

	Standard	Technology
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Inspection Standard**

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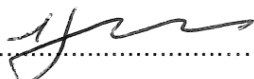
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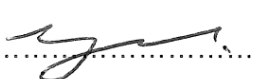
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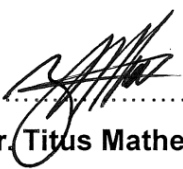
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1. INTRODUCTION

Safe and reliable operation of boiler fans (PA, FD and ID fans) is of critical importance. In order to manage fan erosion and other defects such as crack formation, scheduled fan inspections must be done.

The document content has been compiled by a working group of PEIC draught plant, considering changes in plant operation including high ash loads/increased erosion rates and limited opportunities for plant inspection. This document supersedes the previous Fan Inspection Policy 36-632.

2. SUPPORTING CLAUSES

2.1 SCOPE

This standard is applicable to the centrifugal boiler fans on all coal fired power stations namely the Forced Draught (FD), Primary Air (PA) and Induced Draught (ID) fans, as well as the associated auxiliaries including ducts, dampers, lubrication systems, oil coolers, drive motors and actuators.

Axial flow fans are not covered by this standard.

- 1) Each power station shall develop procedures for the periodic inspection and test of these fans including all the components both rotating and static. This must include PMs being generated in SAP for scheduled fan inspections.
- 2) Each power station shall implement and maintain a record of fan inspections and reports, including repair records.

Should the Engineering Departments at the Power Stations require the approval or comments of Generation Technology specialists, this will be arranged.

2.1.1 Purpose

The purpose of this document is to ensure fan integrity at all times. Assurance of fan integrity can only come from assessments of the fans' status at a given time i.e. by inspection and reference to inspection plans.

2.1.2 Applicability

The defined requirements shall apply to the draught plant fans within all Eskom coal fired boilers.

2.2 NORMATIVE/INFORMATIVE REFERENCES

2.2.1 Normative

- [1] 240-56241639: Construction and Repair Welding of Primary Air, Induced and Forced Draught Fans Standard
- [2] ISO 9001: Quality Management Systems.
- [3] QM-58: Supplier Contract Quality Requirements Specification
- [4] GGD 1447: Plant Asset Management Directive.
- [5] GGP 0464: Administration of Operations related ESKOM Regulations.
- [6] 240-53114002: Engineering Change Management Procedure
- [7] 240-56241933: Control of Welding during Construction, Repair and Maintenance Activities Standard
- [8] 240-56246601: Qualification, Certification and Accreditation Requirements for Personnel and Entities Performing Welding Related Work on Eskom Plant Standard

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2.2.2 Informative

[1] 0363 EPRI 1009651 Forced Draft and Induced Draft Fan Maintenance Guide

2.3 DEFINITIONS

Definition	Description
Exemption	Exemption means permission of a temporary nature to be excused from a provision of this standard.
Waiver	A waiver means permission of a permanent nature to be excused from a provision of this standard.

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
C&I	Control and Instrumentation
ECM	Engineering Change Management (process)
FD fan	Forced draft (secondary air) fan
FFP	Fabric filter plant
GT	Group Technology (department)
HAZ	Heat affected zone
ID fan	Induced draft fan
NDT	Non-destructive testing
OEM	Original Equipment Manufacturer
PA fan	Primary air fan
PEI-C	Production Engineering Integration - Coal
PF	Pulverised fuel
PM	Preventive maintenance (maintenance philosophy)
PS	Power Station
PSM	Power Station Manager
RT&D	Research Test and Development
RTS	Return to service
RVC	Radial vane control
SAP	Software maintenance management system
SM	Senior Manager
UT	Ultrasonic testing

2.5 ROLES AND RESPONSIBILITIES

Each PS is responsible to develop and implement the requirements described in this Standard to ensure that the boiler draught plant fans are inspected and managed such that the integrity of the equipment is ensured, and that it is available on demand to prevent major plant damage and loss of human life.

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2.6 PROCESS FOR MONITORING

Compliance monitoring to this Standard will be via peer reviews and compliance audits.

2.7 RELATED/SUPPORTING DOCUMENTS

The following documentation shall be produced as a result of this Standard;

- The relevant PS shall compile and register a boiler draught plant fan inspection philosophy document as required.
- The relevant PS shall maintain records that certify that proof tests and inspections were completed as required.

