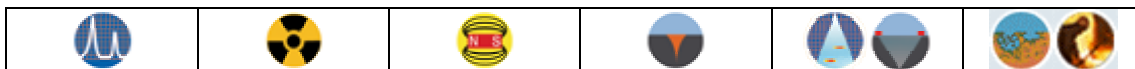


SIMULA

Multimedia Courses on: Non Destructive Testing & Corrosion



INDEX

MULTIMEDIA TRAINING COURSES	2
FEATURES.....	4
ULTRASONIC TESTING	5
RADIOGRAPHIC TESTING	11
MAGNETIC PARTICLE TESTING	16
LIQUID PENETRANT TESTING	20
CORROSION BASIC PRINCIPLES	23
ADVANCED ULTRASONIC TESTING (PHASED ARRAY & TOFD).....	26



NDT Supply.com, Inc.

P.O. Box 7350, Shawnee Mission, KS 66207-0350 USA

e-mail: sales@ndtsupply.com www.ndtsupply.com

phone: 913-685-0675 fax: 913-685-0675

MULTIMEDIA TRAINING COURSES

Non Destructive Testing (NDT) – release 4.0



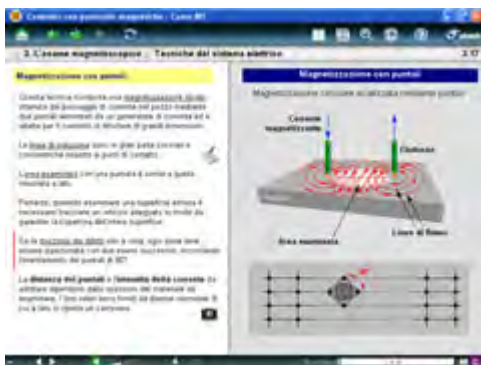
ULTRASONIC TESTING



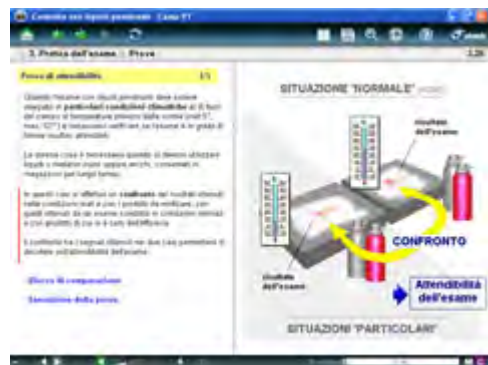
RADIOGRAPHIC TESTING



MAGNETIC PARTICLE TESTING



LIQUID PENETRANT TESTING



ADVANCED ULTRASONIC TESTING



PHASED ARRAY



TOFD – Time of Flight Diffraction



>> FEATURES

Corrosion and Metallurgy - release 4.0



CORROSION BASIC PRINCIPLES



CORSO BASE DI METALLURGIA (only italian version)

>> FEATURES

FEATURES

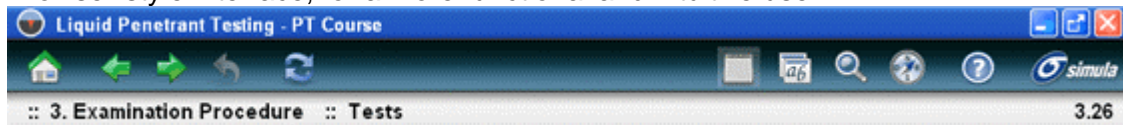
The courses have been designed with the idea of facilitating access to contents and their comprehension.

The attempt to achieve these objectives has led us to develop a set of tools for rapid navigation between sections of the course (index, map, route, search, bookmark) and to use different ways of presenting information (text, voice, video clips, self-assessment tests). The list of some of these features is given below.

- Voice guide
- Interactive text
- Interactive animations
- Video clips
- Theory consolidation
- Intermediate self-assessment tests
- Final tests
- Glossary and Text search
- Display of path completed
- Bookmarking

To these features the new version (4.0) adds the following:

- Browser-style interface, for a more functional and intuitive use.



- New tools, including the "User Notes" to record notes and pictures of personal experiences.
- Management of animation sequences, for a more simple and rapid comprehension.
- Integration of new topics.

