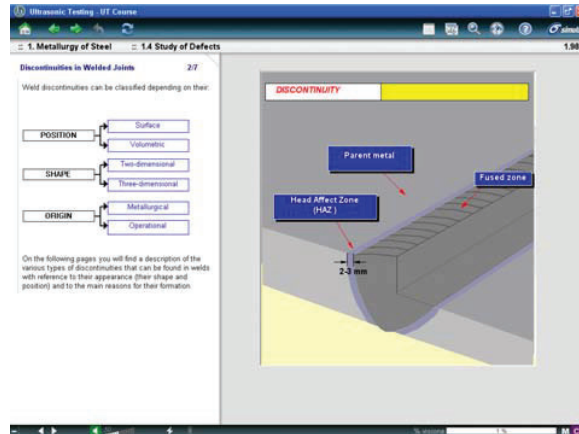


UT - ULTRASONIC TESTING

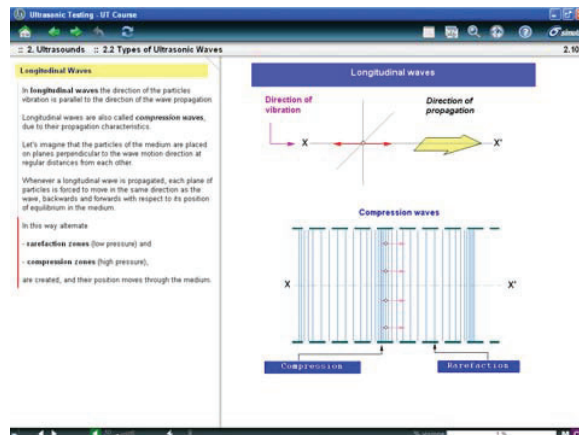
1. METALLURGY OF STEEL

- 1.1 Production of Carbon Steels
- 1.2 Heat Treatments
- 1.3 Mechanical Tests
- 1.4 Types of Fracture
- 1.5 Steel Products
- 1.6 Study of Defects
- Self-evaluation Tests



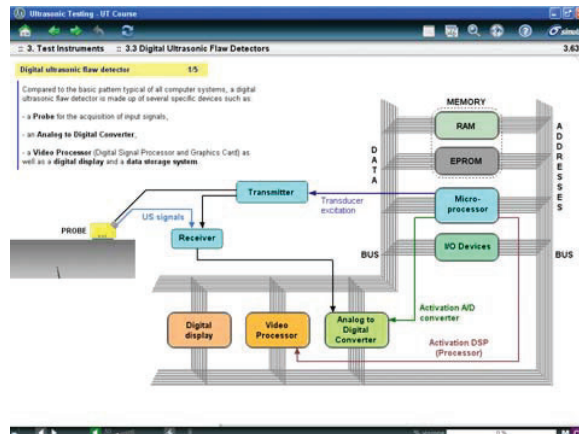
2. ULTRASOUND

- 2.1 Introduction
- 2.2 Types of Ultrasonic Waves
- 2.3 Parameters of Waves
- 2.4 Ultrasound Propagation
- Self-evaluation Tests



3. TEST INSTRUMENTS

- 3.1 Transducers
- 3.2 Ultrasound Equipment
- 3.3 Digital Ultrasound Equipment
- Self-evaluation Tests



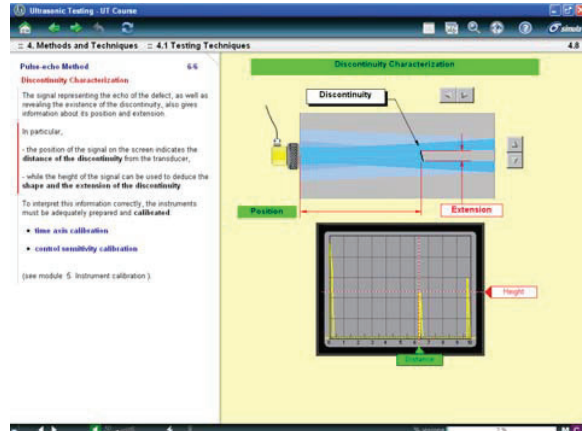
NDT Supply.com, Inc.
7952 Nieman Road
Lenexa, KS 66214-1560 USA

Phone: 913-685-0675, Fax: 913-685-1125
e-mail: sales@ndtsupply.com, www.ndtsupply.com



