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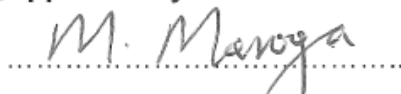


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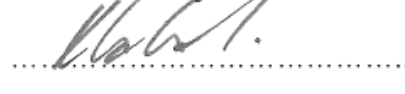


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## **1. INTRODUCTION**

Non Destructive Testing (NDT) is extensively used by Eskom in the management of quality and structural integrity for components ranging from a Level 1 classification (stringent specification and processes) to a Level 3 classification (least stringent). For NDT to be effective, the NDT service providers and personnel undertaking such work must be properly trained, qualified, certified, authorised and have gained the required industrial experience.

However, the qualification and certification of NDT personnel is subject to different international standards and is undertaken by different certification bodies; where each have their own specific requirements and where the required industrial experience may not necessarily have been gained in the power generation industries.

For Eskom to ensure that NDT is effectively performed on components with different safety classifications and where there are varying requirements of NDT personnel qualification, certification and experience, it is necessary for Eskom to provide a set of normalised requirements for the NDT industry and that an Eskom Approval process is used to control NDT activities.

This standard, therefore, details the following:

1. A set of Eskom normalised requirements harmonising the use of differing standards for the qualification and certification of NDT personnel.
2. A set of Eskom requirements by which the NDT Service Provider (SP) may authorise its employees to undertake NDT duties in a manner that is acceptable to Eskom for the issuing of an Eskom Approval to such individuals.
3. The process by which NDT personnel follow to obtain Eskom Approval to work on Eskom plant without the need for direct Eskom NDT Level 3 supervision.
4. Special conditions which may exist where an NDT Service Provider may perform NDT tasks under the supervision of the Eskom NDT Level 3.

## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

#### **2.1.1 Purpose**

1. To provide requirements to obtain Eskom Approval to perform NDT functions on Eskom plant by Eskom staff and non-Eskom personnel.
2. To define the requirements and process by which the NDT Service Providers and their personnel shall obtain Eskom Approval so that NDT can be performed on Eskom plant without the need for direct Eskom NDT Level 3 supervision.
3. This document supersedes the following standard (which has been revoked):

**240-83540088: Requirements for Non-Destructive Testing (NDT) on Eskom Plant Standard**

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### 2.1.2 Applicability

1. This standard shall apply throughout Eskom Holdings SOC Ltd, its divisions and subsidiaries.
2. This standard applies to all NDT personnel, irrespective of whether they are direct or indirect employees of Eskom or employees of NDT SPs. The requirements of this standard shall be complied with before performing any NDT activities on Eskom plant.

## 2.2 NORMATIVE/INFORMATIVE REFERENCES

### 2.2.1 Normative References

- [1] ISO SANS 9712: - Non-destructive Testing. Qualification and certification of personnel
- [2] SANS 20807:- Non-destructive Testing. Qualification of Personnel for Limited Applications of Non-destructive Testing
- [3] ISO 9000 - Quality Management Systems-Requirements

**NOTE:** The Latest version of the code shall be used unless otherwise stated

### 2.2.2 Informative References

- [4] SANS 17024: Conformity Assessment General Requirements for Bodies Operating Certification of Persons
- [5] ASNI/ASNT CP-105: - Training Outlines for Qualification of Non-Destructive Testing Personnel
- [6] EN 473: - Non-destructive Testing Qualification and Certification of NDT Personnel. General Principles. (Superseded by EN ISO 9712:2012)
- [7] ANSI/ASNT CP 189 - ASNT Standard for Qualification and Certification of Non destructive Testing Personnel
- [8] ASNT ACCP CP 1:- ASNT Central Certification Program. ASNT Document ACCP CP 1 Revision 8
- [9] ASNT SNT TC 1A: - ASNT Recommended Practice No. SNT TC 1A
- [10] KSA 037- Qualification And Certification Requirements For Personnel Performing Non-Destructive Testing At Nuclear Portfolio

## 2.3 DEFINITIONS

**Approved / NDT Personnel Approval (NPA):** An Eskom written letter confirming that the qualification and certification of an NDT Service Provider's personnel have been evaluated and the personnel is competent to perform NDT on Eskom plant without the need for direct Eskom NDT Level 3 supervision.

**Authorised/Authorisation:** A written letter by the SP Level 3, based upon the scope of certification, authorising the individual to carry out defined tasks [SANS ISO 9712].

**Approved Procedure:** A procedure that has been reviewed and accepted by the Eskom Level 3, against the minimum requirements of the relevant applicable code and the requirements of this standard.

**Certification:** The procedure used by the certification body to confirm that the qualification requirements for a method, level and/or sector have been fulfilled, leading to the issuing of a certificate [SANS ISO 9712] or equivalent.

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**Certification Body:** A body that administers procedures for certification according to the requirements of SANS ISO 9712.

**Competency Assessment:** The act of physically performing a practical demonstration to verify and prove competence. It will follow the same methodology as a practical examination, using known samples or “*on the job*” assessment at the discretion of Eskom NDT Level 3. This assessment process shall be documented.

**Direct Supervision:** When a supervisor is present whilst an NDT Level 1 or Level 2 personnel is performing an inspection.

**Eskom Approved (Approval) – NDT Service Provider:** Documentary evidence provided by Eskom to the NDT Service Provider that its procedures and processes have been evaluated or assessed against the requirements of this standard in addition to the relevant international prescribed codes for acceptance to conduct NDT operations on Eskom plant.

**Industrial Experience:** The experience acceptable to the certification body that has been gained under qualified supervision, in the application of the NDT method in the sector concerned needed to acquire the skill and knowledge to fulfil the provisions of qualification [ISO 9712].

**Key Performance Indicators:** A measurable metric deliverable used to assess the performance of an organisation.

**Non Destructive Testing:** Broadly; the methods for which NDT certification can be gained in accordance with the requirements of ISO 9712 or (or equivalent).

