

# ASNT Certification Guide

## NDT Level III / PdM Level III



### Certification Requirements

ASNT NDT Level III certification is available in eleven (11) NDT methods: AE, ET, IR, LT, MT, NR, PT, RT, UT, VA, and VT. ASNT PdM Level III certification is available in two (2) PdM methods: IR and VA. Certification will be granted after eligibility requirements have been documented and the candidate has passed the required examinations. Either certification will be valid for five (5) years, beginning on the date that the method examination was passed.

Candidates must meet education and experience requirements prior to taking examinations by satisfying one of the following eligibility criteria:

- Graduated from a minimum four-year college or university curriculum with a degree in engineering or a physical science, plus one year (12 months) of experience in nondestructive testing in an assignment comparable to that of an Level II in the applicable test method(s), as defined in ASNT's *Recommended Practice No. SNT-TC-1A*, latest edition; **OR**
- Completed with passing grades at least two full academic school years of engineering or a physical science study at a university, college, or technical school, plus two years (24 months) of experience in nondestructive testing in an assignment comparable to that of an Level II in the applicable test method(s), as defined in ASNT's *Recommended Practice No. SNT-TC-1A*, latest edition; **OR**
- Four years (48 months) of experience in an assignment at least comparable to that of an Level II in the applicable test method(s), as defined in ASNT's *Recommended Practice No. SNT-TC-1A*, latest edition.

First time candidates **must** take a Basic examination. To become certified as an ASNT NDT Level III in any method, the NDT Basic examination and the Method examination must be passed. To become certified as an ASNT PdM Level III, the PdM Basic examination and the IR and/or VA Method examinations must be passed. Additional certifications may be attained by taking and passing additional Method examinations. A Basic examination need only be taken once as long as certification is continuously maintained.

### References

For a more detailed description of topical outlines, review the topical outlines listed in ASNT's *Recommended Practice No. SNT-TC-1A*. All the references listed here are available from ASNT. Note that other texts are listed as references in *SNT-TC-1A*, but are not currently available from ASNT. These additional references may be found at any good engineering or materials science library.

#### Question And Answer (Q & A) Books

Each Q & A book contains recommended Level I, II, and III questions and answers. An excellent way to learn vital material and prepare yourself for testing situations.

##### Individual Books

	<b>Catalogue Number</b>
Acoustic Emission Testing Method (Book G), 1995	2032
Eddy Current/Flux Leakage Testing Method (Book E), 1995	2030
Magnetic Particle Testing Method (Book B), 1994	2027
Neutron Radiographic Testing Method (Book F), 1994	2031
Liquid Penetrant Testing Method (Book D), 2003	2029
Radiographic Testing Method (Book A), 1996	2026
Ultrasonic Testing Method (Book C), 1994	2028
Visual and Optical Testing Method (Book I), 1999	2034A
<b>Leak Testing Books:</b>	
Bubble Leak Testing (Book HB), 2003	2033B
Halogen Diode Detector (Book HH), 1994	2033H
Mass Spectrometer Leak Testing (Book HM), 1996	2033M
Pressure Change Measurement Testing (Book HP), 2003	2033P

##### Packages

All four leak testing methods	2033A
Any two leak testing methods	2033C
Complete Set of Q&A books, plus Recommended Practice No. SNT-TC1A, 2001 Edition	2190

## NDT Basic

Length: 4 hours

Questions: 135

1. Personnel Qualification and Certification Programs
  - SNT-TC-1A, 2001 edition
  - ASNT CP-189, 2001 edition
  - ASNT Level III certification
2. Basics of Common NDT Methods, including:
  - Acoustic emission testing
  - Electromagnetic testing
  - Leak testing
  - Liquid penetrant testing
  - Magnetic particle testing
  - Neutron radiographic testing
  - Radiographic testing
  - Thermal/infrared testing
  - Ultrasonic testing
  - Visual testing
3. Materials, fabrication, and production technology, including:
  - Properties of materials, origin of discontinuities, and failure modes
  - Materials processing (casting, welding, forging, brazing, soldering, machining, heat treatment, surface treatment, adhesive bonding, etc.)
  - Dimensional metrology

Reference	Catalog Number
NDT Handbook, Second Edition: Volume 10, NDT Overview	135
ASNT Level III Study Guide: Basic	2251R
SNT-TC-1A (2001 edition)	2065
ANSI/ASNT CP-189 (2001 edition)	2506
Materials and Processes for NDT Technology	2250
ASM Handbook Vol. 17, NDE and QC	105