3. BOILER DRAUGHT PLANT FAN INSPECTION PHILOSOPHY DOCUMENT

Each relevant PS shall compile and maintain a boiler draught plant fan inspection philosophy document with the following content;

3.1 INSPECTION PHILOSOPHY

3.1.1 Front Cover

The cover shall include;

- The name of the PS.
- The relevant units at the PS. Where boiler draught plant fans on the same PS incorporate different inspection philosophies, a separate document shall be compiled and authorised for each group of boiler draught plant fans.
- Acceptance, approval and authorisation signatures.
- Revision status of the document.

3.1.2 Plant information

Supporting information, for example OEM descriptions, drawings and other information may at the discretion of the PS Management be attached to the document as an Appendix.

3.2 BOILER DRAUGHT PLANT INSPECTION PHILOSOPHY DOCUMENT CONTROL

- The boiler draught plant fans inspection philosophy document shall be compiled by the relevant PS Engineering department, approved by the PS Manager and authorised by the subject matter expert (Eskom draught plant specialist).
- Modifications to the PS boiler draught plant fans inspection philosophy shall be controlled as per ECM process for Level 1 classified components.
- Where modification to existing equipment is required to meet the requirements of this Standard, a programme to implement will be agreed between the Group Technology SM (PEI-C) and the relevant PS Manager. The Group Technology SM (PEI-C) will issue an exemption for compliance as per the agreed programme.

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3.3 STRATEGY FOR FAN INSPECTION

The interval between fan inspections shall not exceed 16 000 running hours or 50 starts, whichever comes first.

A shorter fan inspection interval shall be introduced on a case-by-case basis in the event of specific plant conditions or engineering requirements occurring, for example

- if erosion rates are known to be high, a shorter interval shall be introduced for erosion wear monitoring
- if there are known recurring defects such as crack development, a shorter interval shall be introduced for NDT inspections
- if any operating condition occurs resulting in fan operation for any length of time outside of the fan design parameters.

It is strongly recommended that fan inspection is scheduled to coincide with main outages, and that the task is performed early in the outage.

In addition the use of opportunities for inspections such as weekend outages is encouraged.

Experienced personnel must be utilised to carry out the fan inspections mechanically. All NDT procedures and executing personnel qualifications must be approved to the relevant Eskom standard.

3.4 MINIMUM REQUIREMENTS

Each Power Station is to develop a procedure which should encompass the following as a minimum:

3.4.1 Crack Testing

3.4.1.1 The following areas of the fan must be inspected for crack formation:

- The weld and heat affected zone (HAZ) of all structural welds, liner attachment welds and balance weight welds.
- If the fan structural welds are concealed by liners, it is required to remove the liners in order to provide access for the verification of the integrity of the structural welds, or use UT as test method where practical to do so.
- All welds on casing supports and braces, such as spider web, turning vanes and braces
- Welds on radial control vane components
- The fan drive hubs
- High stress points on shafts such as keyways and journal shoulders
- Fan/motor couplings

3.4.1.2 NDT Methods

- Inspection of the rotating components to check for cracking: for surface examination magnetic particle inspection can be used.
- Dye penetrant inspection will only be permitted to test stainless steel welded balance weight welds and non-ferrous blade liners.
- Shot blasting of the surface of the runner shall be carried out prior to surface examination. Care must be taken to clean only and not remove impeller material
- Ultrasonic testing – for detection sub-surface defects and concealed weld inspection

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3.4.2 Erosion Wear Inspection

Fans whose runners are exposed to fly ash erosion or PF erosion must be inspected for wear damage.

The following areas of the fan must be inspected for erosion wear:

- Complete impeller: hub, drive plate, side plates and blades. Blade inspection must be all around – not only on leading edges – and to include liners where installed.
- Inlet cones
- Casings and ducts
- Support structure and braces, including guide vanes
- RVC system
- Fan shafts, including keyways

Thinning of the structural sections cannot be permitted so protection liners must be fitted, for which the materials are numerous and the selection is to be engineered. Welding of liners is the standard method of attachment. Bolted liners can be used if approved by GT and the fan OEM. Where bolted protection liners were fitted as standard on the RTS stations they may be retained.

The preferred method of measuring the thickness of the structural components is by ultrasonic means. Erosion measurements shall be conducted in a repeatable manner by using a standard pre-defined template with recording and trending as an aid to forecast replacement intervals

3.4.3 Corrosion on Fan Casings and Ducts

Inspect all areas that might be exposed to corrosion.