ULTRASONIC TESTING (UT)

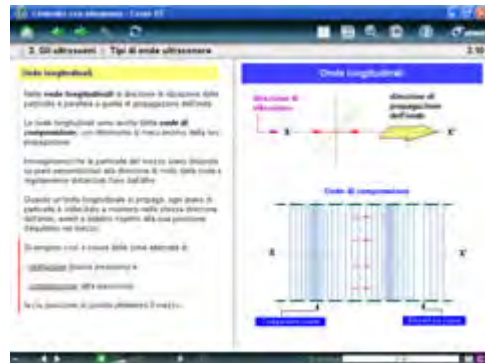
1. METALLURGY OF STEEL

- Production of Carbon Steels
- Heat Treatments
- Mechanical Tests
- Types of Fracture
- Steel Products
- Study of Defects
- Self-evaluation Tests



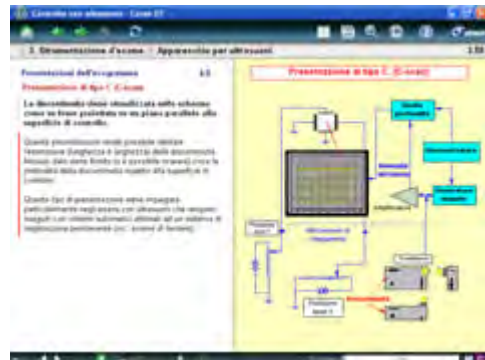
2. ULTRASOUNDS

- Introduction
- Types of Ultrasonic Waves
- Parameters of Waves
- Ultrasound Propagation
- Self-evaluation Tests



3. TEST INSTRUMENTS

- Transducers
- Ultrasound Equipment
- Digital Ultrasound Equipment
- Self-evaluation Tests



4. METHODS AND TECHNIQUES

- Testing Methods
- Testing Techniques
- Self-evaluation Tests



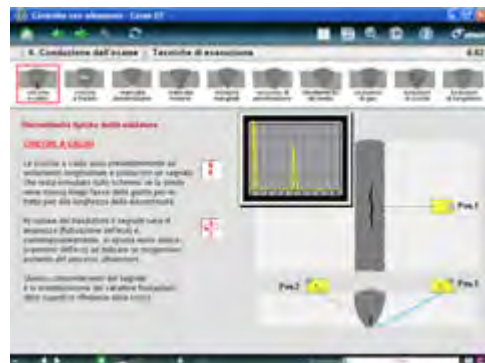
5. INSTRUMENT CALIBRATION

- System Calibration
- Periodical Check of Calibration
- Characterization of Ultrasonic Transducers
- Reference Blocks
- Self-evaluation Tests



6. TESTING OPERATIONS

- Piece Examination and Equipment Selection
- Testing procedure
- Testing Techniques
- Evaluation of reflectors
- Self-evaluation Tests



VIDEOTHEQUE

FINAL TEST

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

2. ULTRASOUNDS (>> 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

2.2 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

2.5 Self-evaluation Tests

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

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

3.2 Ultrasound Equipment

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

3.3 Digital Ultrasonic flaw detectors

- Analog and digital systems
- Architecture of a digital system
- Digital ultrasonic flaw detector
- Components
 - A/D Converter

3.4 Self-evaluation Tests

- Transducers
- Ultrasonic equipment
- Digital Ultrasonic flaw detectors

- 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 Periodical Check of Calibration

- 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

Characterization of Longitudinal Probes

5.4 Reference Blocks

- Reference Blocks
- SDH Block, 10W Block

- 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
- 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

RADIOGRAPHIC TESTING (RT)

1. METALLURGY OF STEEL

- Production of Carbon Steels
- Heat Treatments
- Mechanical Tests
- Types of Fracture
- Steel Products
- Study of Defects
- Self-evaluation Tests



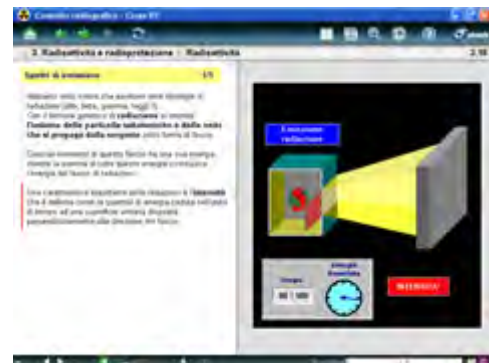
2. PRINCIPLES OF PHYSICS

- Structure of the Matter
- Electromagnetic Waves
- Electricity
- Self Evaluation Test



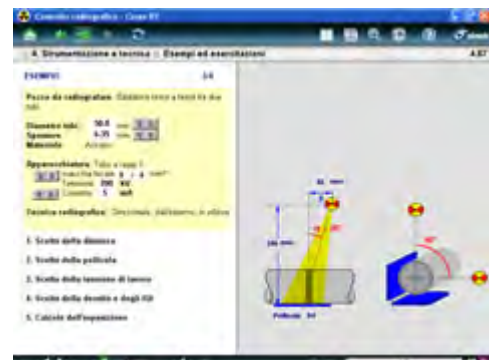
3. RADIOACTIVITY AND RADIOPROTECTION

- Radioactivity
- Radioprotection
- Self Evaluation Test



4. EQUIPMENT AND TECHNIQUES

- Radiation Generators
- Films
- Image Quality
- Exposure Factors
- Radiographic Techniques
- Examples and Exercises
- Self Evaluation Test