**NDT Level 3:** The person authorised by the NDT SP who is approved in accordance with the requirements of this document and has overall responsibility for the NDT activities to be performed and the personnel falling under his or her control.

**NDT Supervisor:** The NDT Level 2 or NDT Level 3 who is given the responsibility for technical supervision of other NDT operators (Level 1 or Level 2 operators) and who is approved in accordance with the requirements of this document (non-technical supervisors are not considered in this Standard).

**NDT Service Provider:** An institution or organization employing personnel competent to perform NDT operations.

**Procedure:** A document which details 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 an authorised procedure.

**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 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.

**Engineer (System Engineer or Owner):** In this document refers to an individual that is responsible for maintaining the integrity of their plant area (system).

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**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 inspection output. This document is drawn up from the requirements specified in an authorised procedure.

**Written Practice:** A written procedure developed and authorised by the NDT Service Provider's Level 3 which details the requirements for the qualification and authorisation of the NDT SP personnel.

## 2.4 ABBREVIATIONS

Abbreviation	Description
DAC	Distance Amplitude Correction
DRT	Digital Radiographic Testing
ET	Eddy Current Testing
ISO	International Organization for Standardization
MT	Magnetic Testing
NCR	Non Conformance Report
NDT	Non-destructive Testing
NPA	Non-destructive Testing Personnel Approval
PAUT	Phased Array Ultrasonic Testing
PT	Penetrant Testing
RPO	Radiation Protection Officer
RT	Radiographic Testing
RT&D	Eskom Research Testing and Development
SANS	South African National Standard
SP	Service Provider
TOFD	Time of Flight Diffraction
UT	Ultrasonic Testing

## 3. PROCESS FOR MONITORING

The control and monitoring of NDT activities performed on Eskom plant shall be in accordance with the requirements of this standard and all the relevant international prescribed codes for NDT. The responsibility to comply with the requirements of this document lies with the NDT SP. The NDT SP's Level 3 bears ultimate responsibility for all technical aspects of the NDT performed. Periodic audits shall be conducted against the requirements of this document by the Eskom NDT Level 3

## 4. ROLES AND RESPONSIBILITIES

Eskom engineering must include SP Level 3 and where possible the Eskom Level 3 during SOW development to ensure correct requirements and techniques are listed for in-service and investigative inspections. Outage, maintenance or contracts managers shall ensure that SP intended to be contracted are Eskom Approved. If a SP is not Eskom Approved, it will have to be assessed and approved by the Eskom Level 3.

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The application forms (as contained in the appendices) for an NDT SP to obtain Eskom Approval for itself and its personnel shall be completed and submitted to the Eskom Level 3. The application forms are available on request from the Eskom Level 3.

A performance demonstration will be required where Eskom Approval is being sought for an advanced method (UT, RT, TOFD, PAUT, DRT or for specific plant geometries and for non-standardised NDT).

#### **Limited NDT Certification**

Limited NDT qualification and certification (e.g. ISO 20807) will be treated on a case by case basis. All cases of limited certification not addressed in ISO 20807 shall be submitted to the Eskom NDT Level 3 for approval

### **4.1 THE ESKOM LEVEL III**

All technical NDT related matters fall under the jurisdiction of the Eskom NDT Level 3.

The Eskom NDT Level 3:

- Is responsible for keeping abreast of national and international standards for NDT qualification and certification and maintaining the current requirements in this standard;
- Is responsible for keeping abreast of national and international standards for NDT inspections and the acceptance criteria used to perform work on Eskom plant. A library of these standards shall be maintained;
- Is responsible for technically reviewing the NDT SP's procedures for the qualification and certification of NDT personnel for compliance with Eskom's requirements;
- Is responsible for technically reviewing procedures and technique sheets relating to work to be performed on Eskom plant.
- Will issue approval to NDT SPs based on acceptance of NDT SP's approved procedures and personnel. This shall fall within the scope of capability and certification held by the SP;
- Shall inform the NDT SP in writing of those employees that are approved to undertake NDT on Eskom plant without the need for direct Eskom NDT Level 3 supervision (i.e. Eskom Approval);
- Shall maintain a database (spreadsheet, list, etc.) which is freely accessible within Eskom and details all the NDT SPs and their personnel who have met the requirements of this standard and have Eskom Approval (an example is shown in **Appendix E** );
- Shall maintain a database (spread sheet, list etc.) which details the authorised NDT procedures and NDT technique sheets that have been reviewed and accepted by Eskom in accordance with the requirements of this standard. The database shall be freely accessible within Eskom;
- Shall intervene and make final decisions on NDT related disputes;
- Shall make the final decision on issuing or revoking of the Eskom Approval;
- Shall liaise with Eskom plant system owner (system engineer) to get clarity on NDT scope and inspection objectives.

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## 4.2 NDT SERVICE PROVIDER

The NDT SP shall retain by appointment in writing, a responsible NDT Level 3, who remains accountable for the integrity of the inspections carried out on Eskom Plant. This appointment can be a person nominated from an outside agency if required. If the primary responsible NDT Level 3 is not certified in all NDT methods, a secondary NDT Level 3 shall be appointed to cover the requirements of those methods. However, the primary NDT Level 3 will remain accountable for all NDT carried out on Eskom plant.

- The approved NDT SP shall ensure that permanent or sub-contracted NDT personnel have the required experience for the scope of work to be carried out. The main contractor NDT SP's Level 3 will be responsible for authorising the subcontracted individual based on the main contractor's written practice requirements.
- The NDT SP shall issue an authorisation for each employee, specifying the extent of certification and the extent of the duties that can be performed following the authorization process in the SP written practice. The authorisation shall document the procedures each employee is authorised to execute and the plant area to which each employee is limited to.
- The NDT SP's authorisation of an employee or sub-contractor is limited by the individuals' certification. The NDT SP shall maintain a database (spreadsheet, list, etc.) of its employees which specifies the employee's certification status. The database shall include details such as type of certification, certification validity, vision test validity, and limitations, if any (see **Appendix E**).