Corrosion will take place in areas where there is potential water accumulation on the outside of the casing and ducting, typically the fan casing cut-off and bottom part of fan casing. Water often accumulates in the casing and ducting heat insulation (lagging and cladding)

3.4.4 Fan and Fan Motor Bearings

Bearings should be opened for inspection based on condition monitoring (known wear rates, oil sampling, temperature, vibration, oil leaks on seals).

The maximum allowed inspection interval is six years (GO cycle) to measure wear and replace seals.

3.4.5 RVC system, including lay shaft assembly and drive actuators

Full inspection, measurement of pin/bush clearances and re-commissioning is required for all planned outages. Commissioning must include centring of the RVC rings and full stroke-checking.

3.4.6 Fan shaft seals

Inspect for wear, alignment & clearance

3.4.7 Fan/Motor Couplings

For direct couplings full inspection and re-lubrication (where applicable) is required during each planned outage

Where hydraulic couplings are fitted inspection and refurbishment will be done at least every GO or more regularly based on OEM requirements and/or historical failure records.

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3.4.8 Fan hold down bolts, bearing pedestals and foundations

Fan hold down bolt tightness to be checked during every GO (six yearly) only, unless if vibration monitoring shows loose bolts. If recurring bolt tightening is required the reason for this must be investigated.

Bearing pedestals are to be inspected and checked for tightness every six years (GO cycle).

Foundations to be checked by civil engineering every six years (GO cycle)

3.4.9 Fan Ducting Expansion Bellows/Supple Joints

Expansion bellows and supple joints must be inspected during planned outages for mechanical damage, ash build-up and material condition.

3.4.10 Fan Lubrication Systems, Including Jacking Oil Systems Where Applicable

- Oil sampling to be done before planned outages. Clean the oil tanks at least once in six years (GO cycle), or more often as indicated by analysis of the sampled oil.
- Check for oil leaks before outages.
- Do vibration monitoring on oil pumps and pump motors before planned outages.
- Do inspection and a leak tests on oil coolers at least once every 6 years (GO cycle). If leaks are evident the inspection interval will be shorter.
- Function test all pressure control valves, pressure relief valves and safety valves during each planned outage.
- Function test all non-return valves during each planned outage.
- Replace all oil filters and breather filters on the appropriate frequency
- Do full lube oil system commissioning at the end of each outage. Commissioning to include setting of safety valves, relief valves and pressure control valves as well as balancing flows between drive-end and non-drive end bearings.

3.4.11 Fan Brake System (Where Applicable)

Inspect service and function test during every planned outage.

3.4.12 Fan Control and Instrumentation

Reference must be made to The Inspection Policy for Fan Control and Instrumentation

3.4.13 Fan Condition Monitoring

Regular on-load condition monitoring to include the following as a minimum:

- Fan vibration monitoring
- Lubrication oil sampling
- Oil cooler performance/leakage

The frequency of the above testing to be specified in the station maintenance philosophy and records thereof must be kept as specified in paragraph 4.2

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4.2 DOCUMENTATION OF PROOF TESTS AND INSPECTIONS

The relevant PS shall maintain records in SAP and on Hyperwave that certify that inspections were completed as required. These include:

- Description of the test and inspection performed.
- Dates of the tests and inspections.
- Name of the person(s) who performed the test and inspections.
- The plant code of the system inspected.
- Results of the tests and inspections, including:
 - NDT Records
 - Erosion Wear Records
 - Maintenance Records
 - Number of Fan Starts and Running Hours
 - The number of starts and influences the fatigue life of a fan. It therefore becomes necessary to record the number of starts as well as fan running hours and store this information along with the inspection records
 - Any Abnormal Operating Conditions Experienced.

4. AUTHORISATION

This document has been seen and was accepted by:

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All	Group Technology Boiler Discipline Managers
All	All Fossil Fired Power Station Boiler Engineering Managers
All	All Fossil Fired Power Station Boiler Maintenance Managers

5. REVISIONS

Date	Re v.	Compiler	Remarks
July 2015	0.1	H. Kleynhans	Updated to 240 document standard, added additional inspection requirements.
July 2015	0.2	H. Kleynhans	Draft Document for Comments Review
September 2015	1	H. Kleynhans	Final Document for Authorisation and Publication

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6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- William Garnett-Bennett (Senior Consultant Draught Plant).
- Mike Lander (Senior Advisor, Draught Plant).

7. ACKNOWLEDGEMENTS

Nil

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