5. RADIOGRAPHIC OPERATIONS

- Preliminary Analysis
- Radiographic Inspection
- Developing
- Self Evaluation Test



6. ANALYSIS AND INTERPRETATION

- Analysis Instruments
- Radiographic Marks
- Radiograph Reading
- Self Evaluation Test



VIDEOTHEQUE

FINAL TEST

RADIOGRAPHIC TESTING: DETAILED INDEX

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

1.1 Production of Carbon Steels

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

1.3 Mechanical Tests

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

1.5 Steel Products

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

1.7 Self-evaluation Tests

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

1.2 Heat Treatments

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

1.4 Types of Fracture

- Tough Fracture
- Brittle Fractures
- Fatigue Fractures

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

2. PRINCIPLES OF PHYSICS ([>> RT](#))

2.1 Structure of the Matter

- Structure of the Atom
- Natural and Artificial Isotopes
- Structure of Metals

2.3 Electricity

- Electrical Charge
- Electrical Field
- Potential Difference
- Electrical Current
- Resistance
- Joule Effect
- Transformer

2.2 Electromagnetic Waves

- Wave Concept
- Wave Parameters
- Electromagnetic Waves

2.4 Self Evaluation Test

- Structure of the matter
- Electromagnetic waves
- Electricity

3. RADIOACTIVITY AND RADIOPROTECTION (>> RT)

3.1 Radioactivity

- Radiations
- Decay
- X-rays
- Emission Spectra
- Penetration Power
- Ionization
- Absorption
- Unit of Measure

3.2 Radioprotection

- Meaning of Dose
- Biological Effects of Radiation
- Dose Limits
- Radiation Protection
- Radiation Measurement

3.3 Self Evaluation Test

- Radioactivity
- Radioprotection

4. EQUIPMENT AND TECHNIQUES (>> RT)

4.1 Radiation Generators

- X-ray Equipment
- Gamma Ray Equipment
- Crawler-Fitted X and Gamma Sources

4.2 Films

- Film
- Sensitometric Curves
- Types of Films
- Film Choice
- Intensifying Screens
- Comparison Between X and Gamma Rays

4.3 Image Quality

- Sensitivity
- Image Quality Factors
- Image Quality Indicators
- Synthesis of Image Quality Parameters

4.4 Exposure Factors

- Exposure Diagrams
- Correction Factors
- Equivalent Radiographs
- Slide Rule for Gamma-Rays

4.5 Radiographic Techniques

- Weld Testing
- Casting and Forging Examination

4.6 Examples and Exercises

- EXAMPLES
- EXERCISES

4.7 Self Evaluation Test

- Radiation generators
- Films
- Image quality
- Exposure factors
- Radiographic techniques

5. RADIOGRAPHIC OPERATIONS ([>> RT](#))

5.1 Preliminary Analysis

- Study of the Test Piece
- Films Preparation
- Markers Positioning
- Film Positioning
- Source Positioning
- Shield Positioning
- Cordon off the Controlled Area
- Filmed Synthesis of Preliminary Analysis

5.2 Radiographic Inspection

- Setting of the X-ray Parameters
- Preparation of a Gamma-ray Equipment
- Operations to Carry Out a Radiograph
- Safety During the Exposure
- Safety After the Exposure

5.3 Developing

- Film Preparation
- Developing Process
- Equipment for Manual Developing
- Equipment for Automatic Developing
- Filmed Synthesis of the Developing

5.4 Self Evaluation Test

- Radiographic inspection
- Developing

6. ANALYSIS AND INTERPRETATION ([>> RT](#))

6.1 Analysis Instruments

- Negatoscopes
- Densitometers

6.2 Radiographic Marks

- Categories of Radiographic Marks
- False Marks
- Imperfect Radiographs
- Indicative Marks

6.3 Radiograph Reading

- Conditions of the Radiograph Reading
- General Interpretation Aspects
- Visibility of the Defects
- Acceptability Standard
- Radiograph Archive
- Reading Exercise

6.4 Self Evaluation Test

- Analysis instruments
- Radiographic marks
- Radiograph reading

MAGNETIC PARTICLE TESTING (MT)

