

COURSE SYLLABUS

NDE TRAINING FOR LONG SEAM EVALUATION

March 2025

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1 Summary

This course covers specific NDE theory and practices for pipeline ERW long seam inspection. Course candidates should be certified to ASNT Level II and have prior experience in multiple NDT methods for ERW flaw detection, characterization, and sizing.

Course activities include lecture, technology demonstrations, and hands-on experience on real and simulated ERW flaw conditions in an NDE lab environment.

The course duration is 40 hours: 8 AM – 5 PM Monday – Friday. Other schedules may be allowed upon agreement.

2 Learning Objectives

By taking this course, learners will develop and measure competency in:

- The use of primary NDE methods
- The use of complementary NDE methods
- System calibration
- Detection of features
- Identification and characterization of features
- Sizing of features
- Avoiding false calls.

NDE methods covered by the course include:

- Phased Array UT, including semi-automated data collection
- Conventional Straight Beam and Shear Wave UT
- Magnetic Particle Testing
- Visual Inspection
- Ultrasonic Flaw Length and Height Sizing
- Ultrasonic Flaw Characterization
- General NDE Best Practices

The material will discuss how to apply these methods specifically to longseam examination. FMC-TFM, PCI ultrasonic methods are included within a limited scope. TOFD is outside of the scope of this course.

3 Required Equipment

The following equipment is to be brought by the student:

Required:

- PAUT instrument (32:128 or greater recommended)
- PAUT probes (10L32 A10 recommended)
 - A second matching probe is recommended (for dual encoded scans)
- COD wedges for 12", 10", 8" (16" recommended)
- Encoder (dedicated long seam scanner with couplant supply recommended)
- PAUT Splitter (for dual encoded scans)
- Shear wave scope with standard selection of angle and straight beam probes.

- Mag particle kit
- Couplant
- Tenth scale, tape measure, etc.
- Calibration blocks (NAVSHIPS, IIW, PACS, etc.)
- Anything else normally used for a longseam inspection

Optional:

- Laptop with analysis software
- Curved calibration blocks
- Zero degree wedge for PAUT probe

4 Agenda

4.1 Day 1 - Introduction

1. Meet and Greet (30 minutes)
 - a. Instructor and Participant Introductions
 - b. Meeting Room Logistics, Attendance, Media Release Form
 - c. Safety Rules
2. Course Overview and Objectives (30 minutes)
3. Entrance Exam and Review (2 hours)
4. ERW Basics (4 hours)
 - a. ERW Seam Welding Process
 - b. ERW Defect Characterization
 - i. *Hook Flaw*
 - ii. *Lack of Fusion*
 - iii. *Lamination*
 - iv. *Crack*
 - v. *Offset*
 - vi. *Trim (ID/OD, Over/Under)*
 - vii. *Inclusion*
 - viii. *Metal Loss*
 - ix. *Surface Discontinuities*
5. Inspection Process
 - a. Work Process Overview
 - i. *Pre-Work*
 - ii. *Visual Inspection*
 - iii. *Magnetic Particle Inspection*
 1. *Lab: Visual Testing (30 minutes)*
 2. *Lab: Magnetic Particle Testing (30-45 minutes)*
 - iv. *Straight Beam Thickness Verification*
 1. *PAUT Data Acquisition*
 2. *Scan Plan and Setup*
 3. *Data Collection*
 - v. *Phased Array Data Analysis*

- vi. *Manual UT Follow-up*
 - 1. *PAUT*
 - 2. *Conventional UT*
 - 3. *UT-TM*
 - 4. *Shear wave*
- vii. *Reporting and Marking*
- viii. *Choosing Landing Zone for Sleeve*

4.2 Day 2 – Phased Array UT for Long Seams

1. Equipment Selection (60-minute lecture)
 - a. Guidance
 - b. Beneficial Tools
 - i. *Wedge Profiling*
 - ii. *Curvature Compensation*
 - iii. *Rebound View*
 - c. Probe Selection
 - d. Scanners
2. Error Sources (90-minute lecture)
 - a. Types of Error Sources
 - i. *Part Configuration*
 - ii. *Velocity Calibration*
 - iii. *Wedge Delay*
 - iv. *Focus*
 1. *Lab – PAUT: Focused vs. Unfocused (30-45 min)*
 - v. *Angle Selection (Sweep) and Resolution*
 - vi. *Sensitivity and TCG*
 1. *Lab – PAUT: Validating TCG (30-45 min)*
 - vii. *Geometric Reflectors*
 - viii. *Probe Selection*
3. Hook Flaw Characterization (30-minute lecture)
 - a. *Demonstration on Optiflaw Hook Flaw Sample (15 min)*
 - b. *Lab: Hook Flaw Characterization (60 min)*
4. Sizing Hook Flaws (30-minute lecture)
 - a. Height Sizing
 - i. *Demonstration Video: Hook Flaw Height Sizing*
 - b. Length Sizing Methods
5. Characterizing Bondline Lack of Fusion (20-minute lecture)
 - a. ERW Detection Challenges
 - b. Examples
 - c. *Demonstration: Lack of Fusion Characterization (30-45 min)*
6. *Lab: Blind Practice (30-45 min, open practice for remainder)*

4.3 Day 3 - UT

1. Conventional UT

- a. *Optional Lab: UT Conventional Shear Wave Crack Sizing*
 - b. *Optional Lab: UT: Straight Beam Characterization*
- 2. Automated UT:
 - a. Scan Planning (30-minute lecture)
 - i. *Lab: Scan Planning (15-30 minutes)*
 - ii. *Lab: AUT Data Collection (60 minutes)*
 - b. Straight Beam AUT (60-minute lecture)
- 3. Data Analysis (60-minute lecture)
 - a. Software Setup
 - b. Reporting
 - i. *Demonstration: AUT Data Analysis*
 - ii. *Lab: Data Analysis (30-60 minutes), discussion and data review*
- 4. Manual Follow-up (20-minute lecture)
 - a. Procedure
 - b. *Demonstration: Manual Follow Up*
 - c. *Open Practice (Data Analysis and Manual Follow Up) for remainder of time*

4.4 Day 4 -

- 1. Q&A and Review (1-2 hours)
- 2. Cracks (30-minute lecture)
 - a. Defect Characterization
 - b. Example Profile
 - c. Hallmarks of a Crack
 - d. Sizing Methods
 - e. *Demonstration: PAUT Crack Sizing*
 - f. *Lab – PAUT: Crack Sizing (60-90 minutes)*
- 3. Open Practice

4.5 Day 5 -

- 1. Q&A and Review (1-2 hours)
- 2. Open Practice, if needed (1-2 hours)
- 3. Exit exam (2 hours)
- 4. Grading and review
- 5. Course evaluation
- 6. Conclusion