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Accreditation For Non-Destructive Testing

PURPOSE

This publication provides detailed guidance for bodies carrying out non-destructive testing as an accredited activity or seeking accreditation, for testing and inspection purposes.

Authorship
The publication has been prepared jointly by the Laboratory Committee and the Inspection Committee.

Official language
The text may be translated into other languages as required. The English language version remains the definitive version.

Further information
For further information about this publication, contact your national member of EA or the Chairman of the EA Laboratory/Inspection Committee. Please check our website for up-to-date information http://www.european-accreditation.org/

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CONTENTS

1. INTRODUCTION

Non - Destructive Testing (NDT) bodies may be accredited against the requirements of EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories* or EN ISO/IEC 17020, *Conformity assessment - Requirements for the operation of various types of bodies performing inspection.*

Whichever route is chosen the accreditation is carried out against the same technical criteria.

A body accredited for performing NDT under EN ISO/IEC 17025 or EN ISO/IEC 17020 may perform and report on the following activities: testing to appropriately defined standards and procedures, interpretation of test results against the agreed acceptance standard, determination of conformity and determination of significance of defects found, based on results.

Note: Determination of significance of defects found is to be considered as an opinion or interpretation, and according with EN ISO/IEC 17025 clause 5.10.5 shall be clearly marked as such in a test report.

This publication provides guidance for bodies carrying out non-destructive testing as an accredited activity or seeking accreditation, for testing or inspection purposes using, for example, the following:

Eddy Current Testing (ET),
Liquid Penetrant Testing (PT),
Magnetic Particle Testing (MT),
Radiographic Testing (RT) and
Ultrasonic Testing (UT).

Note: visual testing and other NDT testing (like acoustic emission, leak testing etc.) are not included in separate appendices of this document.

This guidance should be used as complement to the standards (EN ISO/IEC 17025 or EN ISO/IEC 17020). Alternative NDT methods may be used if they are validated on appropriated way provided they are shown to give an equivalent outcome and satisfy client's needs.

In some specific situations specialised expertise may be required to ensure testing/inspection at the level of precision demanded by individual test/inspection, e.g. remote access eddy current and ultrasonic inspection. It is not intended to indicate all such topics in this publication, but they will be taken into account during the assessment.

All the sections of the document are applicable for NDT accredited bodies whether the accreditation is against ISO/IEC 17025 or ISO/IEC 17020, even where there is reference just to clauses of one of the standards.

Note: Although the document is guidance, as there are mandatory requirements in NDT standards, that requirements are identified by the term "shall".

2. QUALITY MANAGEMENT SYSTEM

(4.2 EN ISO/IEC 17025; 5.1, 5.2 and 8. EN ISO/IEC 17020)

The quality system shall describe the general and specific arrangements for the conduct of all accredited activities including non-destructive testing and should specifically incorporate:

- the arrangements for managing NDT work including the organisational interface and controls between the permanent facilities and remote or site locations;
- the control and authorisation of NDT specific procedures and techniques;
- the need to ensure that inspection procedures and techniques are available at the point of inspection, whether in the laboratory or on site;
- the need for audit and review to include remote locations and the interface controls.

3. ORGANISATION AND MANAGEMENT

(4.1 EN ISO/IEC 17025; 4.1 EN ISO/IEC 17020)

The body procedures shall ensure the integrity of staff involved in NDT test/inspection work and that staff are free from all pressures which might affect their impartiality and affect their judgement.

Due to the nature of NDT the body shall consider the impact on the body of errors and omissions in testing when considering liability insurance.

Note: The body shall have liability insurance that covers all risks especially arising from radiographic testing and also content of liability insurance should include probable affected sides of radioactive source accident (personnel and environmental hazards). National legislation in the countries where the accredited body operates may have requirements for liability insurance to protect personnel and environments.

4. STAFF

(5.2 EN ISO/IEC 17025; 6.1 EN ISO/IEC 17020)

The management shall define the minimum levels of qualification and experience necessary for all staff within the body.

In all instances the body is required to demonstrate that the personnel qualifications specified in the standard / customer specification / applicable regulations are met. When the standard is silent about specific test/inspection method NDT personnel shall be qualified by an accredited certification body. All certificates of personnel shall be valid, or the body shall demonstrate that renewal or recertification procedures are in progress.

The person(s) responsible for NDT shall hold a level 3 certification and, whenever available, issued by an accredited certification body to EN ISO 9712, for all NDT methods included in the scope of accreditation. Where the person performs monitoring is not in the full-time employment of the body or the in-house level 3 certification does not cover all methods, the body shall have contracts with a person or with persons with needed competence for the sufficient monitoring.

This applies, as a minimum, in relation to the common NDT methods i.e. radiographic testing, ultrasonic testing, eddy current testing, magnetic particle testing and liquid penetrant testing.

If level 3 certification issued by an accredited certification body is not available, may be considered as acceptable, in the absence of other requirements, a level 3 certification issued by the organisation under a recognized certification framework and approved by an independent body. Such body should not have commercial or other interest in the organisation to be assessed and shall involve persons holding EN ISO 9712 (or equivalent) level 3 qualifications in all relevant methods.

The person(s) responsible for NDT shall be responsible as a minimum for following activities:

- Authorization of NDT personnel as competent to perform specific inspections/tests and/or to release results;

- Approving test procedures and validating methods;

Note: According to EN ISO 9712 the level 3 inspector is the formal authority for validation of the test procedure. For routine test procedures according to testing standards, sufficient is working NDT instruction approved by persons of level 2.

- Management of the in-house NDT competency program. The in-house competency program shall include job-specific training needed before authorization and procedures for regular controlling of the proficiency of personnel.

Personnel performing NDT should have qualifications from an independent certifying body meeting the requirements of EN ISO 9712 or of a standard that can be demonstrated to be equivalent to EN ISO 9712 are acceptable. Where personnel are qualified using an employer based scheme, the body is required to demonstrate that such arrangements for training and certification comply with recognised schemes, as appropriate approved by an independent body as established above for persons responsible for NDT. Irrespective of the base qualification chosen the body is required to demonstrate that NDT personnel used for inspection and testing have the knowledge, training, education and experience in the type of defects, which may occur during manufacture, and /or use of the plant examined.

In the absence of suitable certification arrangements it may be necessary to establish qualification schemes (in-house or externally) e.g. UT testing for highly attenuative materials.

Where additionally personnel are responsible for the determination of significance of defects found, based on test results they shall, in addition to the appropriate qualifications, experience, training and satisfactory knowledge of the examinations carried out, also have:

- Relevant knowledge of the technology used for the manufacturing of the items tested (materials, products etc,) or the way they are used or intended to be used and of the defects or degradations which may occur during use;
- Knowledge of the general requirements expressed in the legislation and standards and an understanding of the significance of defects found with regard to the normal use of the items, material, product etc. concerned.

Bodies shall have formal documented arrangements for maintaining up-to-date records of all staff qualifications, training and competencies including eyesight checks as specified by the

relevant personnel certification scheme. Records shall clearly identify whether staff can interpret the results in addition to carrying out examinations.

Where staff is contracted the body shall ensure that such personnel are competent, carry appropriate personnel certification, are effectively monitored and that they work in accordance with the bodies quality management system using bodies equipment and procedures.

The body shall check that the qualification and certification of NDT personnel is appropriate to the test/inspection to be carried out. This should include checking any limitations in the scope of competence certified and the resulting need for job specific training and authorisation.

Bodies are responsible for ensuring that staff has all the other relevant competencies, e.g. safety training, necessary for the performance of their duties.

Monitoring of staff shall include the observation of personnel actually testing/inspection both at any permanent facility and in a remote facility. This assists the body in establishing whether the inspectors knowledge of the plant or component that they are examining and the environment in which they are working is sufficient to enable the operator to perform their activities effectively and safely. It also enables the body to establish that personnel are working to procedures and agreed client's requirements.

5. EQUIPMENT AND CALIBRATION

(5.5 and 5.6 EN ISO/IEC 17025; 6.2 EN ISO/IEC 17020)

As part of its quality management system, a body is required to operate a programme for the maintenance and calibration of equipment used for testing/inspection. The body shall normally use only equipment that is owned by, or on long term lease or loan to the body. Where, other equipment has to be used, the body shall have the necessary evidence to show that the requirements of the accreditation standard and this document are met in respect of such equipment.

Note: the clear requirements regarding using the equipment are stated in EN ISO/IEC 17025 and EN ISO/IEC 17020).

Equipment shall be protected as far as possible from deterioration and abuse. Equipment that is moved from one location to another should, where relevant, be checked on defined way before use. Precautions shall be taken to ensure that, after transportation to a site, testing equipment remains in a serviceable state and that the calibration remains valid. Appropriate checks shall be performed on site to confirm calibration status before testing commences.

Equipment records shall be maintained up-to-date and include a list of all reference blocks, probes etc. held by the body.

Where battery-operated equipment is used, measures should be taken to ensure the proper maintenance of the batteries.

The calibration of reference standards or measuring equipment used for in-house calibration or function check of NDT instruments, shall be traceable to (inter)national standards and, wherever possible, shall be evidenced by certificates issued by an EN ISO/IEC 17025 accredited

calibration laboratory or a NMI in line with ILAC P10. The policy of traceability has to be in line with ILAC P10.

Note: Function check is a measurement of at least one point in a range of a measuring instrument or system or material against a known value to confirm that it has not deviated significantly from its original calibrated value. It is also an examination of the condition of an artifact to determine that it has not been adversely affected by constant use.

Where in-house calibration/function check methods are adopted, the body shall have the necessary resources consistent with the accuracy required, and with any standard specifications relevant to the calibration/function check concerned.

Procedures for in-house calibration shall be adequately documented by work instructions. These work instructions shall thoroughly describe step by step the calibration procedure and shall be directly related to (inter)national calibration standards. Equipment records shall clearly define calibration intervals, which have to be in accordance with the calibration program. The required action shall be taken when the calibration results show an exceeding of the pre-determined limits of the accuracy of the instrument under calibration.

Specific requirements on equipment calibration/function check and equipment calibration/function check intervals for various test disciplines are given in Appendices A to E.

Records of all calibrations/function check shall be documented and retained and shall include certificates providing evidence of traceability to (inter)national standards where required.

6. MEASUREMENT UNCERTAINTY

(5.4.6.2 EN ISO/IEC 17025)

Measurement uncertainty is determined by the equipment and procedures used but may also be affected by parameters such as the material, shape and surface finish of the object under test together with the shape and acuity of the defect. It shall be done according to the requirements of EN ISO/IEC 17025.

Formal estimation and reporting of measurement uncertainty is not required for qualitative or semi quantitative tests, or for tests in which qualitative components are the major components of uncertainty. However, where situations arise that require compliance assessment in accordance with numerical test result criteria, measurement uncertainty must be considered. The body shall have written procedures for determination of measurement uncertainties for all quantitative tests performed. The body will need to estimate the uncertainty of measurement for any tests that are considered to be quantitative (e.g. thickness measurement techniques and optical density measurements) and which do not comply with ISO/IEC 17025, sub clause 5.4.6.2, Note 2.

For qualitative or semi-quantitative tests it is expected that body identifies those factors which contribute to uncertainty, to rank these based on importance and then take action to control them as far as is possible.

7. TEST/INSPECTION PROCEDURES AND WRITTEN INSTRUCTIONS

(5.4 EN ISO/IEC 17025; 7.1 EN ISO/IEC 17020)

Accreditation bodies will only accredit bodies for tests/inspections which have been fully documented and validated. These may include national and international standard methods, client and in-house methods. The accredited body shall satisfy itself that the degree of validation of a particular technique is adequate for its purpose.

Bodies are required to have documented procedures supplemented, where necessary, with detailed written instructions or techniques. Wherever possible the body shall use standardised procedures and techniques. The control and authorisation levels of these documents shall be covered in the body document control procedures.

Approval of procedures, i.e. in-house body procedures, shall only be undertaken by qualified personnel authorised by body, as stated on section 5 (Staff). In certain circumstances, e.g. for UT testing of austenitic steels or Inconel the person approving the procedures may need to have specific knowledge of the type of inspection.

The body shall maintain a list of all those considered competent to approve procedures or test/inspection instructions.

Approval of techniques, i.e. in-house body written instructions, shall only be undertaken by qualified personnel authorised by the body.

Where the body finds it necessary to produce written instructions or to describe non-standard test methods the guidance given in Appendix F should be followed.

For specific applications procedures may be developed which incorporate non standard inspection methods. Procedures developed in-house shall be validated and authorised before use. The body shall be able to provide objective evidence of the qualification/validation of the process. Design of the test should be such as to maximise the likelihood of detecting the defects of specific interest. When no defect description is available, it may be difficult to be confident that an inspection detects all potentially significant defects.

Developments in methodology and techniques may require procedures and techniques to be changed from time to time. Obsolete procedures and techniques shall be withdrawn but must be retained for archive purposes and clearly labelled as obsolete. Procedures and techniques must indicate the body's representative who authorised its use and from what date.

The body shall be aware of any limitations of general procedures based on national standards and shall declare and / or report such limitations to the client if the specified procedures have not been demonstrated to be able to achieve the required level of reliability expected by the client.

8. QUALITY ASSURANCE IN TESTS

(5.9 EN ISO/IEC 17025)

An accredited body must have quality control activities to assess testing/inspection competency. Quality assurance in tests must be done in accordance with the requirements of EN ISO/IEC 17025.

The scope of the facility's plan for such external competency assessment is complementary to the in-house competency assessment of personnel, which should be based on the use of test specimens with known defects.

Bodies must ensure that any test specimens used are adequately validated and where it is impractical to provide a suitable range of test specimens, for example due to the nature of testing undertaken, alternative arrangements may be considered. In such cases, items available for testing in the normal course of the facility's operations may be tested by the candidate to be assessed, under monitoring, and then subsequently re-tested by a person authorized by the body for this purpose. This has to be part of route internal quality control.

Each applicant or accredited body is required to participate in appropriate proficiency testing, as broad a range as practicable and available, considering the representativeness of major areas of test and different techniques.

9. RECORDS

(4.13 EN ISO/IEC 17025; 7.3 and 8.4 EN ISO/IEC 17020)

The retention period for all procedures, techniques and records shall be determined and documented to ensure that client and any regulatory requirements are met.

The records retained shall include sufficient information to enable the test/inspection to be repeated, if necessary using the same equipment.

Where operators use notebooks these must be controlled and retained as records by the body.

Documented records shall be maintained of all actions and decisions made during the course of the inspection process. These should typically include:

- contract review,
- change decisions,
- equipment records including servicing and repair,
- details of equipment used, process checks,
- calculations,
- location and detail of observed defects,
- copy of test report.

10. CONTRACT REVIEW

(4.4 EN ISO/IEC 17025; 7.1.5 EN ISO/IEC 17020)

Determining client requirements can be a long and tedious process. The process is assisted when the client provides a clear description of the range and type of defects which the inspection must detect including any test or acceptance criteria to be met. Those requiring the inspection should be encouraged to describe the defects to be detected specify the particular defect characteristics which must be measured and identify the acceptance criteria.

The contract review shall include as applicable:

- That the body has the necessary resources, equipment, qualified personnel to undertake the NDT work;
- Identification of the test/inspection method;
- Identification of any acceptance criteria;
- Any specific qualification requirements e.g. for non-standard test methods or high integrity testing;
- Any client approval requirements (particularly for non-standard methods);
- That the qualification and certification of NDT personnel is appropriate to the inspection to be carried out (This should include checking any limitations in the scope of competence certified and the resulting need for job specific training and authorisation);
- Any specific handling instructions for highly machined components;
- Any specific marking instructions, e.g. use of halogen free markers;
- Any specific reporting requirements including documentation requirements;
- Availability of drawings, inspection plans/programmes;
- Any specific quality control/monitoring arrangements;
- Client acceptance of any necessary sub-contracting.

Where activities on site are involved the review shall also include issues such as:

- Responsibility for removal of any cladding or coatings and preparation of the surface for testing;
- Access arrangements, working conditions and provision of stable working platforms;
- Hazards;
- Environmental requirements.

On completion of the review process the contractual responsibilities of both purchaser and supplier should be clear when contracts are placed.

11. INTERNAL AUDITS AND MANAGEMENT REVIEW

(4.14 and 4.15 EN ISO/IEC 17025; 8.6 and 8.5 EN ISO/IEC 17020)

Detailing particular aspects applicable to NDT which should to be examined during an internal audit is listed in Appendix G.

Management reviews should include NDT specific items such as suitability of personnel certification schemes and arrangements for managing site activities.

12. HANDLING OF ITEMS AND COMPONENTS

(5.8 EN ISO/IEC 17025; 7.2 EN ISO/IEC 17020)

Items to be tested/inspected shall be identified such that traceability is maintained throughout the examination process. Identification shall be such that the areas specifically examined, e.g. welded seams can be precisely identified against test/inspection results.

The method of identification shall not damage the item in question, e.g. halogen free markers may be needed for some components.

Methods for the identification and location of reportable defects and, where appropriate, for the segregation of defective components should be clearly defined and understood.

The status of the test item (e.g. *accepted*, *rejected*, *tested*, *not tested*) shall be clearly indicated at all times.

13. REPORTING

(5.10 EN ISO/IEC 17025; 7.4 EN ISO/IEC 17020)

Clear and accurate reporting is essential. Where results from sub-contracted tests are included these must be clearly identified.

Sampling is often involved as part of the inspection. Reports must indicate the sampling basis and identify when sampling has been carried out by anyone other than the accredited body.

Reports shall identify any factors which have prevented the inspection from being carried out as intended, e.g. restricted access, inadequate surface finish, surface temperature etc. Also, reports shall contain identification of the locations where the NDT testing has been applied.

Interpretation of test results against agreed acceptance standards and determination of conformity is normal practice and is routinely reported in the final report. This use of the word 'interpretation' is not to be confused with the concept of 'opinions and interpretations' used in EN ISO/IEC 17025.
Note: the clear requirements regarding reporting are stated in EN ISO/IEC 17025 and EN ISO/IEC 17020).

14. SUB-CONTRACTING OF TESTS

(4.5 EN ISO/IEC 17025; 6.3 EN ISO/IEC 17020)

The body itself shall normally perform all the tests that it contracts to undertake and for which it holds accreditation.
Note: Hiring personnel is not regarded as sub-contracting (see section dealing with staff).

In the case of a large contract, if the body finds it necessary to sub-contract tests for which it holds accreditation, it should perform the major portion of the test work.

Where by reason of a contract several testing bodies co-operate, the tasks of each body and their reporting hierarchy shall be clearly laid down and documented.

Whenever work is subcontracted the body shall:

(a) Obtain the agreement of the client where appropriate and

(b) Provide all necessary information, materials etc. to the sub-contractor.

The body shall maintain a record of its approved sub-contractors and details of the work carried out.

15. BIBLIOGRAPHY

Relevant list of documents at time of publication.

EN ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
EN ISO/IEC 17020	Conformity assessment - Requirements for the operation of various types of bodies performing inspection
EN ISO 9712	Non-destructive testing - Qualification and certification of personnel
ILAC P10:01	ILAC Policy on the Traceability of Measurement Results.

APPENDICES

The appendices A to E contain specific guidance on equipment calibration /function check and equipment calibration/ function check intervals for each of the test methods covered by this document.

These appendices assume that testing is to be carried out to a specified EN standard. Where an EN standard has not yet been published, other specifications may be used until the relevant EN standard is published. If clients require testing to be carried out to other specifications, then the requirements of those specifications should be met in full. In the absence of specific guidance, the requirements of this Appendix should be adopted.

The responsibility for determining these calibration intervals lies with the body carrying out the tests that shall ensure that they satisfy the requirement of the test specification and any specific client requirements. Inevitably different standards have slightly differing requirements. It is the responsibility of the body responsible for performing the inspection to ensure that the detailed requirements of those standards are met in full.

It is the responsibility of the body carrying out the inspection to ensure that the calibrations or function checks are carried out against the latest version of the appropriate standard unless specifically requested otherwise by the client. In both cases the requirements shall be met in full.

APPENDIX A

Radiographic Equipment ("RT-equipment") - calibration and calibration intervals

Focal characteristics shall be monitored for any significant changes.

The sensitivity of a radiograph shall be established by means of Image Quality Indicators (IQI) or penetrameters appropriate to the material and thickness. It is necessary to hold manufacturer's certificates of conformity for these IQIs. The condition of IQIs and penetrameters should be monitored and damaged devices withdrawn from use.

The type and location of the IQI or penetrometer shall be strictly in accordance with the requirements of the agreed standard or code.

Radiographic film processors should be maintained in accordance with the manufacturer's recommendations. Regular monitoring of the processor using pre-exposed film should take place to ensure the correct operation of the processor and to verify that any film classification system requirements are met.

The density of radiographs shall be ascertained using densitometers. The accuracy required determines whether analogue or digital readouts are needed.

Densitometers shall be calibrated at defined intervals against a reference density strip or set of gray filters of known (calibrated) densities. Hand-held densitometers should be zeroed each time they are used, against the level of background illumination on which they are to be used.

Regular checks to establish that the densitometer is still operating correctly and is in calibration shall be carried out between calibrations.

Reference film density strips shall be uniquely identified and traceable by certificate to a (inter)national standard of measurement and should carry a manufacturer's certificate which is less than five years old unless otherwise specified.

Working density strips should have the density of each step ascertained using a calibrated and certificated densitometer, and recorded either directly into the film or onto a card strip permanently attached to the film. The date of first calibration should be recorded on the strip. All working density strips which are more than three years old, or which have been subject to undue wear, should be taken out of use and destroyed. The strips have to have valid certificates.

Film density strips are subject to discolouring or fading and should be carefully maintained and stored.

Radiographic viewers and illuminators shall be periodically checked for intensity and evenness of illumination.

APPENDIX B

Ultrasonic Equipment ("UT-equipment") - calibration and calibration intervals

Ultrasonic calibration blocks shall be used to set up the assembly of probe and sensory electronics, each time the equipment is used. The blocks shall be manufactured in accordance with the appropriate specification.
All blocks shall be verified at specified intervals as follows:

- visual examination for deterioration such as corrosion or mechanical damage,
- radius and other dimensional checks using equipment traceable to national or international standards.

Where calibration blocks made from the material of the product under test are used for setting up, the final test report should indicate the calibration status of the test blocks. In all such cases the transmission velocity of the pulse through the block material should be measured and recorded, unless the body has alternative methods to demonstrate the traceability of the block.

The correct functioning of testing units, probes and connecting cables shall be checked at regular intervals; the results shall be documented. Verification shall be against the controlling specifications.

Ultrasonic test sets shall be verified weekly or each time the equipment is used including:

- linearity of time base,
- linearity of equipment gain,
- sensitivity and signal to noise ratio,
- pulse duration.

The performance characteristics of ultrasonic probes and the systems should be checked at least once per day or before use:

- probe index,
- probe beam angle,
- visual checks for damage.

Ultrasonic flaw detectors shall be verified at intervals not exceeding twelve months in accordance with the controlling specification, including:

- linearity of time base,
- linearity of amplifier and
- accuracy of calibrated attenuator.

The calibration of reference measuring equipment used for in-house calibration shall be traceable to (inter)national standards and shall be evidenced by a certificate, issued by a body in accordance with the ILAC P10 policy.

Testing units, probes and connecting cables should be carefully stored. Reference blocks, control specimens and calibration blocks should be stored in such a way as to prevent corrosion occurring.

Where automated test equipment is used, special attention shall be paid to the qualifications and training of operators, the system for the identification of defects, and data storage. Checks

should be made to ensure the correct geometric position of the probe in relation to the output signal.

APPENDIX C

Magnetic Particle equipment - calibration and calibration intervals

The solids content of bulk magnetic inks should be checked by a method specified in the controlling standard. In the case of aerosols, certificates of conformity shall be obtained from the manufacturer for each batch.
Note: EN ISO 9934-2 (Non-destructive testing – Magnetic particle testing – Part 2: Detection media) determines in service tests of aerosol material.

When using fluorescent inks and powders:

(a) the intensity of UV(A) light at the test surface shall be checked as frequently as necessary to monitor possible deterioration of the illumination. (Where grimy, dusty or other contaminating environments are involved, checking shall be carried out each time the equipment is used.) These checks require the use of a UV (A) light meter.
(b) the ambient white light level shall be checked at least once every three months where illumination is controlled on a long term basis, and should be checked each time the equipment is used in situations where illumination may vary from test to test (e.g. in daylight conditions). These checks require the use of a white light meter.

When using non-fluorescent inks and powders, the level of illumination at the inspection surface should be checked at regular intervals where illumination is by artificial means, and should be checked each time the equipment is used where daylight illumination is employed. These checks require the use of a white light meter.

The apparatus and ancillary equipment shall be checked at regular intervals.

The strength of permanent magnets and magnetic yokes shall be checked at regular intervals. Tangential field strength has to be measured with tangential filed meters.

Flux indicators should be used to demonstrate the direction of flux. Traceability is not required.

Tests to check the sensitivity of the indications looked for should be carried out using suitable test pieces.

APPENDIX D

Liquid Penetrant Equipment - calibration and calibration intervals

The penetrant shall be suitable for the intended application and meet the requirements of EN ISO 3452-2 *(Non-destructive testing – Penetrant testing – Part 2: Testing of penetrant materials)*. A specific statement by the manufacturer is required, but this may be in the form of a letter, certificate, technical leaflet, or may be included in the labelling of the product.

When undertaking fluorescent penetrant examination, the intensity of UV (A) light illumination at the inspection surface shall be checked as frequently as necessary to monitor possible deterioration of the illumination. (Where grimy, dusty or other contaminating environments are involved, checking should be carried out each time the equipment is used). These checks require the use of a UV (A) light meter.

When non-fluorescent (i.e. colour contrast) penetrant examination is carried out, the intensity of illumination at the inspection surface shall be checked at least once every three months where illumination is controlled on a long term basis, and should be checked each time the equipment is used in situations where illumination may be variable from test to test (e.g. in daylight conditions). These checks require the use of a white light meter.

Standard flaw test pieces should be used to check the process. The use of test pieces is not normally specified for portable test kits.

The temperatures of baths and water washes should be monitored. Where the temperature of the test item is close to specification limits then the temperature of that item should be measured.

The pressure of water washes and compressed air blow-offs should be measured where values are specified in testing standards or procedures.

APPENDIX E

Eddy Current Equipment - calibration and calibration intervals

A list of all reference blocks, control specimens, reference pieces and calibration blocks should be kept with details of the main characteristics: (e.g. material, conductivity, manufacture, heat treatment).

For portable equipment, a reference 'sensitivity block', dimensionally certified by the manufacturer for dimensional (including surface roughness) and material properties (such as alloy, heat treatment, electrical conductivity permeability) should normally be used for checking the response of the equipment to known flaws. For specialised applications, such as tube testing, reference standards should be prepared from material of the same alloy and nominal dimensions as the product to be tested. The dimensions of holes or notches and the thickness of the calibration piece shall be certified by the manufacturer or established in-house by means which are traceable to national standards. Wear on the testing face may reduce the thickness of the sensitivity block or calibration piece and hence the slot depth.

For automatic eddy current testing of tubes, reference standards should be prepared from material of the same alloy and nominal dimensions as the tube to be tested. The dimensions of holes or notches and the thickness of the calibration piece shall be certified by the manufacturer or established in-house by means which are traceable to (inter)national standards. Wear on the testing face may reduce the thickness of the sensitivity block or calibration piece and hence the slot depth.

Where eddy current examination is used for sorting of materials or products, reference test standards shall be prepared from the same material, heat treatment and nominal dimensions as the materials or products to be tested.

Reference test standards shall be carefully maintained and shall not be used as working standards.

The calibration of reference measuring equipment used for in-house calibration shall be *traceable to (inter)national standards and shall be evidenced by* certificate *issued by* body in accordance with the ILAC P10 policy.

Testing units, probes and connecting cables should be carefully stored. Reference blocks, control specimens and calibration blocks should be stored to prevent corrosion occurring, mechanical damage, high temperature and, if appropriate, accidental magnetization.

Where automated test equipment is used, special attention shall be paid to the qualifications and training of operators, the system for the identification of defects, and data storage. Checks should be made to ensure the correct geometric position of the probe in relation to the output signal.

APPENDIX F

Test procedures

Test procedures should contain, or refer to, other documents containing the following, and supplemented by any further information necessary to fully specify the test:

(a) Title, unique reference number, issue or revision status and date of issue;
(b) Unique identification of organisation producing the procedure;
(c) On each page, the page number, the total number of pages in the procedure and the unique reference number;
(d) Preparation and approval signature, such that the author and the Approval authority can be readily identified;
(e) Scope of the procedure, giving precise description of the range of applicability (e.g. range of diameters and thickness);
(f) Reference test procedure (contractual) and/or European or national standard specifications on which the procedure is based and its issue/revision status; work instructions should reference the controlling procedure;
(g) Terms and definitions used within the procedure and/or reference to a document defining such terms;
(h) Equipment to be utilised, including consumables, complying with relevant specification requirements;
(i) Calibration, function check and maintenance requirements, or reference to procedures controlling these activities;
(j) Personnel qualifications and/or certification needed for performance of test work/evaluation of results, complying with any specification requirements;
(k) Surface condition required prior to commencing test;
(l) Environmental conditions required, where applicable;
(m) Requirements for identification of test items (by reference to a general test procedure, if applicable);
(n) Test method, defining precisely how the test is to be performed, including method of establishment of appropriate datum levels;
(o) Criteria for recording and reporting the results;
(p) Acceptance standards, where specified;
(q) Requirements for segregation or identification of samples according to status (by reference to general test procedure if applicable);
(r) Reporting methods, detailing all aspects that are required to be included in the Test Report (whether specified in the accreditation standard or the test standard) with provision for the operator to report any limitation of access or sampling encountered during the test.

APPENDIX G

Internal audit may include but not be limited to the points below:

Staff

- Appropriateness of staff certification/ qualification / authorisation.
- Relevant certification and eyesight checks are current.
- Training records and competencies are being maintained up to date.
- Tests are only carried out by authorised personnel.
- Observation of staff carrying out NDT is made, at least on site.

Contract Review

- Effectively carried out.
- Includes all relevant factors.
- Client is involved where necessary.
- Specific responsibilities particularly relating to site work, such as access, surface preparation, are fully dealt with.

Equipment

- The equipment in use is suited to its purpose.
- Equipment is correctly maintained and records of this maintenance are kept.
- Traceable equipment, e.g. UT sets and blocks, densitometers, etc. are calibrated, and the appropriate calibration certificates demonstrating traceability to (inter)national standards are available.
- Calibrated equipment is appropriately labelled or otherwise identified.
- Only body controlled equipment is being used.
- Instrument calibration procedures are documented and records of calibration are satisfactorily maintained.
- Appropriate instructions for use of equipment are available.
- Instrument performance checks show that performance is within specification.

Procedures and techniques

- Procedures and techniques are adequately documented and appropriately validated if necessary.
- Alterations to procedures and techniques are appropriately authorised.
- Current versions of the procedure/technique are available and being used by the operator.

Quality Control

- Where control checks are used, data has been recorded and performance has been maintained within acceptable criteria.
- The results of interlaboratory comparisons or proficiency tests.

Goods Handling

- Samples are adequately identified and housed.
- Reject and/or defective areas are adequately marked.
- The method of marking shall not inversely affect its usability.

Records

- Notebooks/worksheets include the date of test, operator, test procedure, test item details, test observations, all rough calculations and other relevant data.
- Notebooks/worksheets are adequately completed; mistakes are crossed out and not erased.
- Control and function check are documented.
- Where a mistake is corrected the alteration is signed by the person making the correction.
- The body's procedures for checking data transfers and calculations are being complied with.
- Records are readily retrievable.

Test reports

- The report meets the requirements of accreditation standard, the method and any additional requirements specified by the client or national/international standard.
- The test location is clearly identified and component identification is unambiguously defined.
- Test specifications and acceptance criteria are fully specified.
- Where sampling is involved this is clearly identified.

Miscellaneous

- There are documented procedures in operation for handling queries and complaints and system failures.
- The Quality Manual is up-to-date and is accessible to all relevant staff.
- Copies of up to date national international standards are accessible.
- There are documented procedures for sub-contracting work.