

CERTIFICATION and RECOMMENDED GUIDELINES EXPLAINED

Nondestructive testing (NDT) is a wide group of analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage.

The terms Nondestructive examination (NDE), Nondestructive inspection (NDI), and Nondestructive evaluation (NDE) are also commonly used to describe this technology. Because NDT does not permanently alter the article being inspected, it is a highly-valuable technique that can save both money and time in product evaluation, troubleshooting, and research. Common NDT methods include ultrasonic, magnetic-particle, liquid penetrant, radiographic, remote visual inspection (RVI), eddy-current testing, and low coherence interferometry . NDT is a commonly-used tool in forensic engineering, mechanical engineering, electrical engineering, civil engineering, systems engineering, aeronautical engineering, medicine, and art.

When first introduced as an inspection tool most of the early users of NDT were either self taught or had simple instructions from the equipment manufacturers in operating principles. Large corporations and the military developed several internal training programs and operator qualification procedures.

Following are some of the results that came about as an outgrowth of these procedures.

SNT-TC-1A

In the 1960's, the American Society for NDT issued a guideline called SNT-TC-1A, which outlined a method of "Employer" based certification. At the time this document was written, ASNT did not want to get into the "certification" business or accept the liabilities that might be associated with it.

Therefore, SNT-TC-1A is a guideline to be used by employers to develop their own in-house program to cover training, qualification and certification of their employees performing, evaluating or overseeing nondestructive tests.

This set of guidelines was first printed in 1966 and was called SNT - TC -1A

(An abbreviation for Society for Nondestructive Testing - Technical Council - the first document published).

This document is revised periodically, usually every 4 years (the latest version is the 2007 issue).

This form of employer based certification has been widely accepted throughout the USA as the mainstream form of NDT certification. A brief overview of the main highlights follows.

I. Develop a "Written Practice".

This is an internal company procedure which details how employees are trained, qualified and certified to perform NDT functions for the company. This is not to be confused with a written procedure that specifies the details of performing a specific NDT examination.

The Written Practice must have details of:

- NDT methods and techniques used. A method is UT, PT, RT, etc. A technique is solvent removable – visible dye penetrant.
- Three Levels of qualification and the responsibilities are for each level

NDT "methods" and "techniques" used.

(A method is an overall concept of inspection, such as Radiography or Ultrasonic or Penetrant Testing).

(A technique is how the method is used, e.g. "water washable, fluorescent" is a "technique" of applying the Penetrant "Method" of NDT).

Levels of qualification and responsibilities assigned to each level. Usually there are 3 levels of certification.

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Level I

Basically an operator, capable of performing specific tasks to written instructions under supervision and reporting the results.

Level II

More responsibility and capable of performing independent equipment "set - up" and "calibrations" and can also interpret the results of inspections in accordance with codes and specifications. Level II workers can also perform on the job training and guidance of Level 1 personnel and trainees.

Level III

- 1- Write or approve procedures and techniques.
- 2- Determine what must be done to satisfy specification, code and customer requirements.
- 3- Accept responsibility for the NDT department.
- 4- The Level III must also have a good working knowledge of other NDT methods and manufacturing processes.
- 5- Provide training, testing and qualification of Level I and Level II personnel and periodic reviews to assure compliance with your firms Written Practice as well as the requirements of the specifications, codes and applicable laws.

The exact duties of the various levels may be altered to suit the companies' applications. Details of "Training", "experience", and "examination" requirements for company based certification. Examples of typical requirements are shown below in Table 1.

Certification / re-certification periodicity.

The "Written Practice" should be maintained on file and it is necessary to have a "Written Practice" before any certification is granted.

II. Formal (classroom) training.

The structured training program(s) meeting the requirements of Table 1. and the guidelines of SNT-TC-1A should be successfully completed.

(To successfully complete a training program, sufficient examinations must be passed to ensure that the necessary information has been comprehended).