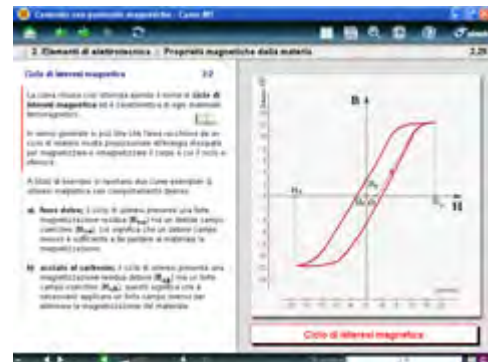
1. METALLURGY OF STEEL

- Steel
- Heat Treatments
- Production of Carbon Steels
- Study of Defects
- Self-evaluation test



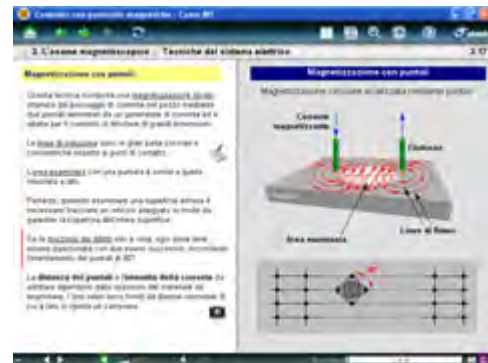
2. ELECTROTECHNICS PRINCIPLES

- Natural magnetism
- Electricity and magnetism
- Magnetic properties of matter
- Electric current
- Standard Units
- Self-evaluation test



3. MAGNETIZATION METHODS

- Examination principle
- Criteria for the examination
- Current-flow method techniques
- Magnetic-field method techniques
- Magnetizing currents
- Self-evaluation test



4. EXAMINATION EQUIPMENT

- Magnetic particles
- Characteristic of the particles
- Lighting lamps
- Magnetization Equipment
- Self-evaluation test



5. EXAMINATION PROCEDURE AND RESULTS EVALUATION

- Preliminary activities
- Magnetization rules
- Magnetic field checking
- Sequence of operations
- Test results evaluation
- Self-evaluation test



VIDEOTHEQUE

FINAL TEST

MAGNETIC PARTICLE TESTING: DETAILED INDEX

1. METALLURGY OF STEEL (>> MT)

1.1 Steel

- Introduction
- Components
- Solidification
- Iron-Carbon Diagram

1.2 Heat Treatments

- Introduction
- Annealing
- Normalization

1.3 Production of Carbon Steels

- Manufacturing Process
- Classification of Products
 - Forged pieces
 - Castings
 - Rolled plates
 - Pipes
 - Welded joints

1.4 Study of Defects

- Discontinuities in steel
- Discontinuities in forged pieces
- Discontinuities in castings
- Discontinuities in rolled plates
- Discontinuities in pipes
- Discontinuities in welded joints

1.5 Self-evaluation test

- Steel
- Heat Treatments
- Production of Carbon Steels
- Study of Defects

2. ELECTROTECHNICS PRINCIPLES ([>> MT](#))

2.1 Natural magnetism

- Magnets
- Magnetic Field

2.2 Electricity and magnetism

- Introduction
- Rectilinear conductor
- Loop
- Coil
- Solenoid
- Toroidal coil
- Magnetomotive force

2.3 Magnetic properties of matter

- Ferromagnetism
- Magnetic Induction
- Magnetic hysteresis loop
- Magnetic flux

2.4 Electric current

- Electric current definition
- Kinds of current
- Alternating current parameters
- Measuring instruments

Standard Units

2.5 Self-evaluation test

- Electricity and magnetism
- Magnetic properties of matter
- Electric current

3. MAGNETIZATION METHODS ([>> MT](#))

3.1 Examination principle

- Magnetic particle examination
- Advantages and limitations

3.2 Criteria for the examination

- Examination methods
- Magnetization methods
- Types of magnetization

3.3 Current-flow method techniques

- Current-flow methods
- Electrodes at either end of the piece
- Prod technique

3.4 Magnetic-field method techniques

- Magnetic-field method techniques
- Central conductor
- Yoke technique
- Coil
- Through-cable technique

3.5 Magnetizing currents

- Magnetizing currents
- Direct current
- Alternating current
- Rectified current
- Current values

3.6 Self-evaluation test

- Examination principle
- Method techniques
- Magnetizing currents

4. EXAMINATION EQUIPMENT ([>> MT](#))

4.1 Magnetic particles

- Types of examination medium
- Dry examination medium
- Wet examination medium
- Examination medium with contrast paint

4.3 Lighting lamps

- Light classification
- Wood light
 - Structure and components
 - Efficiency checking
 - Distance of lighting system
 - Cleaning and maintenance

