



Standards

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1. INTRODUCTION

Non-destructive testing on Eskom plant may be undertaken: 1) During construction, 2) During repair and replacement activities, 3) During in-service and outage activities and 4) During investigative or failure analysis activities.

The four categories listed above are maintained and delineated in this Standard for simplicity reasons. It is recognised, however, that the categories listed may not be all encompassing and in such cases the responsible engineer should use judgement to decide which category represents the nearest fit to the situation at hand.

2. SUPPORTING CLAUSES

2.1 SCOPE

This standard is applicable when any NDT activity is undertaken on Eskom plant.

2.1.1 Purpose

This standard details the NDT requirements when such activities are undertaken on Eskom plant.

2.1.2 Applicability

This standard shall apply throughout Eskom Holdings Limited, its divisions and subsidiaries.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this standard shall apply the most recent edition of the documents listed below:

2.2.1 Normative

SABS ISO 9712: Non-destructive testing-Qualification and certification of personnel.

EST 32-631: Eskom approval of personnel performing quality related special processes on Eskom plant.

GGG1323: Eskom Qualification Requirements for non-destructive testing.

2.2.2 Informative

- 1) SABS ISO 9001: *Quality management systems-Requirements.*

2.3 DEFINITIONS

Non Destructive Testing broadly; those methods for which NDT certification can be gained in accordance with the requirements of ISO 9712 or similar.

NDT Level III the person authorised by the NDT supplier who is approved in accordance with the requirements of EST 32-631 and has overall responsibility for the NDT activity and the personnel falling under his control.

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NDT Supervisor the level II or III given the responsibility for technical supervision of other NDT operators and who is approved in accordance with the requirements of EST 32-631. (Non technical supervisors are not considered in this Standard)

Procedure: a document detailing a series of mandatory and sequential steps that delivers a specific outcome and provides requirements when an outcome cannot be met. Specific technique sheets are developed from the requirements specified in authorised procedure.

Technique sheet: a document, or written work instruction, which details specific instructions on the use of apparatus, equipment, areas of test, reporting criteria and any other information which is necessary to provide the required output.

Authorised: Written confirmation by the employer attesting that qualified and certified NDT personnel or NDT procedures or NDT results meet the employer's quality standards for NDT. Written confirmation can be by way of counter-signature in the example of NDT procedures.

Approved: Written confirmation by Eskom that NDT personnel or NDT procedures or NDT process (as appropriate) are approved for use on Eskom plant.

Radiation Protection Officer: In accordance with the GOVERNMENT GAZETTE, 26 FEBRUARY 1993 No. 14596, HAZARDOUS SUBSTANCES ACT, 1973(ACT No. 15 OF 1973) A person appointed as such in terms of Regulation 6 and having the necessary knowledge and experience appointed to accept, on behalf of the NDT supplier (holder of the authority), the responsibility for the safe use of all radioactive material under the holder's control and to observe any statutory requirements in connection with the use of radioactive material.

2.4 ABBREVIATIONS

Abbreviation	Description
GBE:	Generation Business Engineering
CSD:	Corporate Services Division
S&I:	Sustainability & Innovation
R&I:	Resources and Integrity
NDT:	Non-Destructive Testing
ISO:	International Organization for Standardization
DAC:	Distance Amplitude Correction
EN	European Norm
SABS	South African bureau of Standards
RPO	Radiation Protection Officer
UT	Ultrasonic Testing
MT	Magnetic Testing
PT	Penetrant Testing
RT	Radiographic Testing
ET	Eddy Current Testing

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2.5 ROLES AND RESPONSIBILITIES (NDT)

2.5.1 NDT Level III

The NDT Level III shall be qualified, certified and authorised in the applicable method and shall provide advice to NDT Supervisors and NDT operator as needed.

The NDT Level III shall ensure that:

- a) The NDT personnel within their area of responsibility are suitably authorised.
- b) The NDT procedures are authorised by counter signature of the responsible level III.
- c) Specific technique sheets are developed from authorised procedures are authorised by counter signature by the responsible level III.
- d) Technique sheets exist and are available for all items to be inspected.

2.5.2 NDT Supervisor

The NDT supervisor shall be authorised to at least Level II in the applicable method and shall provide advice to the NDT operator as needed.

The NDT supervisor shall ensure that:

- a) The NDT operator is suitably qualified and certified.
- b) The specific technique sheet is authorised.
- c) The technique sheet is applicable for the particular item being inspected.
- d) The inspection is conducted in accordance with the technique sheet.
- e) NDT data is recorded as required by the technique sheet
- f) All inspection anomalies, limitations, and NDT indications are fully recorded.
- g) Ensure direct supervision of level I personnel.

2.5.3 NDT Operator

The NDT operator shall be qualified, certified and authorised to at least Level I in the applicable method and shall seek advice from the NDT Supervisor as, and when, needed.

