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1. Introduction

The European methodology document [1] is intended to provide a general framework for development of qualifications for the inspection of specific components to ensure 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.

Qualification of a non-destructive test may require assessment of any NDT system, composed of any combination of NDT procedure, equipment and personnel. This qualification or assessment is to be considered as the sum of the following items [1]:

i) Practical assessment (blind or non-blind) conducted on simplified or representative test pieces resembling the component to be inspected.
ii) Technical justification, which involves assembling all evidence on the effectiveness of the test including previous experience of its application, experimental studies, mathematical modelling, physical reasoning and so on.

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 the European methodology one will not find a detailed description of how the inspection of a specific component should be qualified. However, more detailed information on how to apply the general principles for inspection qualification developed in the European methodology document are available in a series of ‘Recommended Practices’.

A recommended practice is a document produced by ENIQ to support the production of detailed qualification procedures by individual countries. A recommended practice is the next level of document below the methodology. Recommended practices are applicable in general to any qualification. This general scope means that valuable advice can be given by ENIQ to promote a uniform approach to qualification throughout Europe but the detail of how qualification is to be done is determined at the national level in line with the regulatory and technical requirements in that country. Organisations will be free to make use at national level of the existing recommended practices, as they see fit.

This document is a recommended practice, which 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. This recommended practice 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 European Union (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.
It is emphasised that the list of contents recommended here is only a starting point. The precise content must be determined on a case by case basis depending on the particular qualification and the component and inspection involved together with the level of detail required. In some cases certain sections of the recommended list of contents may be omitted or truncated.

This recommended practice is relevant to any non-destructive testing method. Because the area in which qualification has been applied most frequently until now is ultrasonics, where examples are given for purposes of clarification, these are drawn from ultrasonic applications. It is emphasised that the principles given in this recommended practice, can also be used for qualification of manufacturing inspections or of inspections performed in the non-nuclear field, although this particular document was developed specifically for in-service inspection of nuclear power plant components.

Section 2 of this document contains a table, which summarises the recommended contents for a qualification dossier and identifies the different sections it might contain.

Appendix 1 of the document gives more detail about the contents of the different sections of the qualification dossier.

The definitions as given in the second issue of the ENIQ glossary [2] are applicable.

The first issue of ENIQ Recommended Practice 4, defining a list of recommended contents for the qualification dossier, has been produced by the ENIQ Task Group 2.2 and was approved by the Steering Committee of ENIQ for publication in January 1999. Finally, this is a living document and, if necessary, a second issue will be published in the future taking into account the experience gained from using this recommended practice.
2. **Recommended list of contents for the qualification dossier**

**Important Note:** Not all the sections listed below may be necessary for any particular qualification dossier. Depending on the purpose and requirements of the particular qualification, some of the sections may be omitted or truncated.

<table>
<thead>
<tr>
<th>Section</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary</td>
<td>Purpose of the qualification and summarising statement indicating how well the inspection objectives as set out in Section 2 are shown by the qualified inspection to be met. Any limitations of the qualification performed should be mentioned also.</td>
</tr>
<tr>
<td>1. Introduction</td>
<td></td>
</tr>
</tbody>
</table>
| 2. Input Information | Relevant details of:  
- Component  
- Defects  
- Inspection method/technique  
- Required inspection performance. |
<p>| 3. Quality assurance scheme applicable to the qualification body | An overview of the quality assurance and organisation used for the qualification to be performed. |
| 4. Requirements to be met by the vendor prior to the start of the inspection qualification exercise | In this section the requirements to be met by the vendor prior to the start of the qualification exercise should be specified: quality assurance, documentation to be provided prior to the start of the qualification, etc. |</p>
<table>
<thead>
<tr>
<th>Section Number</th>
<th>Section Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Qualification procedure</td>
<td>The way the inspection qualification will be implemented in practice covering at least the following issues: qualification level, balance between technical justification and test piece trials, information to be provided by the vendor, way the technical justification and inspection procedure/equipment are assessed, way the personnel is qualified beyond what is required in national certifications schemes, rules for the practical implementation of the test piece trials, criteria used for the overall assessment of the proposed inspection system.</td>
</tr>
<tr>
<td>6.</td>
<td>Details of the inspection system</td>
<td>All documentation relating to the inspection system submitted for qualification: inspection equipment, inspection procedure and inspection personnel.</td>
</tr>
<tr>
<td>7.</td>
<td>Technical justification</td>
<td>All technical justifications produced for the qualification.</td>
</tr>
<tr>
<td>8.</td>
<td>Qualification test pieces</td>
<td>As a result of the analyses done in the technical justification, the exact requirements for the test pieces should be described in the section. The exact characteristics of the manufactured qualification test pieces should also be given in this section. Note that the exact details of blind test pieces should be kept confidential in accordance with the rules agreed.</td>
</tr>
<tr>
<td>9.</td>
<td>Results of open and/or blind test piece trials</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Assessment of the results obtained during qualification</td>
<td>This section should contain the overall assessment of the inspection system taking into account all evidence obtained from technical justification and test piece trials during qualification.</td>
</tr>
<tr>
<td>11.</td>
<td>Conclusion of the qualification</td>
<td>Conclusions on the positive or negative outcome of the qualification performed, the limits of validity of the qualification performed, etc.</td>
</tr>
<tr>
<td>13.</td>
<td>Update of the qualification dossier</td>
<td>Description of the way the qualification dossier will be updated taking into account for example field experience and how this could impact upon the qualification certificates delivered.</td>
</tr>
<tr>
<td>14. Conclusions and Recommendations</td>
<td></td>
<td></td>
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<td>--------------------------------------</td>
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</tr>
<tr>
<td><strong>15. Summary of technical evidence</strong></td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX

Details of the content of the chapters of the qualification dossier

This appendix gives further details of the possible contents of the various chapters of the qualification dossier, using the recommended list of contents given in Section 2. Where appropriate, reference will be made to other recommended practices rather than repeating the information given in them.

It should be emphasised that this Appendix is intended primarily as a kind of checklist of the sorts of information that might be included in each chapter of the qualification dossier. It is not intended to be a prescriptive list. The amount of information to be included in any specific qualification dossier will vary from case to case, depending on such factors as the qualification level, need for test piece trials or not, safety consequences of the inspection and so on.

1. Introduction

This should contain the following information:
- The purpose and scope of qualification dossier
- Components and inspection method covered by the qualification dossier
- Description of the layout of the qualification dossier.

2. Input information

It is essential, before starting the qualification that the full detail of all relevant input information as discussed below is available. This is a requirement of the ENIQ European Methodology [1].

This includes information on all aspects of the components and defects, which can influence the outcome of the particular inspection method used. Information about the required performance levels for detection, size measurement and false calls is also needed for this. More information on this issue can also be found in ENIQ Recommended Practice 1 on “Essential/influential parameters” [3] and ENIQ Recommended Practice 2 on the “Contents of a technical justification” [4].

2.1 Components

The information, which may be needed regarding the components, is listed below although it is emphasised that all the items on the list below may not be needed or may
not be available. The required and available information about all components should be included directly in each qualification dossier.

- Component drawings showing details of the geometry and all dimensions;
- Specifications for all the materials used in the component;
- Welding and buttering procedures used to fabricate the components;
- Details of any weld repairs carried out through the history of the component;
- Details of any known mismatch between components;
- Component surface finish including both small scale roughness and longer scale undulations;
- Details of weld caps and roots where relevant to the inspection i.e. where caps may need to be scanned or defects located near the root (for ultrasonic inspections);
- Details of U-bends, tube sheet expansion geometry, presence of deposits and/or denting (for inspections of steam generator tubes);
- Any access restrictions;
- Any time constraints for inspection set by radiation levels or other environmental factors.

2.2 Defects

For the defects, the following information may be needed depending on the inspection method to be used:

- Defect types which must be detected and sized;
- Defect sizes to be detected;
- Defect positions in thickness and in plan (inside/outside), in particular for ultrasonic inspection of welds, the relationship of defect position to features of welds such as roots, heat affected zones, caps or surfaces or for eddy current inspections of steam generator tubes;
- Defect orientation ranges in tilt and skew;
- Defect gape (for radiographic inspection);
- Any information such as a crack macrograph which is available for previous defects which have occurred in this or similar plant.

2.3 In-service inspection objectives – Inspection performance

Depending on the purpose of the inspection, different criteria defining performance may be of importance. These could be based upon specific fracture mechanical calculations or requirements of codes and standards. The ones, which are relevant to the particular problem, should be included in the input information. The following list indicates some of the parameters, which may be specified:

- Detection requirements
- False call rate
- Sizing accuracy in depth or length
- Detection of remaining ligaments
• measurement accuracy
• Acceptance and rejection criteria.

The way critical defect sizes, obtained for example by fracture mechanics, are translated into in-service inspection (ISI) objectives could be a matter to be discussed between the different parties involved in inspection qualification but the ultimate responsibility is with the utility. An ENIQ recommended practice containing guidelines on how to define qualification objectives from ISI objectives is under preparation [8].

3. Quality assurance scheme applicable to the qualification body

In this chapter an overview should be given on the quality assurance scheme applicable to the qualification body. In ENIQ Recommended Practice 7 [7] on “Recommended general requirements for a body operating qualification of non-destructive tests” more detailed information can be found.

