SNT-TC-1A (2016)

Recommended Practice No.

SNT-TC-1A

2016 EDITION

PERSONNEL QUALIFICATION AND CERTIFICATION IN NONDESTRUCTIVE TESTING

The American Society for Nondestructive Testing, Inc.
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ASNT Mission Statement:
ASNT exists to create a safer world by promoting the profession and technologies of nondestructive testing.

FOREWORD

This Recommended Practice establishes the general framework for a qualification and certification program. In addition, the document provides the educational, experience and training recommendations for the different test methods.

This recommended practice is not intended to be used as a strict specification. It is recognized, however, that contracts require programs, which meet the intent of this document. For such contracts, purchaser and supplier must agree upon acceptability of an employer's program.

The verb "should" has been used throughout this document to emphasize the recommendation presented herein. It is the employer's responsibility to address specific needs and to modify these guidelines as appropriate in a written practice. In the employer's written practice, the verb "shall" is to be used in place of "should" to emphasize the employer's needs.

The 2016 Edition of *SNT-TC-1A* is annotated so that users of the 2011 edition can quickly and easily locate new and updated material. The vertical lines in the margins of this document indicate that information in the text has been modified in some way.

An *SNT-TC-1A* Interpretation Panel is available to respond to written inquiries regarding the *SNT-TC-1A* guidelines. These responses clarify the intent of ASNT's Technical and Education Council and the recommendations of *SNT-TC-1A* and are subject to the statement of "Scope" in each edition of *SNT-TC-1A*.

To make an inquiry, use the *SNT-TC-1A* Interpretation Request Form on the last page of this Recommended Practice.

Inquiries related to this recommended practice should be directed to the chair of the *SNT-TC-1A* Interpretation Panel at the following address:

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Recommended Practice No. SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing

1.0 Scope

1.1 It is recognized that the effectiveness of nondestructive testing (NDT) applications depends upon the capabilities of the personnel who are responsible for, and perform, NDT. This Recommended Practice has been prepared to establish guidelines for the qualification and certification of NDT personnel whose specific jobs require appropriate knowledge of the technical principles underlying the nondestructive tests they perform, witness, monitor, or evaluate.

1.2 This document provides guidelines for the establishment of a qualification and certification program.

1.3 These guidelines have been developed by The American Society for Nondestructive Testing, Inc., to aid employers in recognizing the essential factors to be considered in qualifying personnel engaged in any of the NDT methods listed in Section 3.

1.4 It is recognized that these guidelines may not be appropriate for certain employer's circumstances and/or applications. In developing a written practice as required in Section 5, the employer should review the detailed recommendations presented herein and modify them, as necessary, to meet particular needs. Such modification may alter but shall not eliminate basic provisions of the program such as training, experience, testing, and recertification. Supporting technical rationale for modification of detailed recommendations should be provided in an Annex to the written practice.

2.0 Definitions

2.1 Terms included in this document are defined as follows:

2.1.1 **Certification:** written testimony of qualification.

2.1.2 **Certifying Authority:** the person or persons properly designated in the written practice to sign certifications on behalf of the employer.

2.1.3 **Certifying Agency:** the employer of the personnel being certified.

2.1.4 **Closed Book Examination:** an examination administered without access to reference material except for materials supplied with or in the examination (See 8.1.3.).

2.1.5 **Comparable:** being at an equivalent or similar level of NDT responsibility and difficulty as determined by the employer's NDT Level III.

2.1.6 **Documented:** the condition of being in written form.

2.1.7 **Employer:** the corporate, private, or public entity, which employs personnel for wages, salary, fees, or other considerations.

2.1.8 **Experience:** work activities accomplished in a specific NDT method under the direction of qualified supervision including the performance of the NDT method and related activities but not including time spent in organized training programs.

2.1.9 **Grading Unit:** A Qualification Specimen can be divided into sections called grading units, which do not have to be equal length or be equally spaced. Grading units are unflawed or flawed and the percentage of flawed/unflawed grading units required should be approved by the NDT Level III.

2.1.10 **Limited Certification:** nondestructive test methods may be further subdivided into limited disciplines or techniques to meet specific employer's needs; these are NDT Level II certifications, but to a limited scope.

2.1.11 **Nondestructive Testing:** a process that involves the inspection, testing, or evaluation of materials, components, and assemblies for materials' discontinuities, properties, and machine problems without further impairing or destroying the part's serviceability. Throughout this document the term NDT applies equally to the NDT inspection methods used for material inspection, flaw detection, or predictive maintenance (PdM) applications.

2.1.12 **Outside Agency:** a company or individual who provides NDT Level III services and whose qualifications to provide these services have been reviewed by the employer engaging the company or individual.
2.1.13 **Qualification:** demonstrated skill, demonstrated knowledge, documented training, and documented experience required for personnel to properly perform the duties of a specific job.
2.1.14 **Recommended Practice:** a set of guidelines to assist the employer in developing uniform procedures for the qualification and certification of NDT personnel to satisfy the employer's specific requirements.
2.1.15 **Technique:** a category within an NDT method; for example, ultrasonic thickness testing.
2.1.16 **Training:** an organized program developed to impart the knowledge and skills necessary for qualification.
2.1.17 **Written Practice:** a written procedure developed by the employer that details the requirements for qualification and certification of their employees.

3.0 Nondestructive Testing Methods

3.1 Qualification and certification of NDT personnel in accordance with this Recommended Practice is applicable to each of the following methods:

Acoustic Emission Testing
Electromagnetic Testing
Ground Penetrating Radar
Guided Wave Testing
Laser Testing Methods
Leak Testing
Liquid Penetrant Testing
Magnetic Flux Leakage
Magnetic Particle Testing
Microwave Technology
Neutron Radiography Testing
Radiographic Testing
Thermal/Infrared Testing
Ultrasonic Testing
Vibration Analysis
Visual Testing

4.0 Levels of Qualification

4.1 There are three basic levels of qualification. The employer may subdivide these levels for situations where additional levels are deemed necessary for specific skills and responsibilities.

4.2 While in the process of being initially trained, qualified, and certified, an individual should be considered a trainee. A trainee should work with a certified individual. The trainee should not independently conduct, interpret, evaluate, or report the results of any NDT test.

4.3 The recommended technical knowledge and skill sets for the three basic levels of qualification are as follows:

4.3.1 NDT Level I. An NDT Level I individual should have sufficient technical knowledge and skills to be qualified to properly perform specific calibrations, specific NDT, and specific evaluations for acceptance or rejection determinations according to written instructions and to record results. The NDT Level I should receive the necessary instruction and supervision from a certified NDT Level II or III individual.

4.3.2 NDT Level II. An NDT Level II individual should have sufficient technical knowledge and skills to be qualified to set up and calibrate equipment and to interpret and evaluate results with respect to applicable codes, standards, and specifications. The NDT Level II should be thoroughly familiar with the scope and limitations of the methods for which qualified and should exercise assigned responsibility for on-the-job training and guidance of trainees and NDT Level I personnel. The NDT Level II should be able to organize and report the results of NDT tests.

4.3.3 NDT Level III. An NDT Level III individual should have sufficient technical knowledge and skills to be capable of developing, qualifying, and approving procedures, establishing and approving techniques, interpreting codes, standards, specifications, and procedures; and designating the particular NDT methods, techniques, and procedures to be used. The

NDT Level III should be responsible for the NDT operations for which qualified and assigned and should be capable of interpreting and evaluating results in terms of existing codes, standards, and specifications. The NDT Level III should have sufficient practical background in applicable materials, fabrication, and product technology to establish techniques and to assist in establishing acceptance criteria when none are otherwise available. The NDT Level III should have general familiarity with other appropriate NDT methods, as demonstrated by an ASNT Level III Basic examination or other means. The NDT Level III, in the methods in which certified, should have sufficient technical knowledge and skills to be capable of training and examining NDT Level I, II, and III personnel for certification in those methods.

5.0 Written Practice

5.1 The employer shall establish a written practice for the control and administration of NDT personnel training, examination, and certification.

5.2 The employer's written practice should describe the responsibility of each level of certification for determining the acceptability of materials or components in accordance with the applicable codes, standards, specifications, and procedures.

