Eskom	Standard	Technology

Title: **KIPTS NATURAL AGEING AND POLLUTION PERFORMANCE TEST PROCEDURE FOR OUTDOOR INSULATOR PRODUCTS SECTION 0 – GENERAL REQUIREMENTS**

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1. Introduction

This document is a multi-part document consisting of the following sections:

- 240-100495413: Section 0, General requirements.
- 240 - 75881756: Section 1, Particular requirements for post, longrod and stand-off insulators.
- 240 - 75881784: Section 2, Particular requirements for through wall bushings.
- 240 - 75882042: Section 3, Particular requirements for surge arresters.
- 240-100495417: Section 4, Particular requirements for switch-disconnectors.
- 240 - 75661195: Section 5, Particular requirements for medium voltage cable terminations.
- 240 - 75661213: Section 6, Particular requirements for other insulator products.

The wide variety of insulator products used in the Eskom Distribution networks are subjected to diverse and sometimes severe environmental conditions, which include high pollution levels (marine, industrial etc.), frequent wetting cycles, high ultra-violet radiation exposure and highly variable wind conditions.

The accelerated ageing test defined in SANS 61109, Annex C was specified formerly in order 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, Annex C does not adequately simulate the severe environmental conditions that exist in certain parts of South Africa. Eskom has therefore embarked on natural ageing and pollution performance type testing to account for these conditions in the evaluation of insulator products.

2. Supporting clauses

2.1 Scope

This document describes the general procedure that will be used by Eskom for the natural ageing and pollution performance evaluation of outdoor insulation products for application at nominal system voltages of 11, 22, 33, 66 and 132 kV.

The procedure also stipulates the acceptance criteria used at KIPTS to determine which products are acceptable under general (SANS 60815, light to medium pollution classification) and extreme (SANS 60815, heavy to very heavy pollution classification) environmental conditions.

This document shall be read in conjunction with the relevant product specific section as detailed in the introduction.

2.1.1 Purpose

The document is to ensure uniformity in test procedure, and adequate performance levels when performing the natural ageing and pollution performance evaluation of outdoor insulation products for application in Eskom up to nominal system voltages of 132kV.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

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] ANSI C29.11-1989, “American National Standard for composite suspension insulators for overhead transmission lines - tests”, August 1989.

[2] SANS 60815 [Equivalent to IEC], Selection and Dimensioning of High-voltage Insulators Intended for Use in Polluted Conditions

[3] SANS 61109 [Equivalent to IEC], Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.

[4] 92/1 1992, STRI guide “Hydrophobicity classification guide”

[5] TRR/E/98/EL124, TRI “Field ESDD/NSDD sampling Procedure”

[6] RES/RR/22239, Eskom Report “Procedure for Accelerated Laboratory Ageing of Insulators”

2.3 Definitions

2.3.1 General

Definition	Description
Creepage Distance	The shortest distance or the sum of the shortest distances along the insulating parts of the insulator between those parts which normally have the operating voltage between them.
Insulator Products	All electrical equipment used within the power network with insulation exposed to the outdoor environment (for rated voltages above 1kV).
Leakage Current	The electrical current flowing between the metal end fittings of an insulator. This leakage current can be divided into two components: A resistive component (I_r) and a capacitive (I_c) component (I_c). The resistive component is the parameter related to the pollution performance.
Maximum System Voltage (Umax)	The highest r.m.s. phase-to-phase voltage which occurs under normal operating conditions. It excludes voltage transients and temporary voltage variations due to abnormal conditions.
Specific Creepage Distance(SCD)	The total creepage distance of the insulation in relation to the maximum system voltage (U_m), expressed in mm/kV, and determined by the relation: Specific creepage distance = Total creepage distance ÷ U_m for the equipment.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
DDDG	Directional Dust Deposit Gauge.
ESDD	Equivalent Salt Deposit Density.
KIPTS	Koeberg Insulator Pollution Test Station.
NSDD	Non Soluble Deposit Density.

2.5 Related/supporting documents

This document is a multi-part document consisting of the following sections:

- 240-100495413: Section 0, General requirements.
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- 240-100495417: Section 4, Particular requirements for switch-disconnectors.
- 240 - 75661195: Section 5, Particular requirements for medium voltage cable terminations.
- 240 - 75661213: Section 6, Particular requirements for other insulator products.

3. Test Station

KIPTS is situated along the Cape West Coast, about 50 meters from the sea, on property made available by Koeberg Nuclear Power Station. The test station consists of test bays for 11, 22, 33, 66 and 132kV complete with control room, environmental monitoring station, pollution monitors and leakage current logger systems.

The climate at KIPTS is characterised by dry summers, high winds, mist banks, and heavy marine and industrial pollution. The rainfall occurs mainly in winter. The pollution index at KIPTS is in the order of 2000 μS/cm, which is extremely high and would be classified as 'very heavy' (SANS 60815). The ageing at Koeberg has been correlated to the "SANS 61109, 5000h ageing test" and a factor of 2:1 was found [1]. KIPTS therefore constitutes the ideal marine and industrial pollution condition in which to evaluate insulator products.

3.1 Environmental conditions monitored at KIPTS

Weather patterns and pollution drastically affect the performance of insulators. The type of pollution and wetting cycle determines the amount of leakage current flowing over the insulator surface. This current causes the insulation to deteriorate and can finally lead to electrical and/or mechanical failure of the insulator. Some environmental factors and in particular, ultraviolet solar radiation have detrimental effects on the ageing of materials. Therefore monitoring the environmental conditions at KIPTS is of utmost importance.

Environmental monitoring at KIPTS using the "Round Robin Pollution Monitor Study Test Protocol" [2] as prescribed by the Cigre Task Force 33.04.03 is described below.

3.1.1 Weather Monitoring Station

A weather station is installed at 3 m above mean sea level. The following weather parameters are monitored:

a) Wind speed (m/s) and direction (deg);

b) Relative humidity (%);

c) Temperature (°C);

d) Rainfall (mm);

e) UVA solar radiation (μW/cm2).

f) UVB solar radiation (μW/cm2).

3.1.2 Directional Dust Deposit Gauges (DDDG)

Directional dust deposit gauges are installed at 3 m above mean sea level.

The dust gauge comprises four vertical tubes each with a slot milled in the side, these being arranged to face north, south, east and west. A removable container, which collects the deposits blown through the slots, is attached to the bottom of each tube. The "Pollution Index" [3] is defined as the mean value of the conductivities of dust deposited from each of the four wind directions, expressed in μS/cm, and normalised to a 30-day month.

Table 1: Relationship between pollution level and pollution index

Pollution level (SANS 60815)	Pollution index (μS/cm)
Light	0 – 75
Medium	76 – 200
Heavy	201 – 350
Very heavy	> 350

3.1.3 Equivalent Salt Deposit Density (ESDD), Non Soluble Deposit Density (NSDD)

The Insulators used for ESDD and NSDD consist of a 7 unit string of Sediver F12/146 IEC U120B type insulators. The unenergised insulator string is located at a height as close as possible to that of energised insulators used for leakage current measurement. Each disk of the insulator string is monitored at intervals defined by the task force e.g. every month, every three months, each year, after two years, etc.