Issues which may have to be covered more specifically (also indirectly by reference to already existing documents) in the qualification dossier are the following:
• Quality assurance scheme followed by the Qualification Body
• Confidentiality of the qualification results
• Confidentiality of the test pieces used for blind trials
• Way the results are assessed and evaluated
• Practical organisation of the test piece trials, if required
• Way appeals of and conflicts with vendors will be treated.

4. Requirements to be met by the vendor prior to the start of the qualification exercise

In this chapter the requirements, which have to be met by the inspection vendor before the start of the qualification exercise, should be given. These requirements could cover the following issues:
• Quality assurance scheme
• Documentation related to experience and certification of inspection personnel
• Previous experience
• Documentation to be provided prior to the formal start of the inspection qualification exercise
• ...
5. Qualification procedure

The qualification procedure is defined as an orderly sequence of rules, which describe how a specific non-destructive test on a specific component is to be qualified.

Each specific qualification procedure will depend upon a number of factors such as the specific purpose of the qualification, the type of inspection to be qualified, the component to be inspected, the type of qualification (equipment, procedure, personnel or a combination).

In the qualification procedure instructions should be given on the way the obtained inspection results will be assessed. This involves defining the following:

- The balance between technical justification and test piece trials;
- Need for test piece trials: which parts of the inspection system proposed for qualification can be assessed by technical justification and for which parts of the inspection system additional test piece trials are required;
- Times and conditions available for qualification test piece trials which should be commensurate with times and conditions available for the site tests. Realistic simulation of site conditions and time constraints will not always be necessary or indeed possible.
- Way the technical justification will be assessed;
- Way the inspection equipment will be assessed;
- Way the inspection procedure will be assessed;
- Way the inspection personnel will be assessed;
- Applicable rules for modifying/updating the inspection procedure as a result of feedback from the qualification;
- Criteria used to determine whether a qualification is successful or not.

In the European methodology, it is recommended that the qualification of the NDT procedure/equipment is separated from the complementary 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 obtained inspection results are explained and justified in full detail to the qualification body. It is not recommended to use blind trials for either procedure or equipment qualification.

If it is decided to perform personnel qualification beyond the requirements of the national certification schemes (along EN 473 for example) it is recommended to use technical justification complemented with either open or blind trials.
More information on how to conduct test piece trials can be found in ENIQ Recommended Practice 5 on "Guidelines for the design of test pieces and the conduct of test piece trials" [6].

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

6. Details of the inspection system

In this chapter all relevant information concerning the inspection system should be given. Depending upon the specific purpose of the qualification this chapter should contain any combination of the following items:

- Document describing the inspection equipment
- Inspection procedure document

The inspection procedure should cover at least the following aspects:

1. Examination method and techniques
2. List of essential parameters related to input (component/defects), procedure and equipment group
3. Inspection equipment list including the following items taking into account the equipment essential parameters:
   - make and model of data acquisition and data analysis equipment
   - probes used
4. Inspection equipment checks/verifications
5. Inspection equipment set-up
6. Techniques of calibration and of establishing scanning sensitivity levels, including instrument controls to be used and acceptance standards for calibrated conditions
7. Design of:
   - calibration block(s)
   - probe characterisation block(s)
   - reference block(s)
8. Scanning details
9. Data to be recorded and method of recording
10. Methods of data interpretation
11. Presentation of results
12. Checklists
13. Personnel qualification requirements and responsibilities

The inspection procedure should contain clear and unequivocal instructions of how the inspection should be performed both for data acquisition and data analysis. The data analysis scheme used to judge whether the indications found are due to defects
is an extremely important part of the inspection procedure. In the inspection procedure all the decision steps related to 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. Therefore the data analysis scheme should be sufficiently detailed in the inspection procedure and the most important decision steps should be justified in the technical justification. Examples of decision steps, which should be covered in the inspection procedure, are:

- Criteria used to distinguish indications due to the geometry of the component from those due to real defects
- Choice of sensitivity above which indications have to be reported
- Way the results of the different techniques are combined in order to decide that an indication is due to a defect or not
- Criteria used to characterise defects, for example to determine whether they are surface-breaking
- Criteria/methods used to arrive at the size of the identified indications.

- Information, which may be required for the inspection personnel, in view of the requirements imposed by the inspection procedure and qualification procedure.

The information given should by preference be related to the essential parameters as defined and analysed in the technical justification [4].

7. Technical justification

As mentioned before the technical justification is considered as a very important part of the qualification. Two recommended practices are devoted to technical justification and those interested to know more about the purpose and possible contents of the technical justification are referred to these 2 documents [4-5].

8. Qualification test pieces

It is recommended that all available information on the inspection procedure and technical justification is used in order to define the detailed test pieces requirements. These should be fully documented in the qualification dossier.

In ENIQ Recommended Practice 5 on “Guidelines for the design of test pieces and the conduct of test piece trials” [6] more information can be found regarding the design of the test pieces covering issues such as:

- use of worst case concept
- Number of defects to be inserted in the test pieces
- Size distribution of the defects to be inserted in the test pieces
• Manufacturing of defects
• Test piece quality checks.

All this should be documented fully in the qualification dossier.

The as manufactured data of the qualification test pieces should also be part of the qualification dossier. The list of essential input parameters can be used as a guideline on which information should be available in the data package on the manufactured qualification test pieces. Other information, which might be provided, is the following:
• Quality assurance checks done at the test piece manufacturer’s premises
• Quality assurance scheme used by the test piece manufacturer
• Relevant documentation on the materials and welding procedure used
• Comparison with characteristics of the components found in the plant.

An assessment of the defect fabrication methods used may have to be conducted in order to verify that the defects manufactured simulate to a sufficient extent from an NDT point of view the postulated or specific defects.

It is very important to carry out test piece quality checks before practical qualification work commences. This should, in principle, be done by personnel of the qualification body. The documentation provided by the different test piece manufacturers should be reviewed. The test pieces should be examined using X-rays and ultrasonics and/or any other NDT method judged useful to ensure that the defects are as intended. It is also important to check that the volume around each defect does not contain significant indications that would make the defect unusable for qualification. A report containing the main conclusions of the quality checks should be included in the qualification dossier. If results of destructive examination are available then these should also be included.

9. Inspection results obtained during open and blind trials

If test piece trials were judged necessary for the qualification then the following information should be given in the qualification dossier:
• The detailed way the practical trials have been conducted
• The inspection results obtained during the open and/or blind trials reported in the format agreed.

10. Assessment of the results obtained during qualification

The qualification body should make a report on the assessment of the results obtained during qualification. The main objective is to verify whether the inspection system is capable of meeting its stated objectives in terms of detection, characterisation and sizing.
The assessment should include the following:

- Assessment of the technical justification and the extent to which the presented evidence is relevant and sufficiently convincing to show that the proposed inspection system is capable of meeting the objectives set out at the beginning.
- Assessment of the test piece trial results, if required, against the ISI objectives. This may include:
  - a logbook kept by the qualification body on the conduct of the test piece trials
  - a report on the capability of the inspection team to follow the written instructions as given in the inspection procedure both for data acquisition and data analysis
  - an assessment of the extent to which the ISI objectives were met (for blind trials for example)
- Assessment of the complementarity between technical justification and test piece trials:
  - it should be shown, and this for all essential parameters to be covered within a range, that the inspection system can meet the ISI objectives for the specified range
  - the essential parameters, which are not fully covered in the technical justification, should be covered in the test piece trials and vice versa.

11. Conclusion of the qualification

This chapter should contain the conclusions of the qualification performed in terms of success of meeting the ISI objectives set out at the beginning. Any difficulties encountered during the qualification, which might limit the scope and validity of the qualification performed should also be mentioned in this chapter.

In case of failure to meet the ISI objectives this chapter should contain the reasons for this.

The limits of validity of the qualification with respect to the original scope should also be given in this chapter.

12. Recommendation in view of attribution of certificates

This chapter should contain the recommendation of the qualification body concerning the attribution of the certificates. The detailed contents of the qualification certificates should be agreed between the different parties involved.
13. Update of the qualification dossier

Rules should be agreed between all involved parties of how field experience might be incorporated in the qualification dossier and how this might affect the issued qualification certificates. If, for example field experience shows that a qualified inspection system is not performing satisfactorily rules should be agreed on the procedure to follow in order to cancel the validity of the certificate.

Other issues, which should be agreed, are:

- Extent to which the obtained results can be made public
- Extent to which the experience gained from the specific qualifications can be used for technology transfer
- Extent to which statistical information gained from several qualifications can be used.

14. Conclusions and recommendations

This section should list all major conclusions of the qualification performed. It should also list the recommendations emerging from qualification dossier for issues such as validity of the certificates, limitations of validity of the qualification, etc.

15. Summary of technical evidence

In some cases, the plant owner 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 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. This summary of technical evidence, if available, is also a part of the qualification dossier.

References

2. ENIQ glossary of terms, second issue, under preparation


7. ENIQ Recommended Practice 7: General requirements for a body operating qualification of non-destructive testing, under preparation.

8. ENIQ Recommended Practice 8: Guidelines on how to define qualification criteria from in-service inspection objectives, under preparation.
ABSTRACT

This document is a recommended practice, which 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. ENIQ recommended practice 4 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 European Union (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.

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