## PdM Basic

Length: 2 hours

Questions: 90

2. Personnel Qualification and Certification Programs
  - SNT-TC-1A, 2001 edition
  - ASNT CP-189, 2001 edition
  - ASNT Level III certification
3. Basics of Common PdM Methods, including:
  - Infrared testing
  - Vibration analysis
  - Oil/lube analysis
  - Motor circuit analysis
  - Alignment
  - Thermal testing
  - System performance
4. Machinery Technology
  - Machine design
  - Electrical components
  - Maintenance practice
  - Machine components
  - Engineering mechanics
  - Lubrication

Reference	Catalog Number
NDT Handbook: Volume Nine, Special NDT Methods, 2 <sup>nd</sup> ed.	134A
SNT-TC-1A (2001 edition)	2065
ANSI/ASNT CP-189 (2001 edition)	2506

## AE - Acoustic Emission Testing

Length: 4 hours

Questions: 135

- 1 Principles and Theory
  - Characteristics of acoustic emission testing
  - Materials and deformation
  - Sources of acoustic emission
  - Wave propagation
  - Attenuation
  - Kaiser and Felicity effects, and Felicity ratio
  - Terminology (refer to acoustic emission glossary, ASTM 1316)
- 2 Equipment and Materials
  - Transducing processes
  - Sensors
  - Sensor attachments
  - Sensor utilization
  - Simulated acoustic emission sources
  - Cables
  - Signal conditioning
  - Signal detection
  - Signal processing
  - Source location
  - Advanced signal processing
  - Acoustic emission test systems
  - Accessory materials
  - Factors affecting test equipment selection
- 3 Techniques
  - Equipment calibration and set up for test
  - Establishing loading procedures
  - Precautions against noise
  - Special test procedures
  - Data displays
- 4 Interpretation and Evaluation
  - Data interpretation
  - Data evaluation
  - Reports
- 5 Procedures
- 6 Safety and Health
- 7 Applications
  - Laboratory studies (material characterization)
  - Structural applications

## ET - Electromagnetic Testing

Length: 4 hours

Questions: 135

1. Principles/Theory
  - Generation of eddy currents
  - Effect of fields created by eddy currents (impedance changes)
  - Properties of eddy current
2. Equipment Materials
  - Probes
  - Through, encircling, or annular coils
  - Factors affecting choice of sensing elements
  - Read out selection
  - Instrument design considerations
3. Techniques/Calibrations
  - Factors which affect coil impedance
  - Selection of test frequency
  - Coupling
  - Field strength
  - Comparison of techniques
  - Calibrations
  - Techniques - general
4. Interpretation/Evaluation
  - Flaw detection
  - Sorting for properties
  - Thickness gaging
  - Process control
  - General interpretations
5. Procedures

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 5, Electromagnetic Testing	145
ASNT Level III Study Guide: Eddy Current Testing	2257
Fundamentals of Eddy Current Testing	470

Reference	Catalog Number
NDT Handbook, Second Edition: Volume 5, Acoustic Emission Testing	130
Acoustic Emission: Techniques and Applications	752

## IR - Thermal/Infrared Testing

Length: 4 hours

Questions: 135

- Principles/Theory
  - Conduction
  - Convection
  - Radiation
  - The nature of heat and heat flow
  - Temperature measurement principles
  - Proper selection of Thermal/Infrared testing
- Equipment/Materials
  - Temperature measurement equipment
  - Heat flux indicators
  - Performance parameters of non-contact devices
- Techniques
  - Contact temperature indicators
  - Non-contact pyrometers
  - Infrared line scanners
  - Thermal/Infrared imaging
  - Heat flux indicators
  - Exothermic or endothermic investigations
  - Friction investigations
  - Fluid Flow investigations
  - Thermal resistance (steady state heat flow)
  - Thermal capacitance investigations
- Interpretation/Evaluation
  - Exothermic or endothermic investigation
  - Friction investigations
  - Fluid flow investigations
  - Differences in thermal resistance
  - Thermal capacitance investigations
- Procedures
  - Existing codes and standards
  - Job procedure development
- Safety and health
  - Safety responsibility and authority
  - Safety for personnel
  - Safety for client and facilities
  - Safety for testing equipment

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 3, Infrared and Thermal Testing	143
Fundamentals of Heat and Mass Transfer	952
ASNT Level III Study Guide: Infrared and Thermal Testing	2265

