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Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33 kV)

Remarks:**PLEASE NOTE:**

- The technical committee, SABS TC 66, responsible for the preparation of this standard has reached consensus that the attached document should become a South African standard. It is now made available by way of public enquiry to all interested and affected parties for public comment, and to the technical committee members for record purposes. Any comments should be sent by the indicated closing date, either by mail, or by fax, or by e-mail to

SABS Standards Division
Attention: Compliance and Development department
Private Bag X191
Pretoria
0001

Fax No.: (012) 344-1568 (for attention: dsscomments)
E-mail: dsscomments@sabs.co.za

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- The public enquiry stage will be repeated if the technical committee agrees to significant technical changes to the document as a result of public comment. Less urgent technical comments will be considered at the time of the next amendment.

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SANS 1053:2010

Edition 1

NRS 053:2008

Edition 2

SOUTH AFRICAN NATIONAL STANDARD

Accessories for medium-voltage power cables (3,8/6,6 kV to 19/33 kV)

This national standard is the identical implementation of NRS 053:2008 and is adopted in terms of a Memorandum of Agreement between the Electricity Suppliers Liaison Committee and the SABS Standards Division.

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1 Dr Lategan Road Groenkloof ☒ Private Bag X191 Pretoria 0001
Tel: +27 12 428 7911 Fax: +27 12 344 1568
www.sabs.co.za
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SANS 1053:2010

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Table of changes

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National foreword

This South African standard was prepared by a working group of the Electricity Suppliers Liaison Committee and adopted by National Committee SABS TC 66, *Electric cables*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This adoption has been done in terms of a Memorandum of Agreement between the Electricity Suppliers Liaison Committee and the SABS Standards Division

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Draft SA Standard

**ACCESSORIES FOR MEDIUM-VOLTAGE
POWER CABLES (3,8/6,6 kV to 19/33 kV)**

This document is not a South African National Standard



SANS 1053

This specification is issued by
the Standardization Section, Eskom,
on behalf of the
User Group given in the foreword.

Table of changes

Change No.	Date	Text affected

Correspondence to be directed to

The NRS Projects Manager
The Standardization Section
Industry Association Resource Centre
Eskom
Private Bag X13
Halfway House, 1685

Telephone : (011) 651 6832
Fax : (011) 651 6827
NRS Website : [http:// www.nrs.eskom.co.za](http://www.nrs.eskom.co.za)

Printed copies obtainable from

The SABS Standards Division
Private Bag X191
Pretoria 0001

Telephone: (012) 428-7911
Fax : (012) 344-1568
E-mail : sales@sabs.co.za
Website : <http://www.sabs.co.za>

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Foreword

This specification has been prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC) and approved by it for use by supply authorities and other users, when purchasing joints and termination kits for medium voltage power cables and aerial bundled conductors. This specification was prepared by a working group, which, at the time of publication, comprised the following members:

M Basson	Nelson Mandela Metropolitan Municipality
C Govind	eThekweni Electricity
C Tocknell	Tshwane Municipality
R Kelly (Chairman)	Eskom, IARC
V Medinski	Cape Town (RED 1)
M Ryan	City Power (AMEU)
V Sewchand (Project Leader)	Technology Standardization, Eskom

A Manufacturers' Interest Group (MIG) was consulted on the contents of NRS 053 and its comments were incorporated where the working group was in agreement. The MIG comprised the following members:

M Engelbrecht	African Cables
PO Halloran	Tycoelectronics
R Hardie	Aberdare Cables
P Hoffman	Insulation Enhancement Systems
A Joubert	3M
K Richardson	Jointmaster
K Shackleton	REPL Africa
A van Oosten	Tank Industries
B Wagner	Iso-tech systems
G Whyte	Raytech Energy

Annex C forms an integral part of this specification. Annexes A, B and D are for information only.

Draft SA Standard

NRS 053:2008

Introduction

This specification was prepared to establish and promote uniform requirements for accessories for medium-voltage power cables and aerial bundled conductors, to enable purchasers to acquire the specified equipment without the need for detailed and extensive contract documents. The quality of these accessories is therefore also guaranteed if they have passed the extensive testing requirements of this specification.

The ESLC expresses the wish that, in the national interest and in support of government policy (to foster local manufacture and to stimulate export) all purchasers adopt the requirements of this specification insofar as their particular conditions will permit. Any differences between this specification and the corresponding purchaser's requirements should, as far as possible, be clearly indicated in the schedules attached to this specification and, where appropriate, be submitted for consideration in future revisions thereof.

Keywords

joints; terminations; medium-voltage; aerial bundled conductors; specifications; impregnated paper insulated; cross-linked polyethylene-insulated; accredited laboratory; constant force spring.

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ACCESSORIES FOR MEDIUM-VOLTAGE POWER CABLES (3,8/6,6 kV to 19/33 kV)

1 Scope

1.1 This specification covers the requirements for accessories for medium-voltage cables used on a.c. systems of voltage from 6,6 kV up to and including 33 kV. Accessories for both impregnated-paper and XLPE-insulated cables are covered.

1.2 The accessories covered by this specification are the following:

- a) indoor and outdoor terminations;
- b) shrouded terminations for application within air-filled cable termination enclosures;
- c) straight joints, transition joints, cable-repair sleeves and stop-ends, suitable for direct burial underground or installation in air;
- d) unscreened separable connectors; and
- e) screened plug-in type or bolted-type separable connectors.

2 Normative references

The following referenced documents are indispensable for the application of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

CENELEC HD 629.1 S1, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV – Part 1: Cables with XLPE-insulation.*

CENELEC HD 629.2 S1, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV – Part 2: Cables with impregnated paper insulation.*

IEC 60055-1:2005, *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.*

EN 50180, *Bushings above 1 kV up to 36 kV and from 250 A to 3,15 kA for liquid filled transformers.*

EN 50181, *Plug-in type bushings above 1 kV up to 36 kV and from 250 A to 1,25 kA for equipment other than liquid filled transformers.*

NRS 012:2002, *Cable terminations and live conductors within air insulated enclosures (insulation co-ordination) for rated a.c. voltages of 7,2 kV and up to and including 36 kV.*

NRS 028, *Cable lugs and ferrules for copper and aluminium conductors.*

NRS 075, *Mechanical torque shear connectors.*

SANS 97, *Electric cables – Impregnated paper-insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/33 kV (excluding pressure assisted cables).*

SANS 1339, *Electric cables – Cross-linked polyethylene (XLPE)-insulated cables for rated voltages from 3,8/6,6 kV to 19/33 kV.*

SANS 1713, *Electric cables – Medium-voltage aerial bundled conductors for voltages from 3,3/6,6 kV to 19/33 kV*.

SANS 60502-4:2006/IEC 60502-4:2005, *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)*.

SANS 61442:2006/IEC 61442:2005, *Test methods for accessories for power cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)*.