4.5 Self-evaluation test

- Magnetic particles
- Lighting lamps
- Magnetization equipment

4.2 Characteristic of the particles

- Types of powders
- Efficiency of powders
- Checking the efficiency of powders

4.4 Magnetization Equipment

- Equipment classification
- Stationary magnetic-particle inspection unit
 - Generator for prod examination
 - Portable magnets
 - Portable electromagnets
 - Efficiency of the equipment

5. EXAMINATION PROCEDURE AND RESULTS EVALUATION ([>> MT](#))

5.1 Preliminary activities

- Test piece inspection
- Standard References

5.2 Magnetization rules

- ASME rules

5.3 Magnetic field checking

- Optimum induction level
- Instruments for the checking of magnetizing field
 - ASME probe
 - Berthold's probe
 - Reference block
 - Gauss meter

5.4 Sequence of operations

- Sequence of operations
- Step 1: Surface preparation
- Step 2: Checking for residual fields
- Step 3: Magnetization and spraying
- Step 4: Visual inspection
- Step 5: Demagnetization
- Step 6: Protective treatment

5.5 Test results evaluation

- Detecting a discontinuity
- Types of indications
- Types of discontinuities

5.6 Self-evaluation test

- Practical rules for magnetization
- Checking the magnetizing field
- Sequence of operations
- Evaluation of test results

LIQUID PENETRANT TESTING (PT)

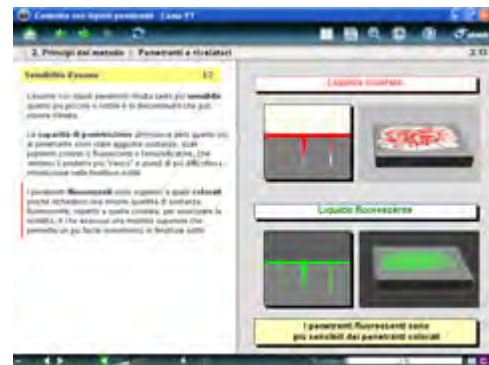
1. METALLURGY OF STEEL

- Steel
- Heat Treatments
- Production of Carbon Steels
- Study of Defects
- Self-evaluation test



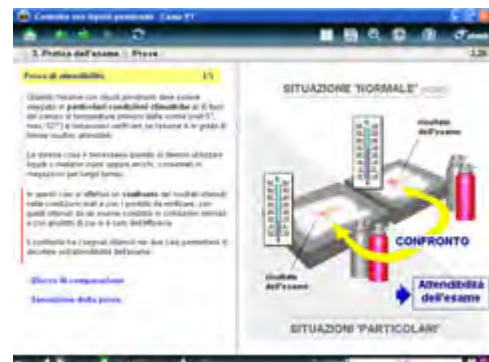
2. METHOD PRINCIPLES

- Penetrants and Developers
- Light Sources
- Self-Evaluation Test



3. EXAMINATION PROCEDURE

- Preliminary Activities
- Examination Operations
- Tests
- Self-Evaluation Test



FINAL TEST

VIDEOTHEQUE

LIQUID PENETRANT TESTING: DETAILED CONTENTS

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

1.1 Steel

- Introduction
- Components
- Solidification
- Iron-Carbon Diagram

1.2 Heat Treatments

- Introduction
- Annealing
- Normalization

1.3 Production of Carbon Steels

- Manufacturing Process
- Classification of Products
 - Forged pieces
 - Castings
 - Rolled plates
 - Pipes
 - Welded joints

1.4 Study of Defects

- Discontinuities in steel
- Discontinuities in forged pieces
- Discontinuities in castings
- Discontinuities in rolled plates
- Discontinuities in pipes
- Discontinuities in welded joints

1.5 Self-evaluation test

- Steel
- Heat Treatments
- Production of Carbon Steels
- Study of Defects

2. METHOD PRINCIPLES ([>> PT](#))

2.1 Penetrants and Developers

- Examination Principle
- Penetrants Classification
- Chemical Characteristics
- Physical Properties
- Other Properties
- Examination Sensitivity
- Developers
- Developers Classification
- Synthesis of the Characteristics

2.2 Light Sources

- Classification
- Black Light Lamp
 - Structure and components
 - Efficiency Verification
 - Distance of lighting system
 - Cleaning and Maintenance

2.3 Self-Evaluation Test

- Penetrants and developers
- Light sources

3. EXAMINATION PROCEDURE ([>> PT](#))

3.1 Preliminary Activities

- Test piece inspection
- Standards References
- Selection of method and type of liquid

3.2 Examination Operations

- Introduction
- STEP 1: Surface Cleaning
- STEP 2: Penetrant Application
- STEP 3: Dwell Time
- STEP 4: Penetrant Removal
- STEP 5: Developer Application
- STEP 6: Evaluation of the Indications
- Synthesis of Operation

