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English version

Non-destructive testing of steel tubes - Qualification and competence of level 1 and 2 non-destructive testing personnel

Essais non destructifs des tubes en acier - Qualification et compétence du personnel en contrôle non destructif de niveaux 1 et 2

Zerstörungsfreie Prüfung von Stahlrohren - Qualifizierung und Kompetenz von Personal der Stufen 1 und 2 für die zerstörungsfreie Prüfung

This European Standard was approved by CEN on 29 March 2000.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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FOREWORD

This European Standard has been prepared by Technical Committee ECISS/TC 29, Steel tubes and fittings for steel tubes, the Secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

This draft is based, with modifications, on ISO 11484, *Seamless and welded steel tubes for pressure purposes - Qualification and certification of NDT personnel*. This draft also takes account of training experience and qualification requirements given in EN 473:1993, *Qualification and certification of NDT Personnel - General principles*, where they apply.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 SCOPE

This European Standard establishes a system for qualification by the manufacturer of Level 1 and Level 2 NDT personnel engaged in non-destructive testing (NDT) of seamless and welded steel tubes and associated products, including flat products used in the manufacture of welded tubes, culminating in a declaration of competence by the manufacturer in respect of such personnel.

This standard specifies the pre-requisite training and experience, and qualification requirements for two levels of NDT personnel competence to execute specified tasks in the NDT of seamless and welded steel tubes, including flat products used in the manufacture of welded tubes.

This standard permits both manufacturer, and manufacturer approved external body, training and qualification of Level 1 and Level 2 personnel, as parallel options in the qualification process.

As an alternative to the use of Levels 1, 2 or 3 personnel in the regular employ of the manufacturer, the manufacturer is permitted to engage on a contract basis such personnel from other organizations, provided that they meet the qualification requirements of this standard.

This European Standard applies to, NDT personnel engaged in the NDT of seamless and welded tubes and flat products used in the manufacture of welded tubes, using any one or more of the following NDT methods:

- a) Eddy Current (ET).
- b) Flux Leakage (FT).
- c) Liquid Penetrant (PT).
- d) Magnetic Particle (MT).
- e) Radiography (RT).
- f) Ultrasonic (UT).

Individuals in the test area and having no involvement in the adjustment/set-up of the NDT equipment itself or the recording of test results, are not required to be qualified under the requirements of this standard.

2 NORMATIVE REFERENCES

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of those publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 473:1993 *Non-destructive testing - Qualification and certification of NDT personnel - General principles*

EN 45020 *Glossary of terms for standardization and related activities*

3 TERMS AND DEFINITIONS

For the purposes of this Standard, the terms and definitions given in EN 45020 together with the following terms and definitions apply.

3.1

qualification

evidence of training, professional knowledge, skill and experience as well as physical fitness to enable NDT personnel to properly perform NDT tasks.

3.2

declaration of competence

written statement by the manufacturer (first party) giving an assurance, under his sole responsibility, that a person has attained a specified level of training, experience and knowledge in NDT in accordance with this standard.

3.3

manufacturer

organization, manufacturing tubes/associates products and flat products used in the manufacture of welded tubes, which employs on a regular basis or engages from an external service company Levels 1, 2 or 3 personnel to execute NDT operations.

3.4

candidate

person seeking qualification.

3.5

manufacturer's qualifying body

manufacturer's department independent of the production department, which either directly or indirectly undertakes the preparation and administration of examinations which lead to the qualification of Levels 1 and 2 personnel and issues the declaration of competence of Level 1 and 2 personnel.

3.6

external qualifying body

body, approved by, but independent of the manufacturer, authorized by the manufacturer to prepare and administer examinations to qualify Levels 1 and 2 personnel.

3.7

NDT method

discipline applying a physical principle in non-destructive testing (e.g. ultrasonic method, eddy current method).

3.8

NDT technique

specific way of utilizing an NDT method (e.g. ultrasonic immersion technique, eddy current concentric coil technique).

3.9

set-up

mechanical and/or electronic adjustment of NDT equipment to establish the testing parameters and/or test sensitivity required.

3.10

capability

having the ability and/or skill to execute a specific NDT task.

