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1. INTRODUCTION

Currently, a wide variety of insulator products are being used on the Eskom Distribution system. These insulating products are exposed to diverse environmental conditions, which include high pollution levels (marine, industrial, sugar cane, etc.), frequent wetting cycles, ultra-violet radiation and variable wind conditions.

The accelerated ageing test as per SANS 61109, Appendix C was specified in the past to obtain an indication of the performance of insulator products under simulated environmental conditions. Research performed at Koeberg Insulator Pollution Test Station (KIPTS) indicated that SANS 61109, Appendix C does not adequately simulate the diverse environmental conditions that exist in South Africa. The Distribution Group has therefore embarked on a philosophy of natural ageing and pollution performance type testing to account for these factors in the evaluation of insulator products.

1.1 KEYWORDS

MV, KIPTS, natural ageing test, cable termination, outdoor cable termination, pollution performance

2. SUPPORTING CLAUSES

2.1 SCOPE

None

2.1.1 Purpose

None

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] DPC 34-224, *Distribution Standard Part 0: KIPTS Natural ageing and pollution performance test procedure for outdoor insulator products. Section 0 – General requirements*
- [2] DSP 34-1624, *Distribution Standard Part 22: Specification for 11kV and 22kV impregnated paper and XLPE-insulated cables.*
- [3] NRS 012, *Cable terminations and live conductors within air-filled enclosures (insulation co-ordination) for rated a.c. voltages from 7,2 kV and up to and including 36 kV.*
- [4] NRS 053 Edition 2, *Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33 kV).*
- [5] SANS 97, *Electric cables – Impregnated-paper-insulated metal-sheathed cables for rated voltages 3,3/3,3 kV up to 19/33 kV.*
- [6] SANS 1339, *Electric cables – Cross-linked polyethylene (XLPE)- insulated cables for voltages from 3,8/6,6 kV to 19/33 kV.*

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- [7] IEC 60055-1, Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas pressure and oil filled cables) – Part 1: Tests on cables and their accessories.
- [8] SANS 60502-4, Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV).
- [9] SANS 61109, Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V.

2.2.2 Informative

None

2.3 DEFINITIONS

All definitions in DPC 34-224 and the normative references shall apply.

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to External Parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

All abbreviations as defined in DPC 34-224 and the normative references shall apply.

2.5 ROLES AND RESPONSIBILITIES

None

2.6 PROCESS FOR MONITORING

None

2.7 RELATED/SUPPORTING DOCUMENTS

None

3. KIPTS NATURAL AGEING AND POLLUTION PERFORMANCE TEST PROCEDURE FOR OUTDOOR INSULATOR PRODUCTS SECTION 5: PARTICULAR REQUIREMENTS FOR OUTDOOR MV CABLE TERMINATORS

3.1 REQUIREMENTS

Nothing in this specification shall lessen the obligations of the supplier as detailed in any other documents forming part of an enquiry document.

3.1.1 General

3.1.1.1 The test procedure

The test procedure focuses on testing of the external insulation of the cable termination and provides a natural ageing and pollution performance test that is intended to replace the salt fog test

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required by IEC 60055-1 and SANS 60502-4.

3.1.1.2 The terminations to be tested

The terminations to be tested shall be in accordance with NRS 053. However, they shall have a termination tail length of 650mm (as defined in NRS 012), two rain sheds per individual core and a trished near the crutch. Torque shear connector lugs shall be used. Terminations that do not comply with these requirements shall be disqualified and shall not be tested.

NOTE The tri-shed is applicable to terminations for paper-insulated cable only.

3.1.1.3 Termination components

Termination components (specifically with outer core tubing, rain sheds and break-out boot) shall be fully marked by the manufacturer in accordance with the requirements of NRS 053. Terminations supplied with unmarked outer core tubing, rain sheds and break-out boots shall be disqualified and shall not be tested.

3.1.2 Samples and product grouping

3.1.2.1 A product group is considered to be a common group of cable terminations

A product group is considered to be a common group of cable terminations, from a specific manufacturer, that are manufactured from the same material (i.e. outer 'non-track' material for the trifurcating break-out boot, core tubing and rain sheds), utilises common technologies (e.g. heat-shrink, cold-shrink or slip-on) and have a common general design (e.g. common stress control design). The differences between products in a product group shall exist due to the modifications that are required to cater for different rated voltages, sizes of cables, external creepage distances, tail lengths and cable insulation media.