The general technique for measurements of ESDD involves dissolving the surface deposits in a known quantity of low conductivity water, measuring the temperature of the solution and calculating the ESDD from the measured conductivity, the volume of water and the insulator surface area.

Table 2: Relationship between pollution level and ESDD

Pollution level (SANS 60815)	ESDD (mg/cm^2)
Light	<0.06
Medium	0.06 – 0.12
Heavy	>0.12 – 0.24
Very heavy	> 0.24

The NSDD is measured by filtering the wash water used for ESDD measurement through filter paper that is pre-dried in an oven. The paper is dried again, after the solution has drained through the filter. The filter paper is then weighed using a scale with a resolution in the order of 0.0001 grams. The NSDD is the difference between the original dried filter paper and the re-dried filter paper masses, divided by the surface area of the insulator.

3.2 Test Setup

Five types of test positions are available at KIPTS:

a) Fixed support – where the insulator product is mounted on a medium equipment support frame as shown in Figure 1A of Annex A. The outline dimensions in plan view of the insulator product shall not exceed 1 m x 1 m.

b) Single-phase suspension – where the insulator product is required to interface with a IEC 16mm tongue as indicated in Figure 2A of Annex A. The outline dimensions in plan view of the insulator product shall not exceed 0.5 m x 0.5 m.

c) Three-phase suspension – where each phase of the insulator product is required to interface with a IEC 16mm tongue as indicated in Figure 3A of Annex A.

d) Stand-off bracket – where the insulator product is required to interface with the stand-off bracket shown in Figure 4A of Annex A.

e) L-bracket – where the insulator product is required to interface with an L-bracket as shown in Figure 5A of Annex A.

The above-mentioned maximum outline dimensions are prescribed due to space constraints at the test station. Insulator products that exceed the dimensions may require two test positions and the test will be priced accordingly.

4. Requirements

a) Insulator products shall comply with the applicable minimum creepage requirement.

b) Insulator products shall comply with the profile characteristics as stipulated in SANS 60815.

c) The number of test samples as detailed in the relevant particular requirements section shall be provided for testing.

d) Detailed design and assembly drawings (including revision control information) of the product to be tested shall be provided.

e) The name of the insulator product supplier and the manufacturer shall be provided.

f) Type test reports for the power frequency wet and dry withstand and impulse tests shall be submitted.

g) The manufacturer/supplier shall be responsible for installation of the insulator product and shall confirm that the installation of the product is satisfactory prior to energization.

h) Insulator products that are intended for application in general pollution environments, (minimum specific creepage distance $\geq$ 20 mm/kV) shall be tested for a six-month winter cycle at KIPTS (starting April or May).

i) Insulator products that are intended for application in extreme pollution environments, (minimum specific creepage distance $\geq$ 31 mm/kV) shall be tested for a twelve month winter and summer cycle at KIPTS (also starting April or May).

5. Test Procedure

The test procedure for all insulator products (see *Figure 1* for flowchart) shall be as follows:

a) The physical design details of the insulator products shall be verified in relation to the detailed design drawing.

b) A material sample shall be stored for future reference in a sealed container to eliminate exposure to all external environmental conditions.

c) A material analysis must be performed in accordance with clause 7 in order to determine a new material “fingerprint”.

d) An artificial ageing test shall be performed in accordance with clause 8. This shall be followed by a material analysis in accordance with clause 7 to determine an artificially aged “fingerprint”.

e) A natural ageing test shall be performed in accordance with clause 9. This may be followed by a material analysis test in accordance with clause 7 to determine a naturally aged “fingerprint”.

Upon completion of the above test procedure, the insulator product shall be deemed to be acceptable or not, based on the acceptance criteria given in clause 10. Comments shall also be given on the results from the material analysis.

6. Material Analysis

The main purpose of the material analysis is to “fingerprint” the material when new for future reference and to determine the condition of the material at the end of the artificial ageing cycle.

The material analysis will be performed in accordance to “Procedure for Fingerprinting Composite Insulator Materials”, Report No. RES/RR/03/22240. The manufacturer must submit samples for material analysis to the applicable polymer science laboratory.

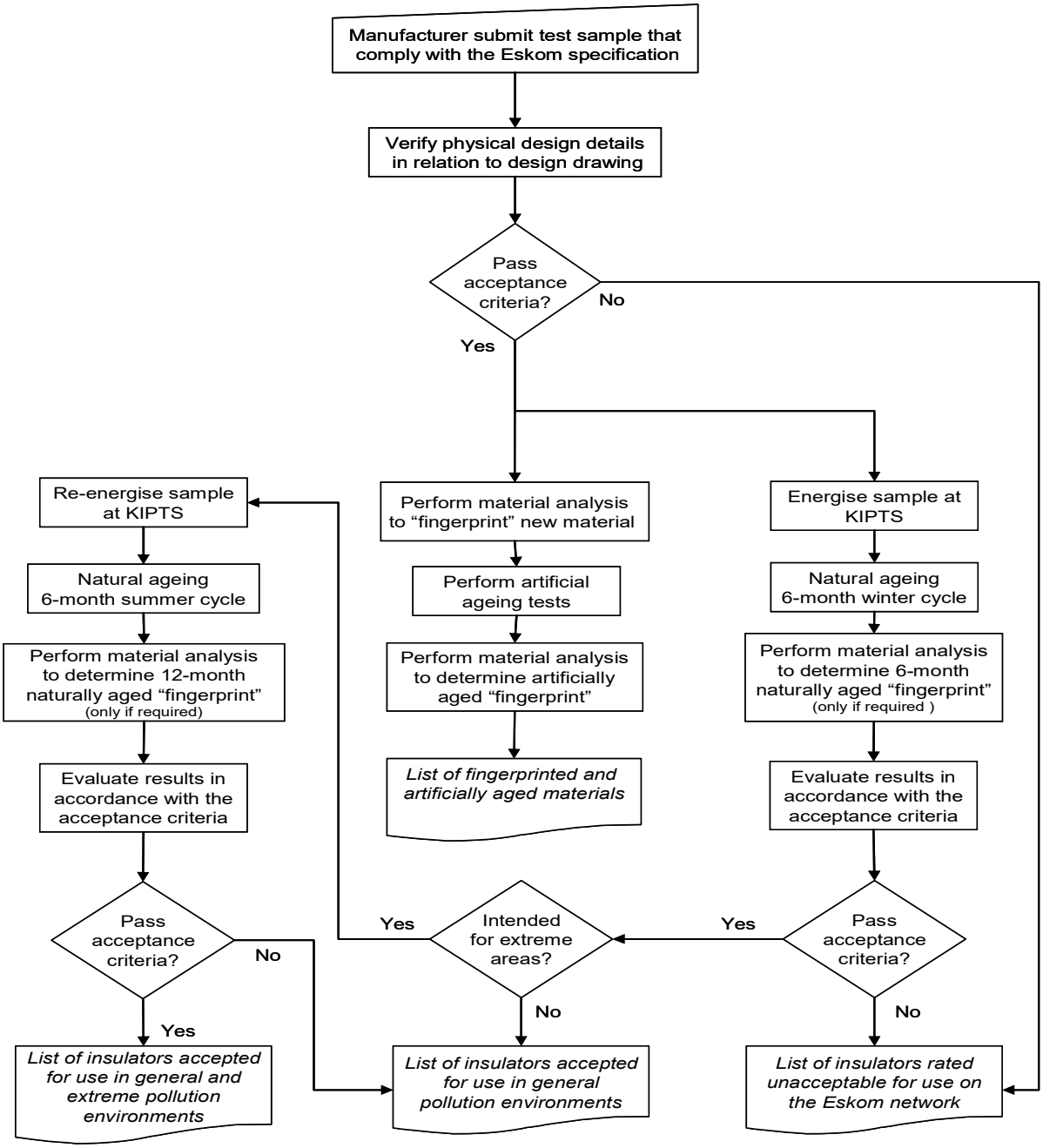

Figure 1: Flowchart of the test procedure for insulator products at KIPTS

7. Artificial Ageing

The main purpose of the artificial ageing is to determine the expected performance of the material under extreme UV, acid and humidity conditions that may not be adequately simulated during the natural ageing test.

