Eskom	Standard	Technology

Title: **STANDARD FOR EXPULSION FUSE LINKS APPLIED AT NOMINAL AC VOLTAGES OF 11, 22 AND 33KV**

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Compiled by	Approved by	Authorized by
Sakkie van Aarde	Mohamed Khan	Bheki Ntshangase
Senior Adviser Engineering	MV Equipment SG Chairperson	Senior Manager – PDE HV Plant
Date: 16 March 2017	Date: 16/3/2017	Date: 17/3/2017

Supported by SCOT/SC

Riaz Asmal

MV/LV SC Chairperson

Date: 17/3/2017

PCM Reference: **<xxxxxx>**

SCOT Study Committee Number/Name: **<Number or name>**

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1. Introduction

This document contains the standard for expulsion fuse links applied at nominal AC voltages of 11, 22 and 33kV.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

This standard covers Distribution Group's minimum requirements for Expulsion Fuse Links applied on rural reticulation networks at nominal AC voltages of 11 kV, 22 kV, and 33 kV (19 kV SWER).

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] 240-75660811 (DSP 34-416): Standard for outdoor, pole mounted, distribution cut-out fuse links.

[2] NRS 035-1:2002, Outdoor distribution cut-outs – Part 1: Drop-out fuse-link assemblies or solid –link assemblies – Pole-mounted types. (PIESA 002-1:2002)

[3] SANS [IEC] 60282-2, High-voltage fuses Part 2: Expulsion fuses.

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

The definitions and abbreviations in NRS 035-1 shall apply to this standard.

Definition	Description
Single wire earth return (SWER):	A single-phase system in which the neutral side of the connected loads is joined to earth. Usually there is not a continuous conductor between the source and load neutral, the neutral current flowing via electrodes into the mass of earth.
Speed Ratio:	The speed ratio of all fuse link sizes 100 amp and below is the ratio between the current that melts the fuse in 0.1 seconds to the current that melts the fuse in 300 seconds.

2.3.2 Classification

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

2.4 Abbreviations

None

2.5 Roles and Responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/Supporting Documents

Not applicable.

3. Standard for Expulsion Fuse Links Applied at Nominal AC Voltages of 11, 22 and 33kV

3.1 General

The Fuse Link shall be suitable for use on non-effectively earthed and effectively earthed networks and under the system conditions and service conditions as follows:

Table 1: System and Service Conditions

a)	nominal system voltage (Un) (r.m.s.)	11, 22, 33kV;
b)	maximum system voltage (Um) (r.m.s.)	12, 24, 36kV:
c)	system frequency (f)	50Hz;
d)	altitude	up to 1800 m;
e)	minimum temperature	-15 ℃;
f)	Maximum temperature	+55 ℃;
g)	maximum daily variation temperature	35 ℃;
h)	pollution level	very heavy
i)	corrosion level	heavy

3.2 Physical

1) The fuse link shall be suitable for mounting in both the standard 22kV and 33kV (with arc-shortening rod) outdoor pole-mounted cut-out base, without any modification to the cut-out base. See standards 240-75660811 and NRS 035-1.

2) The top end of the fuse link shall be a removable button head, or removable button and washer combination, with a diameter of 19 mm, see 1.

3) The button head shall have a maximum thickness of 2 mm ± 0.5 with a removable button head, or removable button and washer combination.

4) The button head and the screw terminal shall have a ¼ inch UNF thread.

5) The fuse-link shall have a tinned copper fuse tail.