III. Experience

Employees cannot be certified until they have achieved the minimum experience level detailed in the "Written Practice". This experience must be documented and kept in the certification records file.

IV. Qualification Examination

The Level III(s) responsibilities include approval / grading of examinations administered for certification purposes. The actual administration of written examinations can be subcontracted to a designee of the Level III.

Level I / II examinations consist of:

A physical exam of the near vision acuity and color response of the candidates eyes.

- A written "General" examination to test the candidates knowledge of the methods basic principles.

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Number of questions required for the general examinations

Test Method	Number of level 1 questions	Number of level 2 questions
Penetrant Testing	40	40
Magnetic Testing	40	40
Radiographic Testing	40	40
Eddy Current Testing	40	40
Ultrasonic Testing	40	40

Table 1

A "Specific" examination will be based on the equipment, procedures (including the "Written Practice" and the techniques used in the performance of their job).

The minimum recommended numbers of questions for the specific examination are given in Table 2, below.

Test Method	Number of level 1 questions	Number of level 2 questions
Penetrant Testing	20	20
Magnetic Particle Testing	20	20
Radiographic Testing	20	20
Eddy Current Testing	20	20
Ultrasonic Testing	20	20

Table 2

A "Practical" assessment of performing typical inspection work is also necessary. This evaluation should be performed to an audible criteria (at least a 10 point checklist). With the exception of the vision examination, at least 70% must be scored in each part of the qualification examinations and an "average" score of at least 80% must be achieved.

V. Certification

If all of the previously detailed criteria have been satisfied and documented evidence exists of satisfactorily completing each task the candidate can be certified by the "Certifying Authority" (a person(s) designated in writing in the "Written Practice") to sign a letter of certification.

Summary

SNT-TC-1A was developed and issued with the intent of providing a level of uniformity across the NDT profession. It has achieved this to a large degree, however, the facility to change the recommendations of SNT-TC-1A to meet employer requirements is often abused. This results in some employer base certification programs being somewhat lower in achievement than the intent. Unfortunately there are no ASNT auditors performing evaluations of the interpretations applied to individual company "Written Practices". The only auditors are the customers quality representatives, who in many instances are not familiar with the intent of SNT-TC-1A.

CP-189

In an attempt to produce a more rigid uniformity, ASNT re-visited the intent of SNT-TC-1A and produced a new document which was designed from the outset to be a "national standard" rather than simply guidelines. This new document was offered as an alternative to SNT-TC-1A. Both exist as parallel programs available for a contractor to specify and a sub contractor to adopt. The overall structure is very similar to SNT - TC - 1A in terms of training, experience, examinations, etc. It differs significantly in several areas. I have

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compiled a brief list of some of the major differences below:

Written Practice - instead of a "Written Practice" as detailed in SNT-TC-1A, a "Certification Procedure" is required for CP 189. This cannot be reduced in rigidity to suit company requirements dictated by CP 189. Again it must be approved by the Level III. The vision requirements for near vision acuity are more stringent in CP 189 requiring acuity to read the Jaeger # 1 instead of Jaeger # 2. There are 5 levels of qualification instead of 3 the additional 2 being "Instructor" and "Trainee". The minimum training hours are not reduced for having a 2 year degree, as is the case for MT, PT, and NRT for SNT-TC-1A. The training requirements for ET Level 1 are less stringent than the recommendations of SNT-TC-1A being only 12 hours instead of 40 (based on a High School education).

Level III certification for CP 189 also requires an ASNT Level III certificate in the method as a pre-requisite. A "Basic" exam is not required, holding a current ASNT Level III certificate satisfies this requirement. Level III examinations also require a procedure be prepared for the practical exam.