The artificial ageing will be performed under laboratory conditions in accordance to "Procedure for Accelerated Laboratory Ageing of Insulators, Report No. RES/RR/22239. The manufacturer must submit samples for material analysis to the applicable polymer science laboratory.

8. Natural Ageing Test

The natural ageing test entails the installation of the insulator product at KIPTS and monitoring the performance of the insulator product over a period of either six or twelve months.

The following measurements and observations shall be performed during the test period to determine a general and extreme environmental ageing condition. Test results will be time independent, which means that test results from one year can be compared to results from any other year, should the necessary environmental data be available. This time independence will be determined by the establishment of a “dose rate” relevant to each environmental parameter.

8.1 Leakage Current Measurements

The leakage current flowing over the surface of an insulator under test is internationally recognised as one of the main parameters required to monitor the performance of insulator products. Small resistive leakage currents in the order of mA’s can cause severe damage to insulating materials (due to sparking). Therefore, monitoring the leakage current is of utmost importance at KIPTS.

The following parameters of the leakage current flowing over the surface of an insulator are monitored (1% accuracy) and stored for a pre-selected interval (e.g. 10 min) sampled at 1 kHz, ignoring all values below 1 mA using a leakage current data logger system. The calibration of the logger units is checked at a yearly interval by the original equipment supplier.

8.1.1 High Positive and Negative Leakage Current Peaks

The maximum positive and negative peaks of the leakage current over a set interval (highest peak current, I_h) are recorded. The relationship between the measured peak current and expected flashover peak current is investigated. Record is also kept of the number of fuse failures (including date) on each product tested.

8.1.2 Current Pulse Counters

A total of 8 counters, with varying thresholds (> 35, 75, 150, 300, 600, 750 and 1000 mA) are available. The positive and negative threshold values are identical in magnitude, with opposite signs. When triggered the counter increments and then disarms. To arm the counter again, the signal must cross the zero line. A trigger results when the instantaneous sample exceeds the appropriate threshold. The counter indicates the frequency of occurrence of a current pulse exceeding a pre-set threshold (> 35, 75, 150, 300, 600, 750 and 1000 mA). The amount of pulses exceeding the 600 mA threshold indicates a high probability for flashover occurrence.

8.1.3 Positive and Negative Integrated Charge

The sum of the positive and negative leakage current waveform samples are integrated over a set interval to obtain the charge (coulomb)

The areas associated with each instantaneous sample (20 samples/cycle) are summed over a pre-selected interval (10 min) and saved as the integrated charge value. The positive and negative half-cycle values are saved separately. The average current can be derived from these parameters The integrated charge is an indication of the degree of material degradation.

$$Q(pos) = \int_0^T pos\,(i(t))dt \qquad \text{Theoretical equation}$$

$$Q(pos) = \sum_{n=0}^{n=N} pos[i(n)]\Delta t \qquad \text{Applied equation}$$

where:

Q(pos) = Integral of the positive leakage current giving the positive integrated charge in coulomb

pos(i(t)) = Positive leakage current i at point t in ampere

T = Selected interval in seconds (60 – 3 600 sec)

$$f = 1kHz = 1000Hz \qquad \text{(Frequency)}$$

$$N = f \cdot T = 1000T \qquad \text{(Sampling points)}$$

$$\Delta t = \frac{1}{f} = \frac{1}{1000} = 1ms \qquad \text{(Time between samples)}$$

Note: The electrical charge Q in coulomb is derived as follows:

$$dQ = idt$$

$$thus$$

$$Q = \int idt$$

8.1.4 Coulomb Ampere

The square of the leakage current waveform samples are summed over a set interval (coulomb ampere)

The areas associated with each instantaneous sample (20 samples/cycle) are squared and summed over a pre-selected interval (10 min) and saved as the coulomb ampere value. The r.m.s. current value can be derived using the coulomb ampere value. The quadratic function in the calculation of the coulomb ampere value when high, indicates a high amount of electrical activity. A sudden increase in current flow on the insulator surface is best determined by examining the coulomb ampere gradient due to the quadratic current function.

$$QA = \int_0^T [i(t)]^2 dt \qquad \text{Theoretical equation}$$

$$QA = \sum_{n=0}^{n=N} [i(n)]^2 \Delta t \qquad \text{Applied equation}$$

where:

QA = the integral of the leakage current squared giving a value in coulomb ampere

Note: The coulomb ampere readings are smaller than the integrated charge values when the leakage current values are below 1 ampere. When the leakage current exceeds 1 ampere, the coulomb ampere values will be larger than the integrated charge values.

Note: The electrical energy W in joule is derived as follows:

$$dW = i^2 R dt$$

$$thus$$

$$W = R\int i^2 dt$$

8.2 Visual Observations

Visual observations are made at KIPTS at a three-monthly interval, with the emphasis on the following:

a) Hydrophobicity in accordance with the STRI 92/1 1992 method;

b) Material degradation (crazing/crocodile skinning, discoloration, chalking, peeling and flaking);

c) Erosion (surface roughening, sheath/shed material loss, cracking/core exposure);

d) Tracking;

e) Puncturing.

8.3 Ultra-Violet recordings

Upon request from the manufacturer, ultra-violet (UV) video recordings can be performed at KIPTS using the "Corocam Mark II" image intensified camera, on a three monthly basis. The vendor may at beginning of the test period, request a video compilation indicating the increase in electrical activity over time. This compilation is at is not included in the standard test price, and is an additional cost.