5.3 The employer's written practice should describe the training, experience, and examination requirements for each level of certification by method and technique, as applicable.

5.4 The employer's written practice should identify the test techniques within each test method applicable to its scope of operations.

5.5 The employer's written practice shall be reviewed and approved by the employer's NDT Level III.

5.6 The employer's written practice shall be maintained on file.

6.0 Education, Training, and Experience Requirements for Initial Qualification

6.1 Candidates for certification in NDT should have sufficient education, training, and experience to ensure qualification in those NDT methods in which they are being considered for certification. Documentation of prior certification may be used by an employer as evidence of qualification for comparable levels of certification.

6.2 Documented training and/or experience gained in positions and activities comparable to those of Levels I, II, and/or III prior to establishment of the employer's written practice may be considered in satisfying the criteria of Section 6.3.

6.3 To be considered for certification, a candidate should satisfy one of the following criteria for the applicable NDT level:

6.3.1 NDT Levels I and II

Table 6.3.1 A lists the recommended training and experience hours to be considered by the employer in establishing written practices for initial qualification of NDT Level I and Level II individuals.

Table 6.3.1 B lists initial training and experience hours, which may be considered by the employer for specific limited applications as defined in the employer's written practice. Limited certifications should apply to individuals who do not meet the full training and experience of Table 6.3.1 A. Limited certifications issued in any method should be approved by the NDT Level III and documented in the certification records.

6.3.2 NDT Level III

6.3.2.1 Have a baccalaureate degree (or higher) in engineering or science, plus one additional year of experience beyond the Level II requirements in NDT in an assignment comparable to that of an NDT Level II in the applicable NDT method(s), or:

6.3.2.2 Have completed with passing grades at least two years of engineering or science study at a university, college, or technical school, plus two additional years of experience beyond the NDT Level II requirements in NDT in an assignment at least comparable to that of NDT Level II in the applicable NDT method(s), or:

6.3.2.3 Have four years of experience beyond the NDT Level II requirements in NDT in an assignment at least comparable to that of an NDT Level II in the applicable NDT method(s).

The above NDT Level III requirements may be partially replaced by experience as a certified NDT Level II or by assignments at least comparable to NDT Level II as defined in the employer's written practice.

Table 6.3.1A: Recommended Initial Training and Experience Levels

Examination Method	NDT Level	Technique	Training Hours	Experience: Minimum Hours in Method or Technique	Experience: Total Hours in NDT
Acoustic Emission	I		40	210	400
	II		40	630	1200
Electromagnetic	I	AC Field Measurement	40	210	400
	II		40	630	1200
	I	Eddy Current	40	210	400
	II		40	630	1200
	I	Remote Field	40	210	400
	II		40	630	1200
Ground Penetrating Radar	I		8	60	120
	II		20	420	800
Guided Wave	I		40	240	460
	II		40	240	460
Laser Methods	I	Profilometry	8	70	130
	II		24	140	260
	I	Holography/ Shearography	40	210	400
	II		40	630	1200
Leak Testing	I	Bubble Testing	2	3	15
	II		4	35	80
	I	Pressure Change	24	105	200
	II		16	280	530
	I	Halogen Diode	12	105	200
	II		8	280	530
	I	Mass Spectrometer	40	280	530
	II		24	420	800
Penetrant Testing	I		4	70	130
	II		8	140	270
Magnetic Flux Leakage	I		16	70	130
	II		12	210	400
Magnetic Particle	I		12	70	130
	II		8	210	400
Microwave Technology	I		40	210	400
	II		40	630	1200
Neutron Radiography	I		28	420	800
	II		40	1680	2400
Radiographic Testing	I	Radiographic	40	210	400
	II		40	630	1200
	I	Computed Radiography	40	210	400
	II		40	630	1200
	I	Computed Tomography	40	210	400
	II		40	630	1200
	I	Digital Radiography	40	210	400
	II		40	630	1200
Thermal/ Infrared	I		32	210	400
	II	Building Diagnostics	34	1260	1800
	II	Electrical and Mechanical	34	1260	1800
	II	Materials Testing	34	1260	1800
Ultrasonic Testing	I		40	210	400
	II		40	630	1200
	II	Time of Flight Diffraction	40	160	n/a
	II	Phased Array	80	160	n/a
Vibration Analysis	I		24	420	800
	II		72	1680	2400
Visual Testing	I		8	70	130
	II		16	140	270

(Table 6.3.1A notes see next page)

Table 6.3.1A Notes:

1.0 A person may be qualified directly to NDT Level II with no time as a certified NDT Level I, providing the recommended training and experience consists of the sum of the hours recommended for NDT Level I and Level II.

2.0 For NDT Level III certification, the experience should consist of the sum of the hours for NDT Level I and Level II, plus the additional time in 6.3.2 as applicable. The formal training should consist of the NDT Level I and Level II training, plus any additional formal training as defined in the employer's written practice.

3.0 Listed training hours may be adjusted as described in the employer's written practice depending on the candidate's actual education level, e.g. grammar school, college graduate in engineering, etc.

4.0 Training should be outlined in the employer's written practice. Magnetic Particle training hours may be counted toward Magnetic Flux Leakage training hours as defined in employer's written practice.

5.0 If an individual is currently certified in an ET technique and a full course format was used to meet the initial qualifications in that technique, the minimum training hours to qualify in another ET technique at the same NDT Level may be reduced up to 40 percent if so defined in the employer's written practice. If an individual is certified in an ET technique, the minimum experience to qualify for another ET technique at the same level or to the next level may be reduced by up to 50 percent if so defined in the employer's written practice.

6.0 While fulfilling total NDT experience requirement, experience may be gained in more than one (1) method, however, the minimum hours must be met for each method.

7.0 If an individual is currently certified in a Radiographic Testing technique and a full course format was used to meet the initial qualifications in that technique, the minimum additional training hours to qualify in another technique at the same level should be 24 hours (of which at least 16 hours should be equipment familiarization). The training outline should be as defined in the employer's written practice. If an individual is certified in a technique, the minimum additional experience required to qualify for another technique at the same level may be reduced by up to 50 percent, as defined in the employer's written practice.

8.0 Independent of the training recommended for Level I and Level II certification, a trainee is required to receive radiation safety training as required by the regulatory jurisdiction.

9.0 If an individual is currently certified in one Thermal/Infrared technique and a full course format was used to meet the initial qualifications in that technique, the minimum additional training hours to qualify in another technique at the same level should be 20 hours (of which at least 16 hours should be specific technique familiarization). The training outline should be as defined in the employer's written practice. If an individual is certified in a technique, the minimum additional experience required to qualify for another technique at the same level may be reduced by up to 50 percent, as defined in the employer's written practice.

10.0 Time of Flight Diffraction and Phased Array require Ultrasonic Testing Level II certification as a prerequisite.

Table 6.3.1B: Recommended Initial Training and Experience Levels for NDT Level II Limited Certifications

Examination Method	Limited Certification	Technician's Starting Point	Formal Training	Minimum Work Experience in Method (Hours)
Radiographic	Film Interpretation	Non-Radiographer	40	220[1]
	Film Interpretation	RT Level I	24	220[1]
Ultrasonic	Digital Thickness Measurement (numeric output only)	Trainee	8	40
	A-scan Thickness Measurement	Trainee	24	175

1 – Should include a review of 1000 radiographs.

7.0 Training Programs

7.1 Personnel being considered for initial certification should complete sufficient organized training. The organized training may include instructor-led training, personalized instruction, virtual instructor-led training, computer-based training, or web-based training. Computer-based training and web-based training should track hours and content of training with student examinations in accordance with 7.2. The sufficiently organized training shall be such as to ensure the student is thoroughly familiar with the principles and practices of the specified NDT method related to the level of certification desired, and applicable to the processes to be used and the products to be tested. All training programs should be approved by the NDT Level III responsible for the applicable method.

7.2 The training program should include sufficient examinations to ensure understanding of the necessary information.

7.3 Recommended training course outlines and references for NDT Levels I, II, and III personnel, which may be used as technical source material, are contained in *ANSI/ASNT CP-105: ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel.*

7.4 The employer who purchases outside training services is responsible for assuring that such services meet the requirements of the employer's written practice.