## 4.3 LABOUR HIRE

The labour hire companies shall retain by appointment in writing, a responsible NDT Level 3 who remains accountable for the verification of the labour hire personnel. The labour hire companies shall maintain a database (spreadsheet, list, etc.) of their employees which specifies each employee's certification status. The database shall also include details such as the type of certification, certification validity, vision test validity, and limitations, if any (see **Appendix E**) as verified by their Level 3.

Eskom will issue a pre-approval for those personnel verified by the labour hire Level 3 that meet the requirements of the ISO 9712.

NDT Labour hire SP shall not be permitted to work independently on Eskom plant. NDT Labour hire personnel shall be authorised by an Eskom Approved NDT SP Level 3. Applications for NPA will be submitted to Eskom for review.

## 4.4 NDT SERVICE PROVIDER APPOINTED LEVEL 3

The NDT SP appointed Level 3's shall have a minimum of 5 years of power plant practical experience. A secondary NDT Level 3 shall be appointed for methods which the primary Level 3 holds no certification. The NDT Level 3 taking responsibility for the activities performed by NDT Level 1 and Level 2 personnel employed/contracted by the NDT SP shall:

- Be qualified and certified in the methods for which they are responsible as a Level 3.
- Be nominated by the SP and presented to Eskom as the primary NDT Level 3 for the methods in which they are qualified and certified.
- Hold a valid Level 2 in the method for which they are accountable in order to comply with the requirements of this standard. This will allow Level 2 NDT functions to be carried out by the NDT Level 3, including the reviewing of reports, evaluation of NDT data and performing NDT operations.

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Additionally, the NDT SP Level 3 shall be required to demonstrate competency in the advanced methods for analysis and use of relevant software.

Where the NDT SP appointed Level 3 does not meet these requirements, that individual shall not be permitted to perform any NDT operations on Eskom plant.

- Ensure that work is undertaken by Eskom Approved, certified and authorised NDT personnel in accordance with approved procedures and techniques.
- Resolve any technical issues brought to their attention by NDT Level 2 and NDT Level 1 personnel.
- Bring to the attention of the Eskom NDT Level 3 those defects/indications that in their opinion are deemed to need further evaluation (possibly with a secondary technique) against acceptance criteria as well as all restrictions/limitations in the application of inspection procedures that cannot be overcome.
- Be personally responsible and accountable for delivery of quality NDT based on the SP's contract. Quality NDT refers to the delivery of quality NDT systems (NDT equipment, qualified NDT procedures and certified NDT personnel) to reliably find and report all indications/deviations/defects/anomalies required by the scope of work (SOW), including accurate reports for all the components in the SOW within 21 days of completing the work.

The key deliverables of the NDT SP Level 3 must include but is not limited to the following:

- Evaluation for optimisation of the SOW to ensure that the most suitable NDT systems are applied
- Qualification/performance demonstration of NDT systems used and suitable competency evaluation of NDT personnel for the specific SOW/project
- Quality NDT system execution, daily progress reporting and completion of the full SOW within the agreed time frame
- Daily evaluation of all NDT systems including testing, personnel and reports under their control and interpretation of all indications, deviations, defects and or anomalies. These shall be complemented or supplemented by the introduction of alternative NDT systems to evaluate and dispose of the indications, deviations, defects and/or anomalies through the site specific engineering processes.
- Reporting of all indications, deviations, defects and/or anomalies requiring additional attention or interpretation by the Eskom NDT Level 3 within 24 hours of detection to the Eskom NDT Level 3.
- Quality spot checks to establish and address shortcomings in the NDT systems
- A formal post-outage/project NDT Level 3 report covering at least the following points:
  - Declaration of complete execution of the entire scope of work by suitably qualified and technically competent Eskom Approved NDT technicians
  - Declaration that the entire SOW was executed. Where this was not done, the components not inspected must be listed with clear reasons why and recommendations on how to rectify this
  - Declaration of consistent and full compliance by all NDT technicians to the applicable procedures
  - Declaration that quality appropriate NDT systems were used to reliably detect indications, deviations, defects and or anomalies as per the requirements of the SOW
  - Declaration that all the NDT reports are accurate and a true reflection of the condition of the components tested

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- Declaration that all indications, deviations, defects and or anomalies were reported within 24 hours from detection
- Reporting of components with critical NDT limitations, how limitations were controlled and recommendations on how to address these in future
- Comments on the lessons learnt
- Reporting of the findings of the spot checks and improvements required to the NDT systems used
- Declaration that the Level 3 can endorse the quality of the NDT performed under their supervision.
- The Level 3 report must be included in the data books containing the SOW, NDT inspection procedures used, signed off test reports, engineering/cutting instructions and dispositioning reports for indications, deviations, defects and or anomalies. The data books will be handed over to Eskom within 21 days of completion of the last NDT tests and no payment will be released until fully completed data books (including the Level 3 report) are received by Eskom.

#### **4.5 NDT SUPERVISOR**

The NDT supervisor shall be authorised to at least Level 2 in the applicable method and shall provide advice to the NDT operator as needed. They shall be trained and have the necessary skills to act in a supervisory capacity. They shall be nominated in writing to act as a supervisor on behalf of the SP. Documentary evidence of training and appointment shall be submitted to the Eskom NDT Level 3.