3.1.2.2 To obtain approval for terminations having a common

To obtain approval for terminations having a common technology (i.e. that are manufactured from the same outer material and share a common general design), two terminations suitable for a 50 mm2 three-core cable shall be tested.

NOTE: Provided the requirements given in 2.2.1 are fulfilled, the following conditions regarding the scope/range of approval for a product group apply:

- Tests carried out for a product group on a paper-insulated cable (in accordance with SANS 97) shall provide approval of that type of product group for use on XLPE-insulated cables (in accordance with SANS 1339). Tests carried out for a product group on XLPE-insulated cable, however, shall not provide approval for use of that type of product group on paper-insulated cables. This is due to the more onerous requirements of the sector shaped phase cores of a paper-insulated cable in accordance with SANS 97.
- Tests carried out for a product group on a three-core cable shall provide approval of that product group for use on single-core cables. Tests carried out for a product group on a single-core cable, however, shall not provide approval for use of that product group on three-core cables.
- Tests carried out for a product group at 22kV shall provide approval of that product group for 11kV. Tests carried out for a product group at 11kV, however, shall not provide approval of that product group for 22kV.

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3.1.2.3 When a cable termination is submitted for testing the manufacturer shall stipulate in writing which part numbers form part of the product range.

3.1.3 Test samples

3.1.3.1 Three samples

Three samples shall be submitted per test item and shall include earthing kits, bills of materials and installation instructions. Two samples shall be used for the natural ageing and pollution performance test and the third sample shall be used to obtain material samples for the material analysis and artificial ageing test as described in DPC 34-224 Section 0 – General requirements. The third sample shall also be stored for future reference.

3.1.3.2 The test samples

The test samples to be used for the natural ageing and pollution performance test shall be installed by the supplier onto a 5 m length of cable that complies with DSP 34-1624 (i.e. SANS 97 and SANS 1339 for paper-insulated and XLPE-insulated cables respectively). The test samples shall be installed as in service making sure that minimum clearances are maintained between phase cores. The cable support bracket as shown in figure A.1 (Appendix A) shall be used for the KIPTS test installation. This support bracket makes provision for the attachment of second bracket as shown in figure A.2 for the mounting of the stand-off post insulators required for the support of each core of the termination.

3.1.3.3 For the purposes of measuring the relevant leakage currents and monitoring the electrical performance

For the purposes of measuring the relevant leakage currents and monitoring the electrical performance, provision shall be made for the installation of constant force springs around the outer tubing near the base of each core that will result in a total creepage distance (i.e. from the top of the core outer tubing to the top of the constant force spring including the two rain sheds) of 372mm for 11kV or 744mm for 22kV (i.e. a specific creepage of 31mm/kV). The constant force spring shall be positioned below the core sheds and above the tri-shed.

NOTE: The constant force springs and measuring equipment will be installed by the test station authority.

3.1.4 Test procedure

3.1.4.1 Terminations not complying with the requirements

Terminations not complying with the requirements stipulated in 3.1.1 shall be disqualified and shall not be tested.

3.1.4.2 The test procedure

The test procedure shall be in accordance with that specified in DPC 34-224 Section 0 – General requirements.

3.1.4.3 The test

The test shall be carried out for a full 12 month cycle

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The test shall be carried out for a full 12 month cycle (i.e. in accordance with a product having a specific creepage of 31mm/kV – resulting in a 'heavy / very heavy' product classification)

3.1.4.4 The test set-up configuration shall be as shown in Figure 1.

- NOTES:
1. The steel support structures shall be earthed.
 2. The main earth braid of each cable termination shall be earthed.
 3. The constant force springs shall be installed in accordance with 2.3.3.

3.1.4.5 The termination #1

The termination #1 will be used for the purposes of the electrical performance as follows:

3.1.4.5.1 The constant force

The constant force spring on core #1 shall be earthed via the leakage current signal box. A 750mA fuse shall be used on the line side of core #1.

3.1.4.5.2 The constant force springs on core #

The constant force springs on core #2 and core #3 shall be earthed via a 750mA fuse. These fuses shall be used for the purposes of counting fuse-operations (checked during daily inspections). A 1500mA fuse shall be used on the line sides of core #2 and core #3 to protect the supply in the event of a product failure (e.g. flashover).

3.1.4.6 The electrical performance of core #1

The electrical performance of core #1 (i.e. number of 750mA fuse operations on the line side of core #1 – being the core on which the constant force spring is attached for the purpose of leakage current measurement) will not be considered during the evaluation of the test results.