8.0 Examinations

8.1 Administration and Grading

8.1.1 All qualification examination questions should be approved by the NDT Level III responsible for the applicable method.

8.1.2 An NDT Level III should be responsible for the administration and grading of examinations specified in Section 8.3 through 8.8 for NDT Level I, II, or other Level III personnel. The administration and grading of examinations may be delegated to a qualified representative of the NDT Level III and so recorded. A qualified representative of the employer may perform the actual administration and grading of NDT Level III examinations specified in 8.7.

8.1.2.1 To be designated as a qualified representative of the NDT Level III for the administration and grading of NDT Level I and Level II personnel qualification examinations, the designee should have documented, appropriate instruction by the NDT Level III in the proper administration and grading of qualification examinations prior to conducting and grading independent qualification examinations for NDT personnel. Additionally, the practical exam should be administered by a person certified in the applicable NDT method as NDT Level II or III.

8.1.3 All NDT Level I, II, and III written examinations should be closed-book except that necessary data, such as graphs, tables, specifications, procedures, codes, etc., may be provided with or in the examination. Questions utilizing such reference materials should require an understanding of the information rather than merely locating the appropriate answer.

8.1.4 For NDT Level I and II personnel, a composite grade should be determined by simple averaging of the results of the general, specific, and practical examinations described below. For NDT Level III personnel, the composite grade should be determined by simple averaging of the results of the basic, method, and specific examinations described below.

8.1.5 Examinations administered by the employer for qualification should result in a passing composite grade of at least 80 percent, with no individual examination having a passing grade less than 70 percent.

8.1.6 When an examination is administered and graded for the employer by an outside agency and the outside agency issues grades of pass or fail only, on a certified report, then the employer may accept the pass grade as 80 percent for that particular examination.

8.1.7 The employer who purchases outside services is responsible for ensuring that the examination services meet the requirements of the employer's written practice.

8.1.8 In no case shall an examination be administered by one's self or by a subordinate.

8.2 Vision Examinations

8.2.1 Near-Vision Acuity. The examination should ensure natural or corrected near-distance acuity in at least one eye such that the applicant is capable of reading a minimum of Jaeger Number 2 or equivalent type and size letter at the distance designated on the chart but not less than 12 in. (30.5 cm) on a standard Jaeger test chart. The ability to perceive an Ortho-Rater minimum of 8 or similar test pattern is also acceptable. This should be administered annually.

8.2.2 Color Contrast Differentiation. The examination should demonstrate the capability of distinguishing and differentiating contrast among colors or shades of gray used in the method as determined by the employer. This should be conducted upon initial certification and at five-year intervals thereafter.

8.2.3 Vision examinations expire on the last day of the month of expiration.

8.3 General (Written – for NDT Levels I and II)

8.3.1 The general examinations should address the basic principles of the applicable method.

8.3.2 In preparing the examinations, the NDT Level III should select or devise appropriate questions covering the applicable method to the degree required by the employer's written practice.

8.3.3 See Appendix A for example questions.

8.3.4 The minimum number of questions that should be given is shown in Table 8.3.4.

Table 8.3.4: Minimum Number of Examination Questions

Method	General		Specific	
	Level I	Level II	Level I	Level II
Acoustic Emission Testing	40	40	20	20
Electromagnetic Testing:				
Alternating Current Field Measurement	40	40	20	20
Eddy Current	40	40	20	20
Remote Field Testing	30	30	20	20
Ground Penetrating Radar	30	40	20	20
Guided Wave	40	40	20	20
Laser Methods:				
Profilometry	30	30	20	20
Holography/ Shearography	30	30	20	20
Leak Testing:				
Bubble Test	20	20	15	15
Absolute Pressure Leak Test (Pressure Change)	20	20	15	15
Halogen Diode Leak Test	20	20	15	15
Mass Spectrometer Leak Test	20	20	20	40
Magnetic Flux Leakage	20	20	20	15
Magnetic Particle Testing	40	40	20	20
Microwave Technology	40	40	20	20
Neutron Radiography Testing	40	40	20	20
Penetrant Testing	40	40	20	20
Radiographic Testing:				
Radiography Testing	40	40	20	20
Radiographic Film Interpretation – Non-Radiographer		40		20
Radiographic Film Interpretation - Radiographer (Certified RT NDT Level I)		20		15
Computed Radiography Testing	40	40	20	20
Computed Tomography Testing	40	40	20	20
Digital Radiography Testing	40	40	20	20
Thermal/Infrared Testing:	40		20	
Building Diagnostic Testing		50		40
Electrical and Mechanical Testing		50		40
Materials Testing		50		40
Ultrasonic Testing:	40	40	20	20
Time of Flight Diffraction				30
Phased Array				30
Digital Thickness Measurement (Numeric output only)		20		10
A-Scan Thickness Measurement		30		15
Vibration Analysis	40	40	20	60
Visual Testing	40	40	20	20

8.3.5 A valid ACCP Level II or ASNT NDT Level II certificate may be accepted as fulfilling the general examination criteria for each applicable method if the NDT Level III has determined that the ASNT examinations meet the requirements of the employer's written practice.

8.4 Specific (Written – for NDT Levels I and II)

8.4.1 The specific examination should address the equipment, operating procedures, and NDT techniques that the individual may encounter during specific assignments to the degree required by the employer's written practice.

8.4.2 The specific examination should also cover the specifications or codes and acceptance criteria used in the employer's NDT procedures.

8.4.3 The minimum number of questions that should be given is shown in Table 8.3.4.

8.4.4 A valid ACCP Level II or ASNT NDT Level II certificate may be accepted as fulfilling the specific examination criteria for each applicable method if the NDT Level III has determined that the ASNT examinations meet the requirements of the employer's written practice.

8.5 Practical (for NDT Level I and II)

8.5.1 The candidate should demonstrate familiarity with and ability to operate the necessary NDT equipment, record, and analyze the resultant information to the degree required.

8.5.2 At least one flawed specimen or component should be tested and the results of the NDT analyzed by the candidate.

8.5.2.1 Phased Array and Time of Flight Diffraction Practical Examination. Flawed samples used for practical examinations should be representative of the components and/or configurations that the candidates would be testing under this endorsement and approved by the NDT Level III.

8.5.2.2 For Film Interpretation Limited Certification, the practical examination should consist of review and grading of at least 20 images.

8.5.3 The description of the specimen, the NDT procedure, including checkpoints, and the results of the examination should be documented.

8.5.4 NDT Level I Practical Examination. Proficiency should be demonstrated in performing the applicable NDT technique on one or more specimens or machine problems approved by the NDT Level III and in evaluating the results to the degree of responsibility as described in the employer's written practice. At least ten (10) different checkpoints requiring an understanding of test variables and the employer's procedural requirements should be included in this practical examination. The candidate should detect all discontinuities and conditions specified by the NDT Level III.

Note: While it is normal to score the practical on a percentile basis, practical examinations should contain checkpoints that failure to successfully complete will result in failure of the examination.

8.5.5 NDT Level II Practical Examination. Proficiency should be demonstrated in selecting and performing the applicable NDT technique within the method and interpreting and evaluating the results on one or more specimens or machine problems approved by the NDT Level III. At least ten (10) different checkpoints requiring an understanding of NDT variables and the employer's procedural requirements should be included in this practical examination. The candidate should detect all discontinuities and conditions specified by the NDT Level III. An example of a practical examination checklist is attached as Appendix B to this Recommended Practice. The example checklist has been provided as guidance on development of practical examinations for any method or level.

Note: While it is normal to score the practical on a percentile basis, practical examinations should contain checkpoints that failure to successfully complete will result in failure of the examination.

8.5.6 A valid ACCP Level II certificate may be accepted as fulfilling the practical examination criteria for each applicable method if the NDT Level III has determined that the ASNT examinations meet the requirements of the employer's written practice.

