

 Eskom	Standard	Technology
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Title: **PASSIVE DEHYDRATING
BREATHERS FITTED TO
TRANSFORMERS, REACTORS
AND ON-LOAD TAPCHANGERS**

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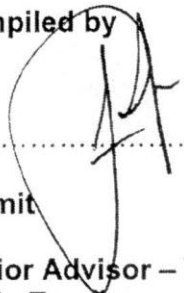
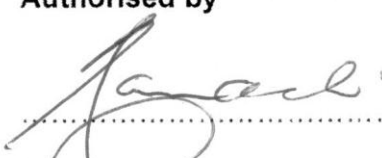
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Compiled by	Functional Responsibility	Authorised by
		
A Smit	Sidwell Mtetwa	Roger Cormack
Senior Advisor – Western Grid - Tx	Corporate Specialist – Transformers and Reactors	Power Delivery Engineering – HV Plant – Senior Manager
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		Supported by SCOT
		
		Bheki Ntshangase
		SCOT PE SC Chair
		Date: 23/8/2013

Content

	Page
Revision history	3
Introduction	4
1 Scope	4
2 Normative references.....	4
3 Definitions and abbreviations.....	4
3.1 Definitions.....	4
3.2 Abbreviations	4
4 Requirements.....	5
4.1 General.....	5
4.2 Environmental Conditions	5
4.3 Corrosion Protection	6
4.4 Calculating of Desiccants Quantity	6
4.5 Desiccants Containment	7
4.6 Oil Bowl	7
4.7 Air Intake during Starting of Oil Circulating Pumps.....	7
4.8 Gaskets: Types & Material	7
4.9 Leak and Flow Testing	7
4.10 Packing and Shipment	8
4.11 Maintenance Documentation	8

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This revision cancels and replaces revision no 1 of document no. TSP 41-623.

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Aug 2013	1	A Smit	Clause no.	Document revised to cater for Gx, Tx and Dx requirements

Acceptance

This document has been seen and accepted by:	
Name	Designation
R Cormack	Power Delivery Engineering (High Voltage Plant PDE Senior Manager)
Sidwell Mtetwa	Corporate Specialist (Transformers and Reactors – PDE)
Calvin Bongwe	Senior Technologist (Northern Grid)
Carl Wolmarans	Carl Wolmarans (Assistant Engineer – PDE)
Adesh Singh	Chief Engineer (Transformers and Reactors – PDE)
B J Ramcharan	Senior Advisor (KZN OU)
Peter Busch	Senior Consultant (PDE)
Lionel Jordaan	Senior Consultant (Transformers GBE)
Goldstone Mungwe	Engineer (Generation Engineering)
Mpumelelo Khumalo	Chief Engineer (Generation Engineering)
Thabang Liphoto	Senior Technician (RT&D)
Annalie Lombard	Corporate Specialist (RT&D)
L Jordaan	Senior Consultant Transformers – Fleet Technology Generation Business Engineering
Peter Busch	Senior Consultant
Adesh Singh	Chief Engineer (Transformers and Reactors HV PDE)
Nkosinathi Buthelezi	Senior Consultant (Transformers and Reactors HV PDE)
Michael Ngubane	Senior Technologist (Transformers and Reactors HV PDE)
Calvin Bongwe	Senior Technologist (Northern grid)
Willie Liebenberg	Senior Advisor (Freestate grid)
Andries Smit	Senior Advisor (Western grid)
Wessel Benecke	Work Manager (Rotek)
Retief Snyman	Senior Advisor (Quality)
Goldstone Mungwe	Engineer (Generation Engineering)
Kevin Bosch	Quality Engineering
Nad Moodley	Chief Engineer (Peaking Generation)
Mpumelelo Khumalo	Chief Engineer (Generation Engineering)
Annalie Lombard	Corporate Specialist (RT&D)
Vuyile Kula	Senior Advisor (Southern Grid, WG Leader)
B J Ramcharan	Senior Advisor (Dx , KZN operating unit)
Steven Da Silva	Senior Advisor (Dx Commodity Sourcing)
Adesh Singh	Chief Engineer (Transformer and Reactors HV PDE)
Bheki Ntshangase	Grid Manager - North East Grid (SCOT PE SC Chairperson)

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Development team

B J Ramcharan, Andries Smit, Oupa Fokazi, Sidwell Mtetwa, Willie Liebenberg, Calvin Bongwe, Michael Ngubane, Peter Busch, Ephraim Mbokodo, Vuyile Kula, Carl Wolmarans & Adesh Singh.