3 Terms, definitions and abbreviations

For the purposes of this specification, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

accreditation

formal recognition that a testing laboratory is competent to carry out specific tests

accreditation body

conducts and administers a laboratory accreditation system and grants accreditation

accredited laboratory

a testing laboratory to which accreditation has been granted

approved (approval)

approved in writing by the purchaser

bolted-type separable connector

a separable connector in which the electrical contact is made by a bolted device

branch joint

accessory that connects a branch cable to a main cable

connector

metallic device that connects cable conductors

constant force spring

strip of essentially non-magnetic stainless steel that is wound to form a spring and that is intended to maintain a constant force on a circular object

NOTE In order to obtain the optimal combination of load force and non-magnetic characteristics, constant force springs do have a minimal residual magnetic component.

dead-break connector

separable connector that is designed to be connected and disconnected on de-energized circuits only

indoor termination

termination that is intended for use where it is not exposed to either solar radiation or weathering

main earthing conductor

conductor that maintains earth continuity throughout a cable joint or that connects the earth circuit of a cable to the metallic enclosure of terminal equipment, and that is rated to carry the prospective earth fault current of the system

outdoor termination

termination that is intended for use where it is exposed to either solar radiation or weathering (or both)

plug-in type separable connector

separable connector in which the electrical contact is made by a sliding device

range-taking

designed to accommodate more than one size of cable

screened separable connector

separable connector that has a fully screened external surface

secondary earthing conductor

conductor that, for XLPE-insulated cable, connects the copper screen of the cable to the main earthing conductor at a joint or termination

separable connector

fully insulated termination that allows the connection and the disconnection of a cable to other equipment

shrouded termination

indoor termination that is used in an air-filled terminal box that is insulated but unscreened at the bushing connection

stop-end

accessory that provides a means of insulating the unconnected end of an energized cable

terminal box

air-filled or compound-filled box that fully encloses a termination

termination

device that is fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection

termination tail length

length of that part of a cable termination that, for an impregnated-paper insulated cable, extends from the metallic sheath to the end of the core insulation and, in the case of an XLPE-insulated cable, extends from the extruded bedding to the end of the core insulation

test

technical operation that consists of the determination of one or more characteristics of a given product, process or service in accordance with a specified procedure

testing laboratory

laboratory that performs tests

test method

specified technical procedure for performing a test

test report

document that presents test results and other information relevant to a test

transition joint

straight or branch joint that forms a connection between cables that have different types of insulation

unscreened separable connector

separable connector that does not have an external screen

3.2 Abbreviations

ABC:	aerial bundled conductors
AWA:	aluminium-wire armoured
CFS:	constant force spring
CWA:	copper-wire armoured
DSTA:	galvanized double steel-tape armoured
ESETA:	Energy Sector Education and Training Authority
IAF:	International Accreditation Forum, Inc.
ILAC:	International Laboratory Accreditation Co-operation
RvA:	Raad voor Accreditatie
SAQA:	South African Qualifications Authority
SANAS:	South African National Accreditation System
SSC:	screened separable connector
SWA:	steel-wire armoured
XLPE:	cross-linked polyethylene
USC:	unscreened separable connector

4 Requirements

4.1 General

4.1.1 Standard operating conditions

All accessories shall be suitable for operation under the following conditions:

- altitude: not exceeding 1 800 m;
- ambient temperature: -5 °C to 40 °C;
- lightning ground flash density: severe (14 flashes per square kilometre per year);
- maximum solar radiation: 1 000 W/m²;
- ultraviolet radiation: high;
- relative humidity: 10 % to 95 %; and
- pollution conditions: very heavy.

4.1.2 Standard ranges for accessories

The type of accessory will be specified in schedule A.

Unless otherwise specified in schedule A, all accessories shall be range-taking in accordance with the ranges given in tables 1 and 2:

Table 1 — Standard ranges for terminations, trifurcating kits, unshielded separable connectors (USC) and shielded separable connectors (SSC)

1	2	3	4	5	6	7
Rated voltage U_0/U kV	Cable size mm ²					
	Accessory range					
	1	2	3	4	5	6
6,35/11	16 to 35	50 to 95	120 to 185	240 to 400	500 to 800	1000
12,7/22	25 to 50	70 to 185	240 to 300	400 to 630	800 to 1000	—
19/33	50 to 95	120 to 185	240 to 500	630 to 1000	—	—

Table 2 — Standard ranges for joints

1	2	3	4	5	6	7
Rated voltage U_0/U kV	Cable size mm ²					
	Accessory range					
	1	2	3	4	5	6
6,35/11	16 to 35	50 to 95	120 to 185	240 to 400	500 to 630	800 to 1000
12,7/22	25	35 to 70	95 to 240	300 to 400	500 to 800	1000
19/33	50 to 70	95 to 150	185 to 400	500 to 630	800-1000	—

4.1.3 Accessory earthing

4.1.3.1 General

4.1.3.1.1 Unless otherwise specified in schedule A, the main earthing conductor of all joints and terminations shall be 70 mm² tinned copper braid. For cable terminations, the main earthing conductor shall be of length 700 mm for indoor terminations and 1200 mm for outdoor three-core terminations, and shall be terminated with a tinned copper connector that has an M12 fixing hole.

4.1.3.1.2 Unless otherwise specified in schedule A, the earth fault current rating of the main earthing conductor shall not exceed 10 kA 1 s. Where a higher earth fault current rating is required, multiple earthing conductors or associated connectors (or both) shall be utilized.

4.1.3.1.3 All cable termination earthing conductors shall be water blocked to prevent the ingress of moisture into the termination. The method of waterproofing shall be stated in schedule B (see also 6.3.2).

4.1.3.1.4 CFSs used to connect the main earthing conductor to the lead sheath or armour of a cable shall be of width at least 20 mm and shall be suitable for the relevant cable dimension.

4.1.3.1.5 Armour clamps shall be stainless steel of thickness 1 mm and of a nominal width of at least 20 mm. Fastening shall be by means of a socket or spanner.

4.1.3.1.6 CFSs that form part of the main earthing connection shall not be used to secure any ferrous metal enclosures used for the mechanical protection of a three-core cable joint.

4.1.3.1.7 The main earthing conductor of a joint shall be separated from the individual core insulation by a collective insulating inner sleeve that

- a) extends from lead sheath to lead sheath for an impregnated-paper insulated cable,
- b) extends from bedding to bedding for an XLPE-insulated cable,
- c) extends from lead sheath to bedding for a transition joint, and
- d) is effectively sealed at each bedding or lead sheath interface.

4.1.3.1.8 The edges of a CFS or armour clamp shall be smoothed using a suitable filler tape positioned around the CFS or clamp. In the case of a CFS, the filler tape shall also serve to restrain the spring.

4.1.3.2 XLPE-insulated cables

4.1.3.2.1 Secondary earthing conductors, intended to connect to the metallic screen of an XLPE-insulated cable, shall be tinned copper braid of cross-sectional area at least 16 mm².