3.1.4.7 Only the core

Only the core (i.e. either core #2 or core #3 of termination #1) having the most fuse operations will be used to rate the overall electrical performance of the 3-phase product. For example, if core #2 has 1 fuse operation and core #3 has 2 fuse operations, then the overall number of fuse operations will be regarded as 2 (not 3).

NOTE: Only if one individual core has more than 3 fuse operations will the product fail from an electrical performance perspective.

3.1.4.8 The termination #2

The termination #2 will be used for the purposes of the material performance.

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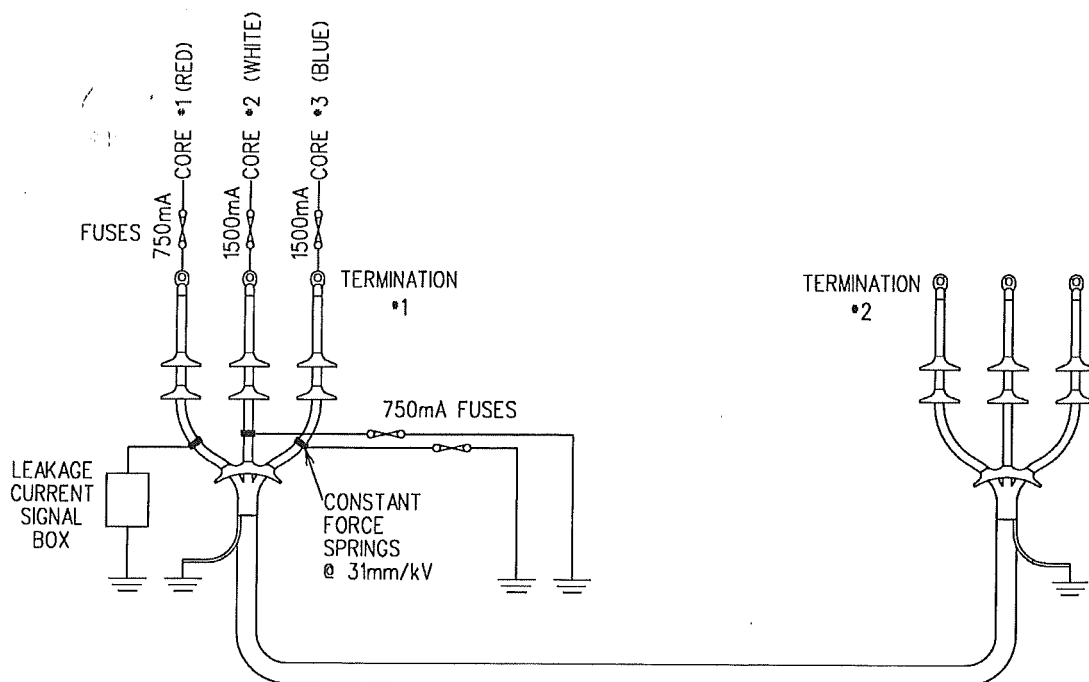


Figure 1: Test set-up configuration for cable terminations

4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
	Document Approved by TDAC ROD 16 July 2103

APPENDIX A: KIPTS CABLE TERMINATION SUPPORT BRACKETS (Normative)