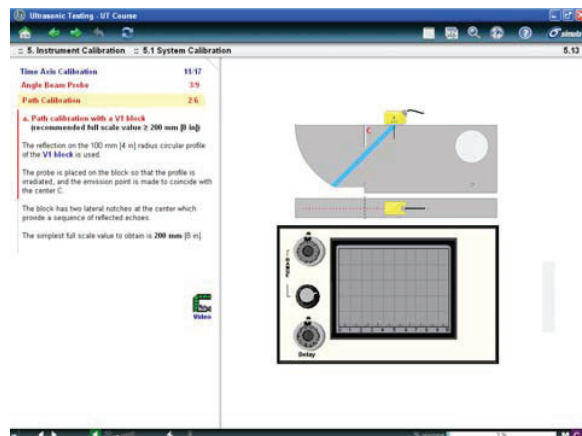
4. METHODS AND TECHNIQUES

- 4.1 Testing Methods
- 4.2 Testing Techniques
- Self-evaluation Tests



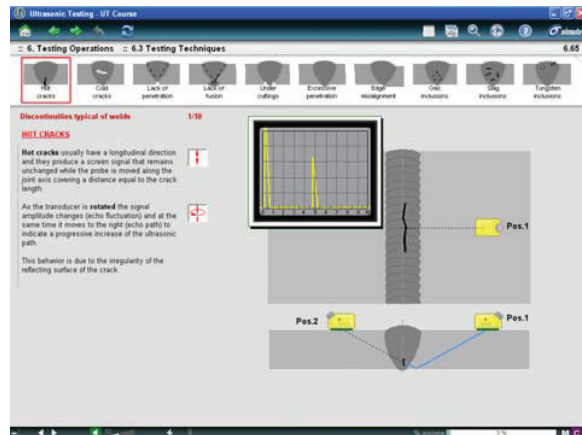
5. INSTRUMENT CALIBRATION

- 5.1 System Calibration
- 5.2 Periodic Calibration Check
- 5.3 Characterization of Probes
- 5.4 Reference Blocks
- Self-evaluation Tests



6. TESTING OPERATIONS

- 6.1 Piece Examination and Equipment Selection
- 6.2 Testing Procedure
- 6.3 Testing Techniques
- 6.4 Evaluation of Reflectors
- Self-evaluation Tests



FINAL TEST: Over 700 final tests.

NORMS: Over 100 norm references

Sim SCAN: UT simulator

ULTRASONIC TESTING: DETAILED INDEX

1. METALLURGY OF STEEL (>> [UT](#))

1.1 Production of Carbon Steels

- Manufacturing Process
- Iron-Carbon Diagram
- Addition of Elements
- Classification of Steels
- Designation of Steels
- Stainless Steels

1.2 Heat Treatments

- Full Annealing
- Normalisation
- Hardening
- Tempering
- Thermo-chemical Treatments:
Cementation, Nitriding

1.3 Mechanical Tests

- Tensile Test
- Hardness Test
- Resilience Test
- Creep Test

1.4 Types of Fracture

- Tough Fracture
- Brittle Fractures
- Fatigue Fractures

1.5 Steel Products

- Classification of Products
- Forged Pieces, Castings
- Rolled Plates, Pipes
- Welded Joints

1.6 Study of Defects

- Discontinuities in Steel
- Discontinuities in Forged Pieces
- Discontinuities in Castings
- Discontinuities in Rolled Plates
- Discontinuities in Pipes
- Discontinuities in Welded Joints

1.7 Self-evaluation Tests

- Heat Treatments
- Mechanical Tests
- Types of Fractures
- Production of Carbon Steels
- Study of Defects

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2. ULTRASOUND (>> UT)

2.1 Introduction

- Generality of Waves
- Wave Propagation
- Wave Parameters
- Wave Front
- Ultrasonic Waves

2.3 Parameters of Waves

- Propagation Velocity
- Frequency
- Wavelength
- Acoustic Impedance
- Sound Pressure
- Acoustic Intensity

2.5 Self-evaluation Tests

- Introduction to ultrasound
- Types of ultrasonic waves
- Parameters of waves
- Ultrasound propagation

2.2 Types of Ultrasonic Waves

- Longitudinal Waves
- Transverse Waves
- Surface Waves
- Lamb Waves

2.4 Ultrasound Propagation

- Huygens' Principle
- Irradiation Field
- Beam Attenuation
- Laws of Reflection
 - Reflection on Thin Films
- Laws of Refraction
 - Snell's Law
 - Critical Angles
 - Beams of Transverse Waves
- Scattering
- Diffraction

3. TEST INSTRUMENTS (>> UT)

3.1 Transducers

- Introduction to Transducers
- Piezoelectric Transducers
- Electrostrictive Transducers
- Characteristics of Materials
- Transducer Excitation
- Types of Ultrasonic Transducers
 - Straight Beam Transducer
 - Angle Beam Transducer
 - Twin Crystal Contact

