

Title: **RTV SILICONE RUBBER
INSULATOR COATING AND
SHED EXTENDER APPLICATION
STANDARD**

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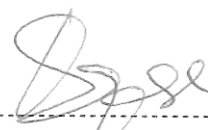
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1. Introduction

Room Temperature Vulcanized (RTV) silicone rubber insulator coating is used to improve the performance of insulators in polluted environments by suppressing leakage currents. Shed extenders were developed to increase the creepage distance of insulators, thereby reducing the probability of flashovers as a result of leakage currents. This specification was compiled to standardise the application of RTV silicone rubber insulator coating and/or shed extenders in all Eskom substations

2. Supporting Clauses

2.1 Scope

This standard sets out Eskom's minimum requirements for the application of approved RTV silicone rubber insulator coatings and, where applicable, shed extenders, on ceramic insulation in all Eskom substations.

2.1.1 Purpose

None

2.1.2 Applicability

This standard shall apply to all Eskom substations on ceramic HV equipment (post insulators, isolators, circuit breakers, surge arresters, current transformers, and magnetic and capacitive voltage transformers).

2.2 Normative/Informative References

Parties using this document shall use the most recent edition(s) of the document(s) listed in this section.

2.2.1 Normative

- [1] 240-56062705, "RTV Silicone Rubber Insulator Coating and Shed Extender Supplier Specification", Eskom Transmission.
- [2] IEC 60815, "Guide for the Selection of Insulators in Respect of Polluted Conditions".
- [3] IEC 62073, "Guidance on the Measurement of Wettability of Insulator Surfaces".

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
Arcing distance	Shortest distance in air external to the insulator between metallic parts which normally have the operating voltage between them. Note: The term "dry arcing distance" is also used.
Creepage distance	The shortest distance or sum of the shortest distances, along the surface of an insulator between those parts which normally have the operating voltage between them. Note: Only the insulating dielectric should be measured (end fittings are excluded)
Creepage factor	Is the creepage distance divided by the arcing distance of the insulator.

Definition	Description
Hydrophobicity	Relates to the wettability of an insulating surface. Hydrophobic and hydrophilic describe the two extreme levels of wettability of a surface by water. A hydrophobic surface has low surface tension and is water-repellent. The opposite of this is a hydrophilic surface, which has a high surface tension and is thus wetted by water (in the form of a film). The actual wetting appearance on the insulator is identified according to one of seven wettability classes (WC 1 to WC 7), as per IEC 62073.
Insulator	A device intended for electrical insulation and mechanical fixing of equipment or conductors which are subject to potential differences.
Insulator Set	An assembly of one or more insulator strings suitably connected together complete with fixing and protective devices as required in service.
Room Temperature Vulcanised (RTV) silicone rubber insulator coating	A hydrophobic (water repellent) compound system which typically consists of a base silicone polymer, alumina trihydrate or alternative fillers for increased tracking and erosion resistance, a catalyst, reinforcing filler or a pigment and a cross linking agent.
Shed extender	A polymeric disc-shaped device which is attached to the perimeters of an insulator shed, thus changing the profile and creepage distance of the insulator.
Specific creepage distance (mm/kV)	The specific creepage distance is defined as the total creepage distance divided by the highest phase to phase system voltage (U_{max}).
Unified creepage distance (mm/kV)	The unified creepage distance is defined as the total creepage distance divided by the highest phase to earth system voltage (U_{max}).