9. Acceptance Criteria

What constitutes an insulator failure remains a contentious issue in the international working groups. However, there are some documents that contain some guidelines as to what constitutes an insulator failure.

a) The IEC 1109 [7], 1 000h Salt fog or 1 000/5 000h ageing test prescribes the following acceptance criteria: "The test is regarded as passed if: no more than three over-current trip-outs occur for each specimen tested, if no tracking occurs, if erosion does not reach the glass-fibre core and if no sheds are punctured or cracked. The core shall not be visible."

b) The following extract is an indication of the current stance of international research: "At present, it is not possible to indicate reliable criteria quantifying the permissible number of erosion cracks. Further experience with this test will have to be correlated with service performance."

c) The following definitions are given in IEC 1109: "Tracking is an irreversible degradation by formation of paths starting and developing on the surface of an insulator material. These paths are conductive even under dry conditions. Tracking can occur on surfaces in contact with air and also on the interfaces between different insulating materials." "Erosion is an irreversible and non-conducting degradation of the surface of the insulator that occurs by loss of material. This can be uniform, localised or tree-shaped."

d) The ANSI C29.11-1989 [8], 1 000h Salt fog test uses the same acceptance criteria as the IEC 1109: "No more than three overcurrent trip-outs are allowed. No tracking is allowed. No weather-shed punctures or cracks are allowed. Erosion is not allowed to reach the core."

e) The following definitions are given in ANSI C29.11-1989: "Tracking is the formation of electrically conducting paths starting and developing on the surface of an insulating material. These paths are conductive even under dry conditions. Tracking can occur on surfaces in contact with air and also on interfaces between insulating materials." "Erosion is non-conductive loss of material from the insulating surface. It can be uniform, localised, or tree-shaped. Shallow surface traces, commonly tree-shaped, can occur on composite insulators as on ceramic insulators after arcing. These traces do not affect the operating characteristics of the insulator."

f) The acceptance criteria used at KIPTS is similar to those used for the IEC and ANSI tests as described above and are summarised as follows:

1) No more than three over-current trip-outs (750 mA Mace fuse blown).

2) No signs of material erosion deeper than 2 mm.

3) No signs of tracking in the material.

4) No signs of punctures or cracks in the material.

5) No signs of corrosion that has exposed the base metal or can lead to failure of hardware.

6) Comments based on results of material analysis are also considered.

10. Authorization

This document has been seen and accepted by:

Name and surname	Designation
P Moyo	Power Delivery Engineering GM
V Singh	Power Plant Technologies Manager
G Strelec	Distribution Insulator Workgroup Chairman

This procedure shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

11. Revisions

Date	Rev	Compiler	Remarks
May 2016	2	K.Ramharak	Document formatted and updated according to latest template.
March 2012	1	W Vosloo	Document on new template with minor corrections. Document number changed Reviewed by G Strelec before stabilisation of the procedure
Nov 2006	0		Additional testing requirements and procedures specified for polymer insulator products. Document re-formatted, new reference issued, changed from SCSPVACI3 to 34-224.
Jan 2002	1		Different testing requirements and procedures were specified for polymer and ceramic insulator products in revision 0. Exactly the same testing requirements and procedures are specified for polymer and ceramic insulator product in revision 0A
Nov 2000	0		Original issue as SCSPVACI3

12. Development team

Distribution Insulator Workgroup

Annex A – Interfacing Requirements

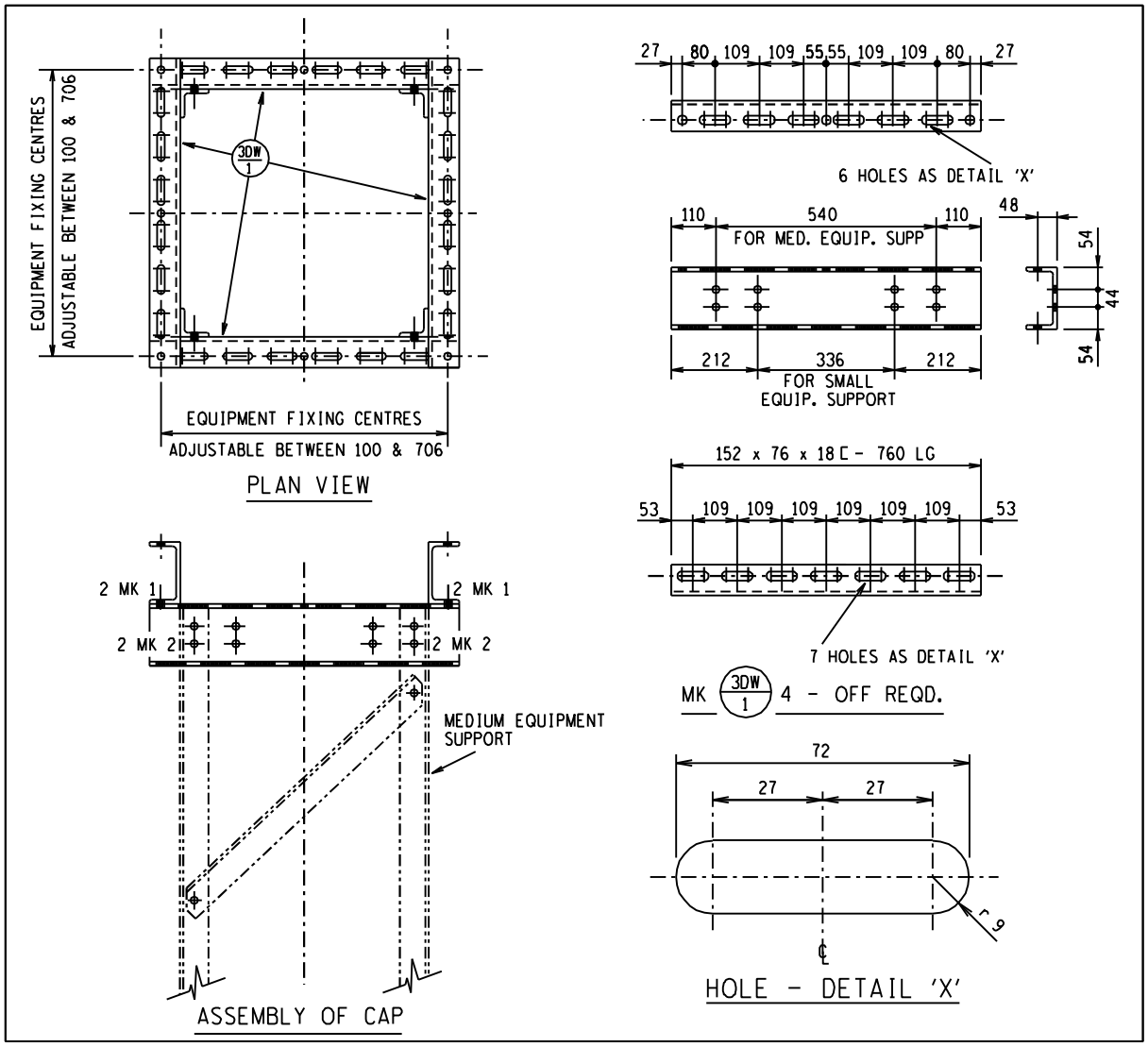

Figure A.1: Fixed support

Note: The supplier shall ensure that the insulator product can be mounted on the standard medium equipment support frame, as indicated above.

Note: The supplier shall provide the necessary nuts and bolts to mount the unit.