4.1.3.2.2 The connection between secondary earthing conductors and the metallic screen of a cable shall be made using a CFS.

4.1.3.2.3 The main earthing conductor of a three-core joint or termination shall be connected to the armour wires of the cable with a CFS or an armour clamp.

4.1.3.2.4 The armour wires directly below the CFS or armour clamp of a three core cable shall be supported. The method of support shall be indicated in Schedule B.

NOTE Support below the armour wires is required to accommodate the triangular shape of certain XLPE cables.

4.1.3.2.5 The earthing conductor arrangement for the various cable types given in SANS 1339 shall be as given in table 3.

Table 3 – Earthing conductor arrangement for XLPE-insulated cables

1 Cable type	2 Armour	3 Screen	4 Earthing conductors	
			Secondary	Main
			Single-core type A	AWA
	AWA	copper wire screen	N/A (see note 2)	1 × 70 mm ² ^{a)}
	CWA	copper tape screen	1 × 16 mm ²	N/A ^{c)}
	CWA	copper wire screen	N/A (see note 2)	N/A ^{c)}
Single core type B	Unarmoured	copper tape screen	N/A	1 × 16 mm ²
	Unarmoured	copper wire screen	N/A	N/A ^{b)}
Three-core type A	SWA		3 × 16 mm ²	1 × 70 mm ² ^{a)}
Three-core type B	Unarmoured		3 × 16 mm ²	1 × 16 mm ²

^{a)} Earth fault current rating of the earthing conductor is 10 kA (1 s).

^{b)} A suitable lug having an M12 fixing hole should be provided for the connection of the copper screen wires.

^{c)} A separate main earthing conductor is not required as the copper wire armour can carry in excess of 10 kA (1 s).

4.1.3.3 Impregnated-paper insulated cables

The main earthing conductor of a joint or termination shall be:

- a) connected to the lead sheath of the cable with a CFS. A layer of tinned copper mesh shall be provided for application under the CFS, and
- b) connected to the armouring of the cable with a CFS.

NOTE No armour clamps are permitted due to the 'cold flow' characteristics of the lead sheath.

4.1.4 Terminations

4.1.4.1 A termination shall be classified as:

- a) an indoor termination for use in air-filled enclosures; or
- b) an outdoor termination.

4.1.4.2 The design of a cable termination shall take into account changes to the electrical field distribution caused by pollution deposited on the surface of the termination in indoor and outdoor applications.

4.1.4.3 The minimum specific creepage distances for type 1 and type 2 cable terminations shall be in accordance with NRS 012. If a higher specific creepage distance is required, it will be specified in schedule A. The actual creepage distance offered shall be stated in schedule B. The creepage path material (i.e. outer anti-track tubing) shall be of the same material for the entire creepage distance.

For single core terminations, no separate earthing/ armour tube shall be used and the outer anti-track material shall extend from the lug to the nearest exposed earth point.

For single core terminations, the creepage distance shall be measured from the end of the cable insulation at the lug, along the surface of the termination tail, to the nearest exposed earthed point (i.e. typically the main earthing conductor of the termination).

For three core terminations, the creepage distance shall be measured from the end of the cable insulation at the lug along the surface of the termination tail to the cable crutch (i.e. where the tails exit the crutch).

4.1.4.4 Unless otherwise specified in schedule A, the cable termination tail lengths shall be as given in table 4. The tail lengths are related to the distance from the terminal centre line to the cable support clamp or gland plate (if applicable) as specified in table 7 of NRS 012:2002.

Table 4 – Tail length for cable terminations

Cable type	2	3	4	5
	Termination tail length mm			
	Rated voltage U_0/U kV			
	3,8/6,6	6,35/11	12,7/22	19/33
Three-core (indoor)	650	650	650	800
Three-core (outdoor)	1200	1200	1200	1200
Single-core (indoor and outdoor)	350 (max.)	350 (max.)	450 (max.)	600 (max.)

4.1.4.5 All three core cable termination instructions shall be based upon the “top down” principle of measurement and shall clearly indicate the distance to the end of the core screen (screen cut) from the top down. The ‘top down’ principle of measurement requires the position of the screen cut to be referenced from the top end of the core insulation. See figure 1.

NOTE The intention of the “top down” measurement is to maximise the length of screened tail to allow for core crossing in the screened section of the termination if necessary.

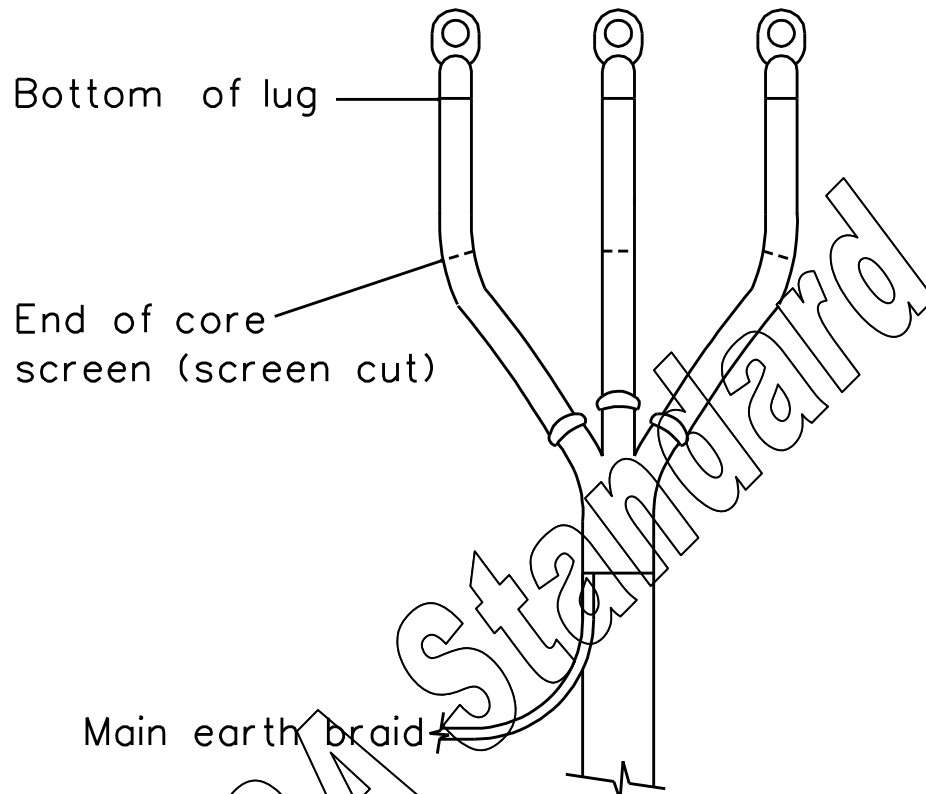


Figure 1 — Position of screen cut

4.1.4.6 Clearances within an air-insulated enclosure shall be in accordance with NRS 012.

4.1.4.7 Cable terminations for impregnated paper-insulated cables shall have semi-conductive tubes that cover the metallic-paper core screen from the break-out boot to the end of the core screen.

