

 <b>Eskom</b>	<b>Standard</b>	<b>Technology</b>
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Title: **STANDARD FOR MEDIUM-VOLTAGE CABLING IN SUBSTATIONS**

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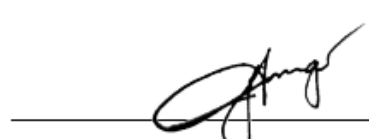


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## 1. Introduction

This standard has been prepared to establish and promote uniform designs for medium-voltage (MV) cabling in substations. Typical applications where MV cables are used in substations are shown in figure 1. The standard covers the general requirements for MV cables within substations, and also provides further details with regards to the following:

- Cabling from the transformer to the indoor switchgear/customer switchgear,
- Cabling from the transformer to the neutral electromagnetic coupler with resistor (NECR),
- Cabling from the indoor switchgear to the overhead line
- Cabling from the indoor switchgear to the cable network or dedicated customer

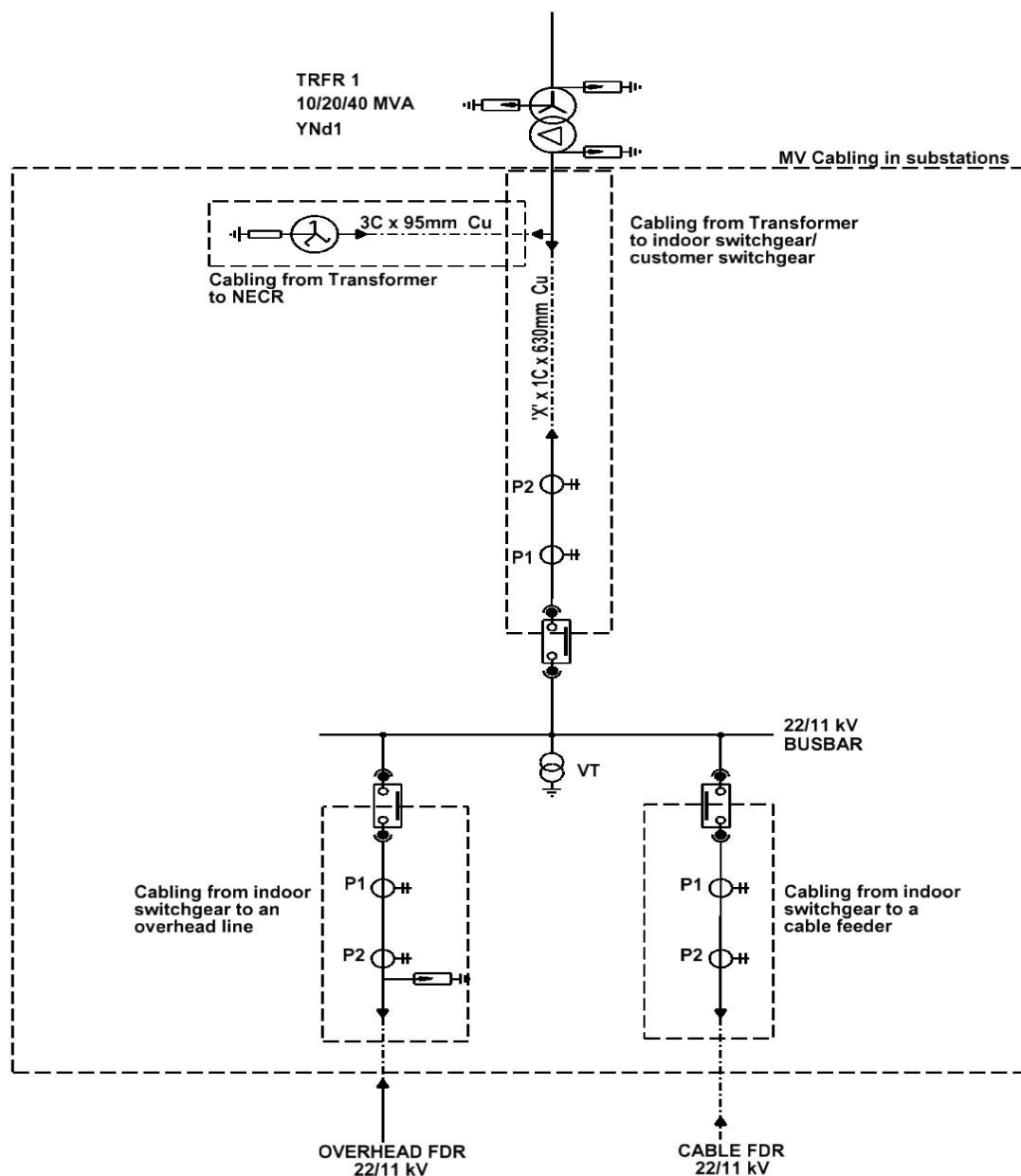


Figure 1: Generic substation layout showing MV cabling

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## **2. Supporting clauses**

### **2.1 Scope**

To establish and promote uniform designs for medium-voltage (MV) cabling in substations.