The NDT supervisor shall ensure that:

- The NDT operator is suitably qualified and certified.
- Clear and specific instructions are provided to the operator on the task to be performed.
- The specific technique sheet is authorised.
- The technique sheet is applicable to the particular item being inspected.
- The inspection is conducted in accordance with the technique sheet. Note that this requires on-site supervision or evaluation.
- NDT data is correctly recorded as required by the technique sheet.
- All inspection anomalies, limitations and NDT indications are fully recorded and reported to the SP Level 3.
- There is direct supervision of Level 1 personnel.
- All recordable indications, deviations, anomalies and/or defects are reported to the responsible SP Level 3 before end of the shift.

#### **4.6 NDT OPERATOR**

The NDT operator shall be qualified, certified and authorised to least Level 1 in the applicable method and shall seek advice from the NDT Supervisor as and when needed.

The NDT operator shall ensure that:

- They possess and understand the applicable technique sheet.
- The inspection is conducted in accordance with the applicable technique sheet.
- The results of the test and all NDT data are recorded in accordance with the technique sheet.
- The NDT report is forwarded to the NDT supervisor without undue delay (within 24 hours).

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- All recordable indications, deviations, anomalies and/or defects are reported to the supervisor and responsible Level 3 before end of the shift.

#### 4.7 GENERAL REQUIREMENTS FOR ALL NDT PERSONNEL

NDT personnel (Level 1, Level 2 and Level 3) shall

- maintain their certification status in accordance with requirements of the NDT scheme to which they are certified [e.g. work continuity in method without significant (12 months) breaks, visual acuity and other statuses as required by code or this standard].
- be in possession of a written authorisation, supplied by their employer, authorising the individual to carry out defined NDT tasks. This includes labour hire contractors who will be authorised by the contracting NDT SP Level 3.
- ensure that work conducted on Eskom Plant does not exceed their certified status.
- not undertake NDT tasks for which they are not authorised.

### 5. ESKOM APPROVAL PROCESS FOR SERVICE PROVIDERS AND PERSONNEL

#### 5.1 NDT SERVICE PROVIDER APPROVAL

An NDT SP wishing to conduct NDT operations on Eskom sites is required to be approved by Eskom as an NDT SP. An application for Eskom approval must be made by the NDT SP's appointed Level 3 in the form of a Quality Management System (ISO 9001 preferred) which will include the:

- **Quality Manual** – addressing NDT SP principles in line with ISO 9001 (basic management principles).
- **Written Practice** – the NDT SP controlling document outlining the methodology for qualification and certification in line with the requirements of ISO 9712.
- **NDT Procedures** – the inspection process document outlining the requirements, per method for conducting inspections on Eskom plant.
- **Equipment List** – a list of equipment in the possession of the SP relevant to the technique for which approval is sought.
- **Personnel Qualifications and Certifications (Eskom Approvals)** – in compliance with the requirements of ISO 9712 (addressed in section 5.2 below).

#### 5.2 PERSONNEL APPROVAL

- All NDT and inspection personnel must be certified for the relevant NDT techniques and levels according to the provisions of EN ISO 9712.
- All personnel have to be authorised in accordance with the NDT SP's approved written practice.
- Where plant specific experience is required (e.g. turbine inspections), documented evidence of this experience shall be submitted.
- All NDT inspection personnel (permanent or contracted) must demonstrate competency (SP authorisation) to apply relevant procedures and techniques as per the NDT SP's written practice. This competency shall be verified by the NDT SP Level 3.
- All applications for personnel shall be submitted via the NDT Personnel Approval (NPA) document in **Appendix C**.
- **Eskom Approval shall be renewed annually**

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## 6. NDT QUALIFICATION AND CERTIFICATION

NDT personnel shall be qualified and certified in accordance with ISO 9712. The exceptions to this requirement are listed in Table 1 and are dealt with as special exceptions by the Eskom NDT Level 3. Table 1 summarises the relationship of referencing codes to the qualification and certification standards.

**Table 1 Summary of Reference Codes Qualification applied for Eskom Approval on a case by case basis**

NDT Referencing Code or Standard	Standard for Qualification and Certification of NDT Personnel
ASME Section 3 Rules for Construction of Nuclear Facility Components	SNT-TC-1A.
ASME Section XI Rules for In-service Inspection of Nuclear Power Plant Components.	ASNT CP-189 <sup>[1]</sup> or ASNT ACCP.
<i>Can be met with the following permissible code options:</i> <sup>[1]</sup> Or, ASNT CP-189 with ASME XI reliefs.	

## 7. VALIDITY OF ESKOM APPROVAL

- Eskom Approval will be permanently removed from any personnel found guilty of either drug and/or alcohol abuse.
- Wilful acts of negligence or unethical issues surrounding activities on Eskom plant can result in the termination of both personnel's and SP's Eskom Approval.
  - Any conviction for abuse of drugs will mean the permanent loss of Eskom Approval for the individual and possible withdrawal of the approval of the NDT Service Provider
  - Any detection of alcohol abuse will mean the loss of Eskom Approval for the individual and possible withdrawal of Eskom Approval of the NDT SP.
  - The validity of Eskom Approval shall not exceed certification validity.
- Eskom Approval expires when NDT personnel's employment with the NDT SP is terminated. Eskom Approval remains valid while the individual is in possession of current annual visual acuity certificate.
- Eskom Approval remains valid while the individual undertakes activities using Eskom Approved NDT procedures and NDT technique sheets of the approved NDT SP. Approved NDT procedures can be verified on the Eskom database.
- The Eskom approval of a SP may be suspended for unapproved changes made to the NDT SP's written practice or NDT procedures.
- The Eskom Approval of personnel shall expire if an individual's certification expires or is revoked.
- Eskom Approval for personnel shall expire when an interruption of greater than 12 months (excluding incapacitation for NDT operations in that method) takes place in any of the methods for which the

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individual is certified. This excludes incapacitation from performing NDT operations because of illness or injury.