NOTE The purpose of the semi-conductive tube is to prevent the metallic-paper core screen from moving during the termination process.

4.1.4.8 Three-core cable terminations shall be designed to accommodate crossing of cable cores within the screened section of the trifurcated cores. See also 6.3.2.

4.1.4.9 The design of a cable termination shall ensure that no part of the armour or lead sheath of the cable is exposed once the termination is completed. In the case of a three-core termination this shall be achieved by either ensuring that the length of the break-out boot is adequate or provision of a separate earthing/armour tube.

4.1.4.10 Outdoor cable terminations for paper-insulated cables shall be provided with crutch support to prevent damage to the cable crutch and core insulation from over-trifurcating (e.g. a tri-shed installed above the crutch).

4.1.4.11 Cable terminations shall be provided with a method of sealing the interface between the termination tail outer tube and the lug barrel either by:

- a) allowing for at least 100 mm of additional length of termination tail outer tube and sealing mastic that covers the lug barrel; or
- b) providing lug outer tubes of length at least 100 mm and sealing mastic (see also 6.3.2).

4.1.4.12 Cable terminations for single-core cable shall be supplied in sets of three i.e. allowing for the termination of three single-core cables.

4.1.4.13 For indoor cable terminations within air-filled cable enclosures fitted with low-voltage current transformers, an "extended screen termination" shall be supplied. The termination design shall allow for the core screen of the cable to extend through the current transformers by having a tail length of 800 mm.

4.1.4.14 Terminations shall be supplied with mechanical torque shear lugs in accordance with NRS 075 and shall be suitable for the standard ranges specified in table 1. The mechanical torque shear lug fixing hole shall be M16.

4.1.5 Cable joints

4.1.5.1 All three-core cable joints shall be of the filled type. The method of filling shall be stated in schedule B.

NOTE The primary purpose of filling three core cable joints is to provide a longitudinal water block.

4.1.5.2 All jointing instructions shall clearly indicate the maximum length and diameter of the ferrule (s) that may be used with the joint.

4.1.5.3 Three-core cable joints shall be designed to accommodate crossing of cable cores within the joint. The method of core crossing shall be indicated in the jointing instruction.

4.1.5.4 Cable joints for single-core cable shall be supplied individually i.e. allowing for the jointing of one single-core cable.

4.1.5.5 Cable joints shall be supplied with mechanical torque shear ferrules in accordance with NRS 075 and shall be suitable for the standard ranges specified in table 2.

4.1.6 Shrouded terminations

4.1.6.1 For type 2 cable terminations in accordance with NRS 012, a method shall be provided for insulating the cable termination at the equipment terminal fixing point for the required connection arrangement specified in schedule A. The connection arrangement will typically consist of a straight or right-angled cable connection onto a bushing, post insulator or solid shaped copper conductor. The configuration will be specified in schedule A. Figure 2 shows an example of a straight shrouded connection onto a solid shaped copper conductor.

NOTE This type of termination is typically only required where non-standard interfaces are provided. Examples of standard interfaces are bushings as specified in EN 50180 or EN 50181 (e.g. Type C bushing).

4.1.6.2 The outer covering of the shroud shall be heatshrink, coldshrink or slip-on.

4.1.6.3 Shrouds shall be supplied with three lengths of self-amalgamating filler tape of minimum dimensions 300 mm x 50 mm x 3 mm that shall be used for covering all sharp edges of the cable/terminal fixing point interface.

4.1.6.4 Shrouds with taped outer layers shall not be used.

4.1.6.5 Shrouds shall be supplied in sets of three i.e. allowing for the termination of one three-core cable or three single-core cables.

4.1.6.6 A shroud shall be tested as a shrouded termination in accordance with IEC 60055-1 or SANS 60502-4 at the minimum phase-to-phase and phase-to-earth clearances. The phase-to-phase and phase-to-earth clearances at which the shrouds are tested shall not exceed those given in NRS 012.

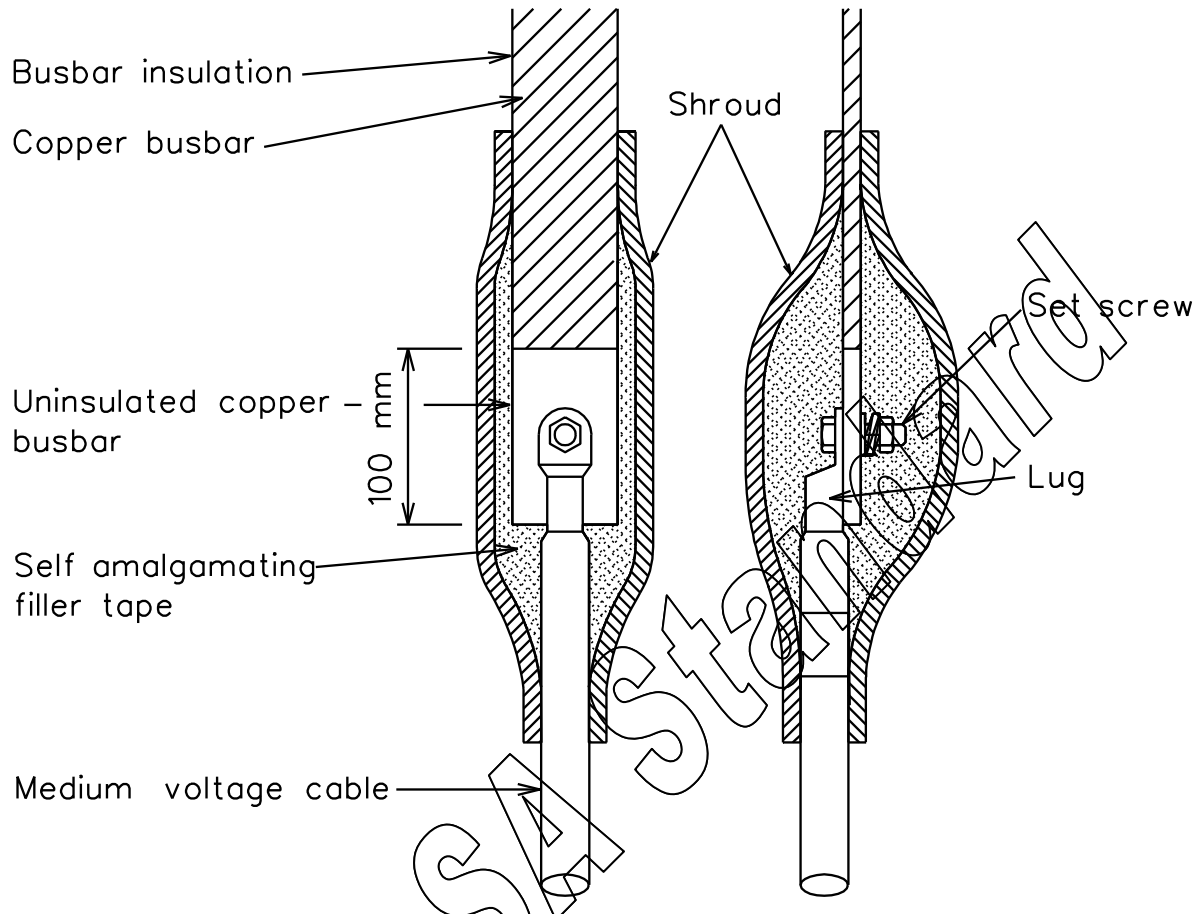


Figure 2 — Example of a straight shrouded connection (Type 2) onto a solid shaped copper conductor

4.1.7 Unscreened separable connectors (USCs) for indoor terminations

4.1.7.1 USCs shall be of the dead-break, bolted contact type and shall be suitable for connecting to a 630 A outside cone plug-in type bushing with interface type 'C' in accordance with EN 50180 and EN 50181 having an M16 × 2 thread.

