

# Ultrasonic Testing

Level I

Training Course Outline

## **SCOPE**

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

This course prepares a candidate

- Select equipment to conduct test
- Setup test equipment
- Steps to conduct test
- Calibration
- Familiarize with codes and standards
- Interpret results with respect to applicable codes and standards
- Understand limitation of the test method
- Write test reports.

## **TRAINING**

Training material is presented in modules that are followed by quizzes

## **PERSONNEL CERTIFICATION**

ASNT SNT-TC-1A

NAS 410

Training, experience and examination requirements

Training Requirements

- Recommended Course Outline
- Training Hours
- Practicals
- Quizzes and examinations

## **MODULE 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

## **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

### **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
- 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
- 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/Squirter Technique
- Wheel Type Transducer

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

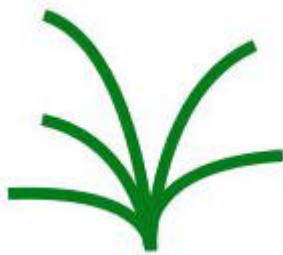
- Lamination, Corrosion Mapping, Base Metal defects, Bolts
- Loss of backsurface echo technique
- Use of Flat bottom holes
- ASME Section V, Article 5
- ASTM standard SA-578 Straight Beam Examination

## **PRACTICALS**

- Thickness Measurement
- Thickness Scanning
- Loss of backsurface echo
- Flaw detection

## **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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