

## **ULTRASONIC TESTING TRAINING COURSE**

### **Level I - Outline**

#### **I. Basic Ultrasonic Course**

1. Introduction
  - a. Definition of ultrasonics
  - b. History of UT
  - c. Applications of ultrasonic energy
  - d. Basic math review
  - e. Responsibilities of levels of certification
2. Basic Principles of Acoustics
  - a. Nature of sound waves
  - b. Modes of sound wave propagation
  - c. Velocity, frequency and wavelength of sound waves
  - d. Attenuation of sound waves
  - e. Acoustic impedance
  - f. Reflection
  - g. Refraction and mode-conversion
  - h. Snell's law and critical angles
  - i. Fresnel and Fraunhofer effects
3. Equipment
  - a. Basic pulse-echo instrumentation (A-, B-, and C-scan)
  - b. Digital thickness instrumentation
  - c. Transducer operation and theory
    - i. Piezoelectric effect
    - ii. Types of crystals
    - iii. Frequency (thickness-frequency relationships)
    - iv. Near field and far field
    - v. Beam spread
    - vi. Construction, materials and shapes
    - vii. Types (straight, angle, dual, etc.)
    - viii. Beam intensity characteristics
    - ix. Sensitivity, resolution and damping
    - x. Mechanical vibration into part
  - d. Couplants
    - i. Purpose and principles
    - ii. Materials and their efficiency
4. Basic Testing Methods
  - a. Contact
  - b. Immersion

#### **II. Ultrasonic Technique Course**

1. Testing Methods
  - a. Contact
    - i. Straight beam
    - ii. Angle beam
    - iii. Surface wave
    - iv. Pulse-echo transmission

- v. Multiple transducer
    - vi. Curved surfaces
  - b. Immersion
    - i. Transducer in water
    - ii. Water column, wheels, etc.
    - iii. Submerged test part
    - iv. Sound-beam path – transducer to part
    - v. Focused transducers
    - vi. Curved surfaces
  - c. Comparison of contact and immersion methods
- 2. Calibration (Electronic and Functional)
  - a. Equipment
    - i. Oscilloscope, CRTs
    - ii. Recorders
    - iii. Alarms
    - iv. Automatic and Semiautomatic systems
    - v. Electronic distance/amplitude correction
    - vi. Transducers
  - b. Calibration of equipment electronics
    - i. Variable effects
    - ii. Transmission accuracy
    - iii. Calibration requirements
    - iv. Calibration reflectors
  - c. Inspection calibration
    - i. Comparison with reference blocks
    - ii. Pulse-echo variables
    - iii. Reference for planned tests (straight-beam, angle-beam, etc.)
    - iv. Transmission factors
    - v. Couplants
    - vi. Materials
- 3. Straight Beam Examination to Specific Procedures
  - a. Selection of parameters
  - b. Test standards
  - c. Evaluation of results
  - d. Test reports
- 4. Angle-Beam Examination to Specific Procedures
  - a. Selection of parameters
  - b. Test standards
  - c. Evaluation of results
  - d. Test reports