8.6 Sample questions for general examinations are presented in the separate question booklets that can be obtained from ASNT International Service Center. These questions are intended as examples only and should not be used verbatim for qualification examinations. The following ASNT Questions & Answers Books are available from ASNT International Service Center:

Test Method	Question Booklets
Acoustic Emission Testing	G
Electromagnetic Testing	E
1. Alternating Current Field Measurement	EA
2. Eddy Current	EE
3. Remote Field Testing	ER
Ground Penetrating Radar	GP*
Guided Wave Testing	GW*
Laser Testing	
1. Profilometry	LP*
2. Holography/Shearography	LH*
Leak Testing	
1. Bubble Test	HB
2. Pressure Change Measurement	HP
3. Halogen Diode Leak Test	HH
4. Mass Spectrometer Test	HM
Liquid Penetrant Testing	D
Magnetic Flux Leakage Testing	MF*
Magnetic Particle Testing	B
Microwave Technology	MW*
Neutron Radiography Testing	F
Radiographic Testing	
1. Radiographic Testing	A
2. Computed Radiography Testing	AA*
3. Computed Tomography Testing	AB*
4. Digital Radiography Testing	AC*
Thermal/Infrared Testing	J*
Ultrasonic Testing	C
Vibration Analysis	K*
Visual Testing	I

* In course of preparation

8.7 NDT/PdM Level III Examinations

8.7.1 Basic Examinations

8.7.1.1 NDT Basic Examination (need not be retaken to add another test method as long as the candidate holds a current Level III certificate or certification). The minimum number of questions that should be given is as follows:

8.7.1.1.1 Fifteen (15) questions relating to understanding the *SNT-TC-1A* document

8.7.1.1.2 Twenty (20) questions relating to applicable materials, fabrication, and product technology.

8.7.1.1.3 Twenty (20) questions that are similar to published NDT Level II questions for other appropriate NDT methods.

8.7.1.2 PdM Basic Examination (need not be retaken to add another test method as long as the candidate holds a current Level III certificate or certification). The minimum number of questions that should be given is as follows:

8.7.1.2.1 Fifteen (15) questions relating to understanding the *SNT-TC-1A* document.

8.7.1.2.2 Twenty (20) questions relating to applicable machinery technology.

8.7.1.2.3 Thirty (30) questions that are similar to published NDT Level II questions for other appropriate PdM methods.

8.7.2 Method Examination (for each method).

8.7.2.1 Thirty (30) questions relating to fundamentals and principles that are similar to published ASNT NDT Level III questions for each method, and

8.7.2.2 Fifteen (15) questions relating to application and establishment of techniques and procedures that are similar to the published ASNT NDT Level III questions for each method, and

8.7.2.3 Twenty (20) questions relating to capability for interpreting codes, standards, and specifications relating to the method.

8.7.3 Specific Examination (for each method).

8.7.3.1 Twenty (20) questions relating to specifications, equipment, techniques, and procedures applicable to the employer's product(s) and methods employed and to the administration of the employer's written practice.

8.7.3.2 The employer may delete the specific examination if the candidate has a valid ASNT NDT Level III or ACCP Professional Level III certificate in the method and if documented evidence of experience exists, including the preparation of NDT procedures to codes, standards, or specifications and the evaluation of test results.

8.7.4 A valid endorsement on an ASNT NDT Level III certificate fulfills the examination criteria described in 8.7.1 and 8.7.2 for each applicable NDT method.

8.7.5 A valid endorsement of an ACCP Professional Level III certificate fulfills the examination criteria described in 8.7.1 and 8.7.2 for each applicable NDT method.

8.8 Reexamination

8.8.1 Those failing to attain the required grades should wait at least thirty (30) days or receive suitable additional training as determined by the NDT Level III before reexamination.

9.0 Certification

9.1 Certification of NDT personnel to all levels of qualification is the responsibility of the employer.

9.2 Certification of NDT personnel should be based on demonstration of satisfactory qualification in accordance with Sections 6, 7, and 8, as described in the employer's written practice.

9.3 At the option of the employer, an outside agency may be engaged to provide NDT Level III services. In such instances, the responsibility of certification of the employees shall be retained by the employer.

9.4 Personnel certification records should be maintained on file by the employer for the duration specified in the employer's written practice and should include the following:

9.4.1 Name of certified individual.

9.4.2 Level of certification, NDT method and/or technique, as applicable.

9.4.3 Educational background and experience of certified individuals.

9.4.4 Statement indicating satisfactory completion of training in accordance with the employer's written practice.

9.4.5 Results of the vision examinations prescribed in 8.2 for the current certification period.

9.4.6 Current examination copy(ies) or evidence of successful completion of examinations.

9.4.7 Other suitable evidence of satisfactory qualifications when such qualifications are used in lieu of the specific examination prescribed in 8.7.3.2 or as prescribed in the employer's written practice.

9.4.8 Composite grade(s) or suitable evidence of grades.

9.4.9 Signature of the NDT Level III that verified qualifications of candidate for certification.

9.4.10 Dates of certification and/or recertification.

9.4.11 Certification expiration date.

9.4.12 Signature of employer's certifying authority.

10.0 Technical Performance Evaluation

10.1 NDT personnel may be reexamined any time at the discretion of the employer and have their certificates extended or revoked.

10.2 Periodically, as defined in the employer's written practice, NDT Level I and II personnel should be reevaluated by the NDT Level III administering a practical examination. The practical examination should follow the format and guidelines described in section 8.5.

11.0 Interrupted Service

11.1 The employer's written practice should include rules covering the types and duration of interrupted service that requires reexamination and recertification.

11.2 The written practice should specify the requirements for reexamination and/or recertification for the interrupted service.

12.0 Recertification

12.1 All levels of NDT personnel shall be recertified periodically in accordance with one of the following criteria:

12.1.1 Evidence of continuing satisfactory technical performance.

12.1.2 Reexamination in those portions of the examinations in Section 8 deemed necessary by the employer's NDT Level III.

12.2 The recommended maximum recertification intervals are 5 years for all certification levels. Certifications expire on the last day of the month of expiration.

12.3 When new techniques are added to the employer's written practice, NDT Level III personnel should receive applicable training, take applicable examinations and obtain the necessary experience, such that the NDT Level III meets the requirements of the new techniques in Table 6.3.1 A, prior to their next recertification date, in the applicable method.

13.0 Termination

13.1 The employer's certification shall be deemed revoked when employment is terminated.

13.2 An NDT Level I, Level II, or Level III whose certification has been terminated may be certified to the former NDT level by a new employer based on examination, as described in Section 8, provided all of the following conditions are met to the new employer's satisfaction:

13.2.1 The employee has proof of prior certification.

13.2.2 The employee was working in the capacity to which certified within six (6) months of termination.

13.2.3 The employee is being recertified within six (6) months of termination.

13.2.4 Prior to being examined for certification, employees not meeting the above requirements should receive additional training as deemed appropriate by the NDT Level III.

14.0 Reinstatement

14.1 An NDT Level I, Level II, or Level III whose certification has been terminated may be reinstated to the former NDT level, without a new examination, provided all of the following conditions are met:

14.1.1 The employer has maintained the personnel certification records required in section 9.4.

14.1.2 The employee's certification did not expire during termination.

14.1.3 The employee is being reinstated within six (6) months of termination.

APPENDIXES

Appendix A: Example Questions

The purpose of this appendix is to provide a guideline for the preparation of the General, Level I and Level II written examinations. Extensive examples of representative questions for degree of difficulty, type, etc., are provided in separate question booklets, which can be obtained from the ASNT International Service Center. These questions are intended as examples only and should not be used verbatim for qualification examinations.

Note: All questions and answers should be referenced to a recognized source.

Acoustic Emission Testing

Level I

1. A qualitative description of the sustained signal level produced by rapidly occurring acoustic emission events is the accepted definition for:

   a. burst emission.
   b. acoustic emission signature.
   c. acoustic emission signal.
   d. continuous emission.

2. Attenuation of a wave is best defined by which statement?

   a. A decrease in frequency with distance traveled.
   b. A decrease in amplitude with distance traveled.
   c. A decrease in wave speed with distance traveled.
   d. A change in direction as a function of time.

3. The number of times the acoustic emission signal exceeds a preset threshold during any selected portion of a test is called the acoustic emission ________

   a. response
   b. count
   c. count rate
   d. energy

Level II

1. When detecting impulsive acoustic emission signals on large objects, the peak of the signals normally decreases with increasing distance from the source. This alteration, dependent on distance, cannot be explained by:

   a. absorption: the elastic pulse gradually converts into heat.
   b. dispersion: the pulse gradually spreads out in time because the different waves involved travel with different velocities.
   c. the geometric factors: the energy in the pulse is distributed into ever-larger volumes.
   d. density: the more dense (hard) the material, the harder it is to move sound through the object.