3.11

qualification examination

examination administered by the manufacturer's qualifying body or by a manufacturer approved external qualifying body to demonstrate the general specific and practical knowledge and skill of Level 1 and 2 candidates.

3.12

general examination

written part of the qualification examination concerned with the principles of an NDT method.

3.13

specific examination

written part of the qualification examination concerned with product (steel tubes) knowledge, applicable testing techniques and the knowledge of standards, codes, specifications and acceptance criteria.

3.14

practical examination

part of the qualification examination, administered by the manufacturer, where the candidate has to demonstrate the ability to operate the testing equipment, set-up the test parameters and test sensitivity and to record/analyse the resulting information to the degree required.

3.15

level 1 or level 2 individual

individual qualified to Level 1 or Level 2 in accordance with this European Standard having a valid declaration of competence issued by the manufacturer which enables it after authorizing by Level 3 individual to carry out NDT operations in the manufacturer's plant to a specific extent.

3.16

level 3 individual

individual qualified and certified to Level 3 in accordance with EN 473 approved by the manufacturer, authorizing the operations to be conducted in the manufacturer's plant and the Level 1 and Level 2 personnel to conduct these operations. A Level 3 individual is included within the examining board of the manufacturer's qualifying body.

4 GENERAL PRINCIPLES

4.1 Under the requirements of this European Standard, the manufacturer has sole responsibility for providing a declaration of competence that a person in its employ performing NDT tasks has pre-requisite qualification and has successfully passed qualification examinations, conducted under the aegis of the manufacturer, in one or more of the NDT methods covered by this standard, in respect of one of the two levels of competence (Level 1 or Level 2).

As an alternative to the use of Levels 1 and/or 2 personnel in the regular employ of the manufacturer to carry out the required NDT operations, the manufacturer is permitted to engage on a contract basis such personnel from other organizations e.g. an NDT service company, provided that they meet the qualification requirements of this standard.

In addition, a Level 3 individual either in the regular employ of or engaged by the manufacturer, has the responsibility for administering Level 1 and Level 2 personnel qualification examinations. The Level 3 individual also has the responsibility to authorize the NDT operations to be conducted and the Level 1 and 2 personnel to conduct these operations.

4.2 This standard specifies the pre-requisite qualification requirements in terms of visual acuity, basic education, training and experience which shall be fulfilled by each candidate for eligibility for the qualification examinations. These pre-requisite requirements shall be verified by the manufacturer and endorsed on the declaration of competence.

4.3 The qualification examination for Level 1 and Level 2 personnel shall consist of three parts; a general part, a specific examination and a practical examination.

4.4 The general, specific and practical examinations of the qualification examination shall be conducted, at the manufacturer's discretion either by the manufacturer's qualifying body or by the manufacturer authorized/approved external qualifying body.

4.5 The manufacturer's qualifying body shall be constituted by individuals independent of the production departments. These individuals form an independent examining board including at least one Level 3 individual not necessarily in the employ of the manufacturer but nominated by the manufacturer's qualifying body as an examiner for Level 1 and 2 personnel.

Such Level 3 individual shall be responsible for administering Level 1 and Level 2 personnel qualification examinations and its proper conduct.

Manufacturer authorized/approved external qualifying bodies shall also meet these basic requirements of independence and structure/constitution.

4.6 The qualification examination results shall be checked/verified by the examining-board to ensure that the pass-mark requirements have been fulfilled and the manufacturer's qualifying body, on the examining board's recommendation, shall issue a declaration of competence in respect of the individual, with regard to the NDT method and level of competence (Level 1 or 2). The issue of the declaration of competence provides the individual with the authorization to carry out specified NDT tasks within the manufacturer's production facilities (i.e. authorization to operate).

This declaration of competence is thus only valid while the individual is in the employ of or engaged by the manufacturer issuing the declaration of competence.

4.7 The procedure for examination and qualification up to the issue of a declaration of competence shall be specified in a written procedure.

5 LEVELS OF COMPETENCE

5.1 General

NDT personnel qualified in accordance with this European Standard shall be classified in one of two levels of competence, i.e. Level 1, or Level 2, with respect to specific NDT tasks to be performed.