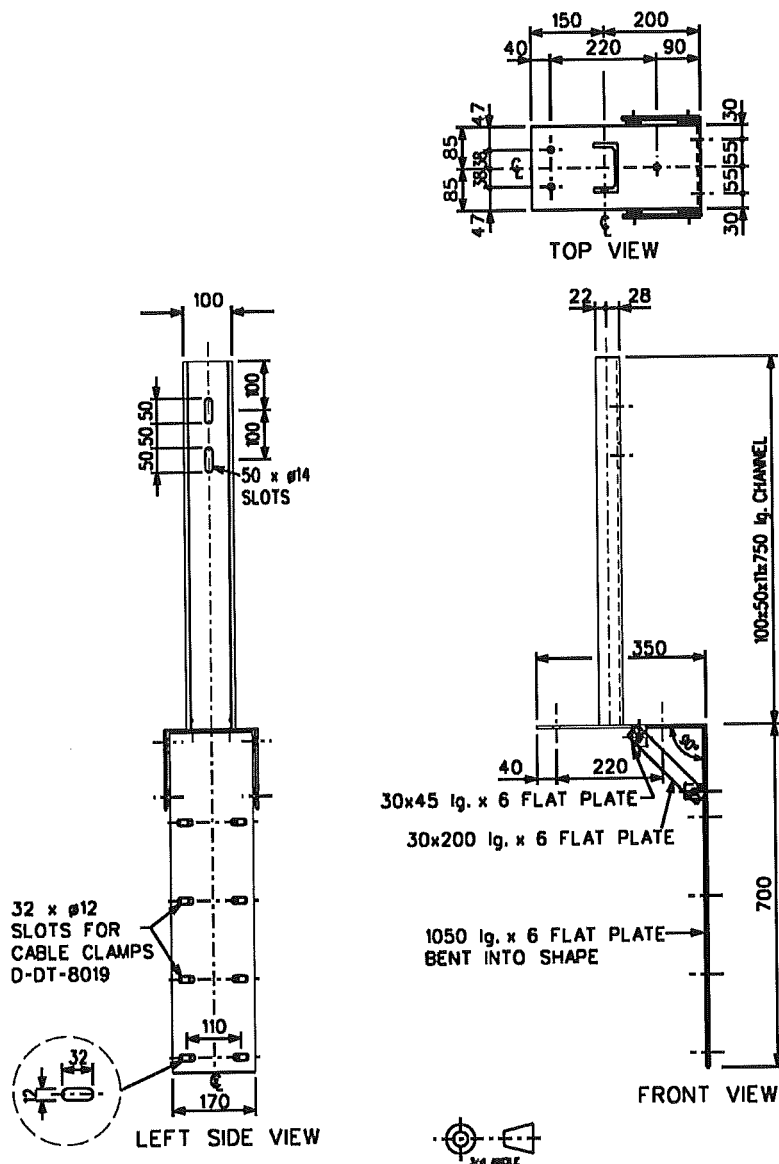


Figure 2: Figure A1

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APPENDIX A (Continued)

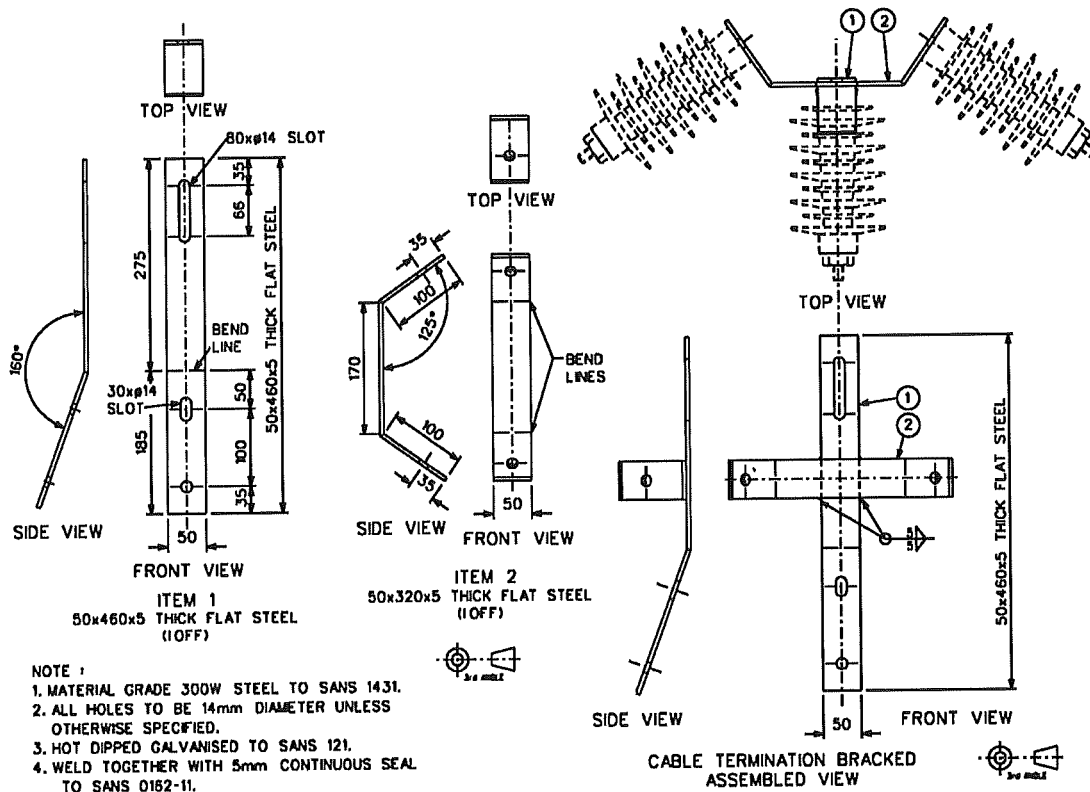


Figure 3: Figure A2

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