Introduction

This document is required to clearly set out Eskom's requirements for the selection and purchase of dehydrating breathers fitted to Transformers and Reactors.

1 Scope

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

This document shall be used as a minimum requirement for the purchase and selection of passive dehydrating breathers relays fitted to transformers, reactors and on-load tapchangers.

- Passive dehydrating breathers fitted to new Transformers and Reactors
- Passive dehydrating breathers fitted to in-service Transformers and Reactors
- Passive dehydrating breathers purchased as Spare Parts

2 Normative references

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

Eskom National document(s):

RES\RR\10\32694	Transformer breather agent evaluation
TRMTI114	Desiccants suitable for use in dehydrating breather applications

3 Definitions and abbreviations

3.1 Definitions

Large diameter breather	Breather with a containment tube diameter of 200 – 250 mm
Desiccants	Moisture removal desiccant used in dehydrating breathers
Small diameter breather	Breather with a containment tube diameter of 100 – 150 mm

3.2 Abbreviations

g	Grams
kg	Kilograms
L	Litres
ID	Internal diameter
OD	Outside diameter
UV	Ultra violet
kV	Kilo volts
°C	Degrees Celsius
MVA	Mega Volt Ampere
PCD	Pitch circle diameter

4 Requirements

4.1 General

Every transformer, reactor and on-load tapchanger shall be fitted with a dehydrating breather. Two types of breathers may be used, i.e. large diameter (200 – 250 mm diameter) and small diameter (100 – 150 mm diameter).

Large breathers shall be flange mounted on a 100 mm diameter flange with 4 x 12 mm holes on a 75 mm PCD. Small breathers shall have ¾" BSP female pipe thread mount.

The breather shall be mounted at 1.5 m measured from the mounting flange or pipe connection point to ground level.

4.2 Environmental Conditions

Outdoor installation

Altitude above sea level – 1800 m

Ambient temperatures

- Maximum + 40°C
- Yearly average + 30°C
- Minimum – 10°C

Average relative humidity 100%

Solar radiation 1.2 kW/m²

Atmospheric UV radiation - High

Seismic conditions at a minimum of 3g.

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4.3 Corrosion Protection

Corrosion shall be eliminated by the use of non-corrodible materials, and by avoiding the contact of dissimilar metals. The top and bottom castings shall be designed to prevent the collection of water.

Where cast components are used they shall be of high quality non-porous material. Bare metal or aluminium castings shall be epoxy powder coated (exterior grade) or anodised.

All fasteners shall be stainless steel – 316 grade bolts with 304 grade nuts shall be used. No electro galvanised or electro plated parts will be accepted.

Thread lubrication shall be applied to all threaded areas of bolts, studs and screws. Any good quality high temperature grease may be used.

4.4 Calculating of Desiccants Quantity

The desiccants quantity shall be calculated according to the equipment oil volume. A minimum of 200 g of desiccants shall be used for every 1000 litres of total oil volume contained in the transformer or reactor.

Desiccants quantity shall not exceed 2 kg in a small diameter breather, and limited to 8 kg in large diameter breather single compartments.

The desiccants weight shall be clearly and permanently indicated on each breather compartment.

4.4.1 Oil volume of up to 1000 litres

A small diameter breather shall not contain less than 1 kg of desiccants , even for equipment with an oil volume of less than 1000 litres. Typically 1 kg gel breathers shall be used on auxiliary transformers and on-load tapchangers where the oil volume does not exceed 1000 litres.

4.4.2 Oil volume of 1001 - 10 000 litres

Equipment with an oil volume in this range shall make use of small diameter breathers with a desiccants weight of 2 kg.

4.4.3 Oil volume of 10 001 – 30 000 litres

For units where the oil volume exceeds 10 000 litres but not 30 000 litres, a combination of large and small diameter breathers shall be used. The breather shall be sub-divided into 2/3 and 1/3 individual compartments. Where 2/3 of the desiccants shall be contained in a single compartment closest to the conservator (large diameter) and 1/3 shall be at the air intake side (small diameter). This is to allow optimised replacement of the desiccants during maintenance by letting the lesser volume saturate first

4.4.4 Oil volume of 30 001 – 60 000 litres

Units in this range shall make use of large diameter breather combinations arranged in series, one below the other. The desiccants shall be sub-divided into 2/3 and 1/3 individual compartments of large diameter. Where 2/3 of the desiccants shall be contained in the compartment closest to the conservator and 1/3 shall be at the air intake side.

