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Non-destructive testing — Qualification and certification of personnel

Essais non destructifs — Qualification et certification du personnel

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9712 was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Sub-Committee SC 7, *Personnel qualification*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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Introduction

Since the effectiveness of any application of non-destructive testing depends upon the capabilities of the persons who perform or are responsible for the test, a procedure was developed to provide a means for evaluating and documenting the competence of personnel whose duties require the appropriate theoretical and practical knowledge of the non-destructive tests that they perform, specify, supervise, monitor or evaluate. An added incentive stems from the world-wide comparability of a wide range of industrial applications requiring common non-destructive testing approaches.

Any country adopting this International Standard will be expected to comply immediately with level 3 requirements for qualification and certification, but is permitted a transition period of up to 15 years to implement levels 1 and 2.

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Non-destructive testing — Qualification and certification of personnel

1 Scope

This International Standard establishes a system for the qualification and certification, by a central independent body, of personnel to perform industrial non-destructive testing (NDT) using any of the following methods:

- a) eddy-current testing;
- b) liquid-penetrant testing;
- c) magnetic testing;
- d) radiographic testing;
- e) ultrasonic testing.

The system described in this International Standard may also apply to visual inspection, leak testing, neutron radiography, acoustic emission and other NDT methods where national certification programmes exist.

2 Abbreviations

The following abbreviations shall be used to identify the five NDT methods covered by this International Standard:

English		French
Eddy current	ET CF	Courants de Foucault
Liquid penetrant	PT RS	Ressuage
Magnetic	MT MG	Magnétoscope
Radiography	RT RI	Rayonnements ionisants
Ultrasonic	UT US	Ultrasons
Non-destructive testing	NDT END	Essais non destructifs

3 Definitions

For the purposes of this International Standard, the following definitions apply:

3.1 authorization: Permission to work, issued by the employer or responsible agency and based on the individual's suitability for a specific job. In addition to the certification, amongst others the job-specific knowledge, skill and physical ability could be assessed.

3.2 qualification: A demonstration of the knowledge, skill, training and experience required to properly perform NDT tasks.

3.3 certification: The procedures leading to a written testimony of the qualification of an individual's competence in an NDT method.

3.4 certificate: Written testimony of qualification.

3.5 national certifying body: The agency that administers procedures for certification of NDT personnel in accordance with the requirements of this International Standard.

3.6 qualifying body: A competent organization, independent of the employer or responsible agency, authorized by the national certifying body to prepare and administer examinations to qualify NDT personnel.

3.7 candidate: The individual seeking certification under the qualification and certification scheme.

3.8 employer or responsible agency: The organization for which the candidate works on a regular basis.

NOTE 1 Candidates may be self-employed.

3.9 basic education: The minimum formal education required for qualification.

NOTE 2 It may be used to determine duration and level of training and experience required prior to qualification.

3.10 NDT training: A process of instruction in theory and practice in the NDT methods in which certification is being sought, which may take the form of training courses to an approved syllabus in addition to periods of practical work under qualified supervision but shall not include the use of specimens used in practical examinations.

3.11 experience: The period during which the candidate performed the specific NDT method as his main activity under qualified supervision, including personal application of the NDT method to materials, parts or structures but not including tests performed during training courses.

3.12 NDT method: The application of a physical principle in non-destructive testing (for example: ultrasonic testing).

3.13 NDT technique: A specific way of utilizing an NDT method (for example: immersion ultrasonic testing).

3.14 NDT procedure: An orderly sequence of rules which describe in detailed terms where, how and in which sequence an NDT method should be applied to a product.

3.15 NDT instructions: A written document detailing the precise steps to be followed in testing in accordance with an NDT procedure.

3.16 industrial sector: A particular area in industry or technology where specialized NDT practices are utilized requiring specific skill, knowledge, equipment or training to achieve satisfactory performance. An industrial sector may be interpreted to mean a product (welds, castings, etc.) or an industry (aerospace, steel, etc.).

3.17 qualification examination: An examination administered by the national certifying body or by an authorized qualifying body, which shall include a general examination and a specific examination for each level of competence.

3.18 general examination: The general examination includes both a written and a practical part for levels 1 and 2, and only a written part for level 3.

a) The written test is concerned with the principles of the applicable NDT method and, at least for level 3, covers basic knowledge of other NDT methods, of materials and processes, and of discontinuities arising through the use of various materials, manufacturing processes or service conditions. For level 3, the requirements for certification of NDT personnel are also included.

b) The practical test for levels 1 and 2 is to verify ability to set up and operate test equipment, and perform the necessary settings to yield satisfactory test results.