#### **2.1.1 Purpose**

To establish and promote uniform designs for medium-voltage (MV) cabling in substations.

#### **2.1.2 Applicability**

This document shall apply throughout Eskom Holdings Limited.

## **2.2 Normative/informative references**

Parties using this document shall apply the most recent edition of the documents listed in the following sections.

### **2.2.1 Normative**

- [1] 240-56062745, Planning guideline for medium voltage underground cable systems.
- [2] 240-71062174, Generic substation design.
- [3] 240-56030635, General information and requirements for medium voltage cable systems.
- [4] 240-56062704, Specification for 11 kV to 33 kV fixed pattern metal-enclosed indoor primary switchgear standard.
- [5] 240-56065131, Specification for 11 kV to 33 kV withdrawable pattern air-insulated indoor primary switchgear standard.
- [6] 240-56030619, Accessories for medium-voltage power cables for systems with nominal voltages of 11 kV to 33 kV standard.
- [7] 240-56063792, Specification for medium voltage XLPE and impregnated paper insulated cables standard.
- [8] 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.
- [9] SANS 1332, Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33 kV).
- [10] NRS 075, Mechanical torque shear connectors.
- [11] IEC/SANS 60853-1, Calculation of the cyclic and emergency current rating of cables. Part 1: Cyclic rating factor for cables up to and including 18/30 (36) kV.
- [12] SANS 62271-200, High-voltage switchgear and controlgear Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.
- [13] SANS 62271-102, High-voltage switchgear and controlgear Part 102: Alternating current disconnectors and earthing switches.
- [14] SANS 62271-100, High-voltage switchgear and controlgear Part 100: Alternating-current circuit-breakers.
- [15] SANS 62271-1, High-voltage switchgear and controlgear Part 1: Common specifications for alternating current switchgear and controlgear.
- [16] SANS 10198-4, The selection, handling and installation of electric power cables of rating not exceeding 33 kV – Part 4 Current ratings.
- [17] SANS 10198-12, The selection, handling and installation of electric power cables of rating not exceeding 33 kV, Part 12 Installation of earthing system.

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### **2.2.2 Eskom assembly drawings:**

- [18] D-DT-0852, Cable support bracket assembly for station class surge arresters.
- [19] D-DT-0850, Cable termination from substation onto overhead line.
- [20] D-DT-0854, MV cable trench details.
- [21] D-DT-4310, MV transformer bay onto sealing end (22 kV Bull) – direct customer supply.
- [22] D-DT-4311, MV transformer bay onto sealing end (11 kV Bull) – direct customer supply.
- [23] D-DT-4312, MV transformer bay onto sealing end (11 kV Twin Bull) – direct customer supply.
- [24] D-DT-4612, NEC/NER/AUX. trfr. 11 kV 360 A cable.
- [25] D-DT-4614, NEC/NER/AUX. trfr. 22 kV 360 A cable.
- [26] D-DT-4646, MV 1-core cable end support 3 x 630 SQ Cu cable/phase TWIN BULL.
- [27] D-DT-4647, MV 1-core cable end support 1 x 630 SQ Cu cable/phase BULL.
- [28] D-DT-4648, MV 1-core cable end support 4 x 630 SQ Cu cable/phase TWIN BULL.
- [29] D-DT-4649, MV 1-core cable end support 2 x 630 SQ Cu cable/phase BULL.
- [30] D-DT-5213, Cable sealing end drawings.
- [31] D-DT-5240, Earthing standard, Sheets 19, 20 and 21 – Earthing of MV cables in substations.
- [32] D-DT-5254, Substation cable trench details.
- [33] D-DT-6215, Station class surge arrester 22 kV.
- [34] D-DT-6216, Station class surge arrester 11 kV.
- [35] D-DT-3207, Bracket, cable termination support.

### **2.2.3 Eskom buyers guide drawings:**

- [36] D-DT-8001, Cable, 11 kV and 22 kV XLPE-insulated.
- [37] D-DT-8006, Termination kit, 1-core and 3-core 11 kV, 22 kV and 33 kV XLPE.
- [38] D-DT-8010, Surge arrester station class 11 kV and 22 kV polymer – indoor.
- [39] D-DT-8011, Shroud, straight, 1-core and 3-core.
- [40] D-DT-8012, Cable route marker, concrete.
- [41] D-DT-8013, Cable warning tape.
- [42] D-DT-8015, Cap, cable end seals.
- [43] D-DT-8016, Connector kits, separable unscreened.
- [44] D-DT-8017, Connector kits, separable screened.
- [45] D-DT-8018, Pipe, PVC cable.
- [46] D-DT-8019, Clamp, cable polypropylene.
- [47] D-DT-8008, Cable joint kits.
- [48] D-DT-8027, Grommet, cable rubber (50-100mm diameter cable).
- [49] D-DT-6255, MV withdrawable pattern air-insulated indoor primary switchgear.
- [50] D-DT-6258, MV withdrawable pattern air-insulated indoor primary switchgear.
- [51] D-DT-6259, MV withdrawable pattern air-insulated indoor primary switchgear.