- Eskom Approval for personnel shall expire if the individual becomes physically incapable of performing their duties based upon failure of the annual visual acuity examination or if the visual acuity certificate expires.
- Eskom Approval for personnel shall expire if the individual fails recertification, until such time as the individual meets the requirements for recertification or initial certification.
- Eskom Approval for personnel shall be revoked pending enquiries in cases where Eskom reports poor performance by the NDT SP. This will be documented via the NCR process.
- Eskom Approval for personnel can be revoked upon the request of the NDT SP.
- Suspended Eskom Approval can be reinstated upon providing documented correction of the reasons for the suspension.
- Eskom Approval for personnel can be revoked when detectable (through correct application of procedures and technique sheets) indications are not reported (e.g. cracks missed by surface crack testing techniques).
- Revoked and expired Eskom Approval shall follow the route of the initial application.

**Note:** A database for suppliers and personnel of approved suppliers will be available for review. When both are confirmed the NDT activity can be undertaken without direct Eskom NDT Level 3 supervision.

## 8. DISCIPLINARY PROCEDURE

In the event that Eskom Approved personnel are involved in, or under investigation for unethical behaviour, procedure violation, code violation, poor performance or any other misconduct that compromises a quality NDT systems/ product (including substance abuse) the following shall apply:

- The NDT SP appointed NDT Level 3 shall inform Eskom immediately of the incident and request Eskom to suspend the individual's Eskom Approval.
- The NDT SP appointed NDT Level 3 shall submit all evidence as well as their interpretation, conclusion and recommendations with regard to the situation, to Eskom for review.
- The NDT SP appointed NDT Level 3 must contact Eskom and request a meeting in which the way forward will be discussed, either to determine if it is possible to reinstate the operator and the agreed mitigation process to be followed, or whether the operator's Eskom Approval will be permanently revoked.
- The NDT SP appointed NDT Level 3 shall complete the agreed mitigation process and submit evidence that all the requirements have been met as agreed upon with Eskom.
- Eskom will notify the NDT SP appointed Level 3 whether the mitigation process was completed satisfactorily and whether the SP can reapply for Eskom Approval for the individual in question.

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**Note:** Failure to adhere to the disciplinary procedure could result in loss of Eskom approval to the Service Provider, NDT Level 3 and personnel actions taken against the NDT SP and the responsible NDT SP appointed NDT Level 3.

**Note:** These documents shall be readily available for Eskom review.

## **9. SPECIFIC REQUIREMENTS**

### **9.1 NDT DURING CONSTRUCTION ACTIVITIES**

- a) All NDT undertaken during construction activities shall be subject 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.

### **9.2 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) Where a repair or replacement activity is undertaken to restore a plant item to a condition different from that of the original construction or as part of a modification not envisaged by the original construction code, an agreed code shall be adopted and/or acceptance criteria agreed upon before any repair or replacement activities take place.

#### **Notes applicable to sections 9.1 and 9.2:**

*Construction codes and Acceptance Standards are internationally published such as ASME VIII, EN codes or are developed by an OEM for its specialised plant component, for example a steam turbine rotor, Eskom may choose to accept either.*

*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 Service Provider and Eskom prior to inspection. Advice on the use of codes and standards for NDT can be sought from the Eskom Level 3.*

*Where an item has historical monitoring criteria, such criteria may form the basis for future inspections*

### **9.3 NDT DURING IN-SERVICE AND OUTAGE ACTIVITIES**

#### **9.3.1 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 9.1 shall be followed.

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### 9.3.2 In-service inspection where no codes and standards exist

- a) The Where no suitable codes and standards exist, Eskom plant system owners (engineers) with the Eskom NDT Level 3 will specify in writing;
- The items to be inspected.
  - The flaw specification or recommend types of flaws or damage to be identified.
  - The type of NDT method to be performed.
  - Recommend suitable acceptance criteria.
  - The NDT reporting criteria.
- b) The provisions listed in section 9.3.2(a) above will be determined by the Eskom material specialists, metallurgists, systems engineers, NDT specialists or in conjunction with OEM specialists and also from operating experiences prior to awarding of a contract.
- c) The NDT Service Provider, or Eskom, may develop written and authorised NDT procedures which are suited to deliver the desired inspection solution in view of Section 9.3.2(a) above. In all such cases, the NDT procedures shall be approved in writing by the Eskom NDT Level 3 **prior** to inspection.

### 9.4 ADDITIONAL REQUIREMENTS

If any of the requirements of this standard cannot be met, the NDT supplier or Eskom engineer shall contact the Eskom NDT Level 3 for resolution prior to the commencement of the inspections.

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) If allowed by codes and standards, repairs based on NDT results are only permitted with the express agreement of the SP's NDT Level 3. When NDT is undertaken as part of investigation no repairs are permitted without the written consent of Eskom.
- c) An NDT written report shall be generated for each item inspected and the original signed report together with relevant supporting documentation including but not limited to radiographs, ET strip charts, PAUT and TOFD electronic calibration files shall be submitted to the responsible Eskom representative.
- d) Unless specified otherwise in the applicable codes and standards, UT indications originating from geometric features shall be recorded at the maximum amplitude location and where possible from both sides of the indication.
- e) A 10 MHz transducer with an "A" scan display shall be used for UT thickness measurements below 3 mm regardless of the digital wall thickness meter readings.
- f) RT safety requirements shall be adhered to at all times. The NDT Service Provider's RPO and NDT Level 3 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 SP.
- h) RT Interpretation guidelines specifically for the following defects;
- **Excess Penetration**

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When excess penetration is recorded on the RT report, a second film must be produced at 90° to the original in an effort to establish the actual size (height) of the excess penetration. If there is limited access or the actual size of the indication cannot be determined, the excess penetration shall be rejected and the weld repaired.

- **Root Concavity**

Whenever root concavity is noted and the recorded optical density is darker than the parent metal density the indication shall be rejected and the weld repaired.

