NDT Training Centres – Requirements and Challenges

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Abstract

NDT Training centres today are operating all over the world. No two training centres are alike. For a training centre to give good output, they have to be standardized. Various standards spell out requirements for training and training centres. In NDT, certification of an individual is a must. The process of certification starts from training. The actual training may be based on the educational background of the candidate. Candidates may find the actual learning easy or difficult, based on the experience they have in the NDT method. It is the skill of the training centres and trainers to make the program suitable for both experienced as well as unexperienced candidates. Training being the foundation of certification, training centres have definite responsibilities. A training centre without a system may not be able to meet the challenge of coming out with industry-ready candidates. Conducting training or conducting good training may not be the only criterion for a training centre. Consistent good service, well equipped facility, qualified tutors, good quality and updated training material, sample specimens related to the method and a candidate-centric attitude play an important role. Consistency is achieved through following an established system. Having followed some standard and after fulfilling some or most requirements, the next best thing for a training centre to do is sustenance. This is an important aspect which if overlooked leads to a decline in the overall standard, sometimes irreparable.

On-line training has sprung up well and will see a phenomenal growth in the near future. These training centres themselves may become virtual. There is a need to set up norms for such training centres too. Keeping a track of the actual learning by the candidates, fair play, the dilemma of how to impart hands-on training, updating training material and software or IT related issues are some of the challenges faced by on-line trainings.

Keywords: NDT (Non-destructive testing), certification, training centres, requirements, responsibilities, challenges.
1.0 Introduction to NDT

Non-destructive Testing (NDT) or Non-destructive examination (NDE) is an essential part of all sectors of engineering. The technology started off small and slow, and now is almost the back-bone of quality assurance. The various methods that developed with time further branched into numerous techniques which have specialized applications.

It is imperative that NDT be done as systematically as any manufacture. The system of NDT comprises procedures, equipment and personnel. When we talk about good NDT or systematic NDT, we need to have qualified procedures for performing NDT, calibrated equipment, and qualified personnel. All are important elements of good NDT. Experience over the years shows that the personnel element dominates. This does not mean we can work without procedures or equipment. It simply relates to the human ability to monitor and control the other two elements, to take decisions and actions, and to get the job done. Being ‘able’ to do this means being qualified and certified.

2.0 What is Qualification and Certification?

So, let’s see what is qualification, and how does it differ from certification. Qualification is demonstration of physical attribute, knowledge, skill, training and experience required to properly perform the NDT task, whereas certification is written testimony of qualification.

A person obviously has to be qualified before he is certified. The whole process has to go about as a system, generally following a standard or a practice. It is required to have the practice or procedure documented and then followed.

3.0 Why is Certification important?

What happens if certification is done half-heartedly or not as per the set rules? NDT is a serious business. It deals with material assessment, product verification, integrity assessment…before construction, during construction, during use…and any mistake can be too costly. It may lead to loss of material, waste of man-hours, compromise on safety, risk to human lives, and catastrophic incidents. NDT has to be performed carefully, keeping all system elements in place, even before actual NDT starts. A certified individual is supposed to do the job correctly, based on his level of certification. The general tasks are setting up the test, actually performing NDT, interpretation and evaluation, and writing or qualifying procedures. The certified individuals are responsible for each and every aspect of NDT, and for good NDT, we need each and every aspect covered well and done right. Any slip in any place, say in equipment, in set-up, in consumables, in interpretation etc. means NDT has failed. Only responsibly certified individuals do justice to the whole process. Hence it is very important that the process of certifying an individual be done rightly and with care.
4.0 Role of training in certification

Experience and training are important factors in the process of certification. We have a number of certification schemes or programs all over the world. Some of these are centralized and some are employer based.

Certification process starts with the candidate’s accumulated experience in the particular NDT method. His experience may or may not be linked to his educational qualification. Next is his training in the NDT method. Next he has to pass a vision test. Finally, there is a written and practical examination. The candidate is entitled to certification after he clears the exam.

The training of a candidate may depend on his educational qualification. The purpose of training in the training centre is to acquire knowledge and skill for performing specific work, which is crucial for the trainee’s performance in working life. Every customer expects a perfect job out of a certified individual, which means the real value of certification lies in getting the individual ready for real life situations in testing. The certified person shall demonstrate competency in testing the product, interpreting and evaluating, and making correct judgement on acceptance and rejection.

Hence, we understand that training is the most important foundation of certification. The major part of the process towards certification is through training and education.

5.0 Training centres: An Overview

The major part of the journey towards the qualification and certification is through training and education. A good certification scheme may become ineffective if a full-fledged strong training activity is not in the background. The purpose of such training shall not be merely getting a person qualified for certification, but to impart all that is necessary and make the person richer in knowledge and application, so as to be ready for field NDT.

A strict quality control mechanism for inspection of a product may achieve only part of the goal. The real results will come when we ensure production of the right quality product by ensuring right design, right material, right processing methods and right facilities. The same logic applies to NDT training. Only when the product, in this case the trainee, is produced with robust manufacturing principles, the certification schemes will be said to be effective.

Now this discussion is leading to a question – how good a training institute should work? There are a number of requirements that a training centre has to meet in case it really wants to contribute to the field of NDT.
For any training institute to succeed, it first needs a robust management system. A systematic approach to all work ensures repetitive good quality work. A training organization shall have documented QMS (Quality Management System) and an organization structure to implement the same. It should cover the induction of students, student assessments, training curriculum and course notes, facilities, training specimens, NDT equipment, technical library, training instructor, and documentation system. The system needs to be controlled and periodically reviewed. The compliance and effectiveness is assured through such reviews. The organization should stress on the competence of the people whose work affects the training quality. Their competence has to be determined, and in case required their competence shall be increased by training or any suitable means. Thus, a strong base in the form of an effective system and competent trainers in the training organization helps. It is obvious that even the non-teaching staff contributes to quality. This is only possible when the overall staff is trained in required matters, and regarding the management system.

In ISO 25108: 2018 the process approach and risk analysis are emphasized. Any process is controlled by controlling the parameters bearing on this process. The risk of forwarding an improperly trained candidate to certification agency is to be identified by the training organization. To minimize that risk, the training organization shall monitor the following parameters:

1. Defining Training Needs
2. Designing and planning training
3. Providing training
4. Evaluating the outcome of training

There has to be criteria for measuring training outcome, like mock-up papers. If we go with the end product and its requirement, we understand that the candidate who gets trained and certified shall be able to shoulder his responsibilities to the certified level. This demands comprehension of knowledge, skills and attitude. Unfortunately, attitude cannot be taught in the class and hence the employer has to select the person of right attitude. Knowledge and skill can be imparted by the training centre. The assessment of this knowledge and skill is done by the certifying body but it is always on a sample basis. This sample basis can give misleading results. Hence only relying on certification bodies will not be correct. A robust training process followed by training completion examination can ensure that the candidate has acquired the requisite knowledge and skill. The certification in such case will become a formality, however it is essential to give confidence to the employer.

Now the question is, what is a robust training process, and how can it be developed, implemented and sustained?

A candidate joining a training program needs to be uplifted to the certification level. A gap analysis is essential. The tricky thing is that different candidates can be at different levels, and
they need to be uplifted to the same certification level through a specific training program. Hence the training program shall have that flexibility.

The starting point is defining training needs, designing and planning training, delivering training and evaluation of training.

The Quality Policy of a training centre shall include the development of the candidate to ensure that he/she can deliver to the specified requirement of certification level. The trained and certified candidate shall be able to carry out testing confidently, accept or reject the products correctly and ensure that the doubtful areas are brought to the notice of higher level.

The Quality Policy shall be supported by well-defined objectives which shall relate to training needs, candidates, training methods, training outline and contents, lesson plans, training duration, resources required and delivery modes. There shall be criteria defined to evaluate training outcome (like mock up test) and monitoring training process (like upgrading trainers, training materials, question banks and so on.)

A good training organization shall have a documented Quality Management System (similar to ISO 9001) and the staff and employees who are responsible for implementing this system shall be adequately trained and retrained to ensure effective implementation of the Quality Management System.

The major activities which shall be controlled by the training organization are:

5.1 Induction and assessment of the candidates

5.2 Training material: training curriculum, course outlines, course notes, PPTs (power point presentations), question banks, practical books, mock up examinations.

5.3 Training equipment and specimens

5.4 Trainers, Demonstrators

5.5 Infrastructures and facilities (safety, library, etc.)

5.6 Documentation

5.7 E-Learning

**5.1 Induction and Assessment of Candidates:**

Very clear and precise information shall be passed to the candidates regarding venue, date, time, pre-joining documentation, fees, method of payment etc. Ambiguity, confusion or sudden surprises not only portray an unprofessional picture, but also affect the learning process. There shall be a training coordinator who will act as a single point contact to the candidates. These details ensure that the candidate has full information on the training activity even before he/she joins the course. The education certificates and experience certificates are very important
documents and need to get verified as per different standard requirements. Verifying authenticity of these documents is also a challenging work for the training organization. We need to refer additional requirements coming in required training standards regarding experience validation. The proper induction documentation of the students (CVs, background knowledge, experience) will help the trainers to take additional efforts to put the candidates on the right track. Ongoing class exams of the students can give information on learning progress of the students and will help the trainer in giving additional counselling.

5.2 Training Material:

This is the backbone of a good training process. The curriculum must meet the syllabus requirements. The course outlines are drawn on the basis of syllabus. The weightage for practical exercises (50% ±10%) shall be ensured for Level I and Level II NDT programs.

It is required that the training organization publishes and makes available the syllabus of the course. Any development in the field of NDT or applicable industry shall be studied to check if the existing syllabus needs a revision. Course notes have to be provided to the candidates. Consistency in the courses has to be maintained to avoid ambiguity and incomplete or inadequate delivery which may affect the examination result. Some factors affecting consistency are course material and a change of the instructor. A master set of the training notes with revision date shall be maintained. This master too has to be periodically reviewed and revised. Course notes should not only properly cover the syllabus but have good flow and the language shall be simple, clear and easily understandable. The size of letters shall be such that candidates shall be motivated to read. NDE handbooks purchased from market may be of interest to hardly 10% of the students. There shall be figures and sample exercises to explain the topics. They shall have relation with the topics covered in the class and shall focus on syllabus and learning objectives. In practice, many times this training material is not prepared but copied from handbooks containing complicated formulae and unwanted information, which does not help the students. Developing right training materials is a complex process and needs experienced and knowledgeable experts, preferably trainers. This course material should be continuously upgraded during use and the upgrading, revisions and additions shall be controlled. The changes in syllabus, changes in technology, new developments in equipment will lead to revisions in training notes. The course material shall be such that the students retain it for their further use.

PPTs are very commonly used in training programs. They shall be properly designed with animations and video/audio additions to cover the subject and enable easy learning. They shall be used adequately (neither more nor less). Students learn by questioning. Hence question banks for homework, question banks for classwork, case studies help students to understand the subject. Questions make the students go through the training material upgrading these question banks shall be done periodically.

Another important training material is in the form of practical books. All practical exercises required to be completed shall be broken down into different lessons and shall be given to the student. The demonstrator shall ensure that all practical lessons are covered and the students
are comfortable with handling of equipment. The practicals shall correlate with real life testing situations and problems.

The mock up examinations designed to be taken at the end of the program shall be similar to the certification body’s examinations, and the training organization shall be convinced about the proper development of the candidate for a specific certification level. If not, he/she shall undergo retraining. This is very important.

5.3 Training Equipment and Specimens:

The practical training is heavily dependent on the equipment and specimens. The number of equipment shall be adequate (for example, one UT flaw detector for every student or for two students). The equipment shall be of latest technology and that presently used in industry.

There is no point in teaching on equipment which were in use twenty years back. Maintenance and calibration of the equipment has to be done as per a documented system, and records of maintenance and calibration shall be kept. When some equipment is not available in practical class (for example, automated penetrant or MPI system), appropriate video clips shall be shown. Making visits to places where such equipment is used will help, but may be time consuming.

Similar to equipment, practical specimens are also important. These specimens are representative of the actual conditions the candidate may face in his work life. Hence, appropriate specimens covering all types of discontinuities will ensure full learning. They can be with artificial flaws or natural flaws. The artificial samples shall be properly manufactured and tested. Natural specimens need verification, characterization and reporting. Sector wise and method wise specimen need to be used. The master report of these specimens shall be available in the organization. This is always a challenge for training centres as the specimens are very costly. Cleaning and maintaining these specimens is also a very important task. Degradation of specimens shall be monitored by periodical cleaning and reporting. Documentation is important.

5.4 Trainers and Demonstrators:

Even when all ingredients are same, different cooks will come up with different tastes. A trainer is the central pivotal point of a training organization. The inputs to the candidates form the base of their knowledge. The inputs must be accurate, unambiguous and leading to an evolution in knowledge. Trainers or instructors form the candidates’ direct link to learning. He/she should have a deep knowledge of the subject. He/she should have real life experience, and good communication skill. He/she should have motivational skills to motivate students to achieve the goal. He/she should have patience. He/she should be trained and qualified to deliver the training. He/she shall be trained and retrained to maintain training timing. A good trainer can take care of inadequacies, if any, in the training material. Assistants who have a degree in the relevant principles of the course content, in case required by the trainer, should be available. It is important that the trainers, having acquired knowledge and qualification, do not become complacent. Knowledge can wear out with time, especially considering the pace at which technology is progressing. The organization has to ensure that the trainers are up to date in their NDT and product knowledge. Training may include the technical aspects but shall definitely cover the finer aspects of conducting training to achieve its objectives. An effective training
requires appropriate teaching technique. A proper mix of techniques like lecture, use of board, audio-visual, case studies, discussions, quizzes, report writing, mock-ups, procedure writing, hands-on etc. shall be used as per requirement. A good session shall start with a PPT on objectives plant for that session and end with objectives achieved in that session with a quick quiz to ensure that objectives are really achieved.

Demonstrators shall be actual working (testing) personnel having skill of communication. They should hand-hold the students to ensure that the required skills are achieved. They should also cover all direct and indirect safety issues related with the equipment and method.

Evaluation of the trainers and demonstrators shall be done periodically.

5.5 Infrastructure and facilities:

Another factor that may deeply affect the training course is the ambience and infrastructure of the training facility. The classrooms should have comfortable seating arrangement and a pleasant ambience. Tea/coffee and lunch arrangement as applicable should be preferably separate from the classroom. It is accepted that a comfortable environment with adequate equipment contributes well in making the course a success. Factors such as lighting and ventilation shall be looked into. All necessary teaching aids such as projectors, boards, flipcharts shall be available. All applicable health and safety legislations should be complied with. Personal protective equipment shall be either supplied to the candidates or they should be asked to get the same, where required. The class size shall be limited and specified by the training centre. There shall be a technical library containing books, guides and codes / standards to enable students to go through these for reference. Reference material shall be updated periodically where applicable.

5.6 Documentation:

All specific training records shall be listed in Quality Management System and shall be maintained on file. The name of trainers, class tests, results, trainers’ credentials and certifications shall be on file. The periodical performance audits of trainers and demonstrators shall be on file. The mock up test results and evaluation of the student shall be on file. The actual course outlines shall be on file.

The accreditation of the training centre by the outside agency and relevant documentation shall be on file.

5.7 E-learning:

E-learning modules are getting introduced in a big way. The coverage of syllabus, documental evidence of completion of module by a specific student, training for specific method, training module for practical and theory are the challenges the training organizations have to deal with.
6.0 Summary:

A robust training process will only end with the ‘right’ product for the industry. The certification will be the testimony of Qualification. However, unless the training organizations produce the product with correct processing, the certification will become meaningless.

Presently, the whole focus is given on certification process. However, one has to understand that quality has to be produced by production in the workshop. The inspection agency cannot inject quality in product!