3.3 Tests

- Leakage Test
- Procedure Qualification
 - Comparator block
 - Operations

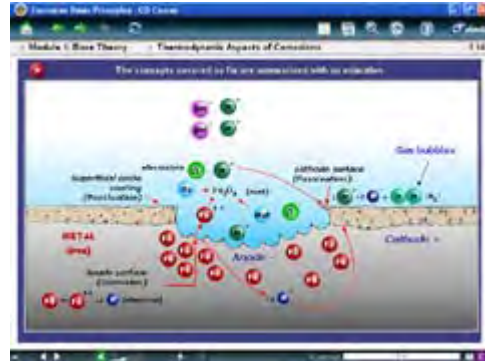
3.4 Self-Evaluation Test

- Examination operations
- Tests

CORROSION BASIC PRINCIPLES (CO)

1. BASE THEORY

- Introduction
- Thermodynamic Aspects
- Kinetics Principles
- Examples of Corrosion Cells in the Pipeline
- Internal Corrosion Parameters
- Corrosive Environments
- Self-evaluation Test
-



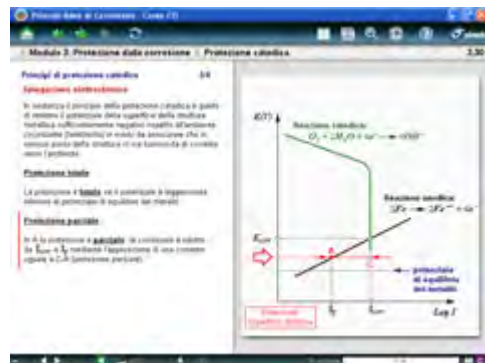
2. FORMS OF CORROSION

- Types of Corrosion
- Examination of Real Cases
- Self-evaluation Test



3. INTRODUCTION TO CORROSION CONTROL

- Introduction
- Protection from the Internal Corrosion
- Passive Protection (Coatings)
- Cathodic Protection
- Self-evaluation Test



CORROSION BASIC PRINCIPLES: DETAILED INDEX

1. BASE THEORY ([>> CO](#))

1.1 Introduction

- The Corrosive Process
- Direct and Indirect Damage
- Corrosion Classification

1.2 Thermodynamic Aspects

- Introduction
- Anode
- Cathode
- Metal Conductor
- Electrolyte
- Corrosion Cell
- Electromotive Force
- Corrosion Rate

1.3 Kinetics Principles

- Polarisation
- Passivity
- Cathodic Characteristic of Oxygen

1.4 Examples of Corrosion Cells in the Pipeline

- Introduction
- Coupling of Different Materials
- Exposure to Different Soils
- Corrosion by Differentiated Aeration
- Contact Between New and Old Pipe

1.5 Internal Corrosion Parameters

- Introduction
- Water Wetting Conditions
- Hydrodynamic Conditions
- Water Composition
- Oxygen
- Carbon Dioxide
- Hydrosulphide
- Sulphate-Reducing Bacteria

1.6 Corrosive Environments

- Corrosion in Sea water
- Corrosion in Soils
- Atmospheric Corrosion

Self-evaluation Test

2. FORMS OF CORROSION ([>> CO](#))

2.1 Types of Corrosion

- Introduction
- Uniform Corrosion
- Localised Corrosion
- Galvanic Corrosion
- Crevice Corrosion
- Pitting Corrosion
- Stress Corrosion Cracking (SCC)
- Corrosion Fatigue
- Hydrogen Induced Cracking (HIC)
- Intergranular Corrosion
- Erosion - Corrosion
- Welding and Corrosion

2.2 Examination of Real Cases

- Uniform Corrosion
- Pitting Corrosion
- Intergranular Corrosion
- Crevice Corrosion
- Stress Corrosion Cracking
- Fatigue and Corrosion fatigue

Self-evaluation Test

3. INTRODUCTION TO CORROSION CONTROL ([>> CO](#))

3.1 Introduction

- The Corrosion Control
- The Aims of Control
- Examples of Control
- Control Methods

3.2 Protection from the Internal Corrosion

- Corrosion inhibitors
- Passivating inhibitors
- Filming inhibitors

3.3 Passive Protection (Coatings)

- Introduction
- Metal Coatings
- Paints
- Thick Organic Coatings
- Coating Properties
- Surface Preparation
- Commercially Available Coatings

3.4 Cathodic Protection

- Principles of Cathodic Protection
- Cathodic Protection Systems
- Activation of the Cathodic Protection

Self-evaluation Test

ADVANCED ULTRASONIC TESTING **(Phased Array & TOFD)**

1. PHASED ARRAY

- Phased array technology
- Phased array probe
- Working principles
- Electronic scanning
- Beam focusing
- Signal presentation
- Calibrations
- Characterizations of defects
- Application for weld inspection
- Self-evaluation tests