2.3.2 Intershed Spacing-to-Projection Ratio: Defined as the ratio of S/P, where

- P, P1, P2 = Shed projection and represents the horizontal distance measured from the rod to the end of the shed.
- S = Shed spacing, which is the vertical distance between two similar points of successive sheds

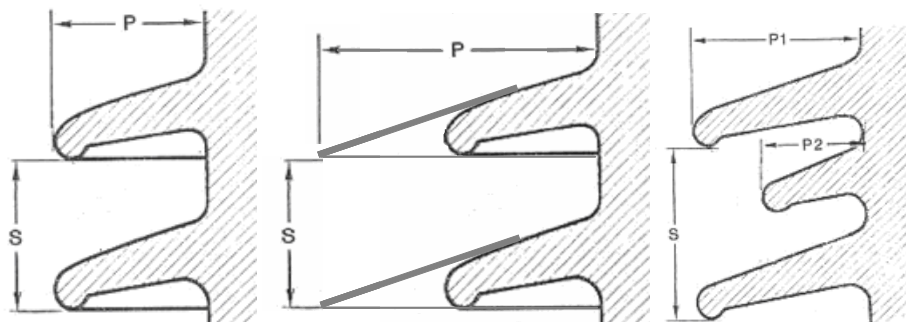


Figure 1: Insulator Shed Parameters

2.3.3 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
HV	High Voltage

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Abbreviation	Description
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
QITP	Quality Inspection Test Plan
RTV	Room Temperature Vulcanized
SCD	Specific Creepage Distance
USCD	Unified Specific Creepage Distance

2.5 Roles and Responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/Supporting Documents

Not applicable.

3. Technical and Application Requirements for RTV Silicone Rubber Insulator Coatings

3.1 Requirements

- The RTV silicone rubber insulator coating shall be applied by supplier accredited persons, in accordance with supplier specifications
- Copies of the supplier's insulator cleaning, material mixing and application procedures shall be made available to Eskom
- The applicator shall only use equipment and cleaning materials specified by the supplier.
- RTV silicone rubber coating material shall only be applied within its shelf life, proof of which must be made available to Eskom on request.
- The RTV silicone rubber coating shall be applied in such a way that overspraying is minimised.
- The RTV silicone rubber coating finish must be applied evenly, to a minimum dry thickness according to Schedule B of 240-56062705, supplied by the supplier.
- After RTV silicone rubber coating, the site should be left in a clean condition. Excessive overspray should be removed by the contractor in accordance with supplier guidelines and Eskom Health and Safety procedures.

3.2 Type test

- The contractor shall supply Eskom with a sample Cullinan Industrial Porcelain EP315 (1700mm creepage) insulator with a RTV silicone rubber coating for evaluation by Eskom.
- If shed extenders are to be used, the contractor shall also supply Eskom with a sample Cullinan Industrial Porcelain EP315 (1700mm creepage) upgraded with shed extenders (as per section 4.4) to a minimum overall creepage distance of 2250mm and the whole insulator coated with a RTV silicone rubber coating for evaluation by Eskom.

3.3 Acceptance tests

- a) The RTV silicone rubber coating thickness shall be measured by an Eskom accredited person, according to the Schedule B of 240-56062705, supplied by the supplier. The measurements shall be done after the RTV silicone rubber coating has fully cured. An appropriate measuring device, such as an ultrasonic thickness tester, must be used.
- b) Eskom reserves the right to perform random material sample testing for compliance.
- c) Eskom reserves the right to perform fingerprint analysis on new coatings to ensure that products supplied are identical to those tested by Eskom.
- d) The hydrophobicity of the applied RTV silicone rubber coating will be measured according to IEC 62073 to ensure compliance with supplier guarantees (Schedule B of 240-56062705). The hydrophobicity of the applied coating will be monitored and measured by an Eskom accredited person.
- e) The applied RTV silicone rubber coating will be bonded to the insulator surface such that no form of peeling occurs during the supplier's guarantee period. This will be monitored and measured by an Eskom accredited person