**2.2.4 Informative**

- [52] ISO 9001, Quality Management Systems.
- [53] 32-9, Definition of Eskom documents.
- [54] 32-644, Eskom documentation management standard.
- [55] 474-65, Operating manual of the Steering Committee of Technologies.

**2.3 Definitions****2.3.1 General**

All definitions in NRS 012, SANS1332 and the normative references shall apply.

Definition	Description
<b>Air filled enclosure</b>	A metallic enclosure designed to protect the ends of the cables, bushings, current transformers or live conductors
<b>Indoor termination</b>	A termination intended for use where it is not exposed to either solar radiation or weathering.
<b>Outdoor termination:</b>	A termination intended for use where it is exposed to either solar radiation or weathering or both.
<b>Screened separable connector termination</b>	Air-filled enclosure within which the cable cores are terminated with screened separable connectors a (Type 4 termination in accordance with)
<b>Shrouded termination</b>	Air-insulated termination that has additional, unscreened, local insulation enhancement at the terminal fixing point (a Type 2 termination in accordance with 240-56063742).

**2.3.2 Disclosure classification**

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

**2.4 Abbreviations**

Abbreviation	Description
<b>AL</b>	Aluminium
<b>CES</b>	Cable End Support
<b>CFS</b>	Constant Force Spring
<b>Cu</b>	Copper
<b>LCC</b>	Leakage Current Collector
<b>MV</b>	Medium Voltage
<b>NGL</b>	Natural Ground Level
<b>PILC</b>	Paper Insulated Lead Covered
<b>U<sub>max</sub></b>	Maximum rise or the RMS phase to phase system voltage (usually nominal voltage plus 10%)
<b>XLPE</b>	Cross-Linked Polyethylene

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## 2.5 Roles and responsibilities

The employer or his delegate shall ensure that this standard is implemented and adhered to when dealing with MV cables within substations.

## 2.6 Process for monitoring

The relevant divisional project approval processes and governance structures shall apply.

## 2.7 Related/supporting documents

For Generation specific requirements refer to the following document:

240-56227443, Requirements for Control and Power Cables for Power Stations Standard

## 3. Requirements for MV cabling in substations

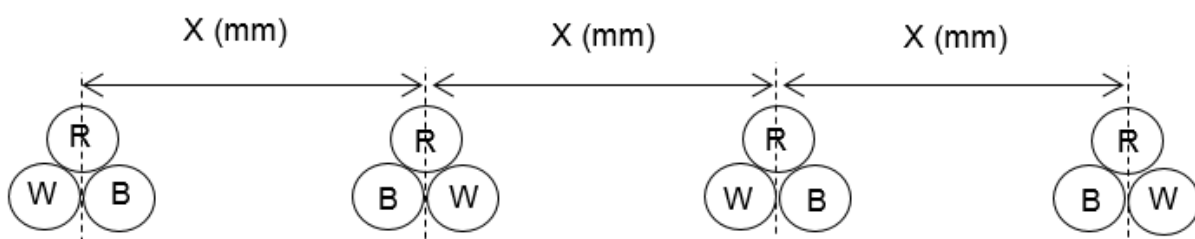
### 3.1 General

- a) Medium-voltage cables used in substations shall comply with the specification for medium voltage XLPE and Impregnated Paper Insulated Cables Standard 240-56063792. The MV cable shall be XLPE-insulated with copper conductors (D-DT-8001).

**Note 1:** PILC cables shall not be used for new installations at substations.

**Note 2:** The rating of all XLPE-insulated cables shall be based on a maximum conductor temperature of 70°C in order to prevent drying out of the soil surrounding the cable. A conductor temperature of 70°C is specified as it has been shown that sustained operation of XLPE-insulated cable with a conductor temperature of 90°C leads to drying out of the soil surrounding the cable and potential thermal runaway.

- b) Where the on-site installation conditions differ significantly from the standard conditions stated in 240-56030635 and this standard, the actual sustained current-carrying capacity can be calculated using appropriate rating factors as given in SANS 10198-4. Refer to 240-56062745 for further information on MV cable current ratings and loading.
- c) All cable work shall be in accordance to 240-56062745 with the following specific requirements:
- 1) Cable shall be laid by direct burial in accordance with D-DT-0854.
  - 2) Single-core cable groups shall be laid in close trefoil with a minimum spacing of 450 mm between circuits (dimension 'X') and a phase rotation as shown in figure 2.



**Figure 2: Phase configuration and spacing for single-core cable groups**

- 3) The phase configuration indicated in figure 2 attempts to equalize the inductance of each single-core and hence the impedance per phase.
- 4) Single-core cable groups shall be bound at least every 3 m using non-metallic ties before back-filling.