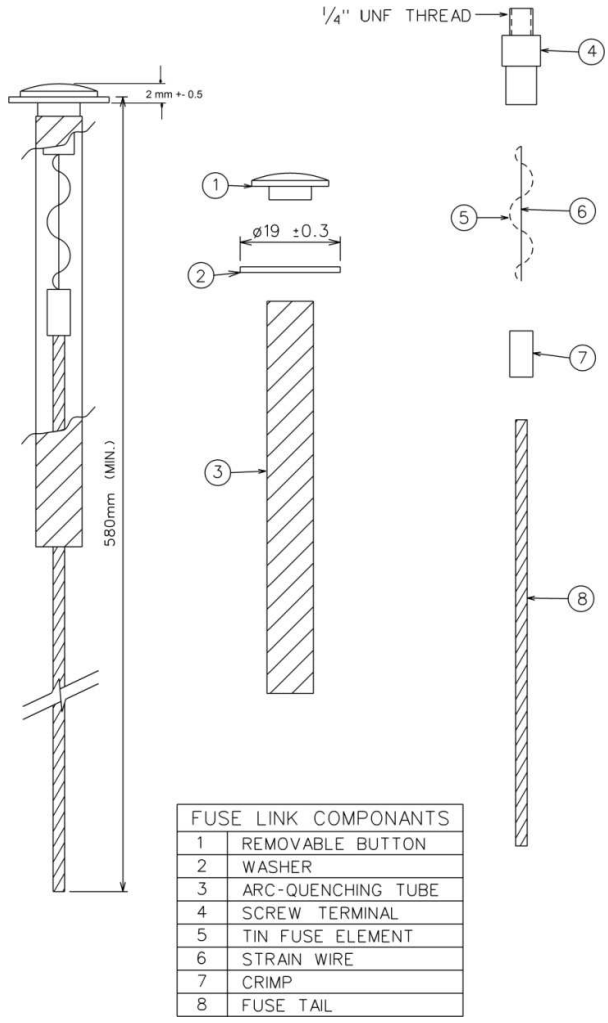
6) The fuse tail shall have a minimum diameter of 2,5 mm (5 mm^2). This diameter shall be achieved without additional coverings (e.g. PVC).

7) The overall length of the fuse link with tail shall be a minimum of 580 mm.

3.3 Material

1) Suitable precautions shall be implemented to prevent corrosion due to the use of dissimilar materials when used in a high corrosive environment.

2) The fuse element shall be manufactured from tin or silver.



FUSE LINK COMPONANTS	
1	REMOVABLE BUTTON
2	WASHER
3	ARC-QUENCHING TUBE
4	SCREW TERMINAL
5	TIN FUSE ELEMENT
6	STRAIN WIRE
7	CRIMP
8	FUSE TAIL

Figure 1: Fuse Link Construction and Dimensional Requirements

3.4 Colour coding

Each fuse link shall be colour coded to the following requirements:

Table 2: Fuse Element Colour Coding

Type	Colour	SAP Material no.
7 D	Grey	0207941
6 K	White	0164925
10 K	Yellow	0164930
15 K	Green	0117257
20 K	Black	0164938
30 K	Orange	0164943
50 K	Red	0175966

Colour coding shall be clearly visible, durable, and will not affect the performance of the fuse link. The colour coding can be applied on the fuse link or on the packaging.

3.5 Electrical requirements

The ratings of the 22 kV and 33 kV fuse links shall be as follows:

Table 3: Melting Current For Type K Fuse Links

Rated current	**Melting Current [A]**						**Speed Ratio**
	300 sec		**10 sec**		**0.1 sec**		
	Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	
6K	12	14.4	13.5	20.5	72	86	6
* 10K	19.5	23.4	22.4	34	128	154	6.6
15K	31	37.2	37	55	215	258	6.9
* 20K	39	47	48	71	273	328	7
30K	63	76	77.5	115	447	546	7.1
* 50K	101	121	126	188	719	862	7.1
* Standard ratings as per SANS [IEC] 60282-2							

Table 4: Melting Current For Type D Fuse Link

Rated current	**Melting Current [A]**						**Speed Ratio**
	300 sec		**2 sec**		**0.1 sec**		
	Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	
7D	14	17	70	90	275	350	22.9

All fuse links shall be Class B fuses, as defined in SANS [IEC] 60282-2

3.6 Labelling

Fuse links shall be packaged individually.