- **Linear Misalignment**

When linear internal diameter (ID) misalignment is noted on a radiograph, a second film shall be produced at 90° to the wall thickness to minimise enlargement and to obtain accurate measurements. Only then can the weld be evaluated. The quality department of the repairer must be informed of this occurrence so that fit ups can be addressed.

- i) The use of computerised RT imaging and viewing techniques (e.g. digital radiography) may be used when permitted by codes and standards.
- j) PT dwell and development times shall be commensurate with the flaw being sought. When in-service flaws such as stress corrosion cracking or creep fatigue are suspected the specific technique sheet shall specify commensurate dwell times.
- k) MT magnetisation shall be commensurate with the flaw being sought. When in-service flaws such as hydrogen cracking or creep fatigue are suspected, the specific technique sheet shall specify the commensurate magnetising times.
- l) ET probe centralisation is mandatory for tubing inspections when conducted from the ID surface of the tube.
- m) A minimum fill factor of 80% for the ET probe is mandatory for tubing inspections when conducted from the ID surface of the tube.
- n) 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.
- o) NDT restrictions and limitations shall be referred to Eskom NDT Level 3 by the SP's NDT Level 3. Where restrictions or limitations cannot be eliminated, they shall be fully recorded by the NDT operator.
- p) NDT reports shall as a minimum include details of:
  - Unique identification of the item or part of item to be inspected
  - Unique identification of the 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
  - The method (or procedure) and acceptance codes and standards used (e.g. ASME V Article 6 and ASME VIII)
  - Operator's name and signature

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- Date of inspection
- NDT supplier's authorisation counter signature

- q) Reports shall be completed in accordance with the relevant procedure and technique sheet.
- r) Reports shall be retained in accordance with the applicable inspection procedure.

## **10. NDT DURING INVESTIGATIVE OR FAILURE ANALYSIS ACTIVITIES**

- a) NDT during investigative or failure analysis will normally be specific and unique to each occasion. Since the necessity for inspection will be driven by Engineering, detailed prescription in this standard would be inappropriate.
- b) For investigative and failure analysis purposes, the principles in section 9.3.2 may be used. Eskom requirements and the NDT SP's scope of work shall be documented in writing and jointly reviewed by both parties. In addition, work as a result of review will be documented by the respective parties. Advice for such work can be sought from the Eskom NDT Level 3.
- c) The NDT Service Provider shall obtain Eskom approval from the Eskom NDT Level 3 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 NDT Level 3 prior to the implementation of any recommendations.
- d) All relevant documents including NDT procedures, NDT results and all other supporting documents shall be collated in one file and submitted to the responsible Eskom representative.
- e) The requirement for operator certification and authorisation in accordance with this standard extends to NDT undertaken during investigative and failure analysis activities.

## **11. PERFORMANCE DEMONSTRATION OF NDT SYSTEMS AND COMPETENCY ASSESSMENT OF CERTIFIED ESKOM APPROVED PERSONNEL**

Eskom reserves the right to (and shall) call on NDT and inspection SPs to carry out:

- performance demonstrations of NDT systems to obtain and maintain Eskom Approvals;
- performance demonstrations of NDT systems when new NDT systems are introduced; and
- competency assessments of certified and Eskom Approved personnel.

**The NDT System Performance Demonstration (qualification to predetermined levels of rigor) process shall be used to:**

- Test the ability of newly developed NDT systems (NDT equipment, qualified NDT procedures and certified NDT personnel) to find applicable engineering indications, deviations, defects and/or anomalies. The process shall include a series of open trials by the NDT SP to develop the NDT system, followed by blind trials in which the NDT system must be applied on test samples/rigs according to the procedure/written practice by NDT operators to test their competency in applying the procedure. All new NDT systems to be introduced in Eskom plant must form part of the qualification process.

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- Test existing NDT systems as part of the Eskom approval process to assess the ability of NDT SP to maintain full competency to reliably find applicable indications, deviations, defects and/or anomalies. This process entails blind trials on test samples/rigs which must be tested strictly in accordance with the procedures/written practice.
- Assess the reliability with which certified and Eskom approved NDT personnel can detect applicable indications, deviations, defects and/or anomalies on blind trial competency evaluations developed for a specific SOW. Only NDT personnel declared competent for the SOW/project will be released to work on the project. Eskom Approval alone is thus not the only requirement to work on Eskom related projects.

## 12. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Andrew Downes	Chief Metallurgist
Zakhele Bhayi	Metallurgical Engineer/NDT Specialist
Dheshan Naran	M&PI CoE Manager
Marthinus Bezuidenhout	Corporate Specialist - Materials
Morris Maroga	Corporate Specialist - Materials, Welding and NDT
Pilani Ndhlovu	NDT Services Manager, Rotek
Thobeka Pete	Chief Materials Engineer
Grant Meredith	Eskom Appointed Level 3
Vusi Ralefeta	Senior Advisor Engineering
Noel Lecordier	Senior Consultant Engineer
Ronnie Scheepers	Corporate Specialist - Turbine

## 13. REVISIONS

Date	Rev.	Compiler	Remarks
September 1988	0	H Neeson	EVS003 – original Eskom number.
August 1993	0	H Neeson	ESKASAAA3 – document was renumbered and reformatted in accordance with the Eskom Documentation System. Revision remained at 0.
April 1998	1	H Neeson	Minor changes made to ESKASAAA3. Revision number changed to 1.
August 1994	0	H Neeson	EVP039 - original Eskom number for procedures.
August 1994	3	H Neeson	EVP039 was renumbered as ESKPVAAD0 was developed and published, in alignment with Eskom Documentation System.
June 1998	4	H Neeson	ESKPVAAD0 was revised and published.