2. Which of the following factors will tend to produce low-amplitude acoustic emission response during a tensile test?

   a. Low temperature.
   b. High strain rate.
   c. Plastic deformation.
   d. Crack propagation.

3. The kaiser effect is:

   a. valid only when testing composites.
   b. a physical law of nature that is never violated.
   c. not applicable when an rms recording is being made.
   d. the absence of detectable acoustic emission until previously applied stress levels are exceeded.

Electromagnetic Testing

Alternating Current Field Measurement Technique

Level I

1. What is the medium between an alternating current field measurement technique (ACFM) probe and a metal surface when operating in air?

    a. An electric current.
    b. Air.
    c. Magnetic field.
    d. Couplant.

2. For which of the following inspection requirements could you NOT normally use ACFM for defect detection?

    a. Fatigue cracks in welded joints of high strength steel.
    b. Subsurface cracks in welded joints of mild steel.
    c. Inspection for cracks in a weld of high strength steel under paint coating.
    d. Surface fatigue in mild steel welds.

3. A fatigue crack perpendicular to the induced current will cause the induced current to:

    a. disperse from the central area of the crack and concentrate around the ends.
    b. disperse from the ends of the crack and concentrate in the central area.
    c. stop flowing in the part.
    d. increase in velocity.

Level II

1. During an ACFM weld inspection, the measurement of crack depth is NOT dependent on:

    a. the frequency of the inspection.
    b. the length of the crack.
    c. the depth of penetration of the alternating current field.
    d. contact with the part.

2. What effect would you expect if the coils in an ACFM probe were smaller and closer together?

    a. No effect.
    b. Improved detection of smaller defects.
    c. Improved sizing on larger defects.
    d. Improved signal-to-noise ratio.

3. The Bx magnetic field can best be described as:

    a. parallel to the plate surface and perpendicular to the current flow.
    b. perpendicular to the weld.
    c. parallel to the plate surface and parallel to the current flow.
    d. perpendicular to the plate surface and parallel to the current flow.

Eddy Current

Level I

1. The impedance of an eddy current test coil will increase if the:

    a. test frequency increases.
    b. inductive reactance of the coil decreases.
    c. inductance of the coil decreases.
    d. resistance of the coil decreases.

2. Which of the following test frequencies would produce eddy currents with the largest depth of penetration?

    a. 100 Hz
    b. 10 kHz
    c. 1 MHz
    d. 10 MHz

3. To generate measurable eddy currents in a test specimen, the specimen must be:

    a. a conductor.
    b. an insulator.
    c. either a conductor or an insulator.
    d. a ferromagnetic material.

Level II

1. The fill factor when a 1.26 cm (0.5 in.) diameter bar is inserted in a 2.54 cm (1 in.) diameter coil is:

   a. 0.5 (50 percent).
   b. 0.75 (75 percent).
   c. 1.0 (100 percent).
   d. 0.25 (25 percent).

2. If the characteristic frequency (fg) of a material is 125 Hz, the test frequency required to give an f/fg ratio of 10 would be:

   a. 1.25 Hz
   b. 12.5 Hz
   c. 1.25 kHz
   d. 12.5 kHz

3. For age-hardened aluminum and titanium alloys, changes in hardness are indicated by changes in:

   a. retentivity.
   b. permeability.
   c. conductivity.
   d. magnetostriction.

Remote Field Testing

Level I

1. The dominant electromagnetic energy distribution process in remote field testing (RFT) is said to be:

   a. reflected impedance.
   b. through-transmission.
   c. piezoelectric energy conversion.
   d. magnetic motive force.

2. In a properly designed RFT probe, the detector coil is positioned in the:

   a. direct field zone.
   b. transition zone.
   c. remote field zone.
   d. junction between remote field zone and transition zone.

3. The zone next to the near zone is called the:

   a. transition zone.
   b. normal zone.
   c. near field extension zone.
   d. remote field zone.

Level II

1. In the remote field zone with distance, the magnetic field distribution decays:

   a. linearly.
   b. exponentially.
   c. logarithmically.
   d. and then increases with distance.

2. The exciter and the receiver coil/coils in a remote field probe are separated by a distance greater than __________ the tube diameter.

   a. twice
   b. three times
   c. one time
   d. four times

3. Frequencies selected for RFT inspection are:

   a. higher than used in eddy current.
   b. lower than used in eddy current.
   c. carefully selected and must never be changed during an inspection.
   d. higher than used in ultrasonic testing.

Ground Penetrating Radar

Level I

1. The most common form of ground penetrating radar (GPR) measurement is:

   a. using a single transceiver device similar to equipment used in shear wave ultrasonic testing.
   b. by deploying a transmitter and a receiver in fixed geometry over the surface.
   c. microwave propagation through a constant time vector.
   d. inspection for landmines.

2. What are the key wave field properties for GPR?

   a. Time, distance, and velocity.
   b. Reflection, refraction, and direction of travel.
   c. Velocity, attenuation, and EM impedance.
   d. Antenna size, shape, and angle of incidence.

3. Electromagnetic waves separate into two independent components. What are they?

   a. Transverse electric field and transverse magnetic field.
   b. Resolution zone and refraction zone.
   c. High impedance and low impedance.
   d. Focused energy and attenuation.

Level II

1. The ratio of the largest receivable signal and the minimal detectable signal is called the:

   a. system detection factor.
   b. peak performance ratio.
   c. dynamic range.
   d. maximum depth of detection.

2. What is gating?

   a. A method of expanding the depth of penetration by viewing only a portion of the total signal.
   b. The ability to control the shape of the transmitted signal.
   c. A method of reducing the signal bandwidth.
   d. Timing the transmit and receiver signals to avoid detrimental effects from strong signals.

3. Why is dewowing important?

   a. It acts as a biomonitor.
   b. It helps to produce a stable image of unstable soils.
   c. It allows positive and negative color filling to be used in the recorded trace.
   d. It is generally used to improve section resolution and create more spatial realistics.

Guided Wave Testing

Level I

1. The velocity of guided waves depends on all of the following except:

   a. the material properties.
   b. the boundary conditions of the component or part.
   c. the dimensions of the component or part.
   d. the dimension of the transducer.

2. Which of the following is a propagating guided wave mode in pipe?

   a. Bulk compression wave.
   b. Bulk shear wave.
   c. Torsion wave.
   d. all of the above.

3. Guided wave testing (GW) of long lengths of pipe:

   a. is used to measure remaining wall thickness.
   b. can determine the change in pipe wall cross section.
   c. is used to measure the exact length of any wall loss.
   d. can determine the exact geometry of any corrosion.

Level II

1. How are guided wave testing results typically calibrated?

    a. Using a target reflector (flat-bottomed hole) machined in a calibration pipe of the same diameter and thickness.
    b. Calibration is not required for GW.
    c. Using an assumed amplitude and known reflectors such as welds.
    d. The results are always calibrated using flange reflections.

2. The dispersion curves for guided waves in steel pipes are MOST influenced by:

    a. changes to the boundary conditions.
    b. changes to the material properties of steel.
    c. temperature changes.
    d. high pressure gas products.

3. Which of the following is a guided wave in plate?

    a. Longitudional waves.
    b. Flexural waves.
    c. Love waves.
    d. Scholte waves.

Leak Testing

Bubble Leak Testing

Level I

1. Before performing a vacuum box leak test, which of the following should be checked for required calibration?

    a. Leak-detector solution.
    b. Evacuation device or equipment.
    c. Lighting equipment.
    d. Pressure (or vacuum) gage.

2. Which factor can most affect the sensitivity attainable by a pressure bubble leak test?

    a. Operator alertness and technique.
    b. Size and shape of the test specimen.
    c. Time of day testing is performed.
    d. Number of test technicians.

3. What does the abbreviation psia stand for?

    a. Pressure referred to National Institute of Standards and Technology's absolute pressure.
    b. Pascals per square inch absolute.
    c. Pressure standard in absolute units.
    d. Pounds per square inch absolute.