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- 5) Warning tape (see D-DT-8013) shall be installed directly above the cable at a depth of 300 mm below natural ground level.
- 6) Cable crossing runways or slipways shall be installed in pipes (see D-DT-8018). The pipes shall be plugged at each end to prevent backfill entering the pipe.
- 7) Cable route markers (see D-DT-8012) shall be installed directly above the cable at each bend, road crossing and cable trench crossing. The base of the marker shall be installed at a depth of 250 mm below natural ground level. The following shall be punched onto the aluminium plate of the cable route marker:
- an arrow indicating the cable route, and
  - the cable descriptor referenced to the source equipment, with a font size of 7 mm.
- d) Where cable is required to be installed in structured cable trenches with pre-cast trench covers, it shall be installed in cable trenches in accordance with D-DT-5254 with the following specific requirements:
- 1) Cable shall be laid in either a single or a double cable trench depending on the number of circuits to be installed.
  - 2) Single-core cable groups shall be laid in close trefoil with a minimum spacing of 300 mm between circuits (dimension 'X') and a phase configuration as shown in figure 2. A single cable trench shall be used for up to 2 trefoil groups and a double cable trench for more than 2 trefoil groups.
  - 3) Single-core cable groups shall be bound at least every 3 m using non-metallic ties.
  - 4) Pre-cast cable trench covers shall be installed over the cable trench to protect the cables from external damage and solar radiation.
  - 5) Adequate water drainage shall be provided.
  - 6) Provision shall be made to allow for adequate cable bending radii.
  - 7) No warning tape or cable route markers are required.
  - 8) If the cable trenches are back-filled (e.g. to reduce risk of theft), suitable back-fill material shall be used in the entire trench with a soil thermal resistivity that is appropriate for the required current carrying capacity.
- e) Medium-voltage cable terminations (see D-DT-8005 and D-DT-8006) and shrouds (see D-DT-8011) shall comply with 240-56030619.
- f) Where cables are terminated in air filled enclosures the clearances shall comply with 240-56063742.
- g) Single-core and three-core cables shall be connected at the equipment connection point using mechanical torque shear lugs in accordance with NRS 075 with M16 fixing holes.
- h) Indoor switchgear panels manufactured in accordance with 240-56065131 shall always be designed to accommodate the number and size of cables as shown in Table 1 and Table 3.
- i) Where there is a risk of MV cable theft within substations, theft mitigation measures should be investigated and implemented based on the specific substation site conditions and theft mode as per 240-56030635.
- j) Where switchgear is supplied with separate points of attachment, only one cable or surge arrester should be terminated on each point. Unused points of attachment shall be shrouded. No back to back lugs are allowed for multiple cable attachments.
- k) Cables shall be terminated onto indoor switchgear using either a shrouded termination (Type 2 termination) or where supplied with type C bushings (fixed pattern), cables and/or surge arrestors shall be terminated using extensible screened separable connectors.
- l) For any MV cabling that falls outside the substation boundaries, refer to 240-56030635.

- m) For new installations, no joints should be installed for MV cables within the substation yard. This is to prevent the introduction of potential weak points on the cable. However, if a joint is required during maintenance, refer to the maintenance task manual 240-133975392.
- n) No joints should be installed within the switch room cable trench. This includes trifurcating joints which are required to terminate 3C cables onto certain types of switchgear. Refer to 240-56030619 for details regarding trifurcating joints.

### 3.2 Cabling from the transformer to the indoor switchgear/customer switchgear

- a) The cable cross-sectional area shall be in accordance with Table 1. Only single core Cu Cable shall be used from the transformers to indoor switchgear.

**Table 1: Cable size for transformer-to-indoor switchgear connection**

1	2	3	4
Transformer rating (MVA)	Cu XLPE cable conductor size (mm <sup>2</sup> )		
	11 kV	22 kV	33 kV
10	1 × 630 mm <sup>2</sup> 1-core / phase	1 × 630 mm <sup>2</sup> 1-core / phase	1 × 630 mm <sup>2</sup> 1-core / phase
20	2 × 630 mm <sup>2</sup> 1-core / phase	1 × 630 mm <sup>2</sup> 1-core / phase	1 × 630 mm <sup>2</sup> 1-core / phase
40	4 × 630 mm <sup>2</sup> 1-core / phase	2 × 630 mm <sup>2</sup> 1-core / phase	2 × 630 mm <sup>2</sup> 1-core / phase

- b) The general arrangement of single-core cable terminations to the transformer secondary shall be as shown in D-DT-4647 (1 × 1-core /phase) or D-DT-4648 (4 × 1-core /phase) or D-DT-4649 (2 × 1-core /phase).
- c) The armouring of each single-core cable shall be bonded to the substation earth mat at the switchgear side using the earth terminal provided. It will be insulated from earth at the transformer side (see D-DT-5240 sheet 21). A leakage current collector (LCC) shall be installed on the cable termination closest to the transformer. LCC is used to protect the PVC outer sheath from damage caused by leakage currents flowing on the outer surface of the anti-track tube. Leakage currents are collected by means of a constant force spring (CFS) wrapped around the bottom end of anti-track tube. This CFS is connected to earth using an earth braid, thereby providing a low resistance path to earth.

