

# **Ultrasonic Testing**

## **Level I**

### **Training Course Outline**

#### **SCOPE**

This course introduces the basic principles of ultrasonics and prepares the candidate for Thickness Measurement and other 0-degree inspections. (See Level II Course Outline for Angle Beam Testing)

This course prepares a candidate to

- Perform Specific Calibrations
- Specific NDT
- Specific Evaluations for Accept or Reject Determinations according to written Instructions
- Record Results

#### **TRAINING**

Training Material is presented in Module that are followed by Quizzes

#### **MODULE CP-1: PERSONNEL CERTIFICATION**

ASNT SNT-TC-1A

NAS 410

CP-189

#### **MODULE MD-1: MANUFACTURING DISCONTINUITIES**

- Types of Discontinuities :- Inherent, Processing and Service
- Casting Discontinuities :- Hot Tear, Cold Shut, Porosity, Shrinkage
- Primary Processing Discontinuities including discontinuities in Rolling, Forging, Drawing, Extruding
- Secondary Processing Discontinuities including discontinuities in Grinding, Heat Treating, Machining, Welding, Plating
- Service Discontinuities:- Erosion, Wear, Fatigue, Corrosion, Creep, Hydrogen Attack

#### **MODULE 1: MATHEMATICS**

- Trigonometry
- Decibels

#### **MODULE 2: WAVE MODES**

- Time Period and Frequency
- Wavelength
- Wave Modes including Longitudinal, Shear, Surface and Lamb Waves
- Velocity of Waves
- Calculation of Velocity
- Factors Affecting Velocity - Temperature, Stress
- Laboratory Measurement of Velocity

### **MODULE 3: ACOUSTIC IMPEDANCE**

- Acoustic Impedance
- Calculation of Acoustic Impedance
- Reflection and Transmission Coefficients
- Transmission through a layer

### **MODULE 4: REFRACTION AND REFLECTION (Covered in Level I and II training)**

- Reflection and Refraction
- Snell's Law
- Mode Conversion
- First and Second Critical Angle
- Creeping Waves
- Problems on Mode Conversion

### **MODULE 5: PIEZOELECTRIC TRANSDUCER**

- Wave Interference: Constructive and Destructive
- Sound Field
- Near Field
- Far Field
- Beam Spread
- Problems on Near Field and Beam Spread
- Laboratory measurement of Beam Spread
- Principles of Piezoelectricity
- Curie Temperature
- Transducer damping
- Bandwidth
- Type of Transducers
- Contact and Immersion Transducers
- Dual Element, Delay Line, Angle Beam Transducer
- Couplant

### **MODULE 6: PULSER RECEIVER**

- Ultrasonic Instrumentation - Analog
- Ultrasonic Instrumentation - Digital
- Time Base
- Pulse Repetition Rate
- Types of Ultrasonic Display – A, B and C Scan
- Gates
- Calibration of Ultrasonic Equipment - Time and Amplitude Linearity (Level II)

### **MODULE 7: ATTENUATION**

- Sound Attenuation
- Causes for Attenuation

- Attenuation Measurement
- Calculation of Amplification
- Laboratory - Measurement of Attenuation

## **MODULE 8: THICKNESS MEASUREMENT**

- Test Modes
- Thickness Measurement
- Thickness Measurement Frequency
- Screen Calibration
- Problems
- Laboratory - Thickness measurement, Corrosion Mapping

## **MODULE 9: IMMERSION TESTING**

- Advantages and Limitations of Immersion Testing
- Technique
- Minimum Water Path calculation
- Types of Immersion Testing Transducers
- Bubbler/Squitter Technique
- Wheel Type Transducer

## **MODULE 10: FLAW DETECTION - 0 DEGREE**

- Lamination, Corrosion Mapping, Base Metal defects, Bolts
- Laboratory scanning on lamination and forged sample as per SA-578 and SA-388

## **PRACTICALS**

- Velocity measurement
- Thickness Measurement
- Thickness Scanning
- Plates
- Tubes
- Corroded samples
- Bolt Inspection
- Laminated Plates

## **EXAMINATIONS**

General

Specific

Practical

Candidates must score a minimum of 70 % in each test and a minimum of 80% average for all the three tests.

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