Level II

1. Which of the following factors directly determines the size of the bubble formation when using the bubble test method?

    a. Method of application of bubble solution.
    b. Ambient temperature and barometric pressure.
    c. Amount of leakage from a defect or leak.
    d. Size of the test specimen.

2. When a vacuum gage is marked with a range of 0-30 with the notation "vacuum" on the face, the units of measurement are:

    a. inches of mercury.
    b. pounds per square inch.
    c. centimeters of vacuum.
    d. feet of water.

3. The type of leaks that are most likely to go undetected during a bubble leak test are:

    a. very small leaks and very large leaks.
    b. leaks occurring at welded joints.
    c. corner-configuration joints.
    d. leaks occurring at fittings.

Halogen Diode Detector

Level I

1. Good operating practice dictates that the period of time to allow for warm up of the halogen diode detector prior to calibrating is:
   a. 30 minutes.
   b. 15 minutes.
   c. 1 hour.
   d. recommended by the manufacturer.

2. While adjusting a reservoir-type variable-halogen standard leak, the operator accidentally vents the gas from the only standard leak available. Which of the following actions would quickly resolve the problem?
   a. Replace the standard leak.
   b. Replace the cylinder in the standard leak.
   c. Recharge the standard leak.
   d. Send the standard leak to the manufacturer for recharging.

3. While performing a halogen-diode detector test, the leak detector becomes difficult to zero, and the pointer on the leak rate meter repeatedly swings up scale. The most likely cause of the problem could be the use of too high a sensitivity range, a shorted element, an excessive heater voltage, or:
   a. poor airflow.
   b. a sensing element that is too new.
   c. a high halogen background.
   d. a faulty leak-rate meter.

Level II

1. Most leaks detected during a halogen sniffer test could have been detected and usually can be verified by:
   a. a bubble leak test.
   b. an ultrasonic examination.
   c. a visual examination.
   d. a pressure change test.

2. The presence of small traces of halogen vapors in the halogen diode detector:
   a. increases the emission of negative ions.
   b. decreases the emission of positive ions.
   c. increases the emission of positive ions.
   d. decreases the emission of negative ions.

3. A halogen standard leak of a certain size produces a known signal on a halogen leak detector. To receive this same intensity signal on the instrument during the test of an object containing a 2% by volume halogen-air mixture, the size of the leak in the object causing the signal would theoretically have to be at least ________ times larger than the standard leak.
   a. 20
   b. 50
   c. 40
   d. 10

Mass Spectrometer

Level I

1. The sensitivity of a mass spectrometer leak detection system is the mass flow rate of tracer gas:
   a. that gives a maximum measurable signal.
   b. that gives a minimum measurable signal.
   c. at standard temperature and pressure.
   d. in a leak.

2. The diffusion pump and mechanical fore pump in a mass spectrometer leak detection system:
   a. use the same type of oil.
   b. use different types of oil.
   c. operate using the same motor.
   d. use the same principle of operation.

3. The helium mass spectrometer detector-probe pressure-test technique is:
   a. a quantitative test.
   b. a qualitative test.
   c. a semiautomatic test.
   d. an automatic test.

Level II

1. A torr is defined as:

   a. 14.7 psia.
   b. 1 mm of Hg.
   c. 1/760 of a standard atmosphere.
   d. 760 mm of Hg.

2. When conducting helium mass spectrometer test of a vacuum vessel in the pressure range of 10^{-4} to 10^{-8} mm Hg, which type gage could be used to measure the pressure?

   a. Alphatron gage.
   b. Thermionic ionization gage.
   c. Pirani gage.
   d. Thermocouple gage.

3. Helium standard leaks in the range of 10^{-6} to 10^{-10} atm cc/s are known in general terms as:

   a. reservoir standard leaks.
   b. capillary standard leaks.
   c. permeation standard leaks.
   d. adjustable standard leaks.

Pressure Change Measurement

Level I

1. A pressure of 66.0 psig, in terms of absolute pressure at sea level and standard temperature, would be approximately:

   a. 96.0 psia
   b. 80.7 psia
   c. 51.3 psia
   d. 36.0 psia

2. When conducting a long-duration pressure change test, it is necessary to measure absolute pressure or gage pressure plus barometric pressure because the barometric pressure will:

   a. always fall.
   b. always rise.
   c. remain constant.
   d. tend to vary.

3. Which one of the following is the correct relationship for converting temperature in degrees rankine (°R) to temperature in kelvin (K)?

   a. K = (5/9) °R
   b. K = (5/9) °R + 273
   c. K = 460 + °R
   d. K = 273 °R

Level II

1. When a system's internal dry bulb's internal temperature and, in turn, total pressure, increase during a pressure change leakage-rate test, the water vapor pressure in the system under test would normally:

   a. increase.
   b. remain the same.
   c. decrease.
   d. oscillate.

2. For a pneumatically pressurized constant-volume system at an internal temperature of 27 °C, what approximate percentage change in the system absolute pressure can be expected for a system internal temperature change of 1 °C?

   a. 3%
   b. 6%
   c. 0.3%
   d. 10%

3. One set of internal dry bulb temperature data for a pressure change leakage-rate test is:

   a. $(T_1 + T_2 + T_3)/3 = 71.87$ °F
   b. $(T_4 + T_5)/2 = 72.32$ °F
   c. $(T_6 + T_7)/2 = 72.68$ °F
   d. $(T_8 + T_9 + T_{10})/3 = 73.07$ °F

Level II

1. A commercial computed radiographic system classification, such as ASTM E 2446, groups CR systems using a ________________ rating in order to characterize their relative performance levels.

   a. standard image quality
   b. light photometer
   c. equivalent IQI
   d. ISO index

2. The phenomenon that causes materials to emit light in response to external stimuli is known as:

   a. stimulation.
   b. fluorescence.
   c. reticulation.
   d. vibration.

3. Photo stimulated luminescence (PSL) is a process in which a phosphor that has ceased emitting light because of removal of the stimulus once again emits light when excited by light with a ____________ than the emission wavelength.

   a. shorter wavelength
   b. longer wavelength
   c. higher frequency
   d. lower frequency

Computed Tomography

Level I

1. The mechanical/manipulation system has the function of   and

   a. positioning the test object between source and detector; storing the data
   b. holding the test object; positioning the computer
   c. moving the source and detector; positioning the test object between source and detector
   d. holding the test object; positioning the test object between source and detector

2. The purpose of the radiation detector is to convert the measured transmission of X-rays through the object into ____________ to be handled by electronic processing.

   a. a phosphor
   b. a crystal
   c. an electrical signal
   d. a digital signal

3. The extent to which a computed tomography (CT) image reproduces an object or feature within an object is influenced by spatial resolution:

   a. detector type, source-to-object distance, and radiation source.
   b. statistical noise, slice plane thickness, and artifacts.
   c. radiation source, statistical noise, and detectors.
   d. statistical noise, detector type, and radiation source.

Level II

1. A CT image is a representative map of ________________ at each point in the plane.

   a. density measurements
   b. linear X-ray attenuation coefficients
   c. noise measurements
   d. X-ray scattered photons

2. Spatial resolution has a limiting value determined by the ____________ of the system and the amount of data and ________________

   a. design and construction; sampling schema
   b. size; X-ray source energy
   c. design and construction; X-ray source energy
   d. size; sampling schema

3. Contrast sensitivity refers to the ability to _________ the presence or absence of features in an image.

   a. mask
   b. calculate
   c. detect
   d. neglect

Digital Radiography

Level I

1. A digital detector array (DDA) can best be defined by a(n):

   a. device that utilizes a flexible phosphor plate and an electrical scanning device.
   b. device that converts the analog radiographic film into a discrete electronic output and is then digitized for display on a computer monitor.
   c. device utilizing a digital camera system in conjunction with a phosphor plate providing real-time or static image capture.
   d. electronic device that converts penetrating radiation into an analog signal and then digitizes it for display on a computer monitor.

2. What is one of the prime reasons to perform a DDA calibration?

   a. To ensure all measurements will be calibrated with an object of known dimensions to compensate for geometric enlargement if the object is not directly in contact with the detector.
   b. To increase the photon collection rate.
   c. Optimize the performance of the DDA.
   d. To minimize the backscatter to an acceptable level especially at high energies.