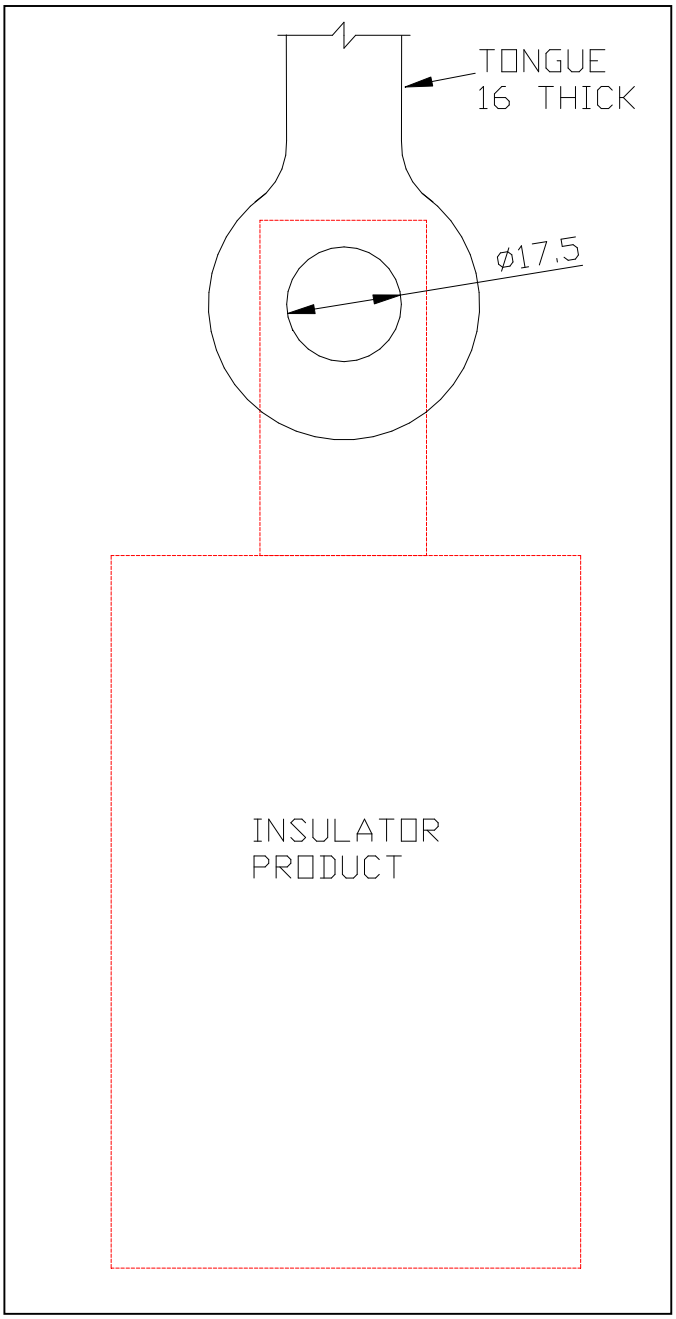

Figure A.2: Single-phase suspension

Note: The supplier shall ensure that the insulator product can be suspended from the standard tongue, as indicated above.

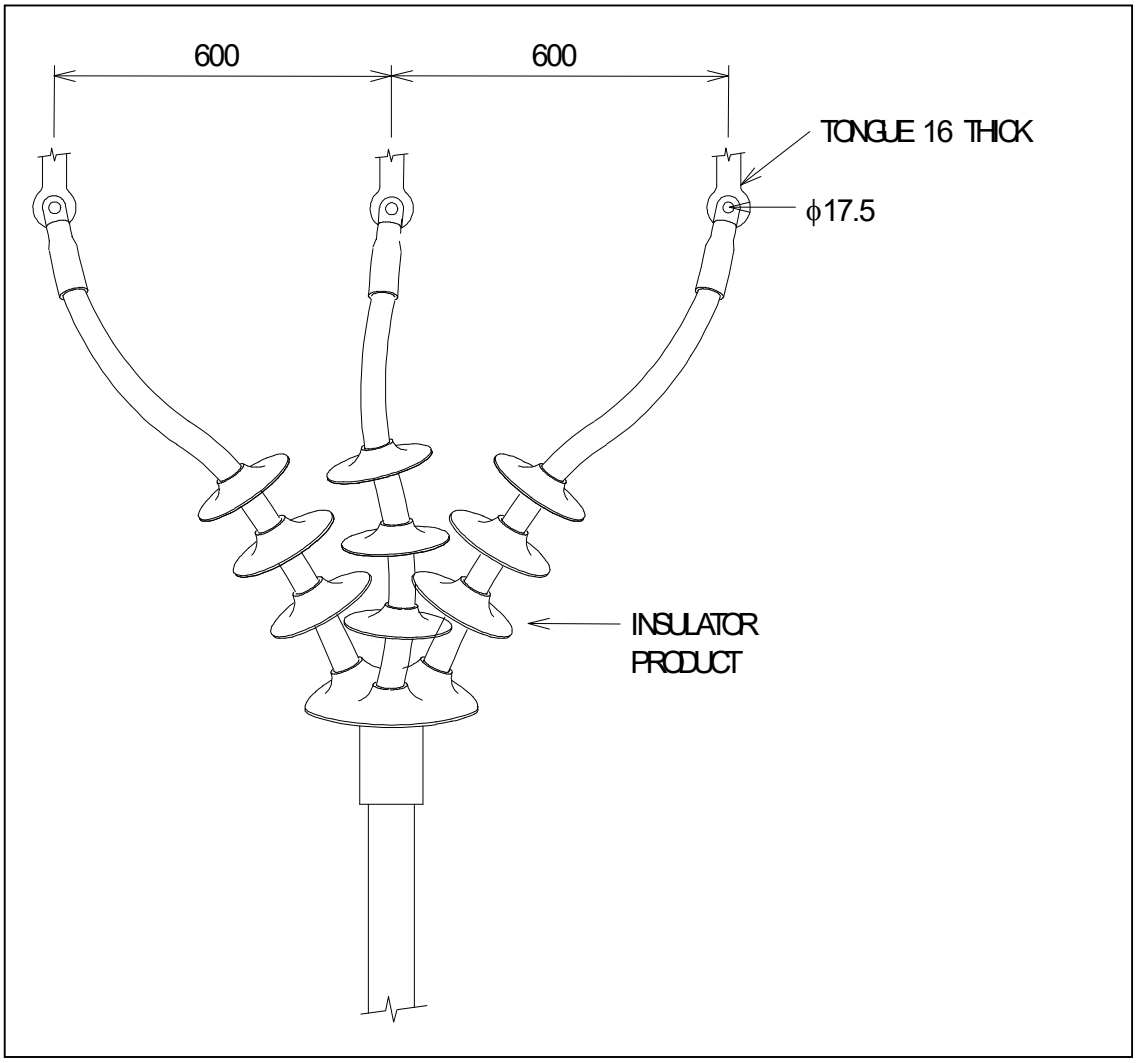

Figure A.3: Three-phase suspension

Note: The supplier shall ensure that the insulator product can be suspended from the standard arrangement, as indicated above.