Both classifications are defined in terms of NDT task content degree of responsibility etc. in accordance with 5.2 and 5.3.

5.2 Level 1 individual

The individual qualified to Level 1 shall be capable of carrying out NDT operations according to written instructions and under the supervision of Level 2 or Level 3 personnel. As appropriate to the testing technique(s) being used, he shall be able:

- to set up the equipment;
- to perform the tests;

- to record and classify the results in terms of written criteria;
- to report on the results in terms of written criteria.

He shall not be responsible for the choice of the test method or technique to be used or for assessing the results.

5.3 Level 2 individual

The individual qualified to Level 2 shall be capable of performing and directing non-destructive testing operations according to established or recognized procedures. As appropriate to the testing technique(s) being used, he shall have the competence:

- to choose the technique for the test method;
- to set and/or to calibrate the equipment;
- to perform and to supervise the test;
 - to interpret and evaluate test results according to applicable standards, codes or specifications;
 - to define the limitations of application of the testing method/technique(s) for which a Level 2 individual is qualified;
 - to adjust the operating parameters of NDT adapted to the problems which are the subject of specifications or procedures;
 - to prepare written test instructions;
 - to perform and to supervise all Level 1 duties;
 - to train or to guide Level 1 personnel;
 - to organize and report on NDT results.

6 PRE-REQUISITE QUALIFICATIONS

6.1 General

Candidates for Level 1 and Level 2 qualification leading to a declaration of competence by the manufacturer in accordance with this European Standard shall have a combination of visual acuity and the necessary training and experience in the applicable NDT method.

The requirements for eligibility of candidates seeking qualification are given in 6.2.

6.2 Eligibility

The minimum eligibility requirements for Level 1 and Level 2 qualification are as follow.

6.2.1 Visual acuity

The candidate shall provide proof of satisfactory vision as determined by an oculist, optometrist or other medically recognized person in accordance with the following requirements:

- a) near vision shall permit reading a minimum of Jaeger number 1 at not less than 30 cm, or equivalent, in at least one eye, corrected or uncorrected;
- b) colour vision shall be sufficient that the candidate can distinguish and differentiate contrast between the colour used in NDT method concerned as specified by the employer.

The verification of the visual acuity shall be done annually under the responsibility of the manufacturer.

6.2.2 Training

Each candidate shall have successfully completed a training programme in the applicable NDT method approved by the manufacturer's qualifying body. The minimum training periods for Level 1 and Level 2 are given in Table 1 below.

Table 1 - Required minimum training period

NDT Method	Level 1 h	Level 2 h
ET	40	40
FT	40	40
PT	16	24
MT	16	24
RT	40	80
UT	40	80

Note 1: The period given above include both theoretical and practical training

Note 2: Direct access to Level 2 requires a minimum training period of the sum of the hours given for Level 1 and Level 2.

Note 3: It is recognized that, in the testing of tubes and flat products used in the manufacture of welded tubes, specialized NDT skills and knowledge (e.g. automated systems) are required to achieve satisfactory candidate performance and the training programme should be so structured to accommodate these specialized requirements.

6.2.3 Experience

Each candidate shall have the necessary experience in the applicable NDT method in relation to the basic technique and specialized skills required during the testing of tubes and flat products used in the manufacture of welded tubes. The minimum periods of experience for Level 1 and Level 2 are given in Table 2:

Table 2 - Required minimum periods of experience

NDT Method	Level 1 months	Level 2 months
ET	3	9
FT	3	9
PT	1	3
MT	1	3
RT	3	9
UT	3	9

Note 1: Work experience in months is based on a nominal 40 hours/week or the legal week of work. When a candidate is working in excess of 40 hours per week, he is credited with experience period based on the total number of hours worked on the applicable NDT method.

Note 2: Direct access to Level 2 qualification requires a minimum experience period of the sum of the months given for Level 1 and Level 2.