3.4 Installation of Shed Extenders

- a) Shed extenders shall be applied by accredited and competent persons, in accordance with supplier specifications. The supplier application specification shall be supplied to Eskom by the contractor. The placement of shed extenders shall be indicated in the Applicator's QITP. The position of all shed extenders shall be approved by Eskom prior to installation.
- b) The contractor shall only use equipment and material specified by the supplier of the shed extenders.
- c) Shed extenders shall be spaced in such a way that the minimum phase clearance between adjacent insulators is not infringed as a result of the installation of the shed extenders.
- d) The angle of the installed shed extender is to be tangential to the insulator shed surface at the point of attachment to a tolerance of +0° to -15°.
- e) The installed shed extender will be centralised, continuous and inline along the circumference of the shed extender, and any joints will be in line with this plane.
- f) The insulator with installed shed extenders shall fully comply with IEC 60815. However, a minimum shed spacing to projection ratio of 0.5 and a maximum creepage factor of 4 will be accepted.
- g) Where shed extenders are installed, the added creepage distance of the shed extender, positioning, as well as the bonding between the shed extender and the porcelain surface shall be checked by an Eskom accredited person prior to the application of the RTV silicone rubber insulator coating.

3.5 Post Application Requirements

- a) All completed work shall be inspected by a competent Eskom employee together with the applicator. Documented proof of the inspection and completion of work shall be issued in the form of a release certificate.
- b) The contractor is to provide Eskom with a touch-up kit per substation and train key Eskom personnel in the use thereof. Transmission shall determine quantities of the touch-up kits to be provided per site.
- c) Repair kit, methods, inventory shall be documented by the supplier and provided to Transmission.

3.6 Training

- a) Training of the contractor, including all other supporting staff, will be accredited by the supplier. Proof of accreditation shall be supplied for all personnel.
- b) Personnel must be properly trained in the cleaning and application of the supplier's RTV silicone rubber insulator coating. They shall demonstrate that they are capable of meeting the quality requirements for cleaning the insulation and for the coating appearance, thickness and consistency.

3.7 Compliance with Health, Safety and Environmental Regulations

When working in substations during the cleaning and application of RTV silicone rubber insulator coating and/or shed extenders, contractors shall comply with all applicable legal and Eskom health, safety and environmental rules and regulations, including, but not limited to, ORHVS.

4. Authorisation

This document has been seen and accepted by:

Name and surname	Designation
	This Document has been approved by TDAC ROD 13 February 2013
B Ntshangase	Senior Manager PDE – HV
K Kleinhans	Chief Engineer

5. Revisions

Date	Rev	Compiler	Remarks
Feb 2017	2	K Kleinhans	Draft Document for review created from TSP41-170
June 2013	1	K Kleinhans	Final Document approved for Publication

6. Development team

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

- Kevin Kleinhans

7. Acknowledgements

Not applicable.

Annex A – : Substation Insulation assessment Checklist

(checklist to be completed for each insulator component of the HV equipment, where applicable)

Substation Insulation Assessment Checklist	
Substation	
Bay	
Phase (R, W or B)	
Equipment / item	
System maximum voltage (Umax) (kV)	
Insulator component type	
Number of insulator components in series per phase (Insulator Set)	
Material	
Condition of insulator surface	
Creepage from top to first shed (mm)	
Creepage per shed pair (mm)	
Number of shed pairs per insulator component	
Creepage from bottom to last shed pair (mm)	
Creepage distance (mm) per insulator component	
Total creepage distance (mm) of insulator components in series per phase	
Dry arcing distance (mm) per insulator component	
Total dry arcing distance (mm) of insulator components in series per phase	
Alternating sheds (Yes/no)	
Under ribs present (Yes/no)	
Number of Large sheds	
Large shed projection (mm)	
Large shed circumference (mm)	
Number of small sheds	
Small shed projection (mm)	

Small shed circumference (mm)	
Large shed spacing (mm)	
Minimum distance between sheds (mm)	
Large shed spacing to large shed projection ratio	
Trunk diameter Top (mm)	
Trunk diameter Bottom (mm)	
Site pollution severity level (if measured)	
Additional comments:	
Name:	Signature:
Date:	

Note: The above checklist is an example for typical insulator types and does not cover insulators with barrel or beehive shapes, nor non-consistent tapers or varying shed projections.