**Note 1:** Single/end point bonding eliminates circulating current and resulting losses in the sheath.

**Note 2:** The voltage induced in the sheath (measured at the open end) will be less than 70 V for circuits < 1500 m.

**Note 3:** Where circuits exceed 1500 m, earthing and bonding at both ends shall generally be applied and the additional losses resulting from circulating currents shall be accepted. Alternative methods of eliminating sheath circulating current are provided in SANS 10198-12.

- d) The cable shall be terminated onto the cable end support at the transformer using an outdoor cable termination (D-DT 8006).
- e) The cable termination shall be supported at the transformer using cable support clamps (see D-DT-8019) attached to the cable end support structure (see D-DT-4647, D-DT-4648 and D-DT-4649). Double support clamps (i.e. two clamps in tandem or 'piggy-back' arrangement) are required where two single core cables are terminated on each side of the support structure.
- f) The cable shall be terminated at the indoor switchgear using the Eskom approved termination type for the switchgear installed (either Type 2 or Type 4 terminations).
- g) The cable termination shall be supported at the indoor switchgear by a cable support clamp (see D-DT-8019) provided with the switchgear.

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### 3.3 Cabling from the transformer to the neutral electromagnetic coupler with resistor (NECR)

- a) The cable shall be 95 mm<sup>2</sup> three-core Cu (XLPE) or 185 mm<sup>2</sup> three-core Al (XLPE) and shall be supported at the NECR by the two cable support clamps (see D-DT-8019) provided on the NECR.

**Note 1:** Where the prospective symmetrical fault level exceeds 10 kA for 1 s it is accepted that the cable will be damaged in the event of an inter-phase fault at the NECR.

- b) The general arrangement of the cable termination on the transformer secondary side shall be as shown in D-DT-4647, D-DT-4648 and D-DT-4649. The NECR cable shall be terminated between the transformer secondary and the outdoor current and voltage transformers (see D-DT-4310, D-DT-4311 or D-DT-4312). The cable termination shall be supported using cable support clamps (see D-DT-8019) attached to the medium equipment support structure.
- c) The cable shall be terminated at the transformer using an outdoor termination (see D-DT 8006).
- d) The general arrangement of the cable termination to the NECR connection shall be as shown in D-DT-4612 (11 kV), D-DT-4614 (22 kV) and D-DT-4616 (33 kV).
- e) The cable shall be terminated at the NECR using an outdoor termination (see D-DT 8006).
- f) The armouring of the cable shall be bonded to the substation earth mat at the transformer side to the cable end support structure as well as at the NECR side to the earth terminal provided (see D-DT-5240 sheet 19).
- g) The cable termination crutch (bottom of the cable termination) shall be at least 2.5 m above the ground level (see D-DT-5240 sheet 19).

### 3.4 Cabling from the indoor switchgear to an overhead line

- a) The cable cross-sectional area shall be chosen to suit the rating of the overhead line conductor as well as the 3 second prospective symmetrical fault level of the system. Table 2 indicates the minimum cable size to be used based upon prospective fault level considerations.

**Table 2: Minimum cable size based on prospective fault level**

Transformer rating (MVA)	Minimum XLPE cable size (mm <sup>2</sup> )			
	11 kV		22 / 33 kV	
	Cu	Al	Cu	Al
10	≥ 95	≥ 185	≥ 50	≥ 95
20	≥ 185	300	≥ 95	≥ 185
40	300	2 x 300	≥ 185	300
<b>Notes:</b>				
1) The transformer impedance is assumed to be 10 %.				
2) The maximum fault level duration is 3 s. The 3 s duration has been selected due to the fact that the protection for overhead line feeders is in general set to auto-reclose.				

- b) The cable shall be terminated at the indoor switchgear using the Eskom approved termination type for the switchgear installed (either Type 2 or Type 4 terminations).
- c) The cable termination shall be supported at the switchgear by a cable support clamp (see D-DT-8019) provided with the switchgear (see D-DT-5240 sheet 20).
- d) The cable entry through the gland plate shall be sealed and protected using a rubber grommet (see D-DT-8027) provided with the switchgear (see D-DT-5240 sheet 20).

- e) The armouring of the three-core cable shall be bonded to the substation earth mat at the switchgear earth terminal provided (see D-DT-5240 sheet 20). Where a three core cable is terminated to indoor switchgear using a trifurcating joint or kit, the 1C earth tails shall not be connected to the earthmat, but shall be terminated using a LCC.
- f) The cable termination to overhead line connection shall be in accordance with D-DT-0850.
- g) The cable shall be terminated at the overhead line using an outdoor termination (see D-DT 8006).
- h) Station class surge arresters (see D-DT-6215 and D-DT-6216) shall protect the cable termination at the overhead line connection.