4.1.7.2 USCs shall be range-taking in accordance with the standard ranges specified in table 1.

4.1.7.3 USCs shall be supplied in sets of three i.e. allowing for the termination of one three-core cable or three single core cables.

4.1.7.4 USCs shall be suitable for both straight and right-angled cable connections onto the bushing.

4.1.7.5 USCs shall be type tested at the minimum phase-to-phase and phase-to-earth clearances.

4.1.7.6 The phase-to-phase and phase-to-earth clearances at which the connectors are tested shall not exceed those given in NRS 012.

4.1.7.7 The USC's shall be supplied with a set of three 40 mm long M16 x 2 set screws with washers and spring washers as shown in figure 3.

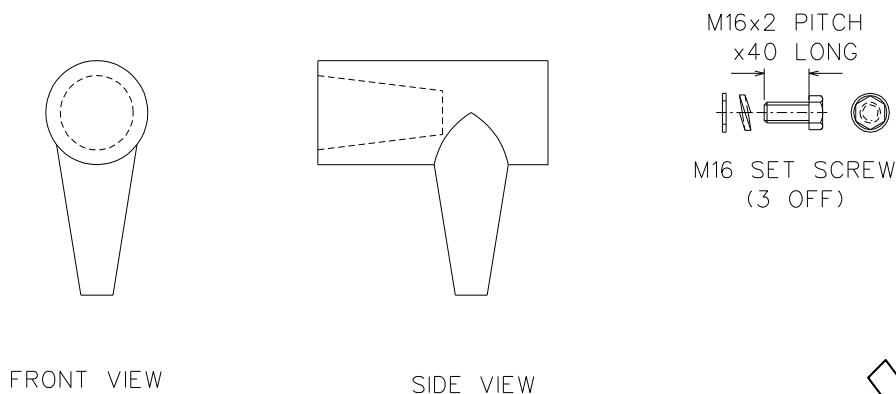


Figure 3 — 40 mm long M16 x 2 set screw with washer and spring washer

4.1.8 Trifurcating termination kits for screened separable connectors used with three-core cable

NOTE A trifurcating termination kit is used when a three-core XLPE-insulated cable is to be terminated with three screened separable connectors. The purpose of the kit is to:

- a) separate the three screened cable cores;
- b) provide an earth connection to the copper core screens and the armour wires of the three-core cable; and
- c) provide a waterproof seal for the screened cores, cable crutch and earth connection.

4.1.8.1 A trifurcating termination kit shall be range-taking in accordance with the standard ranges specified in table 1.

4.1.8.2 An earthing kit shall be provided for connecting to the copper core screens and armour wires and shall comply with the requirements of 4.1.3 and shall have passed a thermal short-circuit (screen) test in accordance with 5.4.4.

4.1.8.3 A trifurcating termination kit shall include all components required for sealing the screened cable cores, cable crutch and earth connection.

4.1.8.4 The tail length of a trifurcated cable shall be 800 mm although the length of the insulating/sealing tubes provided may be 650 mm i.e. it may be assumed that the SSC housing is of length at least 150 mm long.

4.1.8.5 The trifurcating termination kit shall be supplied together with the screened separable connector kit.

4.1.9 Screened separable connectors (SSCs) for single cable terminations

4.1.9.1 Non-extensible SSCs or extensible SSCs may be supplied for a single cable termination provided they comply with all of the requirements of 4.1.9.

4.1.9.2 SSCs are used for type 4 cable terminations in accordance with NRS 012. The stress control is provided within the screened separable connector. This type of termination is suitable for the connection of cable with XLPE insulation that is circular. It cannot be used on cables that have sector shaped cores or metallic tape core screens (e.g. impregnated paper insulated cables that comply with SANS 97).

4.1.9.3 SSCs shall be of the dead-break, bolted contact type and shall be suitable for connecting to a 630 A outside cone plug-in type bushing with interface type 'C' in accordance with EN 50180

and EN 50181 having an M16 × 2 thread. Alternatively, if specified in schedule A, SSCs shall be of the dead-break, sliding contact type and shall be suitable for connecting to a 250 A outside cone plug-in type bushing with interface type 'A' in accordance with EN 50180 and EN 50181. The type of SSC offered (i.e. non-extensible or extensible) shall be stated in schedule B.

4.1.9.4 The SSC's shall be range-taking in accordance with the standard ranges specified in table 1.

4.1.9.5 Each SSC shall be supplied with a stainless steel fixing stem and all associated components (e.g. end plug, test point cap).

4.1.9.6 SSCs shall be supplied in sets of three i.e. allowing for the termination of one three-core cable or three single core cables.

4.1.9.7 SSCs shall be supplied with lugs suitable for the standard ranges specified in table 1. As an alternative to supplying multiple sets of lugs, range-taking torque shear lugs that comply with NRS 075 may be used. The type of lug to be provided will be stated in schedule A.

4.1.9.8 Where SSCs are provided with an external length of insulated conductor that is required for the earthing of the SSC housing, the conductor shall be

- a) an insulated copper conductor of nominal cross-sectional area of at least 4 mm²
- b) of length 700 mm, and
- c) terminated at the non-SSC end with a lug having an M12 fixing hole.

4.1.9.9 The SSC shall be suitable for cable outer sheath testing without the need to disconnect the SSC housing earthing conductor.

4.1.10 Extensible screened separable connectors (SSCs) for multiple cable terminations

NOTE Where applicable, the depth of the particular cable termination enclosure in conjunction with the extensible SSC dimensions should be considered when purchasing.

4.1.10.1 Extensible SSCs shall comply with the requirements of 4.1.9.

4.1.10.2 The number of cables to be terminated in tandem (i.e. back to back) will be specified in schedule A. All the required extensible SSC connectors and necessary interfacing components (including end plugs and test point caps) shall be supplied as a single item to terminate the required number of cables specified.

