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EUROPEAN METHODOLOGY FOR QUALIFICATION OF NON-DESTRUCTIVE TESTING - THIRD ISSUE -

ENIQ Report nr. 31

ENIQ

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European Commission
Directorate-General Joint Research Centre (DG JRC)
http://www.jrc.ec.europa.eu/

Institute for Energy, Petten (the Netherlands)
http://ie.jrc.ec.europa.eu/

Contact details:
Arne Eriksson
Tel: +31 (0) 224 56 5383
E-mail: arne.eriksson@jrc.nl

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Approved for publication by the ENIQ Steering Committee

Documents published by ENIQ, the European Network for Inspection and Qualification, belong to one of the following 3 types:

Type 1 – **Consensus Document**
A *consensus document* contains harmonised principles, methodologies, approaches and procedures, and stresses the degree of harmonisation on the subject among ENIQ members.

Type 2 – **Position/Discussion Document**
A *position/discussion document* may contain compilations of ideas, expressions of opinion, reviews of practices, or conclusions and recommendations from technical projects.

Type 3 – **Technical Report**
A *technical report* is a document containing results of investigations, compilations of data, reviews and procedures without expressing any specific opinion or valuation on behalf of ENIQ.

This document “European Methodology for Qualification of Non-Destructive Testing – Third Issue” (ENIQ Report nr. 31) is a type 1 document.

FOREWORD

Many countries are currently considering their approaches to inspection qualification and risk-informed in-service inspection (RI-ISI), and are carefully assessing experience to date. In Europe most of the utilities operating nuclear plants have joined together to form the European Network for Inspection and Qualification (ENIQ). In addition to the utilities, who provide the voting members on the ENIQ Steering Committee, there is also participation by other organisations with relevant expertise: plant manufacturers, engineering companies, service vendors and research and development institutions. The Joint Research Centre of Petten is the Operating Agent and the Reference Laboratory of the Network.

Currently two Task Groups of ENIQ report to the Steering Committee. The Task Group on Qualification (TGQ) deals with qualification issues, and the Task Group on Risk (TGR) deals with RI-ISI issues. On the qualification side, the main objective of ENIQ is to co-ordinate and manage at European level expertise and resources for the development of schemes for the assessment and qualification of NDT in-service inspection techniques and procedures, primarily for nuclear components. It is in this framework that the European Methodology for qualification of non-destructive testing was developed. However, the general principles of qualification, given in this document, are also applicable to manufacturing and pre-service inspections and to inspections of non-nuclear components where the consequences of failure are unacceptable.

It is worth noting that ENIQ, led by TGR, has also recently produced a Framework Document for RI-ISI (EUR 21581 EN), which can be regarded as a parallel document to this qualification methodology document but covering RI-ISI rather than qualification issues.

The present European Qualification Methodology Document (EQMD) contains guidelines for the qualification of non-destructive testing. Qualification as defined in this document includes technical justification, which involves assembling all the supporting evidence for inspection capability (results of capability evaluation exercises, feedback from site experience, applicable and validated theoretical models, physical reasoning), and may include practical trials using deliberately defective test pieces.

The first issue of the EQMD was initiated by the PISC III Action 8 group on support for codes and standards. It was further developed and finalised by ENIQ. The first issue of the EQMD was approved by the Steering Committee of ENIQ at its meeting of 15 March 1995 in Petten and was published as ENIQ Report 1 (EUR 16139 EN). This document was the first to be published in Europe on this issue and contained a number of innovative proposals such as the use of technical justification, the separation between procedure/equipment and personnel qualification and the use of open trials for procedure and equipment qualification.

Since the issue of this first version of the EQMD, there have been several developments which have led to the issue of a second version of the EQMD in 1997 (EUR 17299 EN) and now to the issue of this third version:

- In April 1996 the European Regulators issued a common position document on qualification of NDT systems for pre- and in-service inspection of light water

reactor components (EUR 16802 EN). This official report of the Nuclear Regulator Working Group (NRWG), sponsored by DG XI, considered the essential elements of the European Methodology and is, in general, in good agreement with the European Methodology. There are two major differences: firstly the European regulators discuss the issue of inspection qualification in a wide context of safety, and secondly they put different emphasis on the different elements constituting inspection qualification. The NRWG followed up their 1996 report with a further report (EUR 20819 EN) in 2003 describing the regulators' experience to date of NDT qualification conducted according to the EQMD.

- Since the first issue of the EQMD the ENIQ approach to qualification has been widely adopted across Europe and considerable feedback in its practical application has been obtained. The issue of inspection qualification has been discussed extensively at national, European and international level and some evolution in thinking has occurred. At the international level the International Atomic Energy Agency (IAEA) has produced a methodology document (IAEA-EBP-WWER-11, March 1998) for the qualification of ISI systems on WWER nuclear power plants, which essentially follows the ENIQ methodology.

- ENIQ has conducted two pilot studies to explore ways of applying the European methodology for inspection qualification to specific components. A number of important lessons have been learned from these pilot studies.

This third issue of the EQMD has been produced by ENIQ TGQ, and was approved for issue by the ENIQ Steering Committee. The main changes from Issue 2 are as follows:

- Updating of this Foreword to reflect the much more mature status of qualification in Europe prevailing today
- Adding references to the text citing existing supporting Recommended Practices wherever possible
- Rewriting of Appendix 3 to summarise the content of Recommended Practices which have actually been issued
- Editorial changes and changes to clarify the text.

No changes to the actual principles of the European methodology have been made. Special recognition should be given to Bob Chapman, who has led the revision of this document. Thanks are also due to several specific individuals of ENIQ TGQ listed below who made a particularly significant input into the commenting process.

I Atkinson	Kande, United Kingdom
R Booler	Serco, United Kingdom, Chairman of Task Group Qualification
R Chapman	British Energy, United Kingdom
Ph Dombret	Tractebel Engineering, Belgium
A Eriksson	Directorate General JRC, European Commission
L Horácek	NRI- Řež, Czech Republic
A Jonsson	Forsmark NPP, Sweden
P Kelsey	Rolls-Royce Marine Power, United Kingdom
P Krebs	Engineer Consulting, Switzerland
B Neundorf	Vattenfall Europe Nuclear Energy, Germany

T Seldis	Directorate General JRC, European Commission, Co-chairman of Task Group Qualification
H Söderstrand	SQC Swedish NDT Qualification Centre, Sweden
A Walker	Rolls-Royce Marine Power, United Kingdom

The Steering Committee of ENIQ has formally approved this document for publication as an ENIQ report by means of the written approval procedure in May/June 2007. The voting members of the Steering Committee of ENIQ are, in alphabetical order:

R Chapman	British Energy, United Kingdom
Ph Dombret	Tractebel Engineering, Belgium
C Faidy	EDF-Septen, France
K Hukkanen	Teollisuuden Voima OY, Finland
P Kopčil	Dukovany NPP, Czech Republic
B Neundorf	Vattenfall Europe Nuclear Energy, Germany, ENIQ Chairman
J Neupauer	Slovenské Elektrárne, Slovakia, ENIQ Vice-Chairman
S Pérez	Iberdrola, Spain
U Sandberg	Forsmark NPP, Sweden
R Schwammberger	Leibstadt NPP, Switzerland
D Szabó	Paks NPP, Hungary

European Commission representatives in the Steering Committee:

A Eriksson	Directorate General JRC, European Commission, ENIQ Network Manager
T Seldis	Directorate General JRC, European Commission, Scientific Secretary to ENIQ

The International Atomic Energy Agency (IAEA) has recently started to attend ENIQ Steering Committee meetings as an observer.