3. Changes in the thickness of the specimen are indicated by ________________________ in the digital image.

   a. a change in area
   b. a change in gray scale
   c. a lack of resolution in the image sharpness
   d. the relationship between exposure and the resultant pixel pitch of the detector

Level II

1. The term "bad pixel" is best described as a pixel:

   a. of a DDA that has performance outside the specification range.
   b. that is processed or sampled due to frame averaging.
   c. that must receive some type of correction to ensure all indications regardless of size resulting from rejectable discontinuities will be evaluated.
   d. that does not operate at all.

2. Flat panel gain, offset, and pixel calibrations ensure:

   a. proper probability of detection.
   b. measurements will be calibrated.
   c. proper defect evaluation.
   d. none of the above.

3. One of the main advantages of DR, or flat panel utilization, as compared to CR to accomplish an inspection task is typically:

   a. portability.
   b. inspection speed.
   c. initial cost.
   d. detector flexibility.

Thermal/Infrared Testing

Level I

1. Which of the following infrared (IR) camera settings may affect a radiometric temperature measurement?

   a. Span.
   b. Level.
   c. Palette.
   d. Focus.

2. Thermal infrared radiation occurs at wavelengths:

   a. shorter than X-rays.
   b. shorter than visible light.
   c. longer than visible light.
   d. longer than radio waves.

3. Which of the following camera parameters is not adjustable in post-processing computer software?

   a. Span.
   b. Level.
   c. Emissivity.
   d. Range.

Level II

1. Latent heat energy can be described as the energy:

   a. that creates or breaks the molecular bonds of the phase state of a material.
   b. that when added to a material will cause its temperature to increase.
   c. released by a material that will cause its temperature to decrease.
   d. released by an object that will break the molecular bonds of a material.

2. Which of the following surfaces will provide the most accurate radiometric temperature measurement?

   a. Thin film plastic.
   b. Oxidized aluminum.
   c. Glass.
   d. Water-based paint.

3. How hot does an electrical connection need to be for it to be classified as a serious problem?

   a. 1 to 5 °C (33.8 to 41 °F).
   b. 5 to 15 °C (41 to 59 °F).
   c. Greater than 15 °C (59 °F).
   d. Depends on the criticality of equipment to continued safe operation.

Ultrasonic Testing

Level I

1. The amount of beam divergence from a transducer element is primarily dependent on the:

   a. type of test.
   b. tightness of the transducer element backing in the search unit.
   c. frequency and transducer element size.
   d. refraction.

2. On the area-amplitude ultrasonic standard test blocks, the flat-bottomed holes in the blocks are:

   a. all of the same diameter.
   b. different in diameter, increasing by 1/64 in. (0.39 mm) increments from the No. 1 block to the No. 8 block.
   c. largest in the No. 1 block and smallest in the No. 8 block.
   d. drilled to different depths from the front surface of the test block.

3. On many ultrasonic testing instruments, an operator conducting an immersion test can remove that portion of the screen presentation that represents water distance by adjusting a:

   a. pulse-length control.
   b. reject control.
   c. sweep-delay control.
   d. sweep-length control.

Level II

1. If a contact angle-beam transducer produces a 45-degree shear wave in steel (VS = 0.323 cm/s), the angle produced by the same transducer in an aluminum specimen (VS = 0.310 cm/s) would be:

   a. less than 45°.
   b. greater than 45°.
   c. 45°.
   d. more information is required.

2. A discontinuity is located having an orientation such that its long axis is parallel to the sound beam. The indication from such a discontinuity will be:

   a. large in proportion to the length of the discontinuity.
   b. small in proportion to the length of the discontinuity.
   c. representative of the length of the discontinuity.
   d. such that complete loss of back-reflection will result.

3. An ultrasonic longitudinal wave travels in aluminum with a velocity of 635 000 cm/s and has a frequency of 1 MHz. The wavelength of this ultrasonic wave is:

   a. 6.35 ft
   b. 3.10 in.
   c. 6.35 mm
   d. 30 000 Å

Phased Array

Level II

1. Identify the factors that would produce the largest beam steering angles:

   a. large elements, small pitch, high-frequency testing low-velocity materials.
   b. small elements, small pitch, high-frequency testing low-velocity materials.
   c. large elements, small pitch, low-frequency testing high-velocity materials.
   d. small elements, small pitch, low-frequency testing high-velocity materials.

2. Which of the following best fits this description "the ultrasonic capabilities of resolving two adjacent defects along the acoustical axis through a small ultrasonic path"?

   a. Lateral resolution.
   b. Axial resolution.
   c. Resolution.
   d. Sensitivity.

3. What happens to the beam spread at higher beam angles when using a swept angle scan from 45° to 70°?

   a. The beam spread decreases.
   b. The beam spread increases.
   c. The beam spread does not change.
   d. Beam spread cannot be changed with angle.

Time of Flight Diffraction

Level II

1. Frequencies used for TOFD inspection are most dependent on:

   a. near field, beam spread, and the reflection factor of the material.
   b. acoustic impedance, beam spread, and penetrating ability.
   c. the thickness of the thinner part.
   d. sensitivity, beam spread, and penetrating ability.

2. Calculate the probe center spacing (PCS) to focus at a 15 mm depth using a pair of 70-degree probes.

   a. 41.3 mm
   b. 54.6 mm
   c. 82.4 mm
   d. 93.8 mm

3. Calculate the depth of a defect given the following information:

   Tx probe delay: 7.8 µs (pulse-echo measured)
   Rx probe delay: 6.2 µs (pulse-echo measured)
   PCS 59.6 mm
   Bottom tip signal 30 µs
   Material velocity 5960 m/s longitudinal
   3230 m/s transverse
   3010 m/s surface
   a. 29.8 mm
   b. 37.2 mm
   c. 61.7 mm
   d. 69.2 mm

Vibration Analysis

Level I

1. The vibration amplitude is a response that is:

   a. inversely proportional to the dynamic resistance in the system.
   b. proportional to the amount of displacement in the signal.
   c. not related at all to the dynamic forces in the system.
   d. meaningless unless it has been initially taken in acceleration units.

2. If a magnetic is attached to an accelerometer, it will:

   a. lower the frequency range capability of the accelerator.
   b. increase the frequency range capability of the accelerator.
   c. not allow the accelerometer to read in acceleration units anymore.
   d. increase the amplitude range of the accelerometer.

3. The enter or store key on a programmable FFT-Analyzer/Data collector should be pressed:

   a. as soon as the accelerator is attached to the mounting surface.
   b. after a pause of 30 seconds from the time the accelerometer is mounted.
   c. after the readings have settled down (usually 3 seconds or longer).
   d. immediately when a display appears on the screen (to save time).

Level II

1. A lissajous orbit that has a long elliptical (cigar shape) appearance is an indication of:

   a. unbalance.
   b. misalignment.
   c. an oil whirl.
   d. a rub event.

2. The purpose of a bode or polar (nyquist) plot is to verify the presence of:

   a. an eccentricity.
   b. a defective bearing.
   c. a resonance.
   d. a bent shaft.

3. The two most common problems that will produce a higher amplitude at 2× RPM than at 1× RPM in a vibration spectrum are:

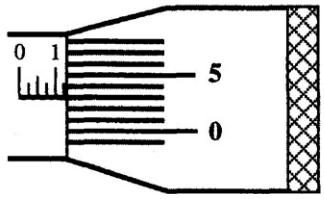
   a. an eccentric pulley and mechanical looseness (Type A).
   b. offset misalignment and mechanical looseness (Type B).
   c. a shaft bent between its bearings and worn gear teeth.
   d. an unbalanced shaft and mechanical looseness (Type C).

Visual Testing

Level I

1. Which of the following is true?

   a. All discontinuities are defects.
   b. Defects that affect the product's usefulness are called discontinuities.
   c. Discontinuities that affect the product's usefulness are called defects.
   d. All discontinuities are unacceptable.



2. The dimension indicated on the sketch of a micrometer is:

   a. 3.25 mm (0.128 in.).
   b. 5.97 mm (0.235 in.).
   c. 3.20 mm (0.126 in.).
   d. 8.33 mm (0.328 in.).