4.1.10.3 The following items will be supplied separately as indicated in schedule A:

- a) cable test rod (i.e. suitable for cable pressure testing);
- b) portable earth connection point/earthing adapter suitable for 20 kA (1 s). The ball diameter will be specified in schedule A;
- c) live end seal (i.e. for use when disconnecting the SSC from the type C bushing for re-energising the cable without it being connected to the equipment); and
- d) blank inserts.

NOTE Blank inserts are required when isolating one of two cables that are connected in tandem (back-to-back).

4.1.11 Cable repair sleeves

NOTE Cable repair sleeves may be used to repair underground cables that have a damaged/punctured outer sheath.

4.1.11.1 Cable repair sleeves shall be suitable for application on cables of outer diameter ranges as follows:

- a) 45 mm to 65 mm; and
- b) 65 mm to 95 mm.

4.1.11.2 A cable repair sleeve shall be of a wrap around design and shall be supplied with a rail and stainless steel zip/channel or any other approved sealing method.

4.1.11.3 Unless otherwise specified in schedule A, the length shall be at least 1000 mm.

4.1.11.4 The minimum wall thickness shall be 2 mm after installation.

4.1.11.5 The inner surface shall be coated with a suitable adhesive to prevent moisture ingress into the cable.

4.1.11.6 Each repair sleeve shall be supplied with the cable preparation equipment and tools necessary to install the sleeve.

4.1.12 Cable sealing end caps

4.1.12.1 Cable sealing end caps shall be suitable for application on cables of outer diameter ranges as follows:

- a) 45 mm to 65 mm; and
- b) 65 mm to 95 mm.

4.1.12.2 The length shall be at least 150 mm.

4.1.12.3 The minimum wall thickness shall be 2 mm after installation.

4.1.12.4 The inner surface shall be coated with a suitable adhesive to prevent moisture ingress into the cable.

4.1.12.5 The cable sealing end cap shall be UV stable.

4.1.13 Special requirements

4.1.13.1 The jointing and termination instructions for accessories used with XLPE-insulated cables shall clearly indicate the cable preparation required for cables having an outer sheath made of polyethylene.

4.1.13.2 Cleaning kits for cable joints, terminations and trifurcating kits shall consist of at least the following:

- a) non-oil based cleaning solvent supplied in a sealed container that prevents leakage or evaporation;
- b) 50 mm × 600 mm aluminium-oxide or glass based abrasive tape;
- c) 1 m of twine for cutting core insulation (supplied only with accessories for XLPE-insulated cables);

- d) eight pieces of 150 mm × 150 mm lint free cloth; and
- e) a material safety data sheet.

4.1.13.3 All materials supplied shall be non-toxic and dermatologically safe.

4.2 Voltage designations and maximum conductor temperatures

4.2.1 Rated voltages

The rated voltages U_0/U of accessories considered in this specification are given in SANS 97, SANS 1339 and SANS 1713. The type of cable for which accessories are required will be specified in schedule A.

4.2.2 Maximum conductor temperatures

The accessories shall be suitable for use on cables having conductor temperatures specified in SANS 97, SANS 1339 and SANS 1713 for normal operation and under fault conditions.

4.3 Conditions and range of approval

4.3.1 For one type of accessory for paper-insulated metal-sheathed cable, approval of the range of cross-sections from 70 mm² to 300 mm² shall be obtained by successfully completing the type tests listed in tables 2 and 3 of IEC 60055-1:2005, on a cable of cross-section as indicated in 5.3.2.1.

4.3.2 For one type of accessory for XLPE-insulated cables, approval of the range of cross-sections from 70 mm² to 300 mm² shall be obtained by successfully completing the type tests listed in tables 4 to 9 of SANS 60502-4:2006, on a cable of cross-section as indicated in 5.3.2.1. In addition, for separable connectors, the type tests listed in table 10 of SANS 60502-4:2006 shall be successfully completed on the smallest and/or largest conductor cross-sectional areas in the range.

4.3.3 Tests carried out in accordance with 4.3.1 or 4.3.2 on a single-core or three-core cable shall provide approval of that type of accessory for use on single-core cables up to the largest sizes included in the relevant cable specification. Tests carried out on a single-core cable, however, shall not provide approval for use of that accessory on three-core cables.

4.3.4 For one type of accessory for three-core paper-insulated metal-sheathed cable, approval of the range of cross-sections up to and including 50 mm² shall be obtained by successfully completing the type tests listed in tables 2 and 3 of IEC 60055-1:2005 on the smallest size offered.

4.3.5 For one type of accessory for three-core XLPE-insulated cables, extension of approval to a wider range of cross-sections to that given in 4.3.2 shall be achieved by carrying out the additional tests listed in table 10 of SANS 60502-4:2006 on the smallest or largest conductor cross-sectional areas (or both) of the required range.

4.3.6 Accessories that have been successfully type tested on XLPE-insulated cables given in SANS 1339 are considered to be acceptable for use with ABC that complies with the requirements of SANS 1713.

4.3.7 All other conditions stated in clause 24 of IEC 60055-1:2005 and clause 7 of SANS 60502-4:2006 shall apply.

5 Testing

5.1 General

5.1.1 Approval, based on this specification, may be obtained by

- a) successful completion of the appropriate tests as required by this specification by an accredited laboratory, and
- b) if the purchaser agrees, the provision of accredited test reports based on an alternative specification whose test requirements are at least equivalent to those in this specification. Details of approval in this regard are provided in 5.5.

5.1.2 It is not necessary to repeat these tests on accessories once successfully completed, unless changes are made in the materials, design or manufacturing process of the accessories that might affect the performance characteristics.

5.2 Accreditation of testing laboratories

All testing laboratories shall have been accredited by an accreditation body (for example, SANAS or RvA) that has a full valid IAF or ILAC membership. When assessing accessories for compliance with this specification, only accredited laboratory test reports shall be considered. Proof that the test laboratory complies with the above requirements shall be provided with the tender.

5.3 Assembly of accessories to be tested

5.3.1 Identification

5.3.1.1 Cables used for testing shall comply with SANS 97 or SANS 1339 and shall be of the same rated voltage as the accessories to be tested. Cables shall be correctly identified in accordance with annex C.

5.3.1.2 Connectors used with the accessories shall comply with NRS 028 or NRS 075 as relevant and shall be correctly identified with respect to

- a) assembly technique,
- b) tooling and necessary setting,
- c) preparation of contact surfaces,
- d) type, reference number and any other identification of the connector, and
- e) details of the type test approval.

5.3.1.3 Accessories to be tested shall be correctly identified with respect to

- a) name of manufacturer and brand name,
- b) type, designation, manufacturing date and part number,
- c) cable cross-sections, material and shape of cable conductor,
- d) rated voltages (see 4.2.1),
- e) cable construction (see annex C),
- f) installation instructions (reference and date) and associated bill of materials,

- g) tail lengths tested (where applicable), and
 h) cross-sectional area of main earth leads.