## LT - Leak Testing

Length: 4 hours

Questions: 135

- Principles theory
  - Physical principles in leak testing
  - Principles of gas flow
  - Proper selection of LT as method of choice
- Equipment/Material
  - Leak testing standards
  - Detector/instrument performance factors
  - Vacuum pumps
  - Bubble testing practices and techniques
  - Absolute pressure testing equipment
  - Absolute pressure hold testing of containers
  - Absolute pressure leakage rate testing of containers

- Analysis of data for determination of accurate results
  - Halogen testing equipment
  - Helium mass spectrometer testing equipment
- Technique/Calibration
    - Bubble test
    - Pressure change/measurement test
    - Halogen diode detector leak test
    - Mass spectrometer leak testing
  - Interpretation/Evaluation
    - Basic techniques and/or units
    - Test materials and equipment effects
    - Effects of temperature and other atmospheric conditions
    - Calibration for testing
    - Probing/scanning or measurement/monitoring
    - Leak interpretation evaluation
    - Acceptance and rejection criteria
  - Procedures
    - Leak testing procedures
    - Leak testing specifications
  - Safety and Health
    - Safety considerations
    - Safety precautions
    - Pressure precautions
    - Safety devices
    - Hazardous and tracer gas safety
    - Types of monitoring equipment
    - Safety

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 1, Leak Testing	141
ASNT Level III Study Guide: Leak Testing	2266

## MT - Magnetic Particle Testing

Length: 2 hours

Questions: 90

- Principles/Theory
  - Principles of magnets and magnetic fields
  - Characteristics of magnetic fields
- Equipment/Materials
  - Magnetic particle test equipment
  - Inspection materials
- Technique/Calibrations
  - Magnetization by means if electric current
  - Selecting the proper method of magnetization
  - Demagnetization
- Interpretation/Evaluation
  - Magnetic particle test indications and interpretations
  - Effects of discontinuities on materials
- Procedures
- Safety and Health

Reference	Catalog Number
NDT Handbook, Second Edition: Volume 6, Magnetic Particle Testing	131
ASNT Level III Study Guide: Magnetic Particle Testing (Revised)	2253R
Principles of Magnetic Particle Testing	436

## NR - Neutron Radiographic Testing

Length: 4 hours

Questions: 135

1. Principles/Theory
  - Nature of penetrating radiation
  - Interaction between penetrating radiation and matter
  - Neutron radiography imaging
  - Radiometry
2. Equipment/Materials
  - Sources of neutrons
  - Radiation detectors
  - Nonimaging devices
3. Techniques/Calibrations
  - Blocking and filtering
  - Multifilm technique
  - Enlargement and projection
  - Stereoradiography
  - Triangulation methods
  - Autoradiography
  - Flash Radiography
  - In-motion radiography
  - Fluoroscopy
  - Electron emission radiography
  - Microradiography
  - Laminography (tomography)
  - Control of diffraction effects
  - Panoramic exposures
  - Gaging
  - Real time imaging
  - Image analysis techniques
4. Interpretation/Evaluation
  - Image-object relationships
  - Material considerations
  - Codes, standards, and specifications
5. Procedures
  - Imaging considerations
  - Film processing
  - Viewing of radiographs
  - Judging radiographic quality
6. Safety and Health
  - Exposure hazards
  - Methods of controlling radiation exposure
  - Operation and emergency procedures

## PT - Liquid Penetrant Testing

Length: 2 hours

Questions: 90

1. Principles/Theory
  - Principles of liquid penetrant process
  - Theory
  - Proper selection of PT as method of choice
  - Liquid penetrant processing
2. Equipment/Materials
  - Methods of measurement
  - Lighting for liquid penetrant testing
  - Materials for liquid penetrant testing
  - Testing and maintenance of materials
3. Interpretation/Evaluation
  - General
  - Factor affecting indications
  - Indications from discontinuities
  - Relevant and nonrelevant indications
4. Procedures
5. Safety and Health
  - Toxicity
  - Flammability

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 2, Liquid Penetrant Testing	142
ASNT Level III Study Guide: Liquid Penetrant Testing, 2 <sup>nd</sup> ed.	2255R

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 4, Radiographic Testing	144
ASM Handbook Vol. 17, NDE and QC	105