3. As a visual examiner, you shall have your eyes checked at least:

   a. every 3 months.
   b. every 6 months.
   c. every year.
   d. every 3 years.

Level II

1. Handheld magnifiers should fall into which of the following ranges?

   a. 2× to 4×
   b. 5× to 10×
   c. 10× to 20×
   d. 20× to 3×

2. Visual examiners who perform visual exams using borescopes and fiberscopes must be:

   a. color blind.
   b. able to meet far-vision requirements (Snellen 20/30).
   c. competent in their use.
   d. ambidextrous.

3. A narrow field of view produces:

   a. higher magnification and a greater depth of field.
   b. higher magnification and a shorter depth of field.
   c. less magnification and a greater depth of field.
   d. less magnification and a shorter depth of field.

Answers to Example Questions

ACOUSTIC EMISSION TESTING

Level I	Level II
1. d	1. d
2. b	2. c
3. b	3. d

ELECTROMAGNETIC TESTING

Alternating Current Field Measurement

Level I	Level II
1. b	1. d
2. b	2. b
3. a	3. a

Eddy Current Testing

Level I	Level II
1. a	1. d
2. a	2. c
3. a	3. c

Remote Field Testing

Level I	Level II
1. b	1. a
2. c	2. a
3. a	3. b

GROUND PENETRATING RADAR

Level I	Level II
1. b	1. c
2. c	2. d
3. a	3. c

GUIDED WAVE TESTING

Level I	Level II
1. d	1. c
2. d	2. a
3. b	3. b

LEAK TESTING

Bubble Leak Testing

Level I	Level II
1. d	1. c
2. a	2. a
3. d	3. a

Halogen Diode Detector

Level I	Level II
1. d	1. a
2. c	2. c
3. c	3. b

Mass Spectrometer

Level I	Level II
1. b	1. c
2. b	2. b
3. b	3. c

Pressure Change Measurement

Level I	Level II
1. b	1. a
2. d	2. c
3. a	3. a

LIQUID PENETRANT TESTING

Level I	Level II
1. d	1. b
2. b	2. c
3. c	3. b

MAGNETIC FLUX LEAKAGE

Level I	Level II
1. c	1. d
2. c	2. c
3. d	3. c

MAGNETIC PARTICLE TESTING

Level I	Level II
1. a	1. d
2. b	2. b
3. b	3. b

MICROWAVE TECHNOLOGY

Level I	**Level II**
1. c	1. c
2. b	2. a
3. a	3. b

NEUTRON RADIOGRAPHIC TESTING

Level I	**Level II**
1. c	1. a
2. b	2. a
3. d	3. c

RADIOGRAPHIC TESTING METHOD

Computed Radiography

Level I	**Level II**
1. d	1. a
2. c	2. b
3. b	3. b

Computed Tomography

Level I	Level II
1. d	1. b
2. c	2. a
3. b	3. c

Digital Radiography

Level I	Level II
1. d	1. a
2. c	2. d
3. b	3. b

Radiographic Testing

Level I	Level II
1. a	1. d
2. c	2. a
3. b	3. c

THERMAL/INFRARED TESTING

Level I	**Level II**
1. d	1. a
2. c	2. d
3. d	3. d

ULTRASONIC TESTING

Level I	**Level II**
1. c	1. a
2. b	2. b
3. c	3. c

Phased Array

Level II (only)
1. d
2. b
3. b

Time of Flight Diffraction

Level II (only)
1. d
2. c
3. c

VIBRATION ANALYSIS

Level I	**Level II**
1. a	1. b
2. a	2. c
3. c	3. b

VISUAL TESTING

Level I	**Level II**
1. c	1. b
2. a	2. c
3. c	3. b

Appendix B: NDT Practical Examination Checklist

NAME: ______________________ EMPLOYEE #: ______________________

COMPANY: ______________________ LOCATION: ______________________

DATE: ______________________ NDT METHOD: ______________________

PROCEDURE DESCRIPTION: ____

SPECIMEN(S) DESCRIPTION: ____

Time Started: ____________ Time Completed: ____________

No.	Categories	Points	Score	Remarks
1.	**Knowledge of NDT Procedure** • Familiarity • Utilization • Consideration for limitations • Adherence to procedural details	10		Record the presence or absence of actions that support your score. Was the procedure picked up, thumbed through, read ahead of time, highlighted or marked up. Did the candidate refer to the procedure when questions arose? Did the output comply with the procedure?
2.	**Equipment and Material** • Stated in procedure or user experience • Proficiency in set up, utilization, and calibration • Proficiency in technique and standardization	5		Record the presence or absence of actions that support your score. Note the equipment and materials used. Evaluate the procedure for calibration adequacy, ease of use, and care.
3.	**Test Specimen Care and Custody** • Appropriate pre-cleaning • Maintenance/control • Appropriate post-cleaning	5		Record the presence or absence of actions that support your score. Note preparation adequacy, specimen care, final cleaning, and final specimen condition.
4.	**Operations** • Calibration verification • Adhering to procedures • Adherence to the sequencing requirements • Utilization of appropriate testing media • Inspecting designated areas of interest	10		Record the presence or absence of actions that support your score. State if calibration was verified or not. List steps followed. Note any steps missed. Describe actual test media used, area of interest, and area(s) missed.
5.	**Detection of Indications**(1) • Adherence to procedure requirements • Accuracy (detection of critical indications) • Finding detectable indications	15		Record the presence or absence of actions that support your score. List all procedure requirements not followed. Note number of hits, misses, and false calls. Reference attached report annotated.
6.	**Interpretation of Indications** • Adherence to procedure requirements • Accuracy (interpreting the critical indications) • Interpreting relevant indications	15		Record the presence or absence of actions that support your score. Identify metrics reflecting inspection accuracy or inaccuracy. Refer to attached report and interpretation standards compared to known defect map and characterization.
7.	**Evaluation of Indications**(2) • Following procedure requirements • Accuracy (evaluating the critical indications) • Evaluating relevant indications	20(3)		Record the presence or absence of actions that support your score. Quantify discrimination accuracy and margin of error between relevant and nonrelevant indications.
8.	**Documentation and Records** • Accurate documentation • Proper data processing • Appropriate control of records • Compliance with procedural routing	10		Record the presence or absence of actions that support your score. State degree of completeness, legibility, clarity, correctness, and appearance of reports with errors and omissions.
9.	**General Health and Safety** • Familiarity with health and safety of method • Volatile substances • Electrical hazards • Respiratory concerns • Compliance with specific site procedures	5		Record the presence or absence of actions that support your score. State violations of industry standards and practices. General statement of compliance is acceptable if no violations.
10.	**General Observable Conduct** • Proficiency in knowledge of the method • Proficiency in application of the method • Proficiency in the results • Adherence to a professional behavior	5		Record the presence or absence of actions that support your score. List comments or behavior that supports or detracts from examinee performance.

(1) The candidate should detect all discontinuities and conditions specified by the NDT Level III.
(2) No more than 10% false calls allowed.
(3) 80% of designated defects correctly classified (16 points required to pass).

Print/Signature of NDT Level III: ______________________ Date: ______________________

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Each inquiry should address a specific section or paragraph of *SNT-TC-1A*. If submitting multiple inquiries, submit a separate form for each inquiry.

In the top section of the form, provide complete contact information so that you can be reached should clarification be required. List the *SNT-TC-1A* edition (year) being referenced and the specific paragraph or section in question.

In the Inquiry block, state the question in the clearest terms possible and in a manner that will permit a Yes or No answer if possible.

In the Background block, provide any additional information that will explain the need for the clarification or the intent of a paragraph or section. Attach additional pages if necessary.

The **Proposed Response** block is for ASNT use only.

All inquiries should be sent to:

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Columbus, OH 43228-0518
E-mail: SNT-TC-1Ainterpretations@ASNT.org
Fax: (614) 274-6899

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PO Box 28518
Columbus, OH 43228-0518
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Date:

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Name: ______________ Phone: ______________ E-mail: ______________

Address: ______________ City: ______________ State: ________ Zip: ________

Country: ______________ *SNT-TC-1A* Edition: ______________ Associated Paragraph(s): ______________

Inquiry:

Background (Add any additional information that will clarify the situation, need, etc.):

PROPOSED RESPONSE (ASNT Use Only)