Eskom	Standard	Technology

Title: **TRANSFORMER AND REACTOR COOLING FANS SPECIFICATION**

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1. Introduction

Transformers and reactor are fitted with radiators to reduce operating temperatures. Where forced air cooling is fitted, fans are installed, and air is forced through the radiators to increase cooling of the oil.

2. Supporting clauses

2.1 Scope

This specification covers the technical requirements for the selection and purchase of cooling fans fitted to Transformers and Reactors. The purpose of this document is to ensure that the requirements of these fans are standardised within Eskom during the procurement stage.

This document shall be used as a minimum requirement for the purchase and selection of cooling fans fitted to transformers and reactors.

- Cooling fans to new Transformers and Reactors
- Cooling fans fitted to in-service Transformers and Reactors
- Cooling fans purchased as Spare Parts

2.1.1 Purpose

This document was produced to record the standardized requirements that shall be applied across-divisional Transmission, Generation and Distribution.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001, Quality Management Systems.

[2] SABS 1461 Hot-dip (galvanised) zinc coatings (other than on continuously zinc coated sheet and wire)

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

None

2.3.2 Disclosure classification

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

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2.4 Abbreviations

Abbreviation	Description
°C	Degrees Celsius
ID	Internal diameter
kV	Kilo volts
L	Litres
mm	Millimetre
mm/s	Millimetre per second
MVA	Mega Volt Ampere
OD	Outside diameter
UV	Ultra violet

2.5 Roles and responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

3. Requirements

3.1 General

Installation position of the fans shall be underneath the radiators with a vertical upward air flow unless otherwise approved in writing.

3.2 Environmental Conditions

Outdoor installation

Altitude above sea level – 1800 m

Ambient temperatures

- Maximum + 40°C
- Monthly average + 28°C
- Yearly average + 25°C
- Minimum – 10°C

Average relative humidity 90%

Solar radiation 2500 W/m²

Atmospheric UV radiation - High

Seismic conditions at a maximum of 3g

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Pollution level – High marine and industrial (C5)

3.3 Corrosion Protection

Corrosion shall be eliminated using non-corrodible materials, and by avoiding the contact of dissimilar metals. Where cast components are used, they shall be of high quality and non-porous castings. Bare metal or aluminium castings shall be epoxy powder coated (exterior grade) or anodised.

Corrosion protection used shall be suitable for use in high marine and industrial polluted environments with a C5 classification.

All fasteners shall be stainless steel – 316 bolts with 304 nuts and washers shall be used. Electro galvanising or electro plating of parts and fasteners is not acceptable. Thread lubrication shall be applied to all threaded areas on bolts, studs, and screws. Any good quality high temperature grease is acceptable.

Fan guards and cowlings shall be stainless steel or hot dipped galvanised according to SABS 1461 and shall remain bare.

3.4 Fan Motors

All motors shall be suitable for direct starting and continuous running from the supply voltage. Three-phase motors are preferred but single-phase motors of 0.5 kW and less will be acceptable.

All motors shall comply at least with IEC 60034 and IEC 60072 and shall have a protection class of IP 55. Three-phase motors shall be standard frame single-cage squirrel cage type. Bearings of all motors shall be of the ball or roller bearing type. IE3 cast iron motors are preferred and deviations from this should be agreed with Eskom first.

Motors shall be provided with contactors and overload protection and, in the case of three-phase motors, single-phasing protection. Contactors and overload protection shall be located inside the Marshalling kiosk.

All motors shall be permanently labelled indicating Make, Type, Voltage, kW and Ampere rating.

The stator insulation system shall be insulated as Class F or Class H. The motors shall be rated for continuous operation.

3.5 Electrical Circuits and Termination Boxes

A terminal box with IP 55 rating shall be provided for electrical connections on the fan motor. Nitrile rubber gasket shall be used on the terminal box cover. Terminal box cover screws shall be hexagon or Allen key type stainless steel with thread lubrication applied. Plug-in connectors shall not be used.

Terminal boxes shall be mounted to allow cable entry from the side or the bottom – cable entry from the top is not acceptable. Terminal boxes and terminal strips shall allow sufficient space for fitting and securing of 2.5 mm control wiring and cabling. Termination strips shall be numbered, and basic wiring diagrams shall be provided inside the lid of the terminal box and in the installation instructions.

The fan motor shall be cabled to the Marshalling Kiosk by means of steel wired armoured cabling that is heat, oil, and UV resistant.

All terminal boxes shall be provided with an earth connection point and shall be effectively earthed.

The fan motors electrical circuits shall withstand an applied voltage of 500 V DC for 60 seconds, applied in turn, between electrically independent circuits and the casing of the motor, and between the separate independent electrical circuits.

3.6 Fan Cowlings

Fan cowlings shall be stainless steel or hot-dipped galvanised. All cowlings shall be provided with removable hot-dipped galvanised (90 µm) or stainless steel (grade 316) wire-mesh guards on both sides of the fan impeller. The rotation and air flow directions shall be clearly indicated by arrows permanently fixed to the outside of the fan cowling. Fan cowlings shall not be painted.

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3.7 Fan Impellers

Air-flow direction shall be away from the motor. Impeller blades shall be secured to the hub in such a manner that it will not come loose due to vibration or impact. Fixing of impeller blades by using epoxy or similar methods is not acceptable. Impeller blades shall be manufactured from aluminium or UV stable material.

Where cast components are used, they shall be of high quality and non-porous castings. Aluminium castings shall be anodised, carbon steel shall be hot dipped galvanised and stainless steel shall remain bare. Corrosion treatment of metal parts and castings shall be subject to written approval from Eskom.

Each impeller shall be individually marked and dynamically balanced and certified according to ISO Specification G6.3.

3.8 Installation

Fans shall be installed underneath the radiators unless otherwise specified by Eskom. To prevent damage to the radiator finish, fans shall not be mounted directly onto the radiators.

3.9 Documentation and Certification

Each fan shall be shipped with the following documentation information:

- Fan supplier details
- Manufacture date
- Air displacement rate (m3/second)
- Nominal motor current
- Impeller dynamic balance certificate
- Fan drawings and dimensions

3.10 Packing and Shipment

Each cooling fan shall be individually packed in a sturdy container or non-returnable wooden crate. The fan shall be securely packed and protected against damage and moisture ingress during shipping and storage.

Original and fully detailed instructions for installation, wiring and maintenance shall be included.

3.11 Technical Evaluation and Final Approval

The OEM / Supplier shall be responsible to supply a cooling fan for technical evaluation. The equipment shall be supplied to Eskom and will be subjected to destructive testing. The sample shall be supplied in accordance with this specification, and it will remain the property of the supplier.

This specification serves as a minimum requirement for manufacturers that supply cooling fans. Any deviation from this specification must be approved by Eskom in writing before ordering or manufacturing of the relay.

Final written approval shall be provided once a technical evaluation has been completed and equipment found in compliance with this specification and Eskom requirements.

Any changes to the approved product will be subjected to re-evaluation and approval.

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4. Authorization

The stabilisation of this document was seen and accepted by the following experts:

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5. Revisions

Date	Rev	Compiler	Remarks
April 2024	3	M. Hlakudi	Document stabilised with: • Updates on corrosion requirements. • Fan cowling requirements elaborated in 3.6. • Fan impellers requirements elaborated in 3.7.
Feb 2018	2	M Ngubane	Document revised to include upgraded corrosion specification.
Aug 2014	1	A Smit	Document was updated to be cross divisional and was put in the new template and replaces TSP 41-897.

6. Development team

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

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7. Acknowledgements

Final document compiled by Generation, Transmission and Distribution

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