**Note:** Station class surge arresters without disconnecting devices are used for the following reasons:

- 1) Under earth fault conditions temporary over voltages (TOVs) are maximum closest to the source and therefore surge arresters with an MCOV equal to  $U_{max}$  are preferred at substation riser pole applications, and
- 2) a failed surge arrester will result in a permanent line fault requiring immediate replacement of the arrester. This is preferred for disconnection of the failed arrester as the consequences of surges on the cable or connected switchgear can be catastrophic.
- i) MV indoor surge arresters (see D-DT-8010) shall be installed in the switchgear at the cable terminal connection point.

**Note:** When specified in schedule A of the switchgear enquiry document or switchgear ordering schedule, 800 A or 1250 A feeder panels are fitted with MV indoor surge arresters as follows:

- 1) surge arresters are in accordance with D-DT-8010,
- 2) a separate and accessible point of attachment is provided for each surge arrester,
- 3) it is possible to disconnect the surge arresters to facilitate overvoltage testing of the switchgear at the commissioning stage, and
- 4) the designed clearance requirements are not reduced by virtue of the fact that the surge arresters are fitted.
- j) Where the overhead line is not fed from a substation with indoor switchgear, but from an outdoor substation, the cable will be terminated onto a CES using an outdoor termination (see D-DT 8006). The armouring of the cable shall be bonded to the substation earth mat at the feeder breaker CES structure, and at the overhead line end as per D-DT-0850.

### 3.5 Cabling from the indoor switchgear to the cable feeder

- a) The cable cross-sectional area shall be chosen to suit the cable feeder load requirement as well as the 1 second prospective symmetrical fault level of the system. The load requirements are limited in terms of the standard switchgear ratings and the associated maximum cable sizes shown in Table 3.

**Note:** For further information and guidelines on cable selection, refer to 240-56062745.

**Table 3: Maximum cable size from indoor switchgear to cable network / customer**

Panel Continuous Current Rating (A)	Cable conductor (Cu) size (mm <sup>2</sup> ) and type	Cable conductor (Al) size (mm <sup>2</sup> ) and type
800	$\leq 2 \times 3$ -core $\leq 300 \text{ mm}^2$ for 11 kV $\leq 185 \text{ mm}^2$ for 22 kV	$3 \times 3$ -core $\leq 300 \text{ mm}^2$ for 11 kV $\leq 185 \text{ mm}^2$ for 22 kV
1250	$2 \times 1$ -core / phase $630 \text{ mm}^2$	N/A
2000	$4 \times 1$ -core / phase $630 \text{ mm}^2$	N/A
2500	$4 \times 1$ -core / phase $630 \text{ mm}^2$	N/A

- b) The cable shall be terminated at the indoor switchgear using the Eskom approved termination type for the switchgear installed (either Type 2 or Type 4 terminations).

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- c) The cable termination shall be supported at the switchgear by a cable support clamp (see D-DT-8019) provided with the switchgear (see D-DT-5240 sheet 20 or 21).
- d) The cable entry through the gland plate shall be sealed and protected using a rubber grommet (see D-DT-8027) provided with the switchgear (see D-DT-5240 sheet 20 or 21).
- e) The armouring of the three-core cable shall be bonded to the substation earth mat at the switchgear earth terminal provided (see D-DT-5240 sheet 20).
- f) The armouring of the three-core cable shall be bonded to the remote earth electrode at the customer/equipment installation.
- g) Where the customer utilises single core cables from the Eskom substation the earthing and bonding arrangement shall comply with the requirements of SANS 10198-12 and shall be agreed upon in writing between Eskom and the customer.
- h) The armouring of the single-core cables at the Eskom substation shall be bonded to the substation earth mat at the switchgear earth terminals provided (see D-DT-5240 sheet 21).
- i) The armouring of the single-core cables at the customer installation may or may not be bonded to the customer's earth mat depending on the earthing and bonding arrangement agreed upon.
- j) As far as practicably possible, all cables exiting the switch-room should be installed 300 mm apart, as per D-DT 0854.