## RT - Radiographic Testing

Length: 4 hours

Questions: 135

1. Principles and Theory
  - Nature of penetrating radiation
  - Interaction between penetrating radiation and matter
  - Radiographic imaging
  - Radiometry
2. Equipment/Materials
  - Electrically generated sources
  - Particulate radiation sources
  - Radiation detectors
  - Gamma
3. Techniques/Calibration
  - Imaging considerations
  - Film processing
  - Viewing of radiographs
  - Judging radiographic quality
  - Exposure calculations
  - Radiographic techniques
4. Interpretation and Evaluation
  - Materials processing as it affects test results
  - Causes and effects of discontinuities
  - Radiographic appearance of discontinuities
  - Nonrelevant indications
  - Film artifacts
5. Procedures
6. Safety and Health
  - Exposure hazards
  - Methods of controlling radiation exposure
  - Operational and emergency procedures
  - Dosimetry and Film Badges
  - Gamma leak testing
  - Transportation regulations

Reference	Catalog Number
NDT Handbook, Third Edition: Volume 4, Radiographic Testing	144
ASNT Level III Study Guide: Radiographic Testing, 2 <sup>nd</sup> ed.	2259R
Working Safety in Gamma Radiography	232

## UT - Ultrasonic Testing

Length: 4 hours

Questions: 135

1. Principles/Theory
  - Nature of sound waves
  - Modes of sound wave generation
  - Velocity, frequency, and wavelength of sound waves
  - Attenuation of sound waves
  - Acoustic impedance
  - Reflection
  - Refraction and mode conversion
  - Snell's law and critical angles
  - Fresnel and Fraunhofer effects
2. Equipment/Materials
  - Pulse/echo instrumentation
  - Digital thickness instrumentation
  - Transducer operation and theory
  - Transducer operation/manipulations
  - Resonance testing equipment
  - Couplants
  - Calibration blocks
  - Cables/connectors
  - Test specimen
  - Miscellaneous materials
3. Techniques/Calibrations
  - Contact
  - Immersion
  - Comparison of contact and immersion methods
  - Remote monitoring
  - Calibration (electronic and functional)
4. Interpretation/Evaluations
  - Evaluation of base metal product forms
  - Evaluation of weldments
  - Evaluation of bonded structures
  - Variables affecting test results
  - Evaluation (general)
5. Procedures
  - Specific applications
  - Codes/Standards/Specifications

Reference	Catalog Number
NDT Handbook, Second Edition: Volume 7, Ultrasonic Testing	132
ASNT Level III Study Guide: Ultrasonic Testing	2261A
Ultrasonics: Fundamentals, Technology, Applications	341

## VA - Vibration Analysis

Length: 4 hours

Questions: 135

1. Principles/Theory
  - Physical Concepts
  - Data Presentation
  - Sources of Vibration
  - Correction Methods
2. Equipment
  - Sensors
  - Signal Conditioning
  - Instruments
  - On-Line Monitoring
  - Equipment Response to Environments Performance Based
3. Techniques/Calibration
  - Calibration
  - Measurement and Techniques
  - Correction Techniques
4. Analysis/Evaluation
  - Data Analysis
  - Data Evaluation
5. Procedures
6. Safety and Health

Reference	Catalog Number
NDT Handbook, Second Edition: Volume 9, Special NDT Methods	134
The Vibration Analysis Handbook	177

## VT - Visual Testing

Length: 2 hours

Questions: 90

1. Fundamentals
  - Vision and light
  - Ambient conditions
  - Test object characteristics
2. Equipment Accessories
  - Magnifiers/microscopes
  - Mirrors
  - Dimensional
  - Borescopes
  - Video systems
  - Automated systems
  - Video technologies
  - Machine vision
  - Replication
  - Temperature sensitive markers and surface comparators
  - Chemical aids
  - Photography
  - Eye
3. Techniques/Calibration
  - Diagrams and drawings
  - Raw materials
  - Primary process materials
  - Joining processes
  - Fabricated components
  - In-service materials
  - Coatings
  - Other applications
  - Requirements
4. Interpretation/ Evaluation
  - Equipment including type and intensity of light
  - Material including the variations of surface finish
  - Discontinuity
  - Determination of dimensions (i.e.: depth, width, length, etc.)
  - Sampling/scanning
  - Process for reporting visual discontinuities
  - Personnel (human factors)
  - Detection
5. Procedures and Documentation
  - Hard copy
  - Photography
  - Audio/video
  - Electronic and magnetic media
6. Safety
  - Electrical shock
  - Mechanical hazards
  - Lighting hazards
  - Chemical contamination
  - Radioactive materials
  - Explosive environments

Reference	Catalog Number
NDT Handbook: Second Edition: Volume 8, Visual and Optical Testing	133
ASNT Level III Study Guide: Visual and Optical Testing	2263
ASM Handbook: Vol. 17, NDE and QC	105

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