The NDT operator shall ensure that:

- a) They possess and understand the applicable technique sheet.
- b) The inspection is conducted in accordance with the applicable technique sheet
- c) The NDT is performed, and all NDT data is recorded, in accordance with the technique sheet.
- d) The NDT report is forwarded to the NDT supervisor without undue delay.

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2.6 PROCESS FOR MONITORING

The control and monitoring of NDT activities performed on Eskom plant in accordance with the requirements of this standard shall be the responsibility of the NDT supplier. The suppliers NDT Level III bears ultimate responsibility for all technical aspects of the NDT thus performed.

2.7 RELATED/SUPPORTING DOCUMENTS

- This standard supersedes EST 0009 Rev 0

3. SPECIFIC REQUIREMENTS

3.1 NDT DURING CONSTRUCTION ACTIVITIES:

- a) All NDT undertaken during construction activities shall be with respect to an agreed construction code and acceptance standard.
- b) All NDT shall be undertaken in accordance with written and authorised NDT procedures which comply with the requirements of the construction code. Authorised item specific technique sheets shall be developed from such procedures.
- c) All NDT results shall be compared to an agreed Acceptance Standard. Acceptance Standards such as "to be agreed at time of test" are not permissible.

3.2 NDT DURING REPAIR AND REPLACEMENT ACTIVITIES:

- a) Where NDT is undertaken during a repair or replacement activity to restore a plant item to an original construction condition then this shall be with respect to the agreed/original construction code and acceptance standard.
- b) All NDT shall be undertaken in accordance with written and authorised NDT procedures which comply with the requirements of the construction code. Authorised item specific technique sheets shall be developed from such procedures.
- c) All NDT shall be undertaken in accordance with written and authorised NDT procedures. Authorised item specific technique sheets shall be developed from such procedures.
- d) Where a repair or replacement activity is undertaken to restore a plant item to a condition different to the original construction or as part of a modification not envisaged by the original construction code an agreed code shall be adopted or one shall be written.

Notes applicable to Sections 3.1 and 3.2:

Construction codes and Acceptance Standards may be internationally published such as ASME VIII, or may be those developed by a particular OEM for a specialised plant component, for example a steam turbine rotor, or may be those written by Eskom.

In any event, an agreed and written criterion for the conduct of NDT and the acceptance of a particular plant item shall exist between the manufacturer, NDT supplier and Eskom prior to

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inspection. Advice on the use of codes and standards for NDT can be sought from the Eskom CSD NDT Level III.

Where an item has historical monitoring criteria this may form the basis for future inspections.

3.3 NDT DURING IN-SERVICE AND OUTAGE ACTIVITIES

3.3.1 In-service inspection in accordance with Codes and Standards

NDT undertaken during in-service or outage activities is rarely undertaken with respect to published codes and standards. One notable exception is the in-service inspection of nuclear plant and in such cases (and similar) the principles in Section 3.1 shall be followed.

3.3.2 In-service inspection Where No Codes and Standards Exist.

- a) Where no suitable codes and standards exist Eskom will specify in writing;
- The items to be inspected.
 - The nature of the NDT to be performed.
 - The NDT reporting criteria.
- b) The provisions listed in Section 3.3.2 (a) above will be determined by Eskom material specialists, metallurgists, systems engineers, NDT specialists or in conjunction with OEM specialists and from operating experiences prior to awarding of contract.
- c) The NDT supplier, or Eskom, may develop written and authorised NDT procedures which are suited to deliver the desired inspection solution in light of Section 3.3.2 (a) above. In all such cases the NDT procedures shall be approved in writing by the Eskom CSD NDT level III **prior** to inspection.

3.4 NDT DURING INVESTIGATIVE OR FAILURE ANALYSIS ACTIVITIES

- a) NDT during investigative or failure analysis will normally be specific and different on each occasion. The necessity for inspection will be driven by the Engineering need and hence detailed prescription in this standard is inappropriate.
- b) For investigative and failure analysis the principles in Section 3.3.2 may be used. Eskom requirements and the NDT supplier's scope of work shall be documented in writing and jointly reviewed both parties. Additionally work as a result of review will be additionally documented by the respective parties. For such work advice can be sought from the Eskom CSD NDT level III.
- c) The NDT supplier shall obtain Eskom approval from the CSD NDT level III in writing for the NDT processes and procedures to be used for the scope of work to be undertaken. The conclusions drawn from inspection are to be discussed with the Eskom CSD NDT level III prior to implementation of any recommendations.
- d) All relevant documents, NDT procedures, NDT results, supporting documents etc shall be compiled into one file and shall be submitted to the responsible Eskom representative.
- e) The requirement for operator certification and authorisation in accordance with 32-631 extends to NDT undertaken during investigative and failure analysis activities.