2. TOFD

- Introduction to techniques
- Detection of discontinuities
- Limits and additional scans
- TOFD system calibration
- TOFD signal analysis
- Self-evaluation test



ADVANCED ULTRASONIC TESTING: DETAILED INDEX

1. PHASED ARRAY (>> PA)

1.1 Phased array technology

- Introduction
- Phased Array transducer
- Ultrasound beamforming
- Beam steering
- Beam focusing
- Electronic scanning
- Signal imaging
- Advantages and disadvantages
- Summary



1.2 Phased array probe

- Probe structure
- Transducer
 - Transducer shape
 - Dimensional parameters
 - Wedge and types of waves
- Wedge-shaped base
 - Zero-degree wedge (Plates)
 - Wedge for complex shapes
- Summary



1.3 Working principles

- Beam forming
- Beam steering
 - Virtual transducer
 - Focal laws
 - Straight beam: Constant focal law
 - Angled beam: Linear focal law
 - Focused beam: Quadratic focal law
 - Angled and focused beam
- Acquisition cycles
 - Emitting
 - Receiving
- Summary



1.4 Electronic scanning

- Electronic beam steering
- Electronic scanning modes
 - Fixed angle scanning
 - Sectorial scanning

- Combination of base scans
- Multichannel mode
- Summary

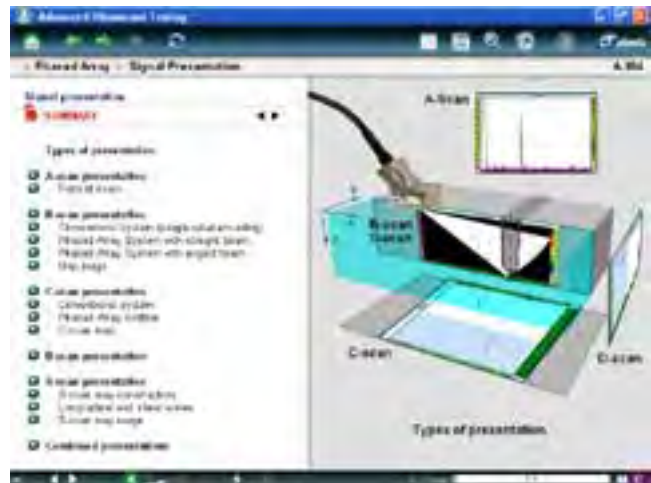
1.5 Beam focusing

- Focusing control
 - Constant focal distance
 - Changing the focal distance
- Dynamic focusing
- Spatial resolution
 - Spatial resolution
 - Lateral resolution
 - Elevation resolution
- Probe resolution and characteristics
 - Probe frequency
 - Virtual aperture of the transducer
 - Virtual aperture and lobes
 - Summarizing table
- Summary



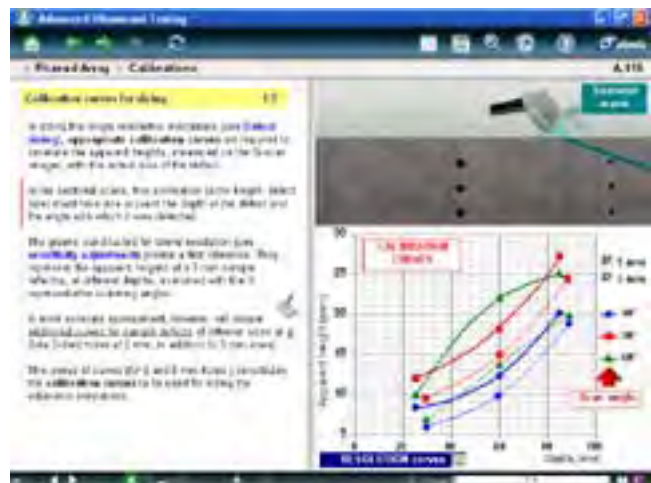
1.6 Signal presentation

- Types of presentation
- A-scan presentation
- B-scan presentation
- C-scan presentation
- D-scan presentation
- S-scan presentation
- Combined presentations
- Summary



1.7 Calibrations

- Introduction
- Calibration block
- Sensitivity adjustment
- Construction of DAC curves
- Determining the lateral resolutions
- Calibration curves for sizing
- Summary
- Standard reference



1.8 Characterizations of defects

- Introduction
- Types of defects
- Defect sizing
- Defect position
- Summary



1.9 Application for weld inspection

- Inspection with Phased Array
- Probe movement
- Scan lines
- Depth zones
- Multi-channel mode (virtual probe)
- Gate setting
- Focusing for welding
- Inspection speed
- Scan plan
- Summary



