NDT Course Syllabus

Ultrasonic Testing Level I:

1- Sound Wave

- Introduction
- ASNT Level I
- Sound Wave Propagation
- Velocity / Frequency / Wave Length
- Acoustic Impedance
- Energy / Intensity

2- Ultrasound Wave Modes and Incidence to Interface

- Longitudinal Wave
- Transverse Wave
- Surface Wave
- Lamb Wave
- Normal Incidence
- Reflection / Transmission
- Oblique Incidence
- Mode Conversion
– Refraction
- Snell's Law
- 1 st Critical Angle
- 2 nd Critical Angle

3- Generation of Ultrasonic Wave

- Piezoelectric Effect
- Ultrasonic Transducer
- Natural Piezoelectric Transducers
- Polarized Ceramic Transducers
- Ultrasonic Beam
- Near Field
- Far Field

- Beam Divergence

4- Attenuation

- Scattering Effect
- Absorption Effect
- Divergence Effect
- Surface Roughness and Coupling Effect
- Graininess

5- Basic Ultrasonic Test Methods

- Through Transmission
- Pulse Echo

6- Test Equipments

Ultrasonic Probe Classification

- Straight single Crystal Probe
- Straight Dual Crystal Probe - Angle Probe
- Damping and Bandwidth - Sensitivity and Resolution
- Dead Zone
- Ultrasonic Flaw Detector Diagram
- Basic Component and Function
- Decibel and Echo amplitude

-A Scan - B Scan - C Scan

7- Calibration

- Standard Calibration Blocks
- Reference Calibration Block
- Linearity Check
- Time Base Calibration
- Sensitivity Calibration and DAC
- Determination of Probe Index Point
- Checking of Probe Angle
- Resolution of Normal Probe
- Penetration Power of Normal probe

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- Determination of Dead Zone for Normal Probe

8- Geometric Rules

- Full Skip Distance
- Beam Path
- Determination of Reflector Location

9- Techniques

- Contact Technique
- Coupling Media
- Immersion Technique

10- Defect Sizing

- 6dB Drop Method
- 20dB Drop Method

11- Welds Type and Testing Procedure

- Joint Types
- Types of Preparation
- Type of Welding
- Ultrasonic Testing Procedure
- Probe Selection
- Visual Testing and Surface Preparation
- Base Metal Testing
- Root Weld Testing
- Weld Body Testing
- Report

12- Weld Defects and Indications

- Non Relevant Indications
- Relevant Indications
- Welding Defects
- Determination of Defect Nature

13- Standards

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Ultrasonic Testing Level II:

1- Introduction

- ASNT Level I/II/III

- Scope and Applications

2- Sound Wave Principles and Terms

- Sound and Ultrasound - Sound Wave Diagram

- Velocity / Frequency / Wave Length

- Acoustic Impedance

- Wave Energy / Intensity / Pressure

3- Ultrasound Wave Modes

- Longitudinal Wave

- Shear Wave

- Surface Wave

- Lamb Wave

4- Wave Incidence to Interface

- Normal Incidence

- Reflection / Transmission Coefficient

- Oblique Incidence

- Mode Conversion

- Refraction - Snell's Law

- 1 st Critical Angle

- 2 nd Critical Angle

5- Generation of Ultrasonic Wave

- Piezoelectric Effect

- Type of Ultrasonic Transducer

- Type of Piezoelectric Transducer

- Natural piezoelectric Crystal

- Polarized Ceramic Transducer

- Advantages / Disadvantages

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6- Ultrasound Beam

- Huygens Principle
- Near Field and Characteristics
- Far Field and Characteristics
- Beam Divergence
- Divergence Coefficient

7- Attenuation

- Wave Scattering
– Absorption
- Wave Diffraction
- Divergence Effect
- Surface Roughness and Coupling Effect
- Graininess and Attenuation
- Effect of Frequency on Attenuation

8- Basic Ultrasonic Test Methods

- Through Transmission
- Pulse Echo
- Resonance

9- Test Equipments - Ultrasonic Probe Classification

- Straight single Crystal Probe Construction
- Dead Zone
- Damping and Bandwidth
- Narrowband / Broadband Probes
- Pulse Length
- Straight Dual Crystal Probe
- Roof Angle
- Angle Probe
- Determination of Wave Angle
- Ultrasonic Flaw Detector Diagram
- Basic Component and Function

- CRT - Transmitter /Receiver

- Timer and PRF - Amplifier / Logarithmic Db

-A Scan - B Scan - C Scan

10- Calibration

- Standard Calibration Blocks

- Reference Calibration Block / Artificial Defect

- Vertical and Amplitude Control Linearity Check - Time Base Calibration

- Sensitivity Calibration and DAC

- Determination of Probe Index Point

- Checking of Probe Angle

- Resolution of Normal Probe

- Penetration Power of Normal probe

- Determination of Dead Zone for Normal Probe

- ASME Reference Block

- ASTM Area and Distance Amplitude Blocks

11- Geometric Rules

- Full Skip Distance

- Beam Path

- Curve Influence

- Determination of Reflector Location

12- Techniques

- Contact Technique

- Coupling Media

- Immersion Technique

- Bubbler and Wheel Type

- Type of Probe Arrangements

13- Defect Sizing

- 6dB Drop Method

- 20dB Drop Method

- DGS Method

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14- Welds Type and Testing Procedure

- Standard and Acceptance
- Joint Types
- Types of Preparation
- Type of Welding
- Ultrasonic Testing Procedure
- Probe Selection
- Visual Testing and Surface Preparation
- Base Metal Testing
- Root Weld Testing
- Weld Body Testing
– Report

15- Weld Defects and Interpretation and Evaluation

- Non Relevant Indications
- Relevant Indications
- Welding Defects
- Determination of Defect Nature

16- Standards

References:

- IAEA Ultrasonic Testing of Material-1999
- ASNT Ultrasonic Method-1979
- ASM Vol. 17 – 2004
- ASNT Level III Study Guide