Transducer

- Wheel-type Transducers
- Water-column Transducers
- Immersion Transducers

3.3 Digital Ultrasonic flaw detectors

- Analog and digital systems
- Architecture of a digital system
- Digital ultrasonic flaw detector
- Components

3.2 Ultrasound Equipment

- Introduction
- Cathodic Ray Tube
- Synchronizer
- Transmitter
- Sweep Generator
- Delay Circuit
- Receiver
- Additional Equipment
- Echo Presentation

3.4 Self-evaluation Tests

- Transducers
 - Ultrasonic equipment
 - Digital Ultrasonic flaw detectors
-

- A/D Converter
- Digital Signal Processor
- Digital display
- Features
 - Data storage
 - Multi-channel operation mode
 - Interface and control panel
- Digital flaw detector simulator
- Examples of digital flaw detector

4. METHODS AND TECHNIQUES ([>> UT](#))

4.1 Testing Methods

- Pulse-echo Method
 - Basic Signals
 - Presence of a Discontinuity
 - Typical Reflection Cases
 - Discontinuity Characterization
- Resonance Method
 - Resonance Frequency
 - Depth of a Discontinuity
- Through-Transmission Method
 - with Transmission
 - with Reflection
 - with Conduction

4.2 Testing Techniques

- Contact Technique
 - Examination of the Surface
 - Coupling Media
- Immersion Technique
 - Straight Beam Testing
 - Angled Beam Testing
- Comparison Between Techniques

4.3 Self-evaluation Tests

- Testing methods
- Testing techniques

5. INSTRUMENT CALIBRATION ([>> UT](#))

5.1 System Calibration

- Time Axis Calibration
 - Delay Calibration
 - Longitudinal Beam Probe
 - Angle Beam Probe
- Sensitivity Calibration
- Construction of a DAC curve
 - Procedure
 - Discontinuities Evaluation
 - Distance-Amplitude Diagram
 - Examples of the DAC curve
- DGS Diagrams
 - Universal Diagrams
 - Sizing Discontinuities
 - Equivalent Diameter Calculation

5.2 Periodic Calibration Check

- Periodic Calibration Checks
- Horizontal Linearity Check
- Vertical Linearity Check
 - Check the Echoes Heights Ratio
 - Check the Surface-Amplitude Ratio
- Amplitude Control Linearity

5.3 Characterization of Ultrasonic Transducers

5.4 Reference Blocks

- Reference Blocks
-

Characterization of Longitudinal Probes

- Ultrasonic Beam Profile
- Alignment of the Beam

Characterization of Angle Probes

- Emission Point
- Emission Angle
- Alignment of the Beam
- Profile of the Ultrasonic Beam
 - Profile on the Vertical Plane
 - Profile on the Horizontal Plane
- Amplification Reserve
- Transverse Resolving Power

- SDH Block, 1OW Block
- Steel Block 25 x 150 x 250 mm
- IIW V1 Block, IIW V2 Block
- ASTM Blocks
- Other Types of Blocks

5.5 Self-evaluation Tests

- System calibration
- Periodical calibration check
- Characterization of ultrasonic

transducers

6. TESTING OPERATIONS ([>> UT](#))

6.1 Piece Examination and Equipment Selection

- Examination of the Piece
- Selection of the Equipment
 - Ultrasound Equipment
 - Probe
 - Coupling Medium

6.2 Testing procedure

- Surface Preparation
- Calibration of the Equipment
- Non-welded Components
 - Tests with Longitudinal Probes
 - Tests with Angle Probes
- Tests on Welds
- Norms and Standards

6.3 Testing Techniques

- Tests on Rolled Plates
- Tests on Forged Pieces
 - Tests with Longitudinal Beam Probes
 - Tests with Angle Beam Probes
- Tests on Castings
- Tests on Seamless Pipes
 - Longitudinal Discontinuities
 - Transverse Discontinuities
- Tests on Welded Joints
 - Longitudinal Discontinuities in Butt Joints
 - Transverse Discontinuities in Butt Joints
 - Nature of the Discontinuity
 - Discontinuities Typical of Welds
 - Detection of Discontinuities in Tee Joints

6.4 Evaluation of reflectors

- False Indications
- Locate the Defect
 - Longitudinal Beam Scanning
 - Angled Beam Scanning
- Sizing the Defects
 - System for Measuring Reflected Intensity
 - Reflector Outline Definition System

6.5 Self-evaluation Tests

- Testing procedure
 - Testing techniques
 - Evaluation of reflectors
-