The following information shall be indicated on each package as a minimum:

a) name of manufacturer;

b) name of supplier and contact details;

c) ampere rating;

d) type (example K or D, etc.);

e) maximum continuous system voltage rating in kV;

f) colour code as specified in Table 2.

g) Eskom's SAP material number as indicated Table 2.

h) Each fuse link shall be marked with the following data as a minimum:

i) name of manufacturer;

j) ampere rating;

k) type (example K or D, etc.);

l) date of manufacture or batch number.

3.7 Additional information

The following shall be submitted with the tender documentation:

a) Details of maintenance and operating requirements;

b) A detailed drawing and parts list;

c) Details of any additional operational features not explicitly specified in this document;

d) Time-current characteristic curves;

e) Samples.

3.8 Tests

3.8.1 Type tests

The fuse link shall be type tested in accordance with, and found to comply with, the requirements of SANS 60282-1. Type test reports, from an independent, certified test authority, shall be submitted with the tender. The appropriate test values and test report numbers shall be stated in schedule B:

a) Static strength;

b) Dynamic strength;

c) Temperature rise test;

d) Tests for time/current characteristics;

e) Breaking capacity test.

3.8.2 Routine tests

Routine tests as required in the relevant standards shall be carried out as a normal requirement of the contract and, if so required, shall be witnessed by the purchaser or by his appointed representative. No additional charge shall be levied for such tests nor for the production or presentation of documentation related to routine tests.

The following tests shall be performed on each fuse link:

a) Static strength test;

b) Resistance test, with the fuse link under strain.

The following tests shall be performed on one fuse link per batch:

a) Confirmation of time/current characteristics;

b) Dynamic strength test.

Duplicate copies of routine tests shall be supplied together with the equipment when the latter is delivered to each of the final destinations stated in the order.

3.9 Packing/documentation

3.9.1 Packing

Each fuse link shall be carefully packed to prevent damage or deformation during normal transportation, handling and storage.

Each container shall bear the following information on the outside of the container:

a) A description of the contents and the type of fuse link;

b) The address of the destination;

c) The gross mass of the container in kilograms;

d) The name of the manufacturer; and

e) The purchaser's order number and, if applicable, the port of destination.

3.9.2 Documentation

General information regarding handling, installation, storage transport and maintenance shall be provided

4. Authorisation

This document has been seen and accepted by:

Name and surname	Designation
Sakkie Van Aarde	Senior Adviser Engineering
Bheki Ntshangase	Senior Manager HV Plant
Neels van Staden	Senior Consultant

5. Revisions

Date	Rev	Compiler	Remarks
March 2017	2	S. van Aarde	3.2.3) Add the button head thickness of 2 mm ± 0.5.

Date	Rev	Compiler	Remarks
Jan 2015	1	S. van Aarde	Document reformatted no content change. This document supersedes 240-75660811.
Jan 2012	1	S. van Aarde	This document was not sent for comments & voting, because the document was re-formatted on the new SCOWT template and no contents change in document. The normative references were up-dated.
May 2008	1	R. Theron	The document reference number was changed from DISSCAAV8 to 34-1670, in accordance with the Eskom Corporate Document Centre requirements. Changed document to new template 2 Changed: SCSSCAAL5 to DSP 34-416. Changed: IEC 282-2 to SANS [IEC] 60282-2. Annex B) Added a guide to completing technical schedules Schedules Revised in accordance with abovementioned changes.
Nov 2004	1	R. Theron	Table 1) Changed 6D to 7D, because the 6D fuse is not a standard product for any of the manufacturers. Table 3) Changed 6D to 7D. 4.6 b) New requirement.
July 2003	1	R. Theron	4.2.6) Corrected the overall length from 550 mm to 580 mm. Fig. 1 Corrected the overall length from 550 mm to 580 mm. 4.4) Added 6D fuse. This fuse was added to provide a more transient insensitive fuse for SWER applications. 4.5.1) Added Tables 2 & 3. 4.6 (f)) New requirement.
Nov 2000	0		Original issue

6. Development team

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

- Izak van Aarde

7. Acknowledgements

Not applicable.