#### 4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
J Pause	MV/LV Cable Care Group Converner
ME Songo	Senior Manager (Acting): Dx PDE HV Plant
Q Khumalo	Cable Systems and Metal Enclosed Switchgear SC Chairperson

#### 5. Revisions

Date	Rev	Compiler	Remarks
May 2020	2	I Moolla	2 <sup>nd</sup> Major Document review <ul style="list-style-type: none"><li>Major changes include:</li><li>Removal of PILC cables</li><li>Addition of XLPE Aluminium cables</li><li>Updating of all referenced document numbers</li><li>Removed reference to cable rating tool</li><li>Updating of all document numbers</li><li>Included 33 kV equipment</li></ul>
April 2017	1	Q Khumalo	Document was stabilised.
Jan 2007	0	R Kelly	1st Major Document review refer to 34-209
Aug 1999	0	G Whyte	Original document approved and published - SCSASABK6

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## **6. Development team**

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

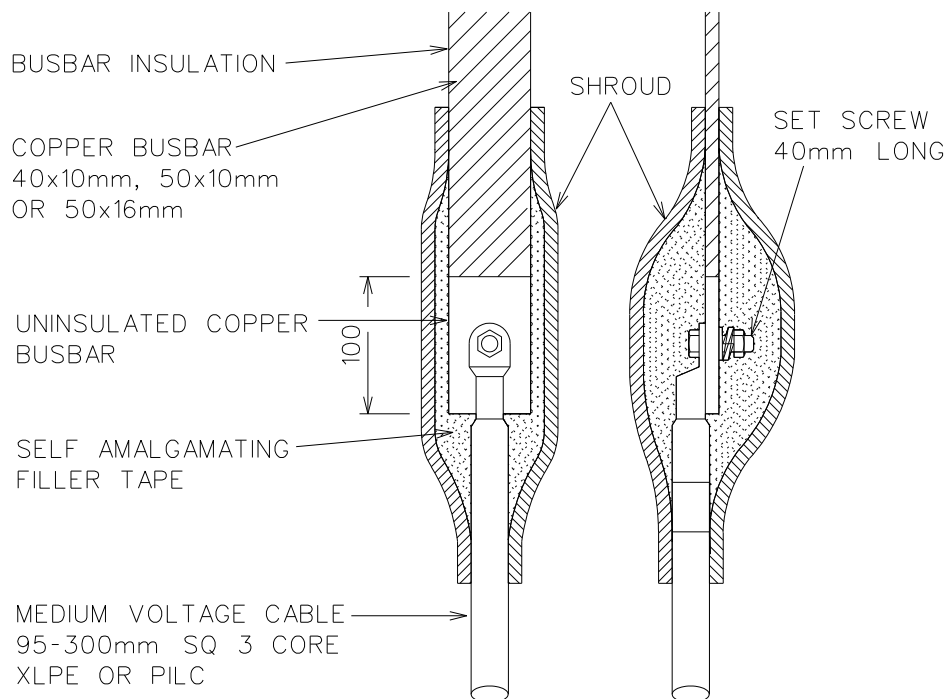
- Barto Olivier: Dx SI WCOU
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## **7. Acknowledgements**

The compiler would like to thank all those who contributed to the development of this standard.

## Annex A – Requirements for the termination of cables into indoor switchgear in accordance with 240-56065131

- a) The point of attachment of the cable/s onto the switchgear shall always be shrouded using a straight shroud (D-DT-8011) as illustrated in A.1.



**Figure A.1: Three-core cable connection to switchgear terminal**

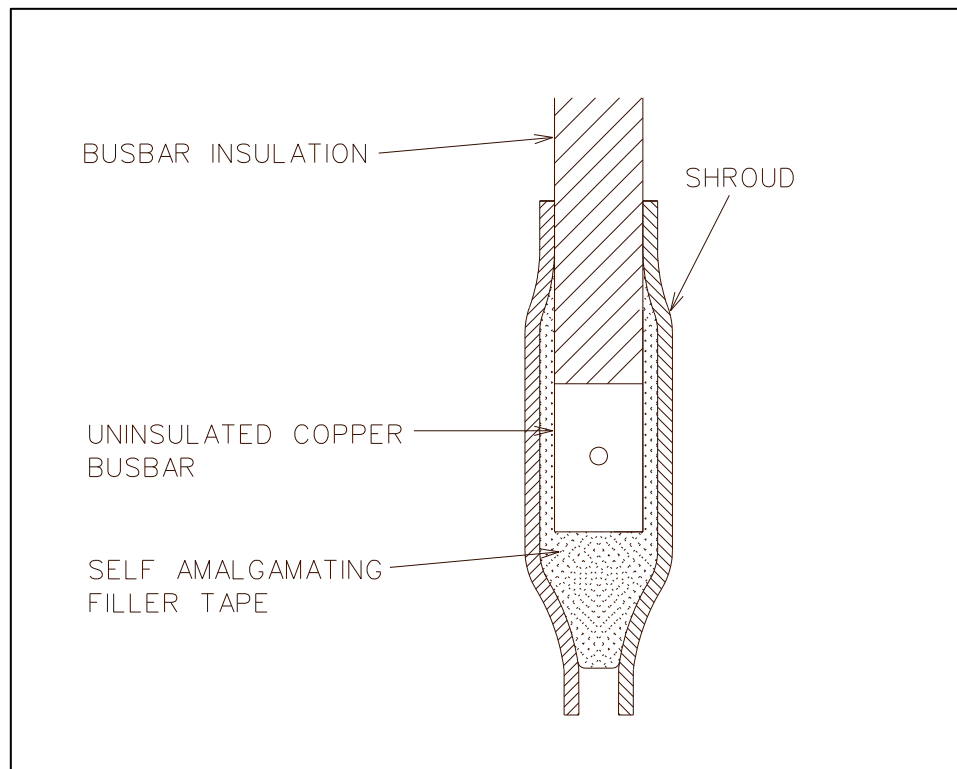
- b) Where fewer cables are to be connected to a panel than the number of attachments provided, e.g. one 3-core cable terminated into an 800 A feeder panel, the following shall apply:
- 1) the cable shall be connected to the inner most attachment points; and
  - 2) the unused attachment points shall be shrouded with straight shrouds (D-DT-8011) as shown in A.2
- c) The weight of the cable shall be supported by the cable support clamp (see D-DT-8019) provided in the panel and shall not hang on the attachment points.