Note 3: When a candidate has obtained experience in two or more NDT methods covered by this Standard concurrently, the total experience period required for each method is reduced as follows:

- a) two NDT methods: a reduction of 25 % of the sum of the periods required for each method.
- b) three NDT methods: a reduction of 33 % of the sum of the periods required for each method.
- c) four or more methods: a reduction of 50 % of the sum of the periods required for each method.

In applying the above rules, under no circumstances shall a candidate have less than 50 % of the minimum experience period requirement, as given in Table 2, in any one method.

Note 4: It is recognized that, in the testing of tubes and flat products used in the manufacture of welded tubes, there may be a predominance of automatic/semi-automatic systems, and the total experience shall be so balanced to accommodate the day-to-day set-up of such systems.

7 QUALIFICATION EXAMINATIONS

7.1 General

The qualification examinations shall consist of a two part written examination and a practical examination and shall cover a given NDT method as it is applied in the steel tube and associated products industries including, where appropriate, flat products used in the manufacture of welded tubes.

Under the requirements of this European Standard, the manufacturer's qualifying body, at its discretion, has the authority to exempt individuals, from the general and/or specific written parts of the qualifying examination, provided that the individual produces satisfactory evidence of holding essentially equivalent qualification in one or both of these written parts of the examination according to 7.2.1 and/or 7.2.2 as appropriate. No exemption from the practical part of the qualifying examination is permitted.

7.2 Content of the examination for Levels 1 and 2

7.2.1 General examination

This written examination shall include a selection of questions of a general nature in the specific NDT method, prepared by the manufacturer's qualifying body or external qualifying body. The required minimum number of questions shall be as given in Table 3.

Table 3 - Required minimum number of questions

NDT Method	Level 1	Level 2
	Number of questions	Number of questions
ET	40	40
FT	40	40
PT	30	30
MT	30	30
RT	40	40
UT	40	40

7.2.2 Specific examination

This **written** examination shall include a selection of questions of a specific nature in the NDT technique(s) used within the manufacturer's production facilities, prepared by the manufacturer's qualifying body or external qualifying body. The required minimum number of questions shall be as given in Table 4.

Table 4 - Required minimum number of questions

NDT Method	Level 1	Level 2
	Number of questions	Number of questions
ET	20	20
FT	20	20
PT	20	15
MT	20	15
RT	20	20
UT	20	20

7.2.3 Practical examination

The practical examination shall be of sufficient duration, complexity and scope to adequately verify the candidate's ability to apply the NDT method and/or technique(s) to real testing situations, within the manufacturer's production facilities.

This examination shall be so structured to verify the candidate's ability to perform testing of steel tubes and associated products, and, where appropriate, flat products used in the manufacture of welded tubes, to record and to analyse the resultant information to the degree required for the NDT level being sought, according to:

- for Level 1, written instructions;
- for Level 2, written instructions, specifications, codes and standards.

For Level 2, the candidate shall demonstrate an ability to prepare written instructions for Level 1.

Where test pieces/specimens are used for the practical examination, they shall be selected and verified by the Level 3 individual under the authority of the manufacturer's qualifying body.

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

7.3 Conduct of Examinations

All examinations shall be conducted at locations designated/approved by the manufacturer's qualifying body or external qualifying body.

At the examination, the candidate shall have in his possession a valid proof of identification and an official notification of the examination, which must be shown to the examiner (Level 3 individual) or invigilator on request.

Any candidate who does not abide by normally accepted examination rules or who perpetrates or is an accessory to fraudulent conduct shall, at the discretion of the examiner, either be excluded from further participation in the examination or be reported to the examining board of the manufacturer or external qualifying body, as appropriate, dependent on the seriousness of the misconduct. In either case, the candidate has the right of appeal to the examining board.

The examiner shall mark the written examinations completed by the candidate; he shall judge and mark the results of the practical examination according to a written procedure which includes at least ten sequential check points, determined from within the framework of the examination. This written procedure shall be developed by the manufacturer's qualifying body or external qualifying body.

For the Level 1 and 2 practical examination, the examiner shall investigate the reliability of the test apparatus made available to the candidate, and unreliable apparatus shall be replaced as well as any apparatus that may be rendered inoperative during the course of the examination.