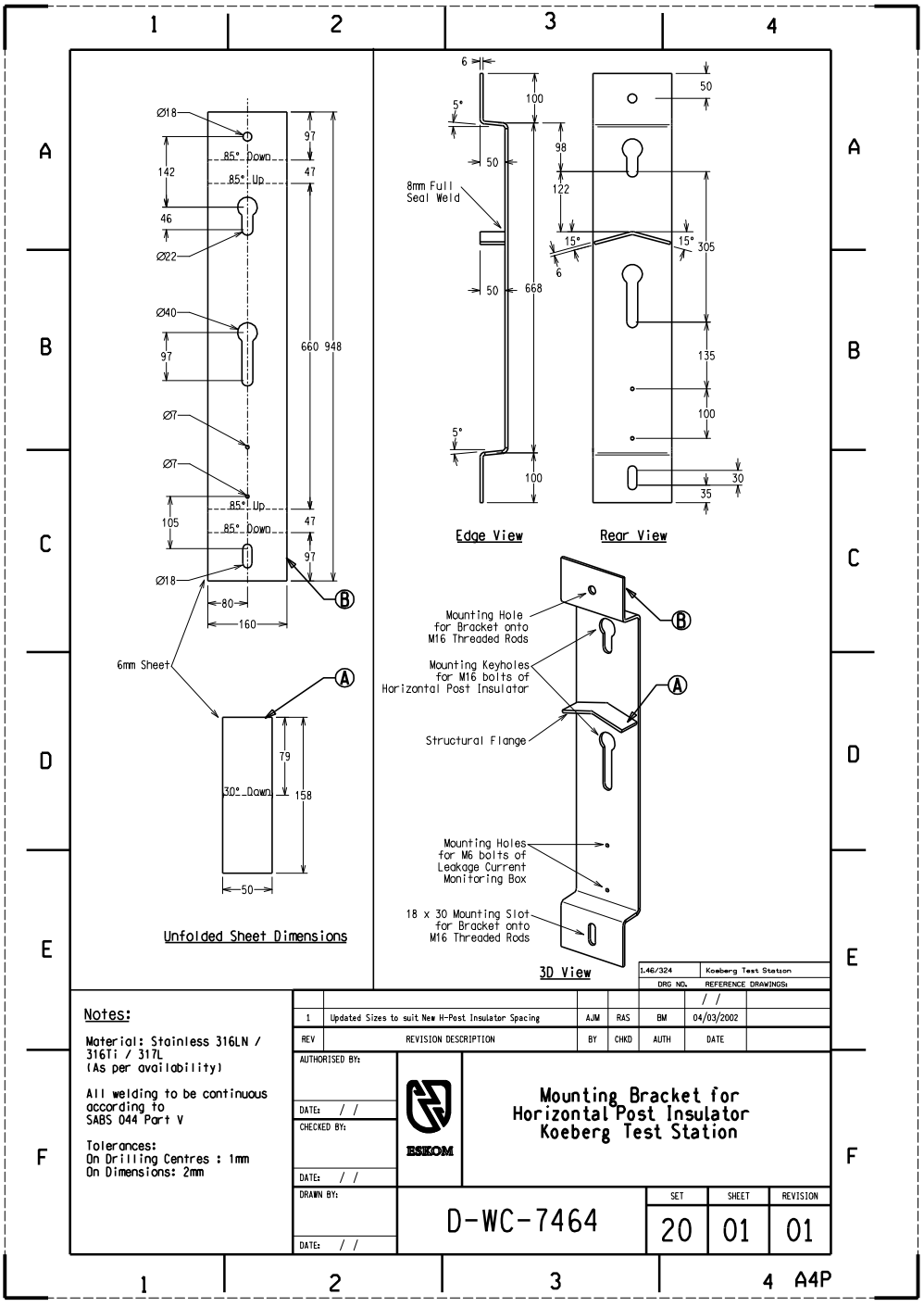

Figure A.4: Stand-off support

Note: The supplier shall ensure that the insulator product can be mounted on the standard stand-off bracket and shall supply the necessary fasteners to mount the unit.

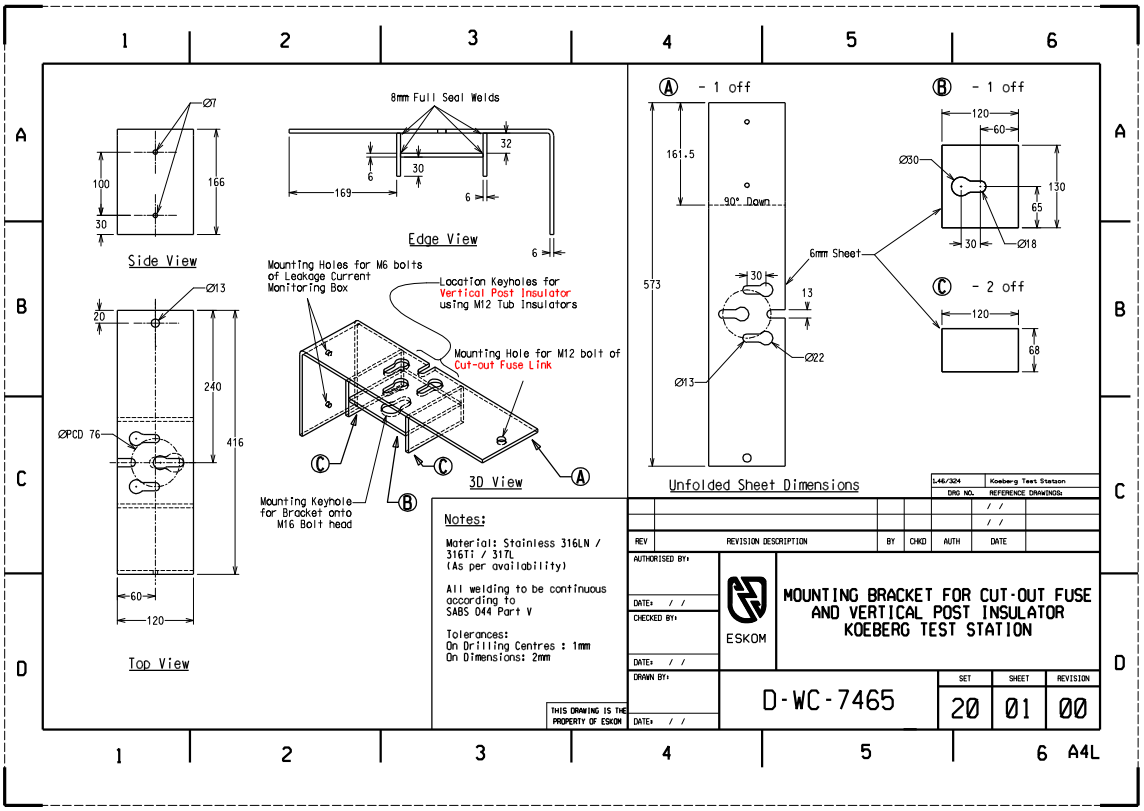

Figure A.5: L-bracket

Note: The supplier shall ensure that the insulator product can be mounted on the standard L-bracket, as indicated above.