The breather size in this category shall not exceed 8 kg and 4 kg combinations thereby limiting this arrangement to a 60 000 litre equipment oil volume.

4.4.5 Oil volume of above 60 000 litres

Breathers where the oil volume exceeds 60 000 litres shall make use of three single breather compartments of large diameter. The three sections shall be mounted next to one another and have equal desiccants quantities. The breather compartments shall have a series air flow arrangement, but the physical connection to the conservator breather pipe shall be from the centre of the assembly.

The largest breather in this range shall be 3 x 8 kg desiccants charge configuration, even if the oil volume exceeds 120 000 litres.

4.5 Desiccants Containment

Desiccants shall be contained in completely transparent cylindrical tubes. The transparent tubes shall not be provided with a protective covering that obscures visual inspection. Each container shall be manufactured from UV, oil and heat resistant material which can be simply and easily removed and replaced without the use of special tools. Joints and inspection windows are not allowed in transparent cylindrical tubes.

The desiccants in large diameter breathers shall be arranged that the air passing through it shall be diffused throughout the charge so as to contact all particles in the charge, and in particular those observable from the outside. To achieve maximum air diffusion, baffle plates spaced at 100 mm intervals shall be used inside the transparent containment tube. The baffle plates shall be mechanically strong enough to support the weight of the desiccants contained in the compartment.

Diffuser plates are not required in small diameter breathers.

The breather air intake hole connected to the equipment shall be provided with a dust filter. The dust filter shall prevent desiccants dust from entering the transformer pipework but shall not restrict airflow.

4.6 Oil Bowl

The desiccants shall not be in contact with the atmosphere unless the transformer is breathing, but shall be sealed by a bowl containing transformer oil. The oil level shall be minimum 100 ml and shall be clearly and permanently marked on the bowl.

The oil bowl shall be manufactured from transparent, UV stabilised, oil and heat resistant material. Design of the oil bowl shall allow for easy cleaning and removal. Fastening method of the oil bowl shall be designed that over-tightening will not cause damage to it. The oil bowl shall not be covered by a protective casing.

The oil inside the oil bowl shall not be drawn into the breather, contaminating the gel, or blown out of the oil containment bowl during normal operation of the transformer or reactor.

4.7 Air Intake during Starting of Oil Circulating Pumps

The arrangement and proportions of the dehydrating breather shall be such that air inhaled during starting of the oil circulating pumps shall receive adequate dehydration. Oil in the atmospheric seal shall not be drawn into the breather unit(s) during this operation, nor blown out of the oil seal during the operation of stopping the oil circulating pumps.

4.8 Gaskets: Types & Material

All seals on the breather shall be oil proof and airtight gaskets that shall be effectively retained on dismantling of the breather for the purpose of changing the desiccants.

All gasketed joints shall be designed, manufactured and assembled to ensure long term leak and maintenance free operation. Rubber seals used on desiccants charges shall be a minimum of 4 mm thick and manufactured from mirror finish Nitrile rubber with 60 shore hardness.

Cork gasket of 4 mm thick shall be used on flanged joints. As an alternative, "O"-rings may be used on flanged joints – in these instances "O" ring grooves shall be provided. The O-rings shall be of Nitrile rubber.

4.9 Leak and Flow Testing

Every breather shall be flow tested to ensure that the air flow path is free from obstructions and pressure tested to ensure there are no leaks in the assembly. This information shall be supplied with the breather.

4.10 Packing and Shipment

All breather units shall be fully assembled and individually packed. The top opening of the breather shall be sealed by means of a blanking plate or stopper plug for breathers filled with desiccants – tape or plastic sheeting is not acceptable. The complete breather shall be sealed in a plastic bag (min 100 microns).

Breathers shall be supplied without desiccants unless otherwise requested by the Purchaser. When breathers are supplied with desiccants it shall be properly sealed to prevent moisture ingress into the gel during transport or storage. Only Eskom approved desiccants shall be used in Eskom breathers

4.11 Maintenance Documentation

Each breather shall be supplied with installation and maintenance instructions.

5. Technical Evaluation and Final Approval

The equipment shall be supplied to Eskom and will be subjected to testing.

This specification serves as a minimum requirement for manufacturers that supply dehydrating breathers. Any deviation from this specification has to be approved by Eskom in writing.

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.