Again this is not a comprehensive list of the differences, but simply the "major" fundamental differences in the concepts. By far the most important fundamental difference is in the concept that CP 189 is a national standard and must be treated as a minimum requirement not simply a set of guidelines which may be altered. This is reflected throughout the 2 documents by the choice of verbs used. CP 189 uses "shall" throughout to emphasize a "mandatory requirement", whereas SNT - TC - 1A uses the verb "should" to emphasize a "recommendation".

MIL-STD-410E

Military Standard - Nondestructive Testing Personnel Qualification and Certification. For companies or personnel employing NDT for the Inspection of products used on Military or Government contracts MIL-STD-410E was the governing document until January 1 st 1998. (It was then replaced by NAS 410). Like CP-189, MIL-STD-410E was a "standard" and not simply a "recommendation". It also had the same 5 levels of qualification as CP-189 (these are not levels of certification). Near vision acuity requirements were Jaeger # 1. A "Certification Procedure" was required rather than a Written Practice. The procedure shall, as a minimum satisfy all of the requirements of MIL-STD-410E. Level III examinations required the writing of a procedure to fulfil the practical examination. Level III certification did not have a pre-requisite of holding an ASNT Level III certificate in the method, however, possession of a current ASNT Level III certificate did satisfy the requirements of the TEST NDT, LLC - QUALIFICATION & CERTIFICATION
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"General" examination. A waiver was given in this event. Level III examinations did not have a separate "Basic" examination. Instead, Level II type questions of other NDT methods were incorporated into the "General" examination.

NAS 410 (Superceded MIL-STD -410E)

"National Aerospace Standard 410, NAS Certification and Qualification of Nondestructive Test Personnel".

The "Aerospace Industries Association" approved NAS 410 as an Industry standard in 1996. With effect from December 31 st 1997 it replaced MIL-STD-410E for all DOD contracts. Again like CP-189 and the MIL-STD-410E that it replaced it is a "minimum standard" to be complied with, not a "recommended guideline" like SNT-TC-1A. The major differences between it and the other programs are as follows:

Two additional levels of qualification added to the existing 5. The new levels being "Auditor" and "Limited level 1".

- The levels of "Certification " are 4 and levels of "Qualification" are 7.
- A "Certification procedure" is still required.
- Possession of an ASNT Level III is not mandated, it does, however, offer a waiver of the "General" examination.
- A procedure preparation examination is required for Level III certification.
- The number of examination questions required for the "Specific" examination is a minimum of 30 for each method.
- As of February 2003, a new Revision 2 was approved which specifies a change in the minimum hours of formal training required for Magnetic Particle and Penetrant methods for Levels I and 2 of 16 hours for Level I and 16 hours for Level 2 (with Level I experience) or 32 hours direct access (without Level I experience). That is an increase of 16 hours for

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Penetrant and 12 hours for Magnetic Particle Level II inspectors.

- Also, the re-certification period for Level I and II has been changed from 3 years to 5 years.

ATA-105

"Guidelines for Training and Qualifying Personnel in Nondestructive Testing Methods".

The Air Transport Association of America (ATA) and in particular representatives from American Airlines, Eastern Airlines, Trans World Airlines, United Airlines and US Air developed this document to provide more uniformity to the training of NDT Inspectors following the FAA sponsored "Aging Aircraft Conference" held in June 1988. It provides a "guideline" for training personnel to be certified under the existing framework of the airlines certification program. It was intended to compliment the knowledge and experience gained while attending airframe and powerplant technical schools. The scope of the specification claims equivalent competency to SNT-TC- 1A and MIL-STD-410E.

This is questionable on several issues as follows:

No additional training (classroom) is required for Level 2 certification. The total classroom training for Level 2 UT, RT and ET is in most instances only 50% of the requirement for each of the other training programs mentioned. See Table 3 for details.