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3.5 PREREQUISITIES FOR NDT WITHIN ESKOM

3.5.1.1 If any requirements of this standard cannot be met, the NDT supplier or Eskom engineer shall contact the Eskom CSD NDT level III for resolution prior to commencement of the inspection.

3.5.1.2 When NDT is undertaken the following shall apply:

- a) Where choices are given in codes and standards and the choice is subject to agreement between the contracting parties then as a general principle the more conservative option shall be adopted. For example, if the recording criteria choice for UT indications is given as either 20% DAC or 50% DAC then the former shall be used.
- b) When allowed by codes and standards, repairs as a result of NDT are only permitted with the express agreement of the suppliers NDT Level III. When NDT is undertaken as part of investigation no repairs are permitted without the written consent of Eskom.
- c) An authorised NDT written report shall be generated for each item inspected and the original signed report together with relevant supporting documentation, eg. radiographs, ET strip charts, electronic calibration files etc shall be submitted to the responsible Eskom representative.
- d) Unless specified otherwise in applicable codes and standards UT indications originating from geometric features shall be recorded at least once, per item, at the maximum amplitude location and where possible from both sides of the indication.
- e) For UT thicknesses measurements below 3 mm a 10 MHz transducer with an "A" scan display shall be used regardless of digital wall thickness meter readings.
- f) RT safety requirements shall be adhered to at all times. The NDT supplier's RPO and NDT Level III shall be held accountable by Eskom for RT safety aspects.
- g) Minimising personnel exposure to radiation following ALARA principles shall be enforced by the NDT supplier.
- h) The use of computerized RT imaging and viewing techniques (eg. digital radiography) may be used when permitted by codes and standards.
- i) PT dwell and development times shall be commensurate with the sought flaw. When in-service flaws such as stress corrosion cracking or creep fatigue are suspected the specific technique sheet shall specify commensurate dwell times.
- j) MT magnetisation shall be commensurate with the sought flaw. When in-service flaws such as hydrogen cracking or creep fatigue etc are suspected the specific technique sheet shall specify commensurate magnetising times.
- k) ET probe centralization is mandatory for tubing inspections when conducted from the ID surface of the tube.
- l) An minimum fill factor of 80% for the ET probe is mandatory for tubing inspections when conducted from the ID surface of the tube.
- m) ET indications shall be evaluated and reported, using combinations of signal amplitude, frequency and phase angle. Evaluation using amplitude or phase only techniques is prohibited.

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- n) NDT restrictions and limitations shall be referred to Eskom by the suppliers NDT level III. Where restrictions or limitations can not be eliminated they shall be fully recorded by the NDT operator.
- o) NDT reports shall typically include details of:
- Unique identification of item or part of item to be inspected.
 - Unique identification of calibration and reference blocks used.
 - Unique identification of equipment and the consumables batch numbers.
 - Personnel qualification levels.
 - Limitations encountered.
 - Recording criteria
 - Sizing methodology used.
 - All flaws detected and the evaluation of such
 - Method (or procedure) and acceptance codes and standards used (eg ASME V Article 6 and ASME VIII).
 - Operator name and signature date of inspection NDT supplier's authorisation counter signature etc.

3.5.2 Reports shall be completed in accordance with the relevant procedure and technique sheet.

3.5.3 Reports shall be maintained in accordance with the applicable inspection procedure.

3.5.4 Inspection Qualification, if required, shall be with regard to GGG 1323

4. AUTHORIZATION

This document has been seen and accepted by:

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5. REVISIONS

Date	Rev.	Compiler	Remarks
November 1993	0	H. Neeson	EVS044 - original document number
November 1993	1	H. Neeson	A standard with reference number ESKASAAE4 was registered, authorised and published on the Eskom Documentation Centre website.
August 1994	0	H. Neeson	EVS045 - original document number
August 1994	1	H. Neeson	A standard with reference number ESKASAAE5 was registered, authorised and published on the Eskom Documentation Centre website.
August 1994	0	H. Neeson	NWS1092 - original document number
August 1994	1	H. Neeson	A standard with reference number ESKASAAE6 was registered, authorised and published on the Eskom Documentation Centre website.
August 1994	0	H. Neeson	EVS063 - original document number
August 1994	1	H. Neeson	A standard with reference number ESKASAAG3 was registered, authorised and published on the Eskom Documentation Centre website.
August 2005	0	H. Neeson	Contents of ESKASAAE4, ESKASAAE5, ESKASAAE6 and ESKASAAG3 were revised and incorporated into a standard, in compliance with the new Eskom document criteria with the following changes: A new number, EST0009, was assigned; and EST0009 formatted accordingly.
March 2010	1	M. van Dalen	A Document number changed from EST 0009 to 32-632. Scheduled revision with text changes and updates.

6. DEVELOPMENT TEAM

This procedure was developed with inputs from the following people.

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