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July 2005	0	H Neeson	Contents of ESKASAAA3 and ESKPVAAD0 were revised and incorporated, due to the Eskom functional changes with the following changes: <ul style="list-style-type: none"> <li>• A new number, EST0002, was allocated; and</li> <li>• EST0002 formatted accordingly.</li> </ul>
August 2009	1	H Neeson	Contents of EST0002 were revised and incorporated, due to the Eskom functional changes with the following changes: <ul style="list-style-type: none"> <li>• A new Eskom identity documentation number, 32-631, was allocated;</li> <li>• 32-631 formatted accordingly; and</li> <li>• processes more defined and clarified.</li> </ul>
February 2013	2	M van Dalen	Scheduled revision with contents changes and updates.
October 2014	0.1	Mark Digby	Unique identifier revised to reflect 240-series i.e. 240-83539994, first Draft for Comments Review
December 2014	0.2	Mark Digby	Final Draft after Comments Review Process
January 2014	1	Mark Digby	Final Document for Authorisation and Publication
March 2017	1.2	GQ Meredith	Revision first Draft for Review Process
May 2017	1.3	GQ Meredith	Final Draft with Updates completed after Review Process
May 2017	2	GQ Meredith	Final Rev 2 Document for Authorisation and Publication

## 14. DEVELOPMENT TEAM

This procedure was developed with inputs from the following people.

- Andrew Downes, Research, Testing & Development – Chief Metallurgist
- Zakhele Bhayi, Boiler, Centre of Excellence - Metallurgical Engineer/NDT Specialist
- Dheshan Naran, Research, Testing & Development – Corrosion, Stress and Materials Manager
- Grant Meredith, Eskom NDT Level 3
- Morris Maroga, Group Technology - Materials, Welding and NDT Corporate Specialist
- Marthinus Bezuidenhout, Research Testing & Development – Materials Corporate Specialist

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## APPENDIX A: ESKOM APPROVAL PROCESS

### Process for gaining Eskom Approval

#### Step 1

The NDT SP seeking approval for NDT operations on Eskom Plant shall:

- Submit a completed application form (see **Appendix D**) for Eskom Approval with all relevant inspection procedures for review to the Eskom NDT Level 3.
- Appoint in writing an NDT Level 3 who meets all the Eskom requirements and submit a completed application form for Eskom Approval (see **Appendix B**).
- Apply for an official Eskom audit, through the senior adviser of Quality assurance who will measure ISO compliance.
- Apply for an official Eskom Audit by the Eskom NDT Level 3 who will assess NDT capacity and capability.

The NDT SP's written practice shall identify the applicable normative qualification and certification standard.

The Eskom NDT Level 3 shall technically review the NDT SP's written practice for compliance to Eskom requirements.

The review process assesses compliance only. The NDT SP's appointed Level 3 remains responsible for adherence to the requirements.

#### Step 2

The NDT SP shall submit a completed application form (see **Appendix B**) for the primary responsible NDT SP Level 3 with all his/her qualification and certification documents. This shall be signed by the manager accountable for the NDT SP. This shall also apply to any secondary (additional) NDT SP Level 3s. These shall be submitted and reviewed by the Eskom Level 3 for approval.

The appointed primary and secondary (if appointed) shall have an examination of the requirements of the Eskom documents. This will consist of a 30 question open book examination to ensure that the document is understood.

Eskom may require performance demonstration for any NDT Inspection to be carried out by the NDT SP's Eskom approved Level 3 in these methods namely PAUT inspection and analysis, Radiographic interpretation and other advanced methods that may be used.

The Eskom Level 3 shall technically review the qualification and certification records against the Eskom requirements.

#### Step 3

The NDT SP shall submit a completed Eskom Approval application form (**Appendix C**) for its NDT Level 2 and NDT Level 1 personnel for Eskom Approval. Each applicant and method shall have a form filled in and signed by the relevant personnel. The NDT SP Level 3 shall submit records to the Eskom Level 3.

The NDT SP shall also submit the NDT SP authorisation record of their NDT Level 1 or Level 2 personnel to the Eskom Level 3.

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The Eskom Level 3 shall technically review the qualification and certification records for compliance with the Eskom requirements.

**Step 4**

A practical assessment based on the level or class of component that is to be inspected may be conducted for any NDT SP personnel requiring Eskom Approval. The extent of evaluation will be assessed on a case by case basis with respect to advanced NDT methods and techniques, e.g. UT, PAUT, TOFD, DRT or RT.

**Step 5**

The Eskom Level 3 will issue to the NDT SP, an Eskom Approval for each individual assessed and found to meet the requirements for conducting NDT operations on Eskom plant.

The Eskom Approval will be issued in writing.

With each revision to the NDT SP's quality manual (e.g. written practice) or change to an individual's qualification and certification and authorisation status, the SP will conduct application for approvals.

**Step 6**

The NDT SP appointed Level 3 will complete on a periodic basis, the KPI Matrix to maintain Eskom Approval as shown in **Appendix E**. Failure to comply with these requirements will affect the Eskom Approval status.

**Step 7**

An audit of the SP shall be conducted on an annual basis and as determined necessary by the Eskom NDT Level 3. This audit shall be conducted by the Eskom NDT Level 3 or delegated alternate.

All audit findings shall be actioned within the prescribed time frame to the extent and satisfaction of the Eskom NDT Level 3. Failure to comply with these requirements will affect the Eskom Approval Status.