<i>NDT Method</i>	<i>Classroom training hours</i>	<i>Experience level 1 hours/months</i>	<i>Experience level 2 hours/months</i>
Eddy Current	40	480/3	1440/9
Ultrasonic	40	480/3	1440/9
Magnetic Particle	16	160/1	480/3
Penetrant	16	160/1	480/3
Radiography	40	480/3	1440/9

Table 3

Formal training and experience requirements for ATA 105

There is no "formal " practical examination of the candidate's ability. Completion of classroom and "On-the-Job Training" (OJT) satisfies the practical examination requirement. Re-qualification is performed after 3 years, simply by, "evaluation for compliance with performance standards by a Level 3 or other designated individual". There is no "Specific TEST NDT, LLC - QUALIFICATION & CERTIFICATION

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Examination " at all. The only concession is the inclusion of some questions on specifications or standard within the 40 questions of the "General Examination". Clearly the requirements for training and certification in accordance with ATA-105 are considerably less stringent than any of the other programs mentioned.

ISO - Accredited Central Certification Programs

ISO - is a Greek word, which roughly translated means "the same or equal". ISO is not an abbreviation for International Standards Organization as many people think. The ISO organization is an international body with representatives from all of the major manufacturing nations (including the USA).

Its main purpose is to develop International Standards, which can be incorporated in any of the member nations. Probably, one of the widest known ISO programs is the ISO 9000 program for Quality Management Systems.

Within the ISO 9000 program are numerous standards detailing the requirements for specific areas of Quality Control. ISO 9712 - International Standard for Nondestructive Testing Personnel Qualification and Certification was published in 1992 and is as the title suggests a "Standard" not a recommended practice. ISO 9712 differs significantly from all programs discussed in several areas.

The major differences are:

It calls for a, "National Certifying Body" supported by and "administrative committee" to initiate, maintain and promote a "National Certification Scheme". All certifications will be issued by the "National Certifying Body" not the employer. Approved training programs must be completed before examinations can be taken. The formal training hours required are considerably longer than the programs previously described. (See Table 4 over page) Corporate Level 3's or outside agency, Independent Level 3's do not have the authority to administer qualification examination. These can only be administered at an, "Authorized

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Examination Center" by qualified staff.

There is also a far vision, acuity requirement for the physical examination. Sector specific examinations are available e.g. Aerospace Industry Sector or Welding Industry Sector, etc. All certificates are valid for 5 years (even Levels 1 and 2). Weighting factors are applied to the grading of examinations. For Level 3's who are not already certified Level 2's in the method, a Level 2 practical examination must also be completed.

Perhaps the most significant conceptual change between the ISO Central Certification program and the other Employer based programs discussed is the fact that the Individual becomes certified with a transportable certificate that he/she can take from employer to employer or job-site to job-site without the need for re-certification each time. Or perhaps of equal importance from the employers perspective is that, when needed, they can hire a new employee or contractor who is already certified to work immediately.

The ISO 9712 relies on independent national programs operation under its umbrella. ISO 9712 is not a certifying board. Various national programs exist such as the Can / CGSB - 48.9712 - 95 in Canada, and Personnel Certification in Nondestructive Testing (PCN) administered by the British Institute for Nondestructive Testing (BINDT) in the UK. PCN examinations are now also available from T.E.S.T. NDT in the USA. These programs are in compliance with ISO 9712.

ACCP

The ASNT Central Certification Program (ACCP) is an attempt at providing a similar program for the USA. The exact status of the ACCP program in relation to ISO 9712 is vague. Early statements regarding this issue were that the ACCP was not designed to "COMPLY" with ISO 9712, but to "ALIGN" with it.

Recent statements from ASNT on the issue are that it not only complies, but, exceeds the requirements of ISO 9712. Comparing some of the requirements for training and examination, however the ACCP appears to be less stringent in some areas.

Main highlights of the ACCP program:

Central certification, administered by ASNT, not employer based.

Portable certification.

Various industry sectors expected, however, at time of writing these notes there is not an "aerospace" industry sector.

Certification is available at 3 levels in MT, PT, UT and RT. It is not currently available in ET.