5.3.2 Installation and connections

5.3.2.1 One of the following cable sizes shall be used:

- a) for terminations, joints and stop ends: 120 mm² or 150 mm² or 185 mm²; and
 b) for separable connectors: each rating shall be tested in accordance with 6.2.1(b) of SANS 60502-4:2006.

5.3.2.2 Installation and connections shall be in accordance with SANS 60502-4 and IEC 60055-1.

5.3.2.3 Phase-to-phase and phase-to-earth clearances for indoor shrouded and unscreened separable connectors shall be not greater than those specified in NRS 012.

5.4 Type test requirements

5.4.1 Accessories for impregnated-paper insulated cables

5.4.1.1 Test requirements shall be in accordance with IEC 60055-1 at the test voltage levels as given in table 5.

Table 5 – Test voltages for impregnated-paper insulated cables

1 Test	2	3	4	5	6 Requirement
	Rated voltage U_0/U kV				
	3,8/6,6	6,35/11	12,7/22	19/33	
Humidity and salt fog (1,25 U_0)	4,75	7,94	15,9	23,8	No failure or flashover No more than three trips No substantial damage ^a
Thermal cycles (1,5 U_0)	5,7	9,5	19,1	28,5	No failure or flashover
A.C. withstand 15 min (2,5 U_0)	9,5	15,9	31,8	47,5	No failure or flashover
A.C. withstand 1 min (4,0 U_0)	15,2	25,4	50,8	76,0	No failure or flashover
A.C. withstand 5 min (4,5 U_0)	17,1	28,6	57,2	85,5	No failure or flashover
Impulse (peak)	75	95	150 ^b	200	No failure or flashover
<p>^a It is considered that substantial damage has occurred when it is evident that the performance of the accessory has been severely reduced by loss of dielectric quality of the surface due to tracking or erosion.</p> <p>^b Purchasers should be aware that at the time of writing, all known commercially available 22 kV screened separable connectors (SSCs) have a rated lightning impulse withstand voltage of 125 kV. Where purchasers feed 24 kV equipment from an overhead distribution system, the equipment could be exposed to higher impulse voltages. Therefore special surge protective measures may be required (e.g. through the correct application of surge arresters). For further information on insulation coordination, reference should be made to NRS 012.</p>					

5.4.1.2 Cable joints for armoured cables shall be subjected to an impact test in accordance with 5.4.3.

5.4.1.3 Accessories for both belted and screened impregnated-paper insulated cables shall be subjected to an impulse test. Each core shall be individually tested with the remaining two cores and metallic sheath bonded to earth.

5.4.1.4 Cable joints and terminations shall be subjected to a thermal short circuit (earth fault) test in accordance with 5.4.4.

5.4.2 Accessories for XLPE-insulated cables

5.4.2.1 Test requirements shall be in accordance with SANS 60502-4 at the test voltage levels as shown in table 6.

Table 6 – Test voltages for XLPE-insulated cables

Test	1	2	3	4	5	Requirements
	Rated voltage U_0/U					
	kV					
	3,8/6,6	6,35/11	12,7/22	19/33		
Humidity and salt fog (1,25 U_0)	4,75	7,94	15,9	23,8	No failure or flashover No more than three trips No substantial damage ^a	
Partial discharge (1,73 U_0)	6,6	11	22,0	33	Maximum partial discharge: 10 pC	
Thermal cycles (2,5 U_0) A.C. withstand 15 min (2,5 U_0) A.C. withstand 500 h (2,5 U_0)	9,5	15,9	31,8	47,5	No failure or flashover	
A.C. withstand 1 min (4,0 U_0)	15,2	25,4	50,8	76,0	No failure or flashover	
A.C. withstand 5 min (4,5 U_0)	17,1	28,6	57,2	85,5	No failure or flashover	
Impulse (peak)	75	95	150	200	No failure or flashover	
^a It is considered that substantial damage has occurred when it is evident that the performance of the accessory has been severely reduced by loss of dielectric quality of the surface due to tracking or erosion.						

5.4.2.2 Cable joints for armoured cables shall be subjected to an impact test in accordance with 5.4.3.

5.4.2.3 Cable joints and terminations shall be subjected to a thermal short circuit (earth fault) test in accordance with 5.4.4. This test is intended to replace the thermal short circuit (screen) test of SANS 60502-4.

5.4.3 Impact test for armoured cable joints

5.4.3.1 The impact test shall be carried out on all types of armoured cable joints only. The impact test shall be performed at ambient temperature and shall be conducted in the following test sequences:

- for impregnated-paper insulated cables the impact test shall be performed in the test sequence 1.1 of table 3 of IEC 60055-1:2005 after the a.c. withstand test, followed by the rest of the test sequence; and
- for XLPE-insulated cables the impact test shall be performed in the test sequence 2.1 of table 5 of SANS 60502-4:2006 after the a.c. withstand test, followed by the rest of the test sequence.

5.4.3.2 The impact test arrangement is illustrated in figure D.1.

5.4.3.3 Before impact, the insulation resistance between the conductor and the metallic screen/sheath shall be measured. The d.c. test voltage shall be 500 V and shall be applied for a sufficient time to reach a reasonably steady measurement, but for not less than 1 min and not more than 5 min.

5.4.3.4 The joint shall be placed on a hard base, for example, a concrete slab or floor, and solidly supported in a box filled with sand to the horizontal centre line of the accessory.

5.4.3.5 A wedge shaped block of mass 4 kg having an angle of 90° with a radius impact edge of 2 mm shall be dropped in a guided freefall from a height of 1 m onto the joint so that the impacting edge is horizontal and at right angles to the axis of the joint. There shall be one impact at each end of the joint and one impact at a position over the conductor connectors. The impact at the end of the joint in an XLPE-insulated cable shall be at the outer sheath cut back and in the case of an impregnated-paper insulated cable at the lead sheath cut back.

5.4.3.6 Following the impact test, the joint shall be fully immersed in water for 24 h at ambient temperature and the insulation resistance shall again be measured as specified in 5.4.3.3 between the conductor and the metallic screen/sheath and between the metallic screen/sheath (if insulated) and the water.

5.4.3.7 The measured insulation resistance shall be not less than

- a) 10 MΩ in impregnated-paper insulated cables, and
- b) 1 GΩ in XLPE-insulated cables.

5.4.3.8 Details of any visible effects and the position of the impacts on the joint shall be recorded by photographs and included in the test report.

5.4.4 Thermal short circuit (earth fault) test

5.4.4.1 A thermal short circuit (earth fault) test in accordance with clause 10 of SANS 61442:2006 shall be performed at 10 kA for 1 s except where this requirement exceeds the earth fault rating of the cable, in which case the test shall be carried out at the 1 s earth fault rating of the cable. The thermal short circuit (earth fault) test is intended to prove the ability of the earthing circuit of an accessory to withstand earth fault currents (i.e. where applicable, including both primary and secondary earthing circuits). For XLPE insulated accessories, this test is intended to replace the thermal short circuit (screen) test specified in SANS 60502-4.