The written and practical examinations shall be conducted and supervised by at least one Level 3 examiner nominated by the manufacturer's qualifying body or external qualifying body, and included within the examining board. The examiner may be assisted by one or more invigilators placed under his responsibility. The sole duty of the invigilator(s) is to monitor that each candidate observes the rules of the examination and to immediately report any misconduct to the examiner.

7.4 Examination Grading for Levels 1 and 2

The general examination shall be graded separately from the specific examination so that the candidate may be examined later for qualification in another part of the tube industry or related industry without having to repeat the general examination; thus the qualified operator changing from one part of an industrial sector to another keeps the benefit of the general examination valid for all areas of the tube and associated products industries.

The composite grade N shall be calculated in accordance with the following formula for Level 1 and 2:

$$N = 0,25 n_g + 0,25 n_s + 0,50 n_p$$

Where:

n_g = grade for the general examination;

n_s = grade for the specific examination;

n_p = grade for the practical examination.

To be qualified a candidate shall obtain a grade of at least 70 % in each part of the examination and a composite grade N of at least 80 %.

7.5 Re-examination

A candidate who fails on his examination shall wait at least 30 days prior to re-taking the examination. A candidate whose examination results have not been accepted for reason of fraud shall wait one year before re-examination.

A candidate who failed to obtain the passing grade for the whole examination may take one, and only one, retest in a maximum of two parts provided that the grade of each part was at least 70 % and that re-examination takes place within one year from the failed examination date.

A candidate who fails his examination with a grade of one part lower than 70 % and the final grade equal to or greater than 80 %, may take one, and only one, retest of the failed part provided that retesting takes place within one year from the failed examination.

8. DECLARATION OF COMPETENCE

8.1 Issue

Based on successful completion of the qualification examinations by an individual in a method or methods, the manufacturer's qualifying body shall issue a dated written declaration of competence with respect to that individual showing the name of the individual, the level achieved (i.e. Level 1, or 2) and the method(s) to which the declaration of competence applies including any restriction as to the applicability of the declaration of competence. The issue of the declaration of competence by the manufacturer, automatically provides the individual with the authorization to operate.

8.2 Validity

The maximum period of validity of the declaration of competence shall be 5 years from the date shown on the document.

The declaration of competence shall become invalid:

- a) if the individual leaves the employ of the manufacturer or changes from the tube sector to another unrelated sector, not covered by the declaration of competence;
- b) at the discretion of the manufacturer's qualifying body after reviewing evidence of unethical behaviour;
- c) if the individual fails the vision requirements (see 6.2.1) which is to be assessed annually;
- d) if a significant interruption takes place in practising the duties corresponding to the level in the method for which the individual is declared competent (see note below).

NOTE: A significant interruption means an absence or a change of activity which prevents the qualified/competent individual from practising the duties corresponding to his level in the method(s) and the sector(s) for which he is qualified, for one or more periods for a total time exceeding one year, within the period of validity. Significant interruption, does not include the period of legal holidays or the absence for illness or attendance at courses, the duration of which is less than one month.

9 RENEWAL

After a period of 5 years from each issue of the declaration of competence by the manufacturer the declaration of competence shall be renewed by the manufacturer, provided the individual meets the following requirements:

- a) evidence is provided of the last satisfactory annual visual examination;
- b) evidence is provided of continued satisfactory work activity without significant interruption in the NDT method/technique(s) for which he is qualified, together with any up-dating of training deemed necessary by the manufacturer.

If the criteria for renewal are not met, the declaration of competence shall become void and the manufacturer's qualifying body or external qualifying body shall inform the individual and indicate that he has to pass a new practical examination evaluated with a grading of at least 80 %.

10 FILES

The manufacturer's qualifying body and the manufacturer approved external qualifying body, where applicable, shall keep:

- a) an updated list of all qualified individuals holding a declaration of competence, classified according to level, test method, etc.
- b) an individual file for each qualified individual holding a declaration of competence and for each individual whose declaration of competence has been withdrawn containing:
 - examination documents, including questionnaires, answers, description of specimens, records, results of test, written procedures and/or instructions and grade sheets;
 - renewal documents, including evidence of visual acuity and continued work activity.