**Note:** The switchgear is supplied with a cable support clamp corresponding to and fitted for each cable entry hole provided in the gland/vermin proofing plate/s.

- d) The cable entry hole through the gland/vermin proofing plate/s shall be sealed using the rubber cable grommet (see D-DT-8027) provided in the panel. The rubber grommet shall be cut on site to fit the cable outer sheath diameter.

**Note:** The switchgear gland/vermin proofing plate cable entry holes are factory pre-drilled ( $\varnothing 110$  mm) and are supplied with the rubber grommets fitted. The purpose of the rubber grommet is to seal (i.e. vermin proof) the cable entry through the gland/vermin proofing plate/s.





**Figure A.2: Shrouding of unused attachment point**

- e) Surge arrester connections into an 800 A / 1250 A feeder panel: An example of a 800 A feeder panel fitted with surge arresters to D-DT-8010 is shown in A.3, A.4 and A.5. When installing the switchgear the following shall apply:
- the requirements of clause 1 of this annex shall apply to the cable and terminations,
  - the required access to terminate the cables shall be obtained by temporarily removing the surge arresters. The surge arresters shall be removed from the panel by disconnecting the common earth bar and the connections at the end of the arrester tails, and
  - once the required overvoltage testing of the switchboard has been completed the surge arresters shall be re-connected and the point of attachment of the surge arresters onto the switchgear shall be shrouded using straight shrouds (D-DT-8011).



SURGE ARRESTERS  
(D-DT-8010)



Figure A.3: 800 A feeder panel with surge arresters fitted

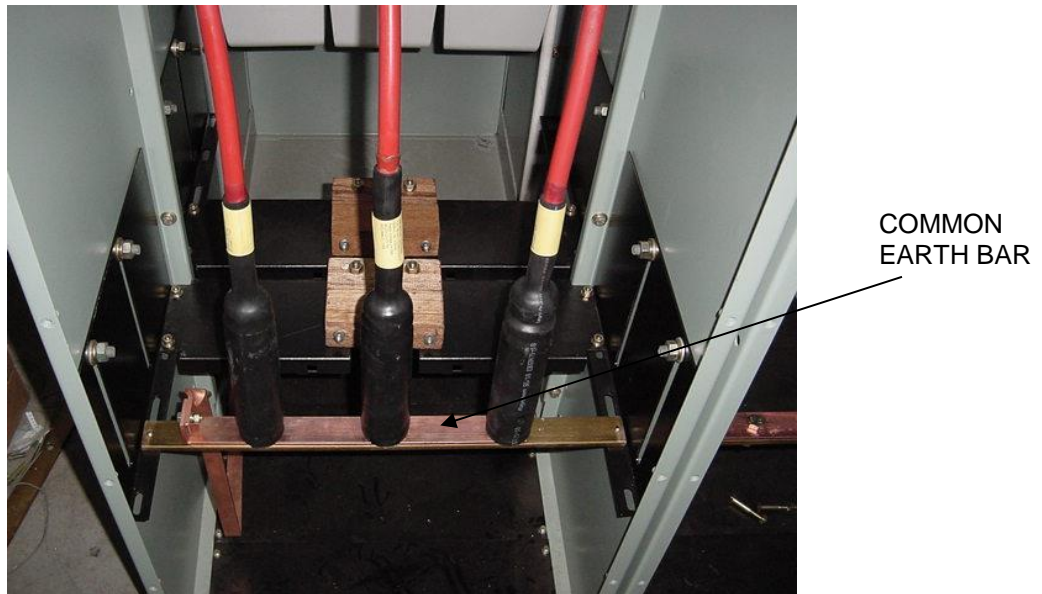
SURGE ARRESTER  
ATTACHMENT POINT  
(TO BE SHROUDED  
AFTER OVERVOLTAGE  
TESTS HAVE BEEN  
COMPLETED)



2 x CABLE  
ATTACHMENT  
POINTS

Figure A.4: Surge arrester point of attachment

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**Figure A.5: Mounting of surge arresters**

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