DISCLAIMER

ENIQ is a network of interested European organisations developing methodologies for inspection qualification and risk-based inspection. ENIQ does not review, endorse or accredit individual qualifications carried out on plant belonging to member utilities, nor does ENIQ operate an accreditation system for Qualification Bodies. Statements by utilities and others that a specific qualification is compliant with the ENIQ methodology should not therefore be taken as implying approval or endorsement of that qualification by the ENIQ network as a whole.

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1 SCOPE

This document sets out the principles that a body carrying out qualification of non-destructive testing should follow in providing confidence that a given NDT inspection is fit for its purpose.

This document is structured as follows. The foreword described the background for the framework in which this document was developed. This section describes the scope of the document. Section 2 refers to the list of definitions, given in Appendix 1, which are applicable to this document. Section 3 contains the general principles of inspection qualification, as proposed by ENIQ. Section 4 contains information on how inspection qualification should be implemented in practice. In section 5 the issue of qualification certificates is discussed. In section 6 the responsibilities of the parties involved in the qualification of in-service inspection of nuclear power components are given. Section 7 treats several important issues, such as the hierarchy of the ENIQ qualification documents, the input information to be provided prior to the start of inspection qualification, when to do inspection qualification and some general ideas on how to deal with human factors.

This document was developed specifically for in-service inspection (ISI) of nuclear power components. However, it is emphasised that the general principles for inspection qualification, described in this document, are also applicable to manufacturing inspections and to the inspection of non-nuclear components.

The scope of this document is limited to giving general guidelines on how inspection qualification should be carried out. The decision on whether an inspection should or should not be qualified is a matter for agreement between the parties involved. It is expected that qualification will not be required for all routine NDT inspections. Qualification should be considered where the safety or economic consequences of possibly poor NDT performance, and/or the difficulty of applying the NDT, are such that additional assurance is desirable that the NDT can meet the requirements. Qualification should also be considered when a novel NDT technique is proposed.

The document deals with methods for assessing NDT inspections to determine whether they are capable of attaining their objectives. It applies to all aspects of inspections which influence their effectiveness, that is the procedure, the equipment and the personnel. In providing an option for personnel qualification, the document does not intend to supplant existing personnel certification schemes but only to supplement them where the NDT imposes requirements beyond those covered by existing schemes, the so-called ‘job specific’ addition to a basic qualification. The precise scope of this qualification is a matter to be agreed between the parties involved.

The document is relevant to any non-destructive testing method and so is written in general terms, setting out the principles which should apply. It does not, in itself, constitute a specification for NDT qualification for a specific component but is intended to be used as a basis for development of such specifications. Because the area in which qualification is applied most frequently is ultrasonics, where examples are given for purposes of clarification, these are drawn from ultrasonic applications.

Prior to the start of the inspection qualification it is very important that the parties involved agree on the exact contents of the input information. Input information in this

context means all information related to the component, the type and size of defects to be considered and the objectives of the inspection qualification. The NDT procedure is, in principle, also part of the input information to be provided. The contents of the input information, to be provided before the inspection qualification starts, is a matter to be agreed between the involved parties. This document is only applicable once all the necessary input information has been provided.

This document embodies the lessons emerging from the many qualification programmes carried out to date, from analysis of the information obtained by PISC on a wide range of test pieces inspected by numerous inspection teams throughout the world, and also from modelling studies, human reliability studies and parametric studies of the significant variables.

The methodology is intended to be flexible so that different countries or organisations can use it to develop qualifications which are consistent throughout Europe but which also meet their different national legal, regulatory and technical requirements.

The document is intended to apply to bodies carrying out qualification of non-destructive testing, and deals with methods for assessing independently whether NDT inspections are capable of achieving their objectives. It is intended to assist utilities, qualification bodies, regulatory bodies or those procuring or developing NDT services or equipment who require independent confirmation that the approach proposed is fit for purpose. Indeed, it is intended that the document should encourage developments in NDT by providing a framework within which new developments can be qualified against laid-down performance criteria, so giving potential users the confidence to adopt them without being obliged to follow a detailed prescriptive standard.

This document is not intended to be a code or standard but it is hoped that codes and standards bodies will make use of it in developing codes and standards for qualification. In this context it is worth noting that the European standards organisation CEN issued a Published Document PD CEN/TR 14748 in 2004 on qualification which has much in common with this Methodology Document. In practice the CEN document is primarily intended for use outside the nuclear industry.

2 DEFINITIONS

The definitions which apply for this document can be found in a published ENIQ Glossary (EUR 18102 EN). The most important ones are also given in Appendix 1.

3 QUALIFICATION PRINCIPLES

3.1 GENERAL PRINCIPLES

Qualification of an inspection may require assessment of any NDT system, composed of any combination of NDT procedure, equipment and personnel.

This qualification or assessment can be considered as the sum of the following items:

i) Technical justification, which involves assembling all evidence on the effectiveness of the inspection, including previous experience of its application, laboratory studies, mathematical modelling, physical reasoning and so on.

ii) Practical trials (blind or open) conducted on simplified or representative test pieces resembling the component to be inspected.

The appropriate mix of the above sources of evidence must be judged separately for each particular case, although the use of technical justification is highly recommended in all cases.

3.2 ELEMENTS OF INSPECTION QUALIFICATION

3.2.1 Technical Justification

i) Practical reasons limit the number of test pieces that can be used for inspection qualification. Therefore test piece trials can often only provide limited information on the performance of an NDT system. The purpose of the technical justification is:

1. to overcome these limitations by citing all the evidence which supports an assessment of the capability of the NDT system to perform to the required level; it follows that a better defined confidence in the inspection is provided
2. to complement and to generalise any practical trials results by demonstrating that the results obtained on the specific defects in the test pieces would equally well have been obtained for any other of the possible defects
3. to provide a sound technical basis for designing efficient test piece trials
4. to provide a technical basis for the selection of the essential parameters of the NDT system and their valid range.

ii) Technical justification includes a written statement of the evidence which supports the case that an inspection is capable of meeting its requirements. It comprises a mixture of experimental evidence and theoretical assessment as appropriate. A technical justification could include:

- Measurements on practice or development test pieces, if relevant
- Physical reasoning
- Feedback from field experience
- Previous qualifications (where available)
- Relevant round robin trials, such as PISC
- Feasibility studies and industrialisation trials
- The results from mathematical models (where available and valid)
- Laboratory studies (where relevant)
- Description of the equipment by the manufacturer
- Experimental development results.

iii) Sometimes theoretical assessment is needed to relate experimental evidence from similar inspections to the actual situation. Theoretical assessment can also provide independent evidence on the adequacy of the proposed inspection.