Individual files shall be kept under suitable secure conditions by the manufacturer's qualifying body and treated as confidential by the manufacturer.

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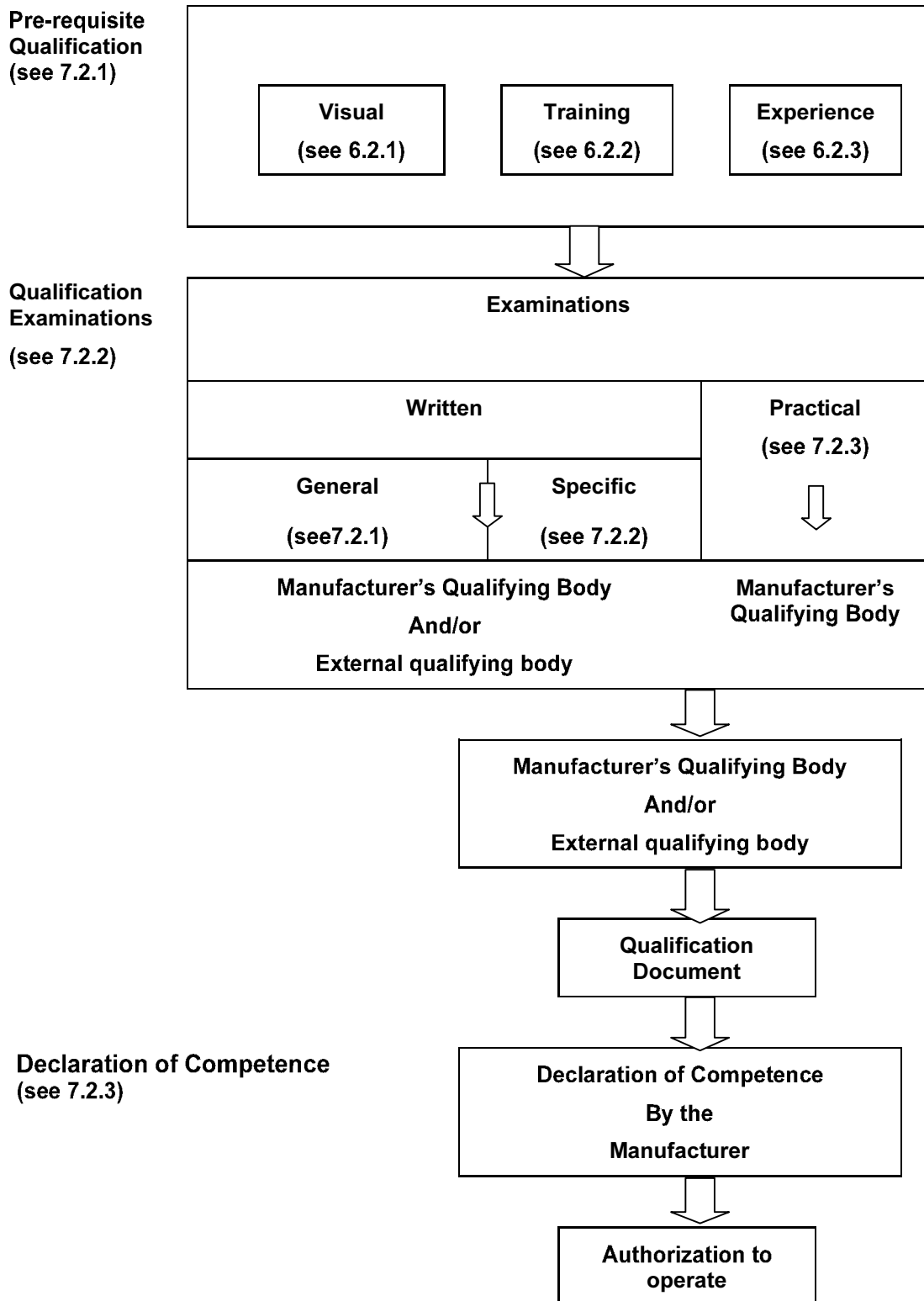


Figure 1 - Qualification procedure for Levels 1 and 2