3.19 specific examination: The specific examination includes both a written and a practical part for levels 1 and 2, and only two written parts for level 3.

a) The written test is concerned with components, systems, equipment, operating procedures and test techniques commonly used in a particular industry or industrial sector. It involves the demonstration of knowledge related to the product being tested and covers the applicable specifications, codes and acceptance criteria. For level 3 only, this examination includes the writing of one or more satisfactory procedures.

b) The practical test involves, for levels 1 and 2, the demonstration of familiarity with and the ability to operate the necessary test equipment on prescribed components and the ability to record and analyse the resultant information to the degree required.

3.20 job-specific examination: Any additional examination concerned with the application of an NDT method to a specialized product not commonly involved in a particular industrial sector. This examination, which supplements this International Standard, is carried out following written guidelines with results recorded to meet quality-assurance or customer-audit requirements.

NOTE 3 This examination is outside the scope of this International Standard.

3.21 trainee: An individual who works under the supervision of certified personnel but who does not conduct any tests independently, does not interpret test results and does not write reports on test results. This individual may be registered as being in the process of gaining appropriate experience to establish eligibility for qualification to level 1 or for direct access to level 2.

4 Levels of competence

4.1 Classification

An individual certified in accordance with this International Standard shall be classified in one of three levels depending upon the individual's respective level of competence, whereas one who has not yet attained certification may be registered as a trainee.

4.2 NDT level 1

An individual certified to NDT level 1 is qualified to carry out NDT operations in accordance with written

instructions and under the supervision of level 2 or level 3 personnel. The individual shall be able to set up the equipment, carry out the tests, record the results obtained, classify the results in accordance with written criteria, and report the results. He shall not be responsible for the choice of the test method or technique to be used, nor for the assessment of test results.

4.3 NDT level 2

An individual certified to NDT level 2 is qualified to perform and direct non-destructive testing in accordance with established or recognized techniques. The individual shall be competent to choose the test techniques to be used; to set up and calibrate equipment; to interpret and evaluate results in accordance with applicable codes, standards and specifications; to carry out all duties for which a level 1 individual is qualified and to check that they are properly executed; to develop NDT procedures adapted to problems which are the subject of an NDT specification; and to prepare written instructions and organize and report the results of non-destructive tests. The individual shall also be familiar with the scope and limitations of the method for which he/she is qualified, and be able to exercise assigned responsibility for on-the-job training and guidance of trainees and NDT level 1 personnel.

4.4 NDT level 3

An individual certified to NDT level 3 shall be capable of assuming full responsibility for a test facility and staff; establishing techniques and procedures; interpreting codes, standards, specifications and procedures; and designating the particular test methods, techniques and procedures to be used. The individual shall have the competence to interpret and evaluate results in accordance with existing codes, standards and specifications; have a sufficient practical background in applicable materials, fabrication and product technology to select methods and establish techniques and to assist in establishing acceptance criteria where none are otherwise available; have general familiarity with other NDT methods; and have the ability to train level 1 and level 2 personnel.

5 General principles of certification

5.1 Administration

The certification activity that includes all procedures adopted to demonstrate the qualification of an individual to carry out tasks in a specific NDT method and leads to a written testimony of his/her competence shall be administered in each country by the national certifying body, with the assistance, where necessary, of duly authorized qualifying bodies.

5.2 National certifying body

The national certifying body shall be a non-profit organization which has no direct involvement in training of NDT personnel and which is recognized by the ISO member body of the country concerned.

5.2.1 Composition

The national certifying body shall be supported by an administrative committee, which shall include eminent representatives of NDT societies, committees, users, suppliers, government departments and other interested parties as appropriate. The NCB shall establish, in writing, the number of members of this committee, their qualifications (including education, training and experience), the means and extent of documentation of their qualifications, and their tenure.

5.2.2 Responsibilities

The national certifying body

- a) shall initiate, maintain and promote the national certification scheme as specified in this International Standard;
- b) shall administer the procedures and operations for certification in accordance with national documents meeting the minimum requirements of this International Standard, and a stringent code of ethics, including sanctions, which shall apply to committee members and certificate holders;
- c) may delegate, under its direct responsibility, the detailed administration of the certification procedure to other organizations which will act as qualifying bodies and which could represent industrial sectors;
- d) shall take the ultimate responsibility for the certification scheme, including technical and administrative requirements;
- e) shall approve, either directly or through a qualifying body, properly staffed and equipped examination centres which it shall monitor on a periodic basis and
- f) shall keep all appropriate records and issue, or delegate the issuing of, written testimonies.

5.3 Employer or responsible agency

The employer or responsible agency shall introduce the candidate to the national certifying body and document the validity of the personal information provided, including the declaration of education,

training and experience needed to establish the eligibility of the candidate, but shall not be directly involved in the certification procedure itself.