A procedure preparation examination forms part of the examination process for Level 3's.

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Certification is valid for 5 years in all methods.

The lack of both an "Aerospace Industry Sector" and ET method certification negates the usefulness of the ACCP for aircraft applications.

FAA Requirements for NDT Personnel Certification

To a large extent the requirements will be as interpreted by the particular Inspector performing the assessment audit. The following is a document found during an internet search on the topic of "FAA NDT requirements" and was co-authored by Cathy Van Assche and Nick Eull from the Long Beach FSDO.

A & P Mechanics Performing NDT Inspections

by Cathy VanAssche and Nick Eull

LGB FSDO Inspectors

Questions have been raised on how to determine if qualified personnel are performing Nondestructive Testing (NDT). Currently there is no national FAA policy to determine if personnel performing NDT are qualified.

Guidance has been developed by the Production and Airworthiness Certification Division and Aircraft Maintenance Division along with the Chief Scientific and Technical Advisor for Nondestructive Evaluation to assure that only qualified inspectors perform NDT.

This guidance discusses the generic elements of the standards considered acceptable to the FAA. NDT personnel should receive documented vision and color blindness testing at reasonable intervals. NDT personnel can be categorized at different levels of competence (e.g. Trainee, Limited, Level 1, 2, 3) and should perform only at the level to which they have been qualified. Inspection personnel should receive documented initial and recurrent training in the standards, methods, and levels they utilize.

NDT personnel should demonstrate documented proficiency, both in classroom knowledge and practical application of test methods. NDT personnel require experience in a test method to be considered qualified to perform that test method. A procedure needs to be in place to

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allow an organization to disqualify a NDT individual from performing inspections when the inspector doesn't meet current standards. Sufficient documentation must be available and retained to demonstrate that only qualified personnel are engaged in the NDT process. There are several current national and international standards acceptable to the FAA that may be used to assure that only qualified personnel perform NDT.

NAS - 410 (replaces MIL-STD-410E), National Aerospace Standard, Nondestructive Testing Personnel Qualification and Certification.

ATA Specification 105, Air Transport Association, Guidelines for Training and Qualifying Personnel in Nondestructive Testing Methods.

AIA - NAS - 410, Aerospace Industries Association, National Aerospace Standard, NAS Certification & Qualification of Nondestructive Test Personnel.

Canadian - Can/CGSB-48.9712-95, Qualification and Certification of Nondestructive Testing Personnel.

British: PCN/GEN/92, General Requirements for the Certification of Personnel engaged in Nondestructive testing at levels 1, 2, and 3.

EN 473, General Principles for Qualification and Certification of NDT Personnel.

ISO 9712, Nondestructive Testing - Qualification and Certification. (EN 473 is a European Standard which is almost identical to the ISO 9712 Standard).

From the article it can be seen that the FAA is employing a "scatter gun" approach to the requirements by allowing the very flimsy ATA 105 in addition to the far more stringent ISO 9712 programs such as PCN and the CGSB programs. This leaves a huge disparity in the competency of the NDT personnel.

Prime Manufacturers Requirements for NDT Personnel Training

Almost all of the Aerospace prime manufacturers have their own "in - house" training, qualification and certification programs which are usually closely based on the recommendations of SNT-TC-1A. Included in these manufacturers are Boeing, Pratt & Whitney, GE, British Aerospace Systems, DASA, etc.

These companies also insist on similar programs for all of their subcontractors who must TEST NDT, LLC - QUALIFICATION & CERTIFICATION

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either have their program audited and approved or adopt the Prime Manufacturers program to the letter. In many instances the sub contractor must accept a "Do as I say, not as I do" relationship with the Prime Contractor, due to the Prime insisting on processes which may be waived in their own manufacturing facilities.

Primes may also insist that all certified NDT personnel or Level 3 service providers are full time employees. Some Primes require that all certification examinations be performed by their staff, etc.