Annex B – Test Certificate

Eskom	RESEARCH, TESTING AND DEVELOPMENT	REFERENCE
PDU DEPARTMENT	TEST CERTIFICATE	DATE

TEST CERTIFICATE AS SUPPLIED BY THE KOEBERG INSULATOR POLLUTION TEST STATION (KIPTS) FOR THE EVALUATION OF AN INSULATOR PRODUCT

ISSUED BY	SUPPORTED BY
..... Dr WL VOSLOO (CORPORATE SPECIALIST: HIGH VOLTAGE)	..... G STRELEC (CHAIRMAN DISTRIBUTION INSULATOR WORK GROUP)

To whom it may concern

Product Code: ****, Drawing: ****«Drw_No»****, Date: ****

Product Type: ****

This is to certify that the above insulation product, as manufactured by **** and tested by ****, has NOT passed the light-to-medium pollution test (winter cycle) and has passed the heavy-to-very heavy pollution test (summer cycle). The unit has been energised for the period May **** to April **** at the Koeberg Insulator Pollution Test Station (KIPTS), South Africa. Tests have been performed in accordance to the Eskom specification «Prod_Spec» and Eskom test procedure «Gen_Spec» & «Test_Spec». This test certificate renders the «Test_Voltage» (U_n) insulation product fit for use in an inland non-coastal environment nor fit for use in a marine and industrial environment and fit for use in a coastal environment

Acceptance criteria	Result		Comment
	L-M	H-VH	
No more than three over-current trip-outs (750 mA Mace fuse blown)	Pass	Pass	
No signs of material erosion deeper than 2 mm	Pass	Pass	
No signs of tracking in the material	Pass	Pass	
No signs of punctures or cracks in the material	Pass	Pass	
No signs of corrosion that has exposed the base metal or can lead to failure of hardware	Pass	Pass	
Material analysis completed			
Note: The test data and results are available on CD: ***			

Annex C – Extrapolation Test Certificate

Eskom **PDU DEPARTMENT**	**RESEARCH, TESTING AND DEVELOPMENT**	**REFERENCE**
	EXTRAPOLATION CERTIFICATE	**DATE**

TEST CERTIFICATE AS SUPPLIED BY THE KOEBERG INSULATOR POLLUTION TEST STATION (KIPTS) FOR THE EVALUATION OF AN INSULATOR PRODUCT

ISSUED BY	1) SUPPORTED BY
..... Dr WL VOSLOO (CORPORATE SPECIALIST: HIGH VOLTAGE)	..... G STRELEC (CHAIRMAN DISTRIBUTION INSULATOR WORK GROUP)

To whom it may concern

Product Code: ****, Drawing: ****«Drw_No»**** - Date: *****

Product Type: ******

This is to certify that the above insulation product, as manufactured by **** and provided by ****, has been certified based on results of ****LM/HVH using the rules of extrapolation as defined in 34-***(KIPTS Natural Ageing and Pollution Performance Test Procedure for Outdoor Insulator Products, Section *** – Particular Requirements for *****)

This test certificate renders the «Test_Voltage» (U_n) insulation product fit for use in an inland non-coastal environment nor fit for use in a marine and industrial environment and fit for use in a coastal environment.

Acceptance criteria	Result		Comment
	L-M	**H-VH**	
No more than three over-current trip-outs (750 mA Mace fuse blown)	Pass	Pass	
No signs of material erosion deeper than 2 mm	Pass	Pass	
No signs of tracking in the material	Pass	Pass	
No signs of punctures or cracks in the material	Pass	Pass	
No signs of corrosion that has exposed the base metal or can lead to failure of hardware	Pass	Pass	
Material analysis completed			

Note: The test data and results are available on CD: ***

Annex D – Declaration

Eskom PDU DEPARTMENT	RESEARCH, TESTING AND DEVELOPMENT DECLARATION	REFERENCE DATE

CONDITIONS ON RECEIPT, AND PRIOR TO TESTING OF INSULATION PRODUCTS AT THE KOEBERG INSULATOR POLLUTION TEST STATION (KIPTS)

The following conditions need to be confirmed to prior to acceptance and testing of insulating material at the Koeberg Insulator Pollution Test Station (KIPTS):

1) The product adheres to all the Eskom relevant standards and specification.

2) The product presented by the manufacturer to Eskom for testing at KIPTS is representative in all aspects to the product to be delivered by the manufacturer to Eskom for use on the power network. The product could therefore be used immediately by Eskom, should it pass the necessary acceptance criteria as specified in procedure ***, and is therefore not of prototype standard.

3) The manufacturer will supply Eskom with a full schematic diagram of each product to be tested at KIPTS.

4) The manufacturer will supply samples to Eskom, as per Eskom specification ***.

5) Eskom has the permission to perform material analysis on the material, should it be required.

6) The test contract will be signed by the manufacturer, prior to installation and testing of the insulator product. The manufacturer will be responsible for the costs pertaining to testing.

……..…	..……..	……
Company Representative	Company	Date

Annex E – Job Agreement Job Agreement

(Informative)

Eskom	**JOB AGREEMENT FOR EXTERNAL CONSULTING** (Refer Procedure RT&D PC 209-61)	Unique Identifier	209-69
		Revision Date	Sept 2012
		Revision	0
		RT&D	

PROJECT/JOB TITLE:		
RT&D FUNCTIONAL AREA:		
CUSTOMER/COMPANY	WBS NUMBER	PROFIT CENTRE/COST CENTRE
	CONTACT PERSON	Telephone: Fax:
Start Date: End Date:	PROJECT LEADER	Telephone: Fax:
Scope of Work:		
Output:		

OTHER TERMS AND CONDITIONS:	CUSTOMER Telephone : ACCOUNTANT Fax: COST CENTRE NO. ORDER NO. TRIM PROJECT CODE LABORATORY: CONTACT PERSON: EMAIL ADDRESS: POSTAL ADDRESS:

BUDGET DETAIL	MILESTONE PAYMENTS	
Total Manpower:	Excl VAT	
Project Other:		
CONTRACT TOTAL:	Excl VAT	

RT&D REPRESENTATIVE	CUSTOMER REPRESENTATIVE
Signature: Name: Date:	Signature : Name: Date:

Job agreement — general conditions (Reverse side of page 1)

RESEARCH, TESTING AND DEVELOPMENT (RT&D)

In this agreement:

a) RT&D shall mean Research, Testing and Development, a department of ESKOM Group Technology Division.

b) Customer shall mean the person, company, body corporate, partnership, firm, association or subsidiary group within Eskom for whom the job is being performed.

c) Intellectual Property Rights shall mean all rights in and to any intellectual property and know-how which may be devised or come into existence in the future in any modifications, variations, enhancements or improvements to the works and products embodying the works.

d) Know-how shall mean all confidential, technical and commercial information relating to the works existing from time to time including without limitation, information contained in any documents together with unrecorded information known to individuals who are unrecorded office bearers or employees of the client. Technical information includes all specifications, methods used by RT&D in implementing its skills.

1. **The project** shall only come into existence when the job agreement form is duly signed and accepted by both parties.

2. Terms of Payment

Invoices will be issued and are payable within thirty (30) days of the invoice date.

3. Cost Escalation

The price is based on costs prevailing at the date of the proposal and unless the contracted price is fixed and firm, any variation in such costs occurring between the tender date and date of payment shall be to the account of the Customer in accordance with the prevailing indices published by CPA (General) Rev 3 April 1982.

4. Withholding of Taxes

All sums payable shall be free of any restriction or condition and without any deduction or withholding for or on account of any tax (except to the extent required by law) imposed, levied, collected, withheld or assessed by or within the Republic of South Africa in respect of any amounts due.

5. Additional Costs

Any additional costs arising from unforeseen work or supply requirements, ie. other than the scope of work defined, will have to be negotiated and agreed to prior to the commencement of such additional work or procurement of supply.

6. Communication Approach

All communication will be under direct control of the project leader and will be confirmed in writing immediately. RT&D accepts that the same communication approach will be adopted by the Customer.