Annex A – Guide to Tenderers on Completing Technical Schedules

This standard caters for the following range of expulsion fuse links applied at nominal AC voltages of 11, 22 and 33 kV

Item 1 - 7 D

Item 2 - 6 K

Item 3 - 10 K

Item 4 - 15 K

Item 5 - 20 K

Item 6 - 30 K

Item 7 - 50 K

The tick boxes in the heading of each schedule must be ticked to distinguish between the variations offered. If all the variations are offered, then all the boxes should be ticked.

Tenderers are required to complete the relevant fields in Schedule B.

Annex B – Type Test Report Summary Sheet

Fuse links for application at nominal voltages up to 33kV

Test		Report no.	Test facility	Comments	Report submitted (Y/N)
3.8.1 (a)	Static strength				
3.8.1 (b)	Dynamic strength				
3.8.1 (c)	Temperature rise test				
3.8.1 (d)	Time/current characteristics				
3.8.1 (e)	Breaking capacity test				

Annex C – : Technical Schedules A and B

Fuse links for application at nominal voltages up to 33kV

Fuse types:

7D☐ 6K☐ 10K☐ 20K☐ 30K ☐50K ☐ (tick relevant box)

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied

1	**2**	**3**	**4**	**5**
Item	**Clause**	**Description**	**Schedule A**	**Schedule B**
1.		**Identification**		
		a) Manufacturer's name	xxxxxxxxxxxxxx	
		b) Supplier's name	xxxxxxxxxxxxxx	
		c) Type designation	xxxxxxxxxxxxxx	
	3.1	**System conditions**		
		a) Nominal system voltage (Un) kV	up to 33	xxxxxxxxxxxxxx
	3.1	**Service conditions**		
		a) Altitude m	up to 1800	xxxxxxxxxxxxxx
		b) Minimum temperature ^{o}C	-15	
		c) Maximum temperature ^{o}C	+55	
		d) Maximum daily variation ^{o}C	35	
		e) Pollution level	Very high	
		f) Corrosion level rating	High	
		g) Highest rated voltage (Um)(r.m.s) kV	xxxxxxxxxxxxxxxx	
		h) Continuous current rating A (7, 6, 10, 15, 20, 30 or 50)	xxxxxxxxxxxxxxxx	
		i) Type (K or D)	xxxxxxxxxxxxxxx	

Fuse links for application at nominal voltages up to 33kV

Fuse types:

7D☐ 6K☐ 10K☐ 20K☐ 30K☐ 50K☐ (tick relevant box)

Schedule A: Purchaser's specific requirements

Schedule B: Particulars of equipment to be supplied

1	2	3	4	5
Item	**Clause**	**Description**	**Schedule A**	**Schedule B**
	3.2.	6) Bottom: Diameter of fuse tail mm	>2.5	
	3.2.	7) Overall length of fuse link mm	>580	
		Material		
	3.2.	5) Fuse tail	xxxxxxxxxxxxxxx	
	3.3.	1) Fuse element	Tin or Silver	
		Arc-quenching tube	xxxxxxxxxxxxxxx	
	3.8.1	**Type tests**		
		a) Static strength test	xxxxxxxxxxxxxxxx	
		b) Dynamic strength test	xxxxxxxxxxxxxxxx	
		c) Temperature rise test	xxxxxxxxxxxxxxxx	
		d) Time/current characteristics tests	xxxxxxxxxxxxxxxx	
		e) Breaking capacity test	xxxxxxxxxxxxxxx	
		f) Number of copies of type test reports	1	xxxxxxxxxxxxxx

Deviation schedule

Fuse links for application at nominal voltages up to 33kV

Any deviations from this standard shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost effective than that specified by Eskom		
Item	Clause	Proposed deviation