The employer or responsible agency shall be fully responsible for all that concerns the authorization to operate and the validity of the results of NDT operations.

If the individual is self-employed, or introduces himself, he shall assume all responsibilities described for the employer or responsible agency.

5.4 Examination centres

Examination centres established by the national certifying body or through authorized qualifying bodies shall, as a minimum requirement,

- a) have adequate qualified staff, premises and equipment to ensure satisfactory qualification examinations for the levels, methods and industrial sectors concerned;
- b) use only those documents and examination questionnaires established or approved by the national certifying body;
- c) use only specimens prepared or approved by the national certifying body for the practical examinations conducted at that centre.

When more than one authorized examination centre exists, each shall have specimens containing comparable defects. Under no circumstances shall examination specimens be used for training purposes.

6 Eligibility for examination

6.1 General

Candidates shall have a combination of education, training and experience adequate to ensure that they have the potential to understand the principles and procedures of the applicable NDT method.

6.2 Education

Evidence of education may be required to establish the eligibility of a candidate.

6.3 Training

6.3.1 Levels 1 and 2

To be eligible to apply for certification in any NDT method, the candidate shall provide evidence of successful completion of a training programme ap-

proved by the national certifying body in that method. Table 1 and annex B are provided for guidance; however national certifying bodies shall take into consideration education, certification in other methods, training facilities and other factors.

Table 1 — Minimum duration of training

NDT method	Training hours	
	Level 1	Level 2
Eddy-current testing	40	80
Liquid-penetrant testing	16	40
Magnetic testing	24	40
Radiographic testing	40	80
Ultrasonic testing	40	80

NOTES

1 Training hours include both practical and theoretical training courses.

2 Direct access to level 2 implies the total of the hours shown for levels 1 and 2.

6.3.2 Level 3

Taking into account the scientific and technical potential of candidates for level 3 certification, it is considered that preparation for qualification could be done in different ways: by taking training courses, attending conferences or seminars such as organized by industrial or independent associations, and studying books, periodicals and other specialized printed matter. No training hours have therefore been specified in table 1, although references cited in annex B do suggest course content and duration.

6.4 Experience

6.4.1 Levels 1 and 2

To be eligible for certification, the candidate shall have the minimum experience indicated in table 2 for the method in which he/she is seeking certification.

Table 2 — Minimum experience requirements

NDT method	Months of experience	
	Level 1	Level 2
Eddy-current testing	3	9
Liquid-penetrant testing	1	2
Magnetic testing	1	3
Radiographic testing	3	9
Ultrasonic testing	3	9

NOTES

1 Work experience in months is based on a nominal 40 h/week (175 h/month). When an individual is working more than 40 h/week, he/she may be credited with experience based on the total hours, but he/she shall be required to produce evidence of this experience.

2 For level 2 certification, the intent of this International Standard is that work experience consists of time accrued as a level 1. If the individual is being qualified directly to level 2, with no time at level 1, the experience shall consist of the sum of the periods required for level 1 and level 2.

3 Credit for work experience may be gained simultaneously in two or more of the NDT methods covered by this International Standard, with the reduction in total required experience as follows:

a) two testing methods — reduction of total required time by 25 %;

b) three testing methods — reduction of total required time by 33 %;

c) four or more testing methods — reduction of total required time by 50 %.

The candidate shall be required to show that, for each of the testing methods for which he/she seeks certification, he/she has at least half of the time required in table 2.

6.4.2 Level 3

Level 3 responsibilities require knowledge beyond the technical scope of any specific NDT method. This broad knowledge may be acquired through a variety of combinations of education, training and experience. Table 3 details minimum experience related to formal education. All candidates for level 3 certification in any NDT method shall have successfully completed the practical examination for level 2 in that method.

Table 3 — Minimum experience requirements for level 3

	Degree	Experience (months)
Access to level 3 by a certified level 2 operator	Graduate of a four-year accredited science or engineering college or university programme	12
	Successful completion of at least two years of engineering or science study at an accredited college, university or technical school	24
	No degree	48
Direct access to level 3 by a non-certified operator with experience equivalent to level 2	Graduate of a four-year accredited science or engineering college or university programme	24
	Successful completion of at least two years of engineering or science study at an accredited college, university or technical school	48
	No degree	72

NOTE — If the college or university degree is issued in non-destructive testing, the experience required for access to level 3 may be reduced by 50 %.

6.5 Vision requirements

The candidate shall provide documented evidence of satisfactory vision, in accordance with the following requirements:

- distant vision shall equal Snellen fraction 20/30 or better in at least one eye, either uncorrected or corrected;
- near vision shall permit reading a minimum of Jaeger number 2, or equivalent type and size letters, at not less than 30 cm on a standard Jaeger test chart for near vision, in at least one eye, corrected or uncorrected;
- colour vision shall be sufficient that the candidate can distinguish and differentiate contrast

between the colours used in the NDT method concerned.