7. Professional Liability

All claims against RT&D, on the ground of professional negligence on the part of RT&D staff, shall not exceed the value of the contract and the Customer shall not have the right, under any circumstances, to claim any amount from RT&D after the expiry period of 3 years from the date of completion of this Agreement.

8. Force Majeure

Neither party shall be liable to the other for inability to perform or delay in performance if such inability or delay is caused by force majeure or strikes, work stoppages for whatever reason or from any cause beyond the reasonable control of such party.

9. Invoicing/Payment

The values on the job agreement will be invoiced against agreed milestones.

10. Intellectual Property Rights

a) The customer acknowledges that any and all of the Intellectual Property Rights including trade marks, trade names, copyright and other rights used or embodied or in connection with the Works are and shall remain the sole property of RT&D and that it shall have no claim of any nature in and to the Intellectual Property Rights.

b) The customer hereto agrees that any Intellectual Property Rights which may arise in future in all modifications, enhancements, variations and improvements to the works, shall vest in RT&D and the customer agrees to honour the rights of RT&D in and to the Intellectual Property Rights by, inter alia, keeping the proprietary information in the strictest confidence notwithstanding termination of this agreement for any reason whatsoever.

c) Upon termination of this agreement for any reason whatsoever, the parties agree that the Intellectual Property Rights shall remain vested in RT&D and that, notwithstanding such termination; the customer shall have no rights to the Intellectual Property Rights save as may specifically be granted by RT&D in its sole discretion to the customer.

11. Secrecy and Usage

a) The parties shall keep and hold secret, confidential all information received, written or oral and shall not disclose the said information other than for the purpose herein intended.

b) In the event of one party visiting any of the establishments or clients of the other party, the visiting party undertakes that any further information related to the works which may come to its knowledge as a result of any such visit, inclusive of the form, materials and design of the various elements of any relevant plant and equipment which may be seen at such establishments or clients as well as all the works as a whole, the methods of operation thereof and the various application thereof, shall be kept strictly confidential and that any such information will not be divulged to any third party and will not be made use of in any way by the visiting party without the other party's prior written consent.

12. The above undertaking shall not apply to:

- information which at the time of disclosure is published or otherwise generally available to the public;
- information which after disclosure by the disclosing party is published or becomes generally available to the public, otherwise than through any act or omission on the part of the receiving party.
- information which the receiving party can show was in its possession at the time of disclosure and which was not acquired directly or indirectly from the disclosing party. (continued)

Annex F – References

1. WL Vosloo, “Koeberg Insulator Pollution Test Station (KIPTS): Final report for 1997”, TRR/E/97/EL189, October 1997.

2. CIGRE TASK FORCE 33.04.03, “ Round Robin Pollution Monitor Study Test Protocol ”, 33-93 (TF 04-03) 5 WD, July 1993.

3. R.E. Macey, “ The performance of High Voltage, Outdoor Insulation in Polluted Environments “, Master of Science theses, April 1981.

Annex G – Impact Assessment

(Normative)

Impact assessment form to be completed for all documents.

1) Guidelines

- All comments must be completed.
- Motivate why items are N/A (not applicable)
- Indicate actions to be taken, persons or organisations responsible for actions and deadline for action.
- Change control committees to discuss the impact assessment, and if necessary give feedback to the compiler of any omissions or errors.

2) Critical points

2.1 Importance of this document. E.g. is implementation required due to safety deficiencies, statutory requirements, technology changes, document revisions, improved service quality, improved service performance, optimised costs.

Comment: This document is already implemented and has impacted on the quality of insulation products that are approved for use in the Eskom network and thereby affected the performance of the network positively.

2.2 If the document to be released impacts on statutory or legal compliance - this need to be very clearly stated and so highlighted.

Comment: N/A

2.3 Impact on stock holding and depletion of existing stock prior to switch over.

Comment: N/A

2.4 When will new stock be available?

Comment: N/A

2.5 Has the interchangeability of the product or item been verified - i.e. when it fails is a straight swop possible with a competitor's product?

Comment: N/A

2.6 Identify and provide details of other critical (items required for the successful implementation of this document) points to be considered in the implementation of this document.

Comment: N/A

2.7 Provide details of any comments made by the Regions regarding the implementation of this document.

Comment: (N/A during commenting phase)

3) Implementation timeframe

3.1 Time period for implementation of requirements.

Comment: Immediate

3.2 Deadline for changeover to new item and personnel to be informed of DX wide change-over.

Comment: Immediate

4) Buyers Guide and Power Office

4.1 Does the Buyers Guide or Buyers List need updating?

Comment: N/A

4.2 What Buyer's Guides or items have been created?

Comment: N/A

4.3 List all assembly drawing changes that have been revised in conjunction with this document.

Comment: N/A

4.4 If the implementation of this document requires assessment by CAP, provide details under 5

4.5 Which Power Office packages have been created, modified or removed?

Comment: N/A

5) CAP / LAP Pre-Qualification Process related impacts

5.1 Is an ad-hoc re-evaluation of all currently accepted suppliers required as a result of implementation of this document?

Comment: N/A

5.2 If NO, provide motivation for issuing this specification before Acceptance Cycle Expiry date.

Comment:

5.3 Are ALL suppliers (currently accepted per LAP), aware of the nature of changes contained in this document?

Comment: N/A

5.4 Is implementation of the provisions of this document required during the current supplier qualification period?

Comment: N/A

5.5 If Yes to 5.4, what date has been set for all currently accepted suppliers to comply fully?

Comment:

5.6 If Yes to 5.4, have all currently accepted suppliers been sent a prior formal notification informing them of Eskom's expectations, including the implementation date deadline?

Comment: N/A

5.7 Can the changes made, potentially impact upon the purchase price of the material/equipment?

Comment: N/A

5.8 Material group(s) affected by specification: (Refer to Pre-Qualification invitation schedule for list of material groups)

Comment: N/A

6) Training or communication

6.1 Is training required?

Comment: NO (If NO then 6.2 – 6.6 will be N/A)

6.2 State the level of training required to implement this document. (E.g. awareness training, practical / on job, module, etc.)

Comment: N/A

6.3 State designations of personnel that will require training.

Comment: N/A

6.4 Is the training material available? Identify person responsible for the development of training material.

Comment: N/A

6.5 If applicable, provide details of training that will take place. (E.G. sponsor, costs, trainer, schedule of training, course material availability, training in erection / use of new equipment, maintenance training, etc).

Comment: N/A

6.6 Was Technical Training Section consulted w.r.t module development process?

Comment: N/A

6.7 State communications channels to be used to inform target audience.

Comment: N/A

7) Special tools, equipment, software

7.1 What special tools, equipment, software, etc will need to be purchased by the Region to effectively implement?

Comment: N/A

7.2 Are there stock numbers available for the new equipment?

Comment: N/A

7.3 What will be the costs of these special tools, equipment, software? N/A

8) Finances

8.1 What total costs would the Regions be required to incur in implementing this document? Identify all cost activities associated with implementation, e.g. labour, training, tooling, stock, obsolescence

Comment: N/A

……

……

……

Impact assessment completed by:

Name: __GAVIN STRELEC

Designation: __DISTRIBUTION INSULATOR WORKGROUP CHAIRMAN