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**APPENDIX B: APPLICATION FOR ESKOM APPROVAL FOR NDT LEVEL 3**

<b>Service Provider Name</b>	<b>Responsible NDT Level 3</b>	<b>Contact Phone No.</b>	<b>Accountable Manager/ Director Email Address</b>
<b>SERVICE PROVIDER DETAILS</b>			
<b>Applicant Full Name</b>	<b>ID No.</b>	<b>Mobile No.</b>	<b>Candidate Email Address</b>
<b>CERTIFICATE LEVEL REQUESTED</b> <input type="checkbox"/> Level 3			
<b>METHODS APPLIED FOR</b>			
<input type="checkbox"/> Magnetic Testing <input type="checkbox"/> Electromagnetic Testing <input type="checkbox"/> Penetrant Testing <input type="checkbox"/> Radiographic Testing <input type="checkbox"/> Ultrasonic Testing <input type="checkbox"/> Visual Testing <input type="checkbox"/> Phased Array UT <input type="checkbox"/> Others Specify.....			
<b>Document Verification</b> Review by the service provider accountable manager			<b>NDT Service Provider Accountable Manager</b>
Candidate detailed CV			
Examination results sheet for Level 2 (e.g. ACCP Level 2 results)			
Qualification Certificate			
Validated documents of experience in the applicable method			
Employment status (contractor/employee)			
Valid visual acuity certificate			
<b>Document Submission</b> Reviewed by Eskom Level 3 or delegate			<b>Eskom Responsible NDT Level 3 or delegate</b>
Copy of valid visual acuity certificate			
Copy of the NDT Service Provider's appointment letter			
Copy of Independent Level 3 certificate/s			
Copy of Level 2 results			
By signing below, the Applicant and the service provider responsible NDT Level 3 confirm that all information submitted is true and valid at the time of submission. Falsification will result in immediate withdrawal of approvals			
_____ <b>Applicant's Signature</b>		_____ <b>Accountable Manager</b>	
_____ <b>Date</b>		_____ <b>Date</b>	
<b>Eskom NDT Level 3 review:</b>			
<b>Approval</b>			
_____ <b>Signed</b>		_____ <b>Date</b>	

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**APPENDIX C: APPLICATION FOR ESKOM APPROVAL FOR NDT OPERATORS**

<b>Service Provider Name</b>	<b>Responsible NDT Level 3</b>	<b>Contact Phone No.</b>	<b>Accountable Manager/ Director Email Address</b>
<b>SERVICE PROVIDER DETAILS</b>			
<b>Applicant Full Name</b>	<b>ID No.</b>	<b>Mobile No.</b>	<b>Candidate Email Address</b>
<b>CERTIFICATE LEVEL REQUESTED</b> <input type="checkbox"/> Level 1 <input type="checkbox"/> Level 2			
<b>NDT METHOD (Select only One per Form)</b>			
<input type="checkbox"/> Magnetic Testing <input type="checkbox"/> TOFD Operator <input type="checkbox"/> Penetrant Testing <input type="checkbox"/> TOFD Analyst <input type="checkbox"/> Radiographic Testing <input type="checkbox"/> PAUT Operator <input type="checkbox"/> Radiographic Testing Film Interpretation <input type="checkbox"/> PAUT Analyst <input type="checkbox"/> Ultrasonic Testing <input type="checkbox"/> Long-range UT (GUL) Operator <input type="checkbox"/> Ultrasonic Testing Thickness Measurement <input type="checkbox"/> Long-range UT (GUL) Analyst <input type="checkbox"/> Visual Testing <input type="checkbox"/> Others Specify.....			
<b>Document Verification</b> Review by the service provider Responsible Level 2			<b>Service Provider Responsible NDT Level 3</b>
Candidate detailed CV			
Examination results sheet			
Qualification Certificate			
Validated documents of experience in the applicable method			
Employment status (contractor/employee)			
Valid visual acuity certificate			
<b>Document Submission</b> Reviewed by Eskom Level 3 or delegate			<b>Eskom Responsible NDT Level 3 or delegate</b>
Copy of valid visual acuity certificate			
Copy of the NDT Service Provider's certification			
Two passport-size photographs (this can be electronic)			
Copy of Level 2 results			
By signing below, the Applicant and the service provider responsible NDT Level 3 confirm that all information submitted is true and valid at the time of submission. Falsification will result in immediate withdrawal of approvals			
_____ <b>Applicants Signature</b>		_____ <b>Responsible NDT Level 3</b>	
_____ <b>Date</b>		_____ <b>Date</b>	
<b>Eskom NDT Level 3 review:</b>			
<b>Approval</b>			
_____ <b>Signed</b>		_____ <b>Date</b>	

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**APPENDIX D: APPLICATION FOR ESKOM APPROVAL FOR PROCEDURES**

Service Provider Name		Responsible NDT Level 3	Contact Phone No.	Responsible NDT Level 3 email address
Document custodian	Accountable Manager/ Director		Accountable Manager/ Director Email Address	
<b>Signed Procedures submitted Document number and revision status</b>				
<input type="checkbox"/> Written Practice _____ <input type="checkbox"/> Magnetic Testing _____ <input type="checkbox"/> Penetrant Testing _____ <input type="checkbox"/> Radiographic Testing _____ <input type="checkbox"/> Ultrasonic Testing _____ <input type="checkbox"/> Visual Testing _____ <input type="checkbox"/> Phased Array UT _____ <input type="checkbox"/> Electromagnetic Testing _____ <input type="checkbox"/> Insert procedure name below..... _____ _____ _____ _____ _____ _____ _____ _____ 				
By signing below, and the service provider responsible NDT Level 3 confirm that all information submitted is true and valid at the time of submission. Falsification will result in immediate withdrawal of approvals.				
_____ <b>Responsible NDT Level 3</b>		_____ <b>Date</b>	_____ <b>Document custodian</b>	
			_____ <b>Date</b>	
<b>Eskom NDT Level 3 review:</b>				
_____ <b>Signed</b>			_____ <b>Date</b>	

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## APPENDIX E: LESTING PER NDT SERVICE PROVIDER

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## APPENDIX F: NDT SERVICE PROVIDER KPI SUBMISSION DOCUMENT

**APPROVED NDT SERVICE PROVIDER KPI SUBMISSION DOCUMENT**

Company Name \_\_\_\_\_ Responsible NDT Level 3 \_\_\_\_\_ Date \_\_\_\_\_

[illegible]

Office use		
Approved by	Date received	Further review required

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