iv) A more quantitative approach to theoretical assessment involves the use of mathematical models of the inspection where these are available. Care should be taken in using such models to ensure that they have been validated under the conditions of the particular inspection. Models can be particularly valuable in being able to extrapolate and interpolate practical inspection results gained under one set of conditions to others. In doing this, they enable specific practical results to be generalised. They can also allow results gained on test pieces to be extended to the real component thereby permitting the use of simple test pieces. Further guidance on the use of mathematical models can be found in ENIQ Recommended Practice 6 (see Appendix 3).

v) All possible parameters of the equipment, the defects and the component which might have an influence on the outcome of the inspection are called influential parameters. In general, of all the possible influential parameters, only a limited number, the essential parameters, will indeed have a significant influence on the inspection outcome. These essential parameters should be identified and the range in which they can vary should be defined. For the defects and the component the essential parameters are defined in the input information to be provided prior to inspection qualification (see section 4.2) and the qualification is only valid within the defined boundaries. For the NDT equipment and procedure it should be verified during qualification that requirements are included (e.g. calibration requirements) which ensure that the essential parameters remain within the defined boundaries in order not to invalidate the qualification. Further guidance on influential and essential parameters can be found in ENIQ Recommended Practice 1 (see Appendix 3).

vi) If practice test pieces are made available prior to the start of inspection qualification, the results obtained on them can be very useful in justifying some of the chosen inspection parameters, especially (for ultrasonic inspection) in the case of austenitic components (provided that the practice test pieces are similar in all relevant aspects to the ones used during qualification).

vii) An important element of the technical justification is the feedback of field experience, mentioned above. This source of information can become the most important one if the population of similar components or plants is large enough. This feedback has, however, to be validated. The information generated should not be biased by experts' impressions. Evaluation, possibly involving destructive examination, is often necessary to validate the information coming from plant inspections.

viii) If the process of assembling the evidence for the technical justification reveals any shortcomings in the capability of the inspection, as compared to the desired performance, these shortcomings should be clearly stated both in the text of the technical justification and in its conclusions.

Further general guidance on technical justifications (TJs) can be found in ENIQ Recommended Practice 2 on the contents of a TJ and in Recommended Practice 3 on the strategy for using TJs (see Appendix 3).

3.2.2 Practical Trials

i) Practical trials may involve test pieces replicating the component being inspected in size and geometry. The defective condition may also be accurately replicated. If metallurgical flaws are involved, the test piece will be designed to contain flaws of the type judged to be possible in appropriate positions and will normally include the 'worst case' defects judged most difficult to detect and size for the given defect situation. Such test pieces produce realistic results but are expensive and time-consuming to make and can usually only replicate a small fraction of the flaws which might actually occur.

ii) Simpler test pieces, i.e. test pieces of simpler geometry and/or containing less realistic defects, can also be used but the results need to be extrapolated to the real situation using physical reasoning and modelling. When this is possible it offers a quicker and less expensive route to inspection qualification.

iii) The qualification body should assess the use of the flaws incorporated in the test pieces as producing either realistic or conservative responses relative to the defects specified by the plant operator.

iv) A further important aspect of practical trials relates to whether or not the test piece is inspected in ignorance of information on the defective condition replicated by the test piece, i.e. whether the trial is blind or open. It is recommended that the personnel qualification is separated from the procedure/equipment qualification. This will aid exact identification of where any weaknesses lie. The procedure/equipment qualification is preferably done using open trials, both for detection and sizing. An important aspect of using open trials for procedure/equipment is that the inspection results obtained have to be explained and justified in full detail to the qualification body[1]. A blind trial can be a realistic way of assessing the performance, particularly in terms of whether the combined personnel, equipment and procedure or some combination of these can produce satisfactory results in practice.

v) It is to be noted that test pieces containing real flaws or simulated ones may have to be examined destructively if the test piece results have to be evaluated objectively. Full certifications of test pieces which do not require destructive examination need to be documented in the qualification dossier.

Further guidance on test piece design and test piece trials can be found in ENIQ Recommended Practice 5 (see Appendix 3).

[1] It can sometimes be beneficial to ask the inspection team to explain their results to the qualification body before the true locations and sizes of the defects in the open trial test pieces are revealed to them,

3.3 QUALIFICATION APPROACH

3.3.1 Qualification Level

In practice, qualification can be performed with varying degrees of complexity and cost, varying from a capability statement (a simple form of technical justification) based on existing evidence, through to an extensive qualification consisting of a detailed TJ together with open and blind trials on full-scale test pieces. Some countries and organisations might wish to formalise this by providing for a number of different qualification levels and qualification approaches depending on such factors as the safety significance of the component, the role of the inspection in ensuring its structural integrity, and the difficulty or novelty of applying the proposed NDT technique. Guidance on qualification levels and approaches can be found in ENIQ Recommended Practice 8 (see Appendix 3).

3.3.2 Qualification of Equipment / NDT Procedure

Where required the NDT procedure and the equipment can be qualified by technical justification, open trials or both.

i) Where an item of the equipment falls within the scope of a national, European or international NDT standard or other written specification, the qualification should include, where appropriate:

- a paper study to determine the relevance of the standard or specifications to the specific case
- proof of compliance with the standard(s).

ii) Where an item of the equipment does not fall within the scope of an appropriate standard or specification or the plant operator does not want to use existing standards or specifications, the qualification should ensure that provision is made to measure the equipment essential parameters, identified during the analysis of the influential parameters. Such provision might be made through including appropriate calibration requirements in the procedure, through commissioning trials of the equipment or through open practical trials. The NDT procedure should identify the essential parameters and should specify allowable values and tolerances.

iii) Qualification of NDT procedures using technical justification involves the following:

- Assessment of the technical adequacy of the NDT procedure
- Assessment of the analysis of the essential parameters
- Checking that all those NDT procedure essential parameters which affect the outcome of the NDT significantly, and the ranges within which they can vary, are specified and that they are, if necessary, considered in the practical trials
- Checking that the NDT procedure is written in a sufficiently systematic and unambiguous way that its application is reproducible.

Open practical trials should be performed for the NDT procedure, where a sufficient demonstration of its adequacy through technical justification is not possible.

3.3.3 Qualification of Personnel

Personnel, using qualified NDT procedures and equipment, should be qualified through one or any combination of the following:

- certification through a national NDT personnel certification scheme
- theoretical and/or open practical examination
- blind trials.

i) Any personnel certification requirements invoking relevant national NDT personnel certification schemes (EN 473, for example) should be specified in the inspection procedure. Any additional personnel training requirements should also be specified there. The qualification body should satisfy itself that these requirements are appropriate.

ii) If no relevant scheme exists or if extra personnel qualification is needed, the qualification body should determine the additional practical and theoretical examinations needed beyond those in the national certification scheme, include these in the qualification procedure and ensure that the NDT procedure also includes the necessary requirements. For automated non-destructive inspections, carried out by a team of inspectors, it may be necessary for only certain designated members of the team to be qualified, for example those carrying out the data analysis and interpretation. The qualification procedure should describe the proposed system.

4 CONDUCT OF QUALIFICATION

The most important steps before and during inspection qualification, with references to the corresponding sections of this document, are given in Appendix 2. Note that the steps may be taken in a different order from that given in Appendix 2.

4.1 CONTENTS OF THE QUALIFICATION DOSSIER

The qualification dossier is a file assembled by the qualification body. It contains all information related to the whole process of inspection qualification, including at least:

- the input information (see section 4.2)
- the technical justification (see section 3.2.1)
- the qualification procedure (see section 4.3)
- the results of the qualification (see section 4.4).

More detailed advice on the contents of the dossier is given in Recommended Practice 4 (see Appendix 3).

4.2 INPUT INFORMATION

Prior to the start of inspection qualification all necessary input information for the qualification must be made available. These input data are typically:

1. objectives of the inspection qualification
2. full description of the component to be non-destructively inspected
3. types, dimensions, orientations, locations and morphologies of defects to be detected and/or sized, depending on the defect situation considered (see the last paragraph of this section below)
4. If applicable, the acceptance and rejection criteria for any detected defects.
5. the inspection performance (detection, sizing, location and characterisation) to be achieved
6. the qualification level required, for those using this concept (see Recommended Practice 8)
7. the NDT procedure, equipment and personnel requirements.

In general, the information for points 1 to 6 is made available by the plant operator whereas the NDT procedure is prepared by the vendor. More information can be found in section 7.2.

The information on the defects to be detected and/or sized (point 3 above) will generally be determined from applicable codes and standards, or by metallurgy and fracture mechanics experts, preferably in discussion with NDT experts. Only the outcome of these deliberations is relevant to inspection qualification and is provided as input information under point 3. The detailed metallurgical deliberations and fracture mechanics calculations, including consideration of safety factors etc, are outside the scope of qualification and do not need to be provided.

4.3 QUALIFICATION PROCEDURE (CONDUCT OF QUALIFICATION)

Following agreement between the involved parties on the qualification approach required, the qualification body produces a qualification procedure which should be submitted to the plant operator for acceptance. In the qualification procedure the way the qualification will be implemented in practice is described. The qualification procedure should contain, at least, the following information:

- objectives of the inspection qualification
- qualification level if this has been specified
- the way the technical justification and NDT procedure will be assessed
- details of how the practical trials will be conducted (blind and open)

- details of the qualification test pieces (in the case of blind trials some aspects will be confidential)
- the way the results of the qualification will be evaluated.

The qualification procedure is produced taking into account all the input information (see section 4.2) and the objectives set out at the beginning.

The following points should be considered by the qualification body when producing and implementing the qualification procedure.

a) Before starting any practical trials as part of qualification, it may be appropriate for the qualification body to brief the NDT personnel on the conduct of the trials using the NDT procedure. The availability of test pieces will have been discussed with the plant operator as part of a contract for qualification. Where practice test pieces are made available, they should not subsequently be used in blind trials. The practice test pieces can be used to optimise the NDT procedure and the results obtained can be used in the technical justification.

b) The only information which can be withheld by the qualification body is that relating to the detail of the defective condition of any test piece where release of information would prejudice the ability to carry out blind trials if these are required. Such retention of information should be agreed between the relevant involved parties.

c) The qualification body should assess the technical justification and the NDT procedure. Where the assessment reveals deficiencies in the NDT procedure, the qualification body should provide feedback to the plant operator or inspection company on the need for change. Responsibility for provision of an amended NDT procedure is with the plant operator (though in some cases the procedure will actually be written by the inspection vendor – see Section 6 below). The qualification body should determine the test piece trials which are needed so that, when combined with the technical justification, they together provide convincing evidence on the adequacy of the NDT to meet the defined objectives.

   In some cases, the long lead times involved may necessitate the initiation of test piece procurement for the trials before the full technical justification is available. The information in the technical justification relating to test piece design is often available at an early stage in its preparation, frequently once the physical reasoning part is complete. It is acceptable for test piece design and procurement to begin once this information is available to the satisfaction of the qualification body, even if the rest of the technical justification remains to be completed.

d) The need for practical trials, either blind or open, should be determined and the test pieces identified. The specification for these in terms of geometry, size and the defects contained should be included in the qualification procedure. Where blind test piece trials are a major element of the qualification process, a sufficiently large number of defective and blank zones should be considered in order to minimise the influence of chance on the final results. A bank of test assemblies (test pieces and available components) should be assembled to present enough different situations to the NDT procedure and personnel to be qualified.

e) As already discussed in section 3.2, it is recommended that the qualification of the NDT procedure/equipment is separated from the personnel qualification. This will aid exact identification of where any weaknesses lie. Furthermore, qualification of the NDT procedures/equipment should be done through technical justification and, if required, open trials, for both detection and sizing. Note that the qualification procedure may be different for detection and sizing. An important aspect of qualification of the NDT procedure/equipment through open trials is the fact that the inspection results obtained are explained and justified in full detail to the qualification body. A blind trial, on the other hand, can be a realistic way of assessing the performance, particularly in terms of whether the combined personnel, equipment and procedure or some combination of these can produce satisfactory results in practice.

f) The qualification body should detail in the qualification procedure how the qualification results will be assessed.

g) Test reports and examination papers produced during the qualification process should be archived as part of the qualification dossier.

h) Times and conditions available for qualification tests should be included in the qualification procedure where relevant and be commensurate with times and conditions available for the site inspections. Realistic simulation of site conditions and time constraints will not always be necessary or indeed possible.

When practical assessment is carried out using blind trials, the following steps should be taken in addition to the above:

- All test pieces used for blind trials should be uniquely identified but all identification marks should be concealed during qualification. When not in use for qualification purposes they should be inaccessible except to authorised staff of the qualification body. Likewise manufacturing drawings, details of defective conditions and all documentary information relating to flaws should be secure except to authorised staff of the qualification body.
- All blind trials and written personnel examinations should be invigilated continuously. Steps should be taken by the qualification body to ensure that NDT carried out on test pieces is in conformity with the written procedures and that data gathered from blind trials is not removed from the qualification site. Care should be taken to meet this requirement when equipment with electronic memory capability is used.

4.4 CONCLUSION OF THE QUALIFICATION

The qualification dossier should contain all the data and results generated during the qualification. The evaluation of the results must be done according to rules set out in the qualification procedure that refer to the different options and that are part of the qualification procedure. The evaluation can vary from a statistical assessment to a judgment by the qualification body. The reasoning must be included in the qualification dossier. The results may contain information obtained after destructive examination of the test pieces, if executed.

In some cases, the plant operator and regulator may agree that the results of the qualification should be summarised in a single document. This document, a "Summary of Technical Evidence", contains, or gives references to, all the evidence for the capability of the proposed inspection, both the technical justification and the results of any open and blind trials. It thus combines and summarises in a single document all the key information in the qualification dossier. If such a document is produced, the qualification dossier is still compiled, but is not generally issued. The dossier remains accessible if required by, say, the regulatory body.

4.5 UPDATING OF THE QUALIFICATION DOSSIER

i) The qualification dossier will be updated with results of other NDT systems, applied to the same components, which have already undergone qualification.

ii) If feedback from site experience shows evidence which deviates from what was obtained during qualification, then the qualification dossier should be updated accordingly. The consequences of the feedback results should be analysed and assessed.

4.6 POST-QUALIFICATION FOLLOW-UP

Following qualification, the qualification body may provide advice on meeting the requirements of the actual inspections or on technology transfer in the light of knowledge or experience gained through the qualification process. Where blind trials are involved, no information regarding defective conditions in the test pieces used should be given if the test pieces are to be used for further blind trials. Statistical information, if available, on the success achieved on a number of test pieces and errors of measurement, if appropriate, may be passed on. The degree of post-qualification support to be provided by the qualification body should be agreed between the parties concerned.

5 QUALIFICATION CERTIFICATES

5.1 NDT EQUIPMENT AND PROCEDURES

i) Where required by the plant operator or inspection company as appropriate, in cases where qualification has been successful, the qualification body should issue a certificate to the plant operator or inspection company, which identifies the inspection procedure and/or equipment which was qualified and the criteria used for assessment.

ii) Qualification certificates for procedures and equipment may be considered as being valid indefinitely unless changes are made to the procedures or equipment or to any mandatory code whose requirements must be met. If, following changes to alter the procedure or the equipment, the plant operator wishes to extend the qualification certificate, the qualification body should seek technical information from the plant operator to justify extension. Only if then satisfied that the changes have not invalidated the certificate, should the qualification body extend the

certificate to the new circumstances. If not satisfied, the qualification body should identify the further checks it believes to be necessary and make proposals to the plant operator for these to be carried out as a condition of extending the certificate.

The process of consulting the qualification body described in the previous paragraph is not necessarily required in cases of minor changes which cannot conceivably affect the inspection performance (e.g. purely editorial changes to procedures). Technical changes should always be submitted to the qualification body.

iii) When changes are needed to meet updated code requirements, the plant operator should request the qualification body to consider the need for changes. The timescale for changes to be implemented is a matter for the regulatory body or plant operator, depending on circumstances.

iv) In cases where the qualification process has shown that some of the qualification requirements cannot be met, then one of the following options must be followed:

- The qualification requirements should be revised, by agreement among all the involved parties, so that the requirements can be met
- The limitations should be explicitly stated on the qualification certificate.

An example of such limitations might be if the qualification requirements in the input information have been met for defect detection but not for sizing.

5.2 PERSONNEL

The text in this section refers to personnel qualification carried out as part of the process of qualifying a specific inspection. The personnel qualification certificates referred to are those issued by the qualification body for that specific inspection. They must not be confused with the certificates issued under a general personnel certification scheme such as EN 473.

i) It is recommended that qualification certificates for personnel are generally made valid for a limited time period. The precise term should be agreed with the plant operator at the outset. If, at the end of this period, the plant operator or vendor can produce documentary evidence of continued satisfactory involvement by staff in the qualified inspection, the certificate may be renewed by the qualification body for a further period. Multiple renewals by this documentary route may also be allowed, but eventually recertification is required after an agreed time period has elapsed from when the original certificate was awarded.

ii) In cases where the qualification process has shown that some of the qualification requirements cannot be met, any such caveats must be explicitly stated on the qualification certificate. An example might be if the qualification requirements in the input information have been met by a particular individual for defect detection but not for sizing.

iii) Where any applicable code or standard requirements change, the updated requirements should be implemented at the next renewal.

5.3 REGULATORY REQUIREMENTS

When qualification has been conducted because of regulatory requirements the certificates issued by the qualification body do not constitute approval of the inspection. Such approval must come from the regulatory body using the certificates as supporting evidence.

5.4 FORMAT

The format of any qualification certificate to be issued (including that for the personnel) is a matter to be agreed between the parties involved.

6 RESPONSIBILITIES OF THE PARTIES INVOLVED

In this section the roles and responsibilities of the different parties involved in inspection qualification are described. It should be stressed that the responsibilities, as described in this section, are applicable to the case of in-service inspection of nuclear power components only. For the inspection of non-nuclear components or for manufacturing applications some or all of the responsibilities described in this section are either not necessary or taken over by other parties. For example, if inspection qualification is required for a specific non-nuclear application, because inefficient NDT would have important economic consequences, it may be that no regulatory requirements exist. The plant operator could then, if necessary, take over the responsibilities attributed to the regulatory body in section 6.2. In the case of qualification of a manufacturing inspection the manufacturer will in many cases be responsible for the qualification and will take over many of the responsibilities attributed to the plant operator in section 6.1.

6.1 PLANT OPERATOR

In all European Union countries (and Switzerland) the plant operator (licensee), being responsible for the safety of his installations, has to take care of the surveillance of his nuclear power plants. This is normally done, among other means, through in-service inspections assigned to vendors of inspection services. The plant operator is responsible for the adequacy of the inspections and has to provide the evidence to the regulatory body. The plant operator provides input for the qualification dossier that should be prepared by the qualification body. The qualification body can require additional information to complete the qualification dossier, if they judge this to be necessary. The following actions are thus the responsibility of the plant operator:

- The plant operator decides on the items that require inspection qualification, by considering the component to be inspected and the defects to be detected. The list of such cases is updated taking into account national and international field experience.

- The plant operator gives to the vendor and to the qualification body all the required input information (components, defects, objectives of the qualification) pertaining to the inspection(s) to be qualified, including the inspection performance to be met.
- The plant operator has the ultimate responsibility for the NDT procedure and technical justification. In some cases these documents will be written by the plant operator, in others by the inspection vendor (see section 6.3 below).
- The plant operator may assess the qualification procedure proposed and comment upon it. Depending on the particular relationship between operator and regulatory body, the plant operator could approve the qualification procedure in some countries.
- The plant operator is responsible for ensuring that the results of the qualification exercise (including any limitations) are taken into account in, and remain applicable to, the subsequent inspection.
- The plant operator takes the necessary steps to enable the qualification body to keep the qualification dossier updated with national and international field experience.
- The plant operator supervises the whole of the inspection activities that affect the performance, especially receipt and verification of the equipment, qualification of the personnel, contents of the procedures, logistics of the operations and evaluation of the results.

6.2 REGULATORY BODY

In all countries the regulatory body has been assigned the task of monitoring and evaluating safety and ensuring that the licensees fulfill the conditions of their site licences. In the context of NDT qualification the regulatory bodies either define or review the basic qualification requirements that must be met from a safety point of view. The regulatory body also undertakes audits, periodic reviews and monitors the licensees' compliance with the qualification requirements.

6.3 VENDOR OF INSPECTION SERVICES

By agreement between the vendor and the plant operator, in some cases the vendor himself writes the NDT procedure and the technical justification, while in other cases one or both of these documents are written by the plant operator. The vendor performs the inspection. The vendor must provide all the necessary elements allowing the qualification body to set up the qualification dossier. The vendor, if requested, has to participate in the qualification of the NDT procedure, e.g. when instruments and personnel are included in the qualification. The vendor helps the qualification body to keep the qualification dossier up to date.

6.4 QUALIFICATION BODY

The responsibility of the qualification body in this text relates to the NDT procedure and equipment, and also to the personnel in the cases where operators are involved in the qualification.

The qualification body has the following responsibilities:

- preparation of the detailed qualification procedure
- assessment of the NDT procedure and technical justification
- dentification or design of test pieces and their fabrication
- invigilation (or proctorship) - if applicable - of any test piece trials
- assessment of the qualification results
- assembling and issuing of the final qualification dossier (or associated Summary of Technical Evidence - see Section 4.4)
- issuing qualification certificates.

The need for the qualification body to be separate from the plant operator is a matter to be determined by the plant operator and by the regulatory body if qualification is carried out as a result of regulatory requirements. Where it is necessary for the qualification body to be independent but it is within the plant operator's organisation, the qualification body should have a quality system which guarantees its independence from commercial or operational considerations.

Further guidance on the requirements for a qualification body, and on the different types of qualification body, are given in ENIQ Recommended Practice 7 (see Appendix 3).

7 VARIOUS ISSUES

7.1 HIERARCHY OF DOCUMENTS

As stated before, this document is intended to provide a general framework for the development of qualifications for the inspection of specific components, to ensure that they are developed in a coherent and consistent way throughout Europe while still allowing qualification to be tailored in detail to meet different national requirements. It should be stressed that in this general document one will not find a detailed description of how the inspection of a specific component should be qualified.

However, more detailed guidance on how to apply the general principles for inspection qualification developed in this document is available in a series of 'Recommended Practices' referenced throughout this document and listed in Appendix 3. Organisations are free to make use of these Recommended Practices at national level, as they see fit. They can be downloaded from the ENIQ website http://safelife.jrc.nl/eniq/

Qualification procedures are developed by qualification bodies for individual qualifications, using the Recommended Practices for guidance. These qualification procedures contain the detailed qualification requirements for a specific inspection, or group of inspections of specific geometries and sizes of components, and relate to the precise way in which the NDT method is applied in practice. These qualification procedures need to reflect the technical, legal and regulatory requirements in the country of application.

Table 1 summarises the contents of the different ENIQ documents, their application field and who should prepare them.

Table 1: Qualification documentation

DOCUMENT	CONTENTS	APPLICATION	PREPARED BY
European Methodology Document	Strategy	General	ENIQ
Recommen-ded practice	Guidance on various aspects of qualification	General	ENIQ
Qualification procedure	Description of how the specific qualification will be implemented	Specific component Specific NDT procedure Specified defects	Qualification Body

7.2 INPUT INFORMATION TO BE MADE AVAILABLE BEFORE THE START OF INSPECTION QUALIFICATION

At the outset of qualification, the qualification body should agree with other relevant involved parties the objectives of the NDT and its qualification. The items discussed below, which are an essential part of the input information, should be available to the qualification body before qualification commences and comprise the initial part of the qualification dossier. If not immediately available, the qualification body should agree with the other involved parties on the steps to be taken to ensure that the information necessary is available before qualification commences. Further guidance on the parameters which should be provided in the input information is given in Recommended Practice 1 (see Appendix 3).

7.2.1 The component: the item to be non-destructively inspected, and all features of the item which influence the inspection and its qualification. This may include its size, geometry, surface finish, material composition, restrictions to access etc, depending on the NDT method to be used and range of variation of relevant characteristics.

7.2.2 The flaw population: The flaws or conditions which must be detected by the actual NDT in the real components. The information required will usually include size, position, type, orientation and any other factors affecting response to the NDT method used. In the framework of in-service inspection of nuclear power components it is possible to distinguish three different cases depending on the nature of the defects. Therefore, the following three defect situations are considered: specific, postulated and unspecified.

a. Specific defect situation

A specific defect situation relates to the case where specific defects have been found in a specific component. The type of damage is potentially widespread ("repeatable") and could be found on other similar components. The type of defect to be detected is well known. An example of a specific situation is the presence of subclad cracks in the reactor pressure vessel.

b. Postulated defect situation

A postulated defect situation relates to the case where the existence of defects of particular types is postulated in a particular component. The exact characteristics of the defects are not known and have therefore to be postulated using, if applicable and available, experience obtained on similar defects which have occurred in other components of the same general type. An example of a postulated defect situation is the postulated presence of mechanical fatigue defects in reactor pressure vessel components.

c. Unspecified defect situation

An unspecified defect situation relates to those cases where neither a specific defect has been detected, nor a defect has been postulated, nor a damage process has been identified. Inspection is done in a preventive way for surveillance purposes only or because it is required by an existing prescriptive standard.

In the case of an unspecified defect situation, where the defect types and positions cannot be specified, no inspection qualification is possible.

7.2.3 The inspection objectives:

Detection and false calls: The detection rate which the relevant involved parties regard as necessary for the actual inspection. (This may arise from a regulatory requirement.) Qualification will aim to assess whether this detection rate is attainable for the inspection method chosen. Likewise, if false calls are important in the particular application, the performance which is regarded as unacceptable should be established.

Acceptance and rejection: If applicable, the acceptance and rejection criteria for detection should be defined.

Sizing and characterisation: If the objective of the inspection is to detect and size flaws, the parameters which must be measured such as length, through-wall extent, ligament and location should be defined and the maximum acceptable departures of reported flaw locations and sizes from actual locations and sizes respectively should be established. Any defect characterisation requirements should also be defined.

Any limits on the time available for the site inspection or limitations imposed by site conditions.

7.2.4 The qualification level required, for those using this concept (see Recommended Practice 8).

7.2.5 The NDT procedure, which is in fact the object of the qualification procedure, must also be known before the qualification starts. The description of the NDT procedure must consider all aspects such as the techniques, equipment, decision steps used and personnel. For an ultrasonic inspection, this description typically includes:

- the description of the NDT equipment (including software used)
- ultrasonic techniques
- ultrasonic probe selection, calibration and characterisation
- the list of essential parameters
- the range of variation acceptable for these parameters
- inspection personnel requirements
- instrument settings
- scanning method and sensitivity
- reporting level and acceptance standard
- decision process to interpret the indications
- documentation requirements.

In practice it is often the case that the process of qualification reveals weaknesses in the initial NDT procedure, and the NDT procedure is revised accordingly. This iterative development of the NDT procedure can be accommodated within the overall qualification process, provided that (a) at least an initial version of the NDT procedure is available before qualification starts; (b) the final qualification is conducted against the final version of the NDT procedure.

7.2.6 The required qualification for the personnel and the specification of any additional qualification necessary that would be part of the qualification of the inspection in question.

7.3 MATTERS TO BE AGREED

The following are thus all matters to be determined by the plant operator, and if required agreed with the regulator, before inspection qualification starts:

- for any given case, the decision on whether an inspection should or should not be qualified
- the Qualification Level, for those organisations who are using this concept (see Recommended Practice 8)

- exact definition and classification of the defect situation
- the way the defect situation affects the objectives of the qualification procedure that will be followed.

Besides the technical decisions, some other aspects must be agreed between the different parties, such as:

- the interaction between the parties (mainly with the regulator)
- the facilities available to the qualification body
- the staff capability and certification used by the qualification body for the conduct of the qualification.

7.4 HUMAN FACTORS AND EXPERT EVALUATION OF INSPECTION RESULTS

7.4.1 Human Factors

When qualification is intended as a full validation of an inspection process including working conditions and human factors, the operators must be involved in the qualification process. This could require practical trials involving the whole of the instrumentation and executed in conditions as similar as possible to real conditions. Industrial surroundings, inspection times and access restrictions should be simulated.

Assurance of the effectiveness of the human operators during the actual inspection cannot be obtained through qualification alone. Additional assurance can be obtained through a quality assurance procedure, use of audit, repeat inspection, good management practice, freedom of operators from excessive time pressure, etc.

7.4.2 Expert Evaluation of Inspection Results

In the procedure all the decision steps related to the combination and interpretation of the results of the different techniques allowing one to arrive at the final result should be written down in a clear, logical and traceable manner. This will minimise the extent to which the results depend on the experience of the evaluating expert.

NDT procedures in which the decision steps are not described in full detail are not suitable for qualification because the performance could depend excessively on the experience of the expert.

APPENDIX 1: LIST OF THE MOST IMPORTANT DEFINITIONS

For the purposes of this document the following definitions apply. A more complete list can be found in the ENIQ Glossary (EUR 18102 EN). Underlined terms are cross-references to other terms defined in this Appendix.

Blind Trial

A trial in which an inspection technique is applied to a test piece and those applying the NDT have no specific and detailed knowledge of the numbers, sizes, orientations and positions of defects which the test piece may contain. It is normally part of a formal qualification exercise supervised by the qualification body.

Data Acquisition Software

Software which determines which signals in an inspection are recorded and how.

Data Analysis Software

Software which analyses and plots the NDT data recorded.

Essential Parameters, Essential Variables

Those parameters, among the influential parameters, whose change in value would actually affect a particular inspection in such a way that the inspection could no longer meet its defined objectives. Further information can be found in ENIQ Recommended Practice 1.

False Call

An erroneous reporting of a defect indication from a part of a test object which is, in fact, free of defects.

Human Factors

The influences on the outcome of a non-destructive inspection arising from the fallibilities which humans can exhibit when working under the actual conditions of the inspection.

Influential Parameters, Influential Variables

Those parameters, relevant to the particular inspection, which can potentially influence the outcome of the inspection. Further information can be found in ENIQ Recommended Practice 1.

Inspection

Inspection is a process of verifying conformity with a written requirement which can be carried out at a number of levels:

i) At the highest level, inspection can mean formal third party inspection to satisfy a legal requirement for independent endorsement.

ii) At the intermediate level, inspection can mean verifying by a variety of means that a specification has been met, e.g. with regard to the overall size and shape of a component.

iii) The most specialised use of the word is synonymous with NDT, e.g. in-service inspection of nuclear components.

Because the word “inspection” is in widespread use throughout the world in each of the three senses given above, no single meaning is given here. The applicable meaning must be deduced from the context.

Inspection Equipment

The means by which the inspection is implemented. For example, in the case of automated ultrasonics and eddy currents, the inspection equipment consists of cables, probes, pulser-receiver (only for ultrasonics), data acquisition and data processing tools and scanner.

Inspection Method

Discipline applying a physical principle in non-destructive testing, e.g. ultrasonic testing method.

Inspection Procedure

A definition of how an inspection is implemented for a specific inspection situation; a written description specifying all essential parameters and setting out the detailed steps and precautions to be taken when applying the specified inspection technique to the inspection situation.

Inspection Qualification

The systematic assessment, by all those methods that are needed to provide reliable confirmation, of an inspection system to ensure that it is capable of achieving the required performance under real inspection conditions.

Inspection System

All parts of the non-destructive inspection including equipment, inspection procedure and personnel which can influence the outcome and quality of the inspection.

Inspection Technique

A specific way of utilising an inspection method (e.g. ultrasonic immersion technique).

Involved Parties

These include the plant owner or operator (licensee), the regulatory body, the inspection company (vendor) and the qualification body as appropriate.

Open Trial

A trial of an inspection in which those applying the inspection to test pieces have specific knowledge of the defects in the test pieces. It is normally part of a formal qualification exercise supervised by the qualification body.

Pass/Fail Criteria

The criteria relating to the number of defects detected in test assemblies, number of false calls, size and positional accuracies and so on reported in an inspection qualification which determine success or failure of the NDT inspection.

Performance Demonstration

Generally used to describe the process of qualification described in ASME Section XI, Appendix VIII.

Physical Reasoning

Part of the technical justification, containing a compilation of the detailed reasons for selection of a particular NDT approach expressed in qualitative terms. If early design of test pieces is needed, the input can be based on physical reasoning which is usually available at the start of compiling the technical justification.

Practical Assessment, Practical Trials

The assessment of a non-destructive inspection by applying it to test pieces containing defects. More information can be found in ENIQ Recommended Practice 5.

Qualification Body

Body that conducts inspection qualification.

Qualification Certificate

A document issued under the rules of an inspection qualification system. It indicates that adequate confidence is provided that inspection procedures, equipment and personnel or any combination of these are capable, for a specific inspection, of achieving the stated objectives of the inspection.

Qualification Dossier

An assembly of all the information relevant to the definition and execution of the inspection qualification. It includes information on defects, components to be inspected, the inspection procedure and NDT conditions. It also includes the qualification procedure and the technical justification, and its final part contains the results of the inspection qualification.

Qualification Procedure

An orderly sequence of rules which describes how a specific non-destructive inspection on a specific component is to be qualified.

Real Defect

A defect which has developed in a component during its manufacture or in service, without any steps having been taken to deliberately encourage its development.

Realistic Defect

A defect deliberately introduced into a test piece which simulates the metallurgical appearance of a real defect. The most useful types of realistic defect for qualification purposes are those whose NDT responses resemble, or can be related to, those of the real defects of interest, for the inspection techniques being considered.

Recommended Practice

Document produced by ENIQ to support individual countries and organisations in how to implement in practice the European methodology for inspection qualification. A Recommended Practice is the next level of document below the methodology.

Summary of Technical Evidence

A document summarising all the evidence from the qualification on the capability of the proposed inspection. The document therefore contains, or gives references to, both the technical justification and the results of any open and blind trials.

Technical Justification

Most commonly used for a collection of all the necessary information which provides evidence that the inspection system can meet its stated objectives. Technical justification may, however, be used for a number of other purposes such as for example to justify the defects or test pieces to be used during test piece trials or to justify an upgrade in inspection equipment without the need to repeat the whole qualification. Further information can be found in ENIQ Recommended Practices 2 and 3.

APPENDIX 2: THE MAJOR STEPS TO BE FOLLOWED PRIOR TO AND DURING INSPECTION QUALIFICATION

Note that this table only includes the major steps, and that the steps need not necessarily be performed in the order listed.

prior to inspection qualification	
step	relevant section(s) and Recommended Practices (RPs)
1. make available all required input information concerning component, defects, inspection and qualification objectives	4.2 and 7.2
2. optimise NDT procedure using typical reference/ training test pieces	3.2.1 and 4.3
during inspection qualification	
step	relevant section(s)
1. prepare NDT procedure and technical justification	3 and 4, RPs 1, 2 and 3
2. assess submitted NDT procedure and technical justification	3.2.1, 3.3.2 and 4.3
3. propose qualification procedure including open and blind test piece trials, as required	3.3.1 and 4.3, RPs 5 and 8
4. accept/refuse qualification procedure	4.3
5. if required, conduct open trials for NDT procedure/equipment	3.2.2, 3.3.2 and 4.3
6. issue/refuse qualification certificate for procedure/equipment	5.1
7. conduct complementary qualification of personnel using qualified NDT procedure/equipment	3.2.2, 3.3.3 and 4.3
8. issue/refuse qualification certificate for personnel	5.1
9. compile and finalise qualification dossier	4.1, RP 4
10. accept qualified inspection	6

APPENDIX 3: LIST OF RECOMMENDED PRACTICES

1. Introduction

A Recommended Practice is a document produced by ENIQ to support the production of detailed qualification procedures by individual countries or organisations. The hierarchy of documents in qualification is described in Section 7.1 of the main document. This describes the different documents, the responsibility for their production and their scope.

A Recommended Practice is the next level of document below this methodology document. As such, it is still general in scope, which means that valuable advice can be given by ENIQ to promote a uniform approach to qualification throughout Europe, while leaving the detail of how qualification is to be done to be determined at the national level in line with the regulatory and technical requirements in that country. Organisations are free to make use at national level of the Recommended Practices, as they see fit.

2. List of currently available Recommended Practices

The table below gives a list of the currently available Recommended Practices relevant to this document, with a brief summary of the scope of each.

Note that all the Recommended Practices may be downloaded from the ENIQ website http://safelife.jrc.nl/eniq/

RP1	Influential/essential parameters, EUR 21751 EN
	ENIQ Recommended Practice 1 should assist those involved in inspection qualification in how to use and implement the concept of influential/essential parameters in agreement with the spirit of the European methodology. This version of RP 1 – Issue 2 – builds upon the experience gained in the use of Issue 1 since it was published in 1998. The main objectives of this Recommended Practice are: - to explain the concept of influential/essential parameters - to indicate how the concept can be used in inspection qualification according to the European methodology - to give advice concerning the classification of influential parameters - to give examples of parameters which can be influential as a function of the specific inspection to be qualified for two cases: an ultrasonic inspection of welds and an eddy current inspection of steam generator tubes.

RP2	Recommended contents for a technical justification, EUR 18099 EN
	RP 2 defines a list of recommended contents for writing technical justifications. It should assist those producing technical justifications to identify the material that might be included. It should also assist in producing technical justifications in a uniform format throughout Europe.
RP3	Strategy document for technical justification, EUR 18100 EN
	The purpose of this RP is to describe a strategy on how to use and implement the concept of technical justification, which is an important element of the ENIQ European methodology for qualification of NDT. The main objectives are: - to explain the different purposes of technical justifications - to indicate how the specific purpose or application of the technical justification may affect its contents - to give guidance on the relative weight to be given to test piece trials and technical justification taking into account a number of factors such as level, available evidence, specific application etc.
RP4	Recommended contents for the qualification dossier, EUR 18685 EN
	This RP should assist those doing qualifications to identify the material which might be included in the qualification dossier, which is defined as an assembly of all the information relevant to the definition and execution of the qualification. It should also assist in producing qualification dossiers in a uniform format throughout Europe, an essential element in providing a general framework for a scheme of recognition of qualifications performed in the EU. Note that the concept of dossier is not that of a single document or report but rather that of a file in which key documents of the qualification are inserted.
RP5	Guidelines for the design of test pieces and conduct of open trials, EUR 18686 EN
	The purpose of RP5 is to provide guidelines for the design of test pieces and the conduct of test piece trials, once it is has been decided (for example, as a result of the analysis done in the technical justification) that they are required. It refers especially to those test piece trials (open or blind) that are supervised by the qualification body.

RP6	The use of modelling in inspection qualification, EUR 19017 EN
	This RP deals with the use of mathematical modelling in inspection qualification. Mathematical models have been developed by several organisations for various inspection situations and, where applicable, can provide valuable evidence on inspection capability for inclusion in a technical justification. Authors of technical justifications may therefore be considering the use of models. This RP provides advice on: - the types and range of mathematical models which are available - how the models can be used to generate evidence for a technical justification - important considerations and constraints in using models.
RP7	Recommended general requirements for a body operating qualification of non-destructive tests, EUR 20395 EN
	The document provides guidance on the minimum criteria that a body operating qualification of non-destructive testing should follow if it is to be recognised as impartial, independent of operational pressures, competent and reliable. Three types of qualification body are considered within the RP: Type 1: A qualification body which is an independent third party organisation Type 2: A qualification body which is an independent part of the utility's organisation set up on a permanent or long-term basis Type 3: An ad hoc qualification body set up for a specific qualification. The RP is mainly intended to provide guidance on the requirements for qualification bodies of types 1 and 2. An ad hoc qualification body, type 3, being more temporary and inspection-specific in nature, will generally be established in a less formal way than qualification bodies of types 1 and 2. However, many parts of the RP should still provide useful guidance for setting up an ad hoc qualification body. The RP should assist those who want to establish a qualification body and those who have to audit the competence of a qualification body. It should also assist in providing a general framework for a scheme of recognition of qualifications performed in the European Union (EU).

RP8	Qualification levels and qualification approaches, EUR 21761 EN
	This RP is intended to provide guidance on the setting of Qualification Level and on determining the Qualification Approach based partly on this choice of level. The Qualification Level required reflects the assurance required that the inspection will attain its objectives in demonstrating structural integrity and may depend on e.g. the safety significance of the component and the role of the inspection in assuring structural integrity. In practice, qualification can be done with varying degrees of complexity and cost. The way such work is carried out is defined in this document as the "qualification approach", and needs to take into account both the structural integrity significance and the difficulty of each specific inspection. The qualification approach determines to what extent the various aspects of qualification, i.e. technical justification, open trials, blind trials etc., are included in a particular case.
RP9	Verification and validation of structural reliability models and associated software to be used in risk-informed in-service inspection programmes, EUR 22228 EN
	Structural Reliability Models (SRMs) are commonly used to evaluate failure probabilities in the development of Risk-Informed In-Service Inspection (RI-ISI) programmes. This report summarises the Verification and Validation (V&V) requirements that a Structural Reliability Model (SRM) and associated software should satisfy in order to be suitable for such purpose. These requirements are mainly based on the work performed within the NURBIM project.

An ENIQ Glossary, giving definitions for commonly used terms in inspection qualification, is also available (EUR 18102 EN) and may be downloaded from the ENIQ website.

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EUROPEAN METHODOLOGY FOR QUALIFICATION OF NON-DESTRUCTIVE TESTING – THIRD ISSUE –

Editors
B. Chapman British Energy
T. Seldis DG-JRC-IE
A. Eriksson DG-JRC-IE

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Abstract
In this publication the third issue of the European methodology for qualification of NDT is described. The European methodology document contains guidelines for the qualification of non-destructive testing. Qualification as defined in this document is a combination of technical justification, which involves assembling all supporting evidence for inspection capability (results of capability evaluation exercises, feedback from site experience, applicable and validated theoretical models, physical reasoning), and test piece trials using deliberately defective test pieces.

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