5.4.4.2 If a higher short circuit current is specified in schedule A (see 4.1.3.1.2), the thermal short circuit (earth fault) test shall be performed at the specified short circuit current.

5.4.5 Natural aging test for outdoor terminations

If installed in very heavy pollution conditions, it is recommended that outdoor cable terminations be subjected to a natural aging test at the Eskom Koeberg Insulator Pollution Test Site (KIPTS). This test would replace the 1000-hour salt fog test specified in IEC 60055-1 and SANS 60502-4.

NOTE Users are referred to the Eskom document DPC 34-211 for KIPTS testing.

5.5 Acceptance of alternative test reports

Accessories that have been successfully tested in accordance with the relevant test methods of IEC 60055-1, SANS 60502-4, CENELEC HD 629.1 S1 or CENELEC HD 629.2 S2 shall be deemed to comply with the requirements of this specification provided that

- a) an additional impulse withstand voltage test is performed at the voltage levels required by this specification,
- b) for armoured cable joints, impact tests are performed in accordance with 5.4.3, unless already tested in the previous test,
- c) for terminations, natural aging tests are performed in accordance with 5.4.5, if so specified in schedule A,

- d) a written guarantee is provided stating that the accessories are suitable for cables that comply with SANS 97 and SANS 1339, and
- e) the accessory complies with all other requirements of this specification.

6 Marking, packaging and documentation

6.1 Marking

All accessories shall be clearly and durably marked by the manufacturer to indicate the following:

- a) the manufacturer's identification mark and reference/catalogue number (visible on the completed accessory);
- b) the rated voltage and accessory description (e.g. 12 kV Outdoor termination (XLPE));
- c) the accessory range (visible on the accessory packaging);
- d) the purchaser's unique stock code/number;
- e) the manufacturer's identification mark and a part number (visible on all components forming part of an accessory). This part number shall be referenced in the bill of materials. Components that are physically impossible to mark shall be individually packed and the packaging shall be marked;
- e) the expiry date (visible on the packaging of all components of consumables that are subjected to a shelf life limitation). These components of consumables shall be individually packed;
- f) in addition, where an accessory contains components or consumables that have an expiry date it shall be clearly marked on the outside of the cardboard container; and
- g) the completed accessory shall be provided with an indelible identification tag that indicates the manufacturer/supplier, accessory part number and allows the joiner to record his/her name and date of installation. Details of the tag offered shall be indicated in schedule B.

NOTE A tag is not required for unscreened and screened separable connector kits.

6.2 Packaging

6.2.1 With the exception of cable end caps, each accessory shall be packed in a cardboard container to protect it from mechanical damage. Individual parts shall be packed in sealed plastic bags. The package shall contain

- a) an installation instruction (see 6.3.2),
- b) all necessary components and consumables required to complete the installation in accordance with the instruction i.e. accessory components, cleaning kit and earthing kit, and
- c) a bill of materials.

6.2.2 Cable end-caps shall not be individually packaged in cardboard containers. However, they shall be individually sealed in clear plastic packaging with an installation instruction.

6.2.3 Plastic packing shall be such as to permit easy identification of the components without their removal from the packing.

6.2.4 Mastic fillers shall be packed in the required lengths for the various applications i.e. it shall not be left to the joiner to decide how much mastic should be used in each application.

6.2.5 Where accessories are bulk-packed, the mass of each container shall not exceed 30 kg.

The container shall be marked with the following information:

- a) the name of the manufacturer;
- b) the accessory reference;
- c) the number of accessories per container; and
- d) the purchaser's order number.

6.3 Documentation

6.3.1 Language of documentation

All documentation shall be in English.

6.3.2 Installation instructions

Installation instructions shall be supplied for each accessory and shall

- a) be supported by legible illustrations that clearly indicate the application and assembly of all components of the accessory,
- b) reference the bill of materials by quoting the relevant part number at least once when describing the components,
- c) be unique to the rated voltage and the cable type for which the accessory has been designed,
- d) indicate a date of issue and a revision number,
- e) be unique for the indoor and the outdoor application of terminations,
- f) be individually printed and not photo-copied,
- g) indicate how, where and when the accessory identification tag shall be attached, and
- h) include the following clause at the end of the instruction:

“ANY COLOUR CODED INSULATING TAPES (E.G. PVC) USED FOR PHASE IDENTIFICATION PURPOSES SHALL BE REMOVED PRIOR TO ENERGISING THE TERMINATION.”

- i) indicate the positioning of the waterproofing for cable termination earthing conductors,
- j) indicate the method of core crossing along with minimum clearances for terminations,
- k) indicate the method of sealing the interface between the termination tail outer tube and the lug barrel for cable terminations,
- l) indicate the maximum length and diameter of the ferrule (s) that may be used with the joint, and
- m) indicate the minimum thickness of insulation required at any point of the shroud.

6.3.3 Bill of materials

The bill of materials shall provide the following information for each component:

- a) a short description;
- b) the quantity; and

c) a part number or a batch number.

6.3.4 Test reports

6.3.4.1 Test reports shall be submitted with a tender and shall be arranged according to the applicable type test sequence.

6.3.4.2 Test reports shall be accompanied by installation instructions and a bill of materials that form part of the test report issued by the accredited laboratory.

6.3.4.3 On the cover page of each test report there shall be a clear statement as to which clause(s) of the relevant specification have been excluded from the test requirement.

6.3.4.4 All test reports shall bear the mark of accreditation which the accredited laboratory holds. This mark of accreditation shall be prominent on the front page of the test report.

7 Samples and storage

7.1 Samples

Where so specified in schedule A, a sample of the accessory shall be supplied with the tender.

7.2 Storage

Components shall be capable of being stored without deterioration within the temperature range $-10\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$ for a minimum of 12 months.

8 Training

The supplier shall provide the following details with the tender regarding training offered:

- a) the available training courses;
- b) the duration of each course;
- c) the cost per delegate (for non purchaser affiliated delegates);
- d) the minimum number of delegates required;
- e) the certification of delegates;
- f) delegate evaluation criteria;
- g) the relevant of SAQA or ESETA accreditation (or both); and
- h) on-site training and technical support.

All training course material shall be subject to the approval of the purchaser.

Annex A (informative)

Guide to purchasers on preparing an enquiry

A.1 General

A model form is given in annex B to provide the purchaser with a convenient aid to purchasing. The use of this form is intended to obviate the need for preparing a detailed technical specification.

The purchaser need only specify compliance with this specification, provide the tenderers with details of his particular requirements, and set out the information he requires the tenderer to provide, as indicated below.

A.2 Schedules

A.2.1 General

The model form in annex B provides the purchaser with examples of a schedule A and a schedule B. In his enquiry, the purchaser should provide his own schedule A and schedule B, based on these examples.

A.2.2 Schedule A

Schedule A lists the requirements to be specified by the purchaser in enquiries and orders. These requirements include references to the relevant subclauses in this specification, to assist in compiling the schedules.

Where the text of any referenced standards stipulