



ACCREDITATION SCHEME FOR LABORATORIES

Technical Notes NDT 001
Specific Requirements for Non-
Destructive Testing Laboratories

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1. Introduction

- 1.1 This document describes the specific requirements to be complied by non-destructive testing (NDT) laboratories before they can be accredited or maintain accreditation.
- 1.2 This document shall be studied in conjunction with the standard ISO/IEC 17025 - General Requirement for the Competence of Testing and Calibration Laboratories and other NDT Series Technical Notes (NDT 002 & NDT 003) published by SAC.

2. Background

- 2.1 The field of non-destructive testing covers examination of materials, weldments, components and assemblies by means of the following techniques:
 - Radiographic Testing (RT)
 - Ultrasonic Testing including Thickness Gauging (UT)
 - Time of Flight Diffraction (TOFD)
 - Phased Array Ultrasonic Testing (PAUT)
 - Magnetic Particle Testing (MT)
 - Penetrant Testing (PT)
 - Eddy Current Testing (ET)
 - Visual Testing (VT)
 - Positive Material Identification (PMI)
 - Infrared Testing (IT)
 - Magnetic Flux Leakage
 - Other NDT methods
- 2.2 The tests are generally carried out at sites, in client workshops and in laboratories for assessment of quality of material, weldments, components and assemblies and/or examination to determine internal construction and dimensions.

3. Personnel

- 3.1 It is recognized that the standard of performance of a non-destructive testing service depends on the capabilities of the staff responsible for and performing the testing. SAC assessments of NDT laboratories therefore stress heavily on appraisal of staff.
- 3.2 Guidelines for the recognition of NDT personnel qualification for SAC assessments of NDT laboratories are given in Technical Note: NDT-002.
- 3.3 The laboratory shall use personnel who are employed by, or under contract to, the laboratory. Where contracted and additional technical and key support personnel are used, the laboratory shall ensure that such personnel are supervised and competent and that they work in accordance with the

laboratory's quality system (ISO/IEC 17025).

3.4 Staff Structure

3.4.1 Non-destructive testing staff may be classified into three categories:

- a) persons exercising technical control - those who are responsible for control and supervision of non-destructive tests.
- b) persons who, under direction, can take responsibility for performance of routine tests
- c) assistants who perform routine technical and non-technical duties, working under close supervision.

3.4.2 Persons exercising technical control shall have the competence, authority and time for effective control of non-destructive testing operations that they are responsible. They are expected to have

- a) NDT personnel certification as per Technical Note: NDT-002
- b) sound knowledge of, and experience in the use of, applicable non-destructive testing techniques
- c) knowledge of relevant materials, manufacturing processes and service conditions
- d) experience and ability to interpret and evaluate test data
- e) experience in the use of relevant codes, standards and specifications and ability to prescribe suitable procedures in the absence of appropriate codes, standards and specifications.
- f) ability to prepare routine and critical reports
- g) ability to control quality of performance of non-destructive tests
- h) relevant tertiary qualification
- i) adequate training and experience in non-destructive testing

A person without tertiary qualification may be considered acceptable to exercise technical control if the other attributes above are satisfied, together with compensating practical experience.

3.4.3 Persons responsible for specific routine tests are expected to have at least:

- a) NDT personnel certification as per Technical Note: NDT-002)

- b) experience in performance of applicable non-destructive test
 - c) experience in the use of relevant codes, standards and specifications and ability to apply appropriate codes, standards and specifications to the requirements of specific projects
 - d) experience and ability to interpret test data
 - e) ability to maintain job records and prepares routine reports
 - f) knowledge and experience that enables them to understand the reasons for and purposes of the operations for which they are responsible
 - g) relevant training in specialised equipment used for the non-destructive test methods.
- 3.4.4 Assistants should have knowledge and experience commensurate with the duties that they are required to perform.

3.5 Vision

- 3.5.1 The laboratory shall ensure adequacy of the natural or corrected vision of staff responsible for viewing non-destructive testing indications.
- 3.5.2 As a guide, an examination shall assure near-distance acuity in at least one eye such that the staff is capable of reading a minimum of Jaeger No. 1/Times Roman 4.5 or equivalent type and size letters at a distance of not less than 300 mm, corrected or uncorrected on a standard Jaeger test chart.
- 3.5.3 The examination shall also demonstrate the capability of the staff to distinguish and differentiate contrast between colours used in NDT methods.
- 3.5.4 Vision examinations shall be administered annually in accordance with a procedure, and by personnel, approved by an NDT Level III designated by the employer, or responsible agency.
- 3.5.5 All vision examination results shall be recorded and maintained in the laboratory.

3.6 Approved Signatories

- 3.6.1 Nominated signatories are to be proposed before the assessment and interviews will be conducted before or during the assessment. These nominees shall be full time employees and shall have worked in the NDT laboratory for at least 12 months.
- 3.6.2 When non-destructive testing is performed at site and on-the-spot reports are required, the officer in charge at site shall be an approved signatory of SAC accredited test reports.

3.6.3 The nominees for Approved Signatories should be those certified to Level II or Level III by any independent certification bodies as listed in paragraph 2.2 of technical note NDT-002 except for Positive Material Identification (PMI) and X-ray Diffraction (XRD).

4. Measurement Uncertainty

4.1 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 item under test together with the shape and acuity of the defect.

4.2 NDT methods involve an element of subjective judgement. It is therefore, required to identify components that contribute to measurement uncertainty for the different methods covered in this document, unless it is clearly stated by a testing standard or specification.

5. Equipment

5.1 Radiographic Testing

5.1.1 X-ray equipment and radioactive sources shall be suitable for the materials to be examined. They shall cover the expected thickness range and the shape, nature and location of items likely to be submitted for examination. Required accessories such as image quality indicators and intensifying screens shall be provided. A calibrated densitometer or step wedge comparison film shall be available for measurement of film density.

5.1.2 Facilities for processing films at a consistently high level of quality shall be available. They shall be adequate for the number of films to be processed. Procedures shall be followed which ensure that processing remains satisfactory.

5.1.3 Facilities shall be available for viewing radiographs under optimum conditions of illumination. Viewing facilities shall be located where operators are free from disturbance.

5.1.4 Equipment, processing facilities and films shall be checked for performance in accordance with relevant standards, codes or specification being used. Records of such checks shall be kept.

5.1.5 The following shall be adhered in accordance with regulatory requirements:

- a) Disposal of chemicals shall be controlled and monitored to prevent environmental contamination.
- b) A documented programme for monitoring personnel doing radiography tests.
- c) Procedures for the transportation of radioactive source materials

- 5.1.8 Where digital radiographic equipment is used, the laboratory shall ensure that the computerised results are Digital Imaging and Communication in Non-destructive examination (DICONDE) compliant (reference to ASTM E 2339)

5.2 Ultrasonic Testing

- 5.2.1 Ultrasonic equipment of appropriate sensitivity and resolution for each application shall be available.
- 5.2.2 All NDT laboratories shall possess and maintain the equipment listed in Table 1 of NDT-003. The calibration and performance checks in accordance with relevant standards, codes and specification for these equipment shall be carried out and documented.

5.3 Phased Array Ultrasonic Testing (PAUT)

- 5.3.1 Equipment of appropriate sensitivity and resolution and relevant qualification blocks for each application shall be available.

The examination using PAUT shall be performed in accordance with a written procedure and it shall have been demonstrated to perform acceptably on a qualification block.

- 5.3.2 All NDT laboratories shall possess and maintain the equipment listed in Table 1 of NDT- 003. The calibration and performance checks in accordance with relevant standards, codes and specification for these equipment shall be carried out and documented.

5.4 Time of Flight Diffraction Testing (TOFD)

- 5.4.1 Equipment of appropriate sensitivity and resolution and demonstration blocks shall be available.

The examination using TOFD shall be performed in accordance with a written procedure and it shall have been demonstrated to perform acceptably on a demonstration block.

- 5.4.2 All NDT laboratories shall possess and maintain the equipment listed in Table 1 of NDT- 003. The calibration and performance checks in accordance with relevant standards, codes and specification for these equipment shall be carried out and documented.

5.5 Magnetic Particle and Penetrant Testing

- 5.5.1 The performance of equipment and materials for magnetic particle and penetrant testing shall be checked periodically for compliance with the testing standards in use.

- 5.5.2 The pole spacing of electromagnetic and permanent yokes should be checked for compliance with relevant standards, codes and specification. Some method of field adequacy and direction measurement shall be available for use during testing with magnetic flow systems.
- 5.5.3 Magnetic particle solution concentrations shall be checked regularly using a centrifuge tube, where applicable.
- 5.5.4 Where UV enhancement is used, the UV source output shall be checked at intervals required by the relevant codes in use, with a calibrated UV light meter.
- 5.5.5 A standard test panel is recommended for verification of dyes used for penetrant testing.

5.6 Magnetic Flux Leakage Testing

- 5.6.1 Equipment of appropriate sensitivity and resolution for each application shall be available.
- 5.6.2 All NDT laboratories shall possess and maintain the equipment listed in Table 1 of NDT-003. The calibration and performance checks in accordance with relevant standards, codes and specifications for these equipment shall be carried out and documented.

5.7 Eddy Current Testing

- 5.7.1 Equipment of appropriate sensitivity and resolution for each application shall be available.
- 5.7.2 All NDT laboratories shall possess and maintain the equipment listed in Table 1 of NDT-003. The calibration and performance checks in accordance with relevant standards, codes and specification for these equipment shall be carried out and documented.
- 5.7.3 Any change in the probe, extension cables, eddy current instruments, recording media or any parts of the equipment shall require recalibration.

5.8 Positive Material Identification

- 5.8.1 Only X-Ray Fluorescence and Optical Emission Spectroscopy are applicable for accreditation under non-destructive testing field.
- 5.8.2 The basic reference samples shall be obtainable from an equipment manufacturer. Where reference samples are not available from the manufacturer an accredited test certificate/report on the composition of the test samples can be used.
- 5.8.3 NDT laboratories shall comply with relevant regulatory requirements.

5.9 Visual Testing

- 5.9.1 All equipment used in visual testing such as welding gauges, measuring tools, replicas and templates shall be given an initial check for gross errors before being placed in service. Subsequent periodic checks shall be undertaken to check for damage and wear. Records of all checks shall be maintained.
- 5.9.2 When the use of a pit gauge is required, a zero check on the gauge shall be undertaken prior to each use.
- 5.9.3 Visual aids used for remote visual testing shall have a resolution capability at least equivalent to that obtainable by direct visual testing.
- 5.9.4 Adequate illumination of the test site shall be provided for each inspection. An appropriate light source of at least 1000 lux at the area of interest shall be available.

6. Records System

- 6.1 The laboratory shall keep complete records of all work undertaken and all discontinuities found for each job performed.
- 6.2. Adequate identification shall be given to welds or components prior to testing and shall be included in the test report with reference to drawing numbers, sketches, etc.
- 6.3 In situations where there are limitations to access, a written confirmation shall be obtained from the client prior to commencement of testing and shall be documented.

6.4 Digital Records

- 6.4.1 Digital Records are to be kept in easily retrievable format. These records are to be kept in such manner as to prevent tampering.
- 6.4.2 Procedures shall be available for retention, storage and issuance of the Digital Records.

6.5 Radiographs

- 6.5.1 Unless specifically requested by the client, a laboratory shall retain all radiographs. Where it is necessary for clients to receive radiographs, the laboratory shall keep records of traceability of the radiographs, which will adequately allow them to be retrieved wherever possible.

7. Laboratory Practices

7.1 General Requirements

- 7.1.1 Health, Safety and Environmental practices, where applicable, shall be

documented for each NDT technique.

7.1.2 The quality of non-destructive testing depends largely on the knowledge and experience of the person performing the work. SAC accredited test report shall be signed by approved signatory for the respective accredited technique with recognised qualification (see NDT-002) for the relevant technique.

7.1.3 Laboratory shall have monitoring procedures in place to assess the technical performance of each NDT Staff at least once a year.

The monitoring procedures shall include periodic visits to workplaces. The frequency of visits shall be appropriate to the work scope. Records of these visits shall be maintained in the laboratory.

7.1.4 Laboratory shall prepare written procedures for all non-destructive methods. All written procedures shall be approved by the company's NDT level III staff.

7.2 Radiographic Testing

7.2.1 Laboratory shall be routinely audited both for radiographic quality and for accuracy of interpretation on a regular basis.

7.2.2 Check viewing shall become part of a laboratory's internal audit system, with such audits undertaken by the appropriate approved signatory every 6 months. As with any audits undertaken in a laboratory, records of the check viewing shall be maintained.

Note:

As a general guide, the extent of check viewing considered reasonable for audit purposes would be 2% for repetitive work where the procedures are qualified and documented (e.g. pipeline projects) and 20% for general jobbing work and other work not covered by qualified procedures.

7.2.4 Compliance or otherwise of each radiographic exposure with sensitivity requirement shall be recorded. The sensitivity achieved in each exposure outside the specified range shall be recorded and reported, but if all exposures are within the specified range, it is sufficient to note this in the report.

7.3 Visual Testing

7.3.1 Tests covered by visual testing include direct visual examination and remote visual testing using such aids as mirrors, telescopes, borescopes, magnifying glasses, fibre optics and camera systems.

7.3.2 Visual testing shall be carried out in accordance with written procedures. Such procedures could be provided through codes and specifications, contract documents, or documents provided by the inspection service. The documentation used shall adequately identify:

- a) areas to be inspected and features required to be observed
- b) methods of surface preparation
- c) inspection procedure
- d) acceptance/rejection criteria (where relevant)
- e) equipment to be used, including visual aids, and where applicable, the measuring accuracy required
- f) terminology to be used for recording and reporting
- g) recording and reporting procedures (SAC endorsement does not cover subjective statements of opinion. Results should therefore be reported as conform/non-conform, in accordance with applicable standard, code and/or specification.

7.3.3 Visual testing shall be carried out by staff holding signatory approval for the relevant test. The above requirement may only be waived in cases where a permanent image is available for viewing by the signatory at a later stage.

8. Guidelines for Site Laboratory

8.1 Laboratory shall inform SAC whenever they engage in a contract involving the use of a site laboratory or establish an annexed laboratory. Site laboratories shall seek accreditation if they wish to issue accredited reports. The accreditation shall serve for the duration of the project.

8.2 Definitions

8.2.1 Site laboratories

A site laboratory is defined as a testing facility, established at a different location from the permanent facility, to service a project and from which interim or final reports will be issued. Site laboratories are in most cases temporary laboratories.

A site laboratory has separate staff (where possible) and separate equipment from the permanent facility, but has a records system, which is completely compatible with that of the permanent facility. Site operations for a period not exceeding two months are considered to be routine testing operations of the base testing service.

8.3 Accreditation of Site Laboratory

8.3.1 When a testing laboratory operating an accredited laboratory establishes a site laboratory, the following information shall be provided to SAC prior to commencement of testing:

- a) location of the laboratory
 - b) expected period of operation of the laboratory
 - c) nature of the work of the laboratory - type of project
 - d) volume and type of testing work
 - e) staffing of the laboratory including the arrangements for direction and supervision of staff
 - f) the major test equipment items in the laboratory, and the nature of the housing provided.
- 8.3.2 On receipt of this information, it will be decided whether an assessment of the laboratory will be conducted.

8.4 Staff of Site Laboratory

- 8.4.1 Adequate technical control and conditions shall be exercised over site operations.
- 8.4.2 In defining these conditions, particular emphasis is placed on:
- a) whether the person exercising technical control must be resident
 - b) whether specific officers must approve new test procedures before reports are issued
 - c) minimum frequency of supervisory visits by non-resident persons exercising technical control
 - d) the proportion or types of reports which must be checked and initialed by non-resident persons exercising technical control.
- 8.4.3 When the person exercising technical control is not resident, adequate records of his supervisory visits shall be maintained, including dates of visits and a list of procedures and reports he has checked and countersigned