Inspection Techniques
  - VT for toe radius and surface uniformity
  - MT for ferromagnetic weld crack detection



- PT for aluminium, titanium, Inconel welds
- UT/PAUT for subsurface crack monitoring

## 2. Validation of Peening Quality

- Residual stress measurement (XRD, hole-drilling, Barkhausen noise)
- Surface geometry verification (profilometry/laser scans)
- Documentation and acceptance criteria

## 3. Recurrent Inspection (Long-Term Monitoring)

- Fatigue life extension tracking
- Inspection interval determination
- Offshore re-inspection challenges

## DAY 4 (Optional) — Case Studies, Method Selection Exercise & Certification

### 1. Method Selection Framework

- Choosing inspection techniques based on:
  - coating condition
  - corrosion level
  - weld material
  - loading conditions
  - access and safety

### 2. Offshore Case Studies

- HFMI on ageing structures
- Failures linked to poor inspection
- Lessons learned

### 3. Competency Exercise

- Students select the appropriate inspection sequence
- Crack detection and validation workflow development

### 4. Final Assessment & Certification

## LIST OF RELEVANT INSPECTION METHODS FOR ULTRASONIC PEENING

### Surface Methods:

- Visual Testing (VT)
- Magnetic Particle Testing (MT)
- Dye Penetrant Testing (PT)
- Eddy Current Testing (ET)
- ACFM (Alternating Current Field Measurement)
- 3D Scanning / Profilometry



# LETSGLOBAL

life extension of technical structures

## Subsurface Methods:

- Ultrasonic Testing (UT)
- Phased Array UT (PAUT)
- TOFD
- Radiography (RT/DR)

## Residual Stress & Validation:

- X-Ray Diffraction (XRD)
- Hole-Drilling Method
- Barkhausen Noise Analysis
- Ultrasonic Residual Stress Measurement

## Process Monitoring:

- Parameter logging
- Indentation depth check
- Temperature monitoring
- Tool wear inspection