7 Examinations

7.1 Examination content

The qualification examination shall consist of a general and a specific examination and normally cover a given NDT method as it is applied in one or more specific industrial sectors.

For level 1 and level 2, each of these two examinations shall include both a written and a practical test.

For level 3, however, besides the written general examination, the specific examination shall consist of two written tests to be respectively designated "specific (sector)" and "specific (procedure)". No level 3 practical test as such is required.

In the general examination, the candidate shall demonstrate sufficient proficiency in performing the NDT method. In the specific examination, he shall demonstrate his ability to use the same NDT method in the industrial sector concerned.

7.2 Administration of examinations

All examinations shall be conducted in examination centres established or approved by the national certifying body. Detailed procedures for the structure, monitoring and grading of examinations by the national certifying body are contained in annex A.

7.3 Re-examination

Criteria applicable to re-examination with respect to (a) partial or complete failure of examination and (b) extension of certification to other methods or sectors are described in annex A: subclause A.1.5 refers to levels 1 and 2, and A.2.4 to level 3.

8 Certification

8.1 Administration

Based on the results of the qualification examinations, the national certifying body, directly or through its authorized qualifying bodies, shall announce the certification, and issue certificates and/or corresponding wallet cards.

8.2 Certificates and wallet cards

Certificates and corresponding wallet cards shall bear:

- a) the name of the individual certified;

- b) the date of certification;
- c) the date upon which certification expires;
- d) the level of certification;
- e) the NDT method;
- f) the industrial sector(s) concerned;
- g) a unique identification number;
- h) the signature of the individual certified;
- i) a photograph of the individual certified and
- j) the cold seal of the national certifying body or the approved qualifying body cancelling the photograph to avoid falsification.

NOTE 4 By issuing the certificate and/or the corresponding wallet card, the national certifying body or the qualifying body attests to the qualification of the individual but does not give any authority to operate. There may be a special space on both the certificate and the wallet card for the signature of the employer or responsible agency authorizing the holder of the certificate to operate and taking responsibility for test results. This authorization also serves as testimony of activity of the certified individual.

9 Validity and renewal

9.1 Validity

The period of validity shall not exceed a maximum of five years from the date of certification indicated on the certificate and/or wallet card.

Certification shall be invalid

- a) if the individual changes from one industrial sector to another, in which case he/she shall successfully complete supplementary examinations for the new industrial sector;
- b) at the option of the national certifying body after reviewing evidence of unethical behaviour;
- c) if the individual becomes physically incapable of performing his/her duties, based upon the visual examination taken at least every second year under the responsibility of his employer or responsible agency.

9.2 Renewal

After the first period of validity, certification may be renewed by the national certifying body, directly or through an authorized qualifying body, for a new

period of similar duration, provided the individual meets the following criteria:

- a) he/she provides evidence at least every second year of satisfactory visual examination and
- b) he/she provides evidence of continued satisfactory work activity without significant interruption.

NOTE 5 A significant interruption means an absence or a change of activity which prevents the certified individual from practising the duties corresponding to his/her level in the method and the industrial sector(s) for which he/she is certified, for one or several periods for a total time exceeding one year.

If the criteria for renewal are not met, the individual shall apply for recertification.

9.3 Recertification

Upon completion of each second period of validity, or at least every ten years, certification shall be renewed by the national certifying body, directly or through an authorized qualifying body, for a similar period, provided the individual meets the two criteria for renewal and successfully completes a simplified examination to assess his/her current knowledge.

This simplified examination shall consist of:

- a) *Level 1 and level 2*: a practical examination organized in accordance with a simplified procedure;
- b) *Level 3*: a written examination which includes 20 questions on the application of the test method in the industrial sector concerned and 5 questions on this International Standard (the

national certifying body will have the option of replacing this simplified examination by an alternative structured credit system under its control).

If the individual fails to achieve a grade of 80 % or better in the simplified examination, he/she shall apply for new certification.

10 Files

The national certifying body or its authorized qualifying bodies shall keep

- a) an updated list of all individuals certified, classified according to level, test method and industrial sector;
- b) an individual file for each individual certified and for each individual whose certification has been withdrawn, containing
 - 1) application forms,
 - 2) examination documents, including questionnaires, answers, descriptions of specimens, records, results of tests, written procedures and/or techniques, and grade sheets,
 - 3) renewal documents, including evidence of physical condition and continuous activity,
 - 4) reasons for any withdrawal of certification and details of any further penalty inflicted.

Individual files shall be kept under suitable conditions of safety and discretion for a period at least equal to the total of the initial period of validity plus the renewal period.

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