Self-evaluation Test

- Phased Array technology
- Phased Array probe
- Working principles
- Electronic scanning
- Beam focusing
- Signal presentation
- Calibrations
- Characterisations of defects

2. TOFD (Time Of Flight Diffraction) (>> TOFD)

2.1 Introduction to techniques

- Technique principle
 - TOFD Signals
 - Types of waves and signals produced
 - Sizing a discontinuity
 - Scan zones and dead zones
 - Suitable scan materials
 - Summary

- Advantages and disadvantages of TOFD
 - Advantages of TOFD
 - Disadvantages of TOFD
 - Summary

- Data visualization
 - A-scan presentation
 - B-scan presentation
 - Summary



2.2 Detection of discontinuities

- Defect inspection
 - Scan types
 - Non-parallel scan
 - Parallel scan
 - Combined scans
 - Summary

- Defect characterisation
 - Phase relationships between signals
 - Types of discontinuity
 - Summary

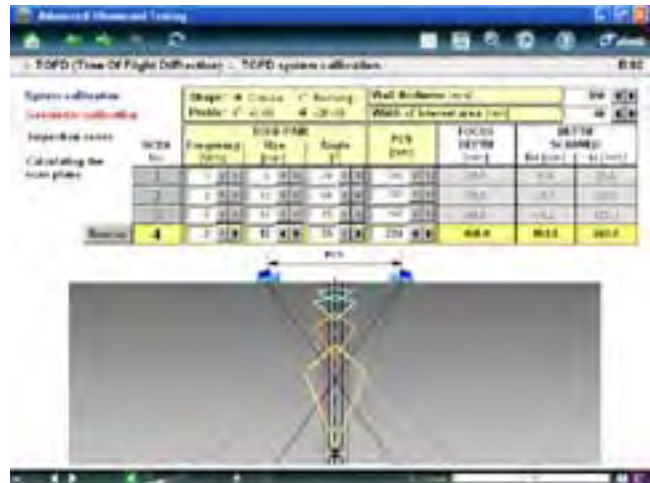
- Defect sizing
 - Depth calculation
 - Height calculation
 - Measuring time of flight
 - Calculation time of flight

- Summary



2.3 Limits and additional scans

- Limitations of the technique
 - Locating accuracy
 - Calculation error in locating
 - Spatial resolution
 - Dead zones
 - Calculating spatial resolution and dead zone
 - Additional scans
 - Scans with different frequencies
 - Scans with different emission angles
 - Scans with offset distances
- Summary



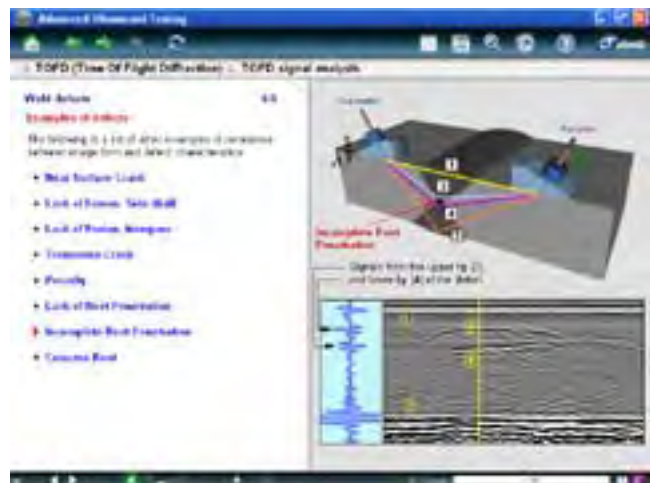
2.4 TOFD system calibration

- TOFD system structure
 - Operation and characteristics
 - Ultrasound probes
- System calibration
 - Geometric calibration
 - Ultrasonic calibration
 - Calibrating the acquisition system
 - Other adjustments
- Reference blocks
- Image quality
 - Basic requirements of TOFD image
 - TOFD image anomalies
- Summary



2.5 TOFD signal analysis

- Introduction
 - Weld defects
 - Examples of defects
 - Sizing defects
 - Measuring depth and height
 - Measuring length
 - Examples of sizing
 - TOFD references
- Summary



Self-evaluation Test

- Introduction to techniques
- Detection of discontinuities
- Limits and additional scans
- TOFD system calibration
- TOFD signal analysis



phone: 913-685-0675
e-mail: sales@ndtsupply.com
web: www.ndtsupply.com



SIMULA
Via IV Novembre, 65
61032 Fano (PU) – Italy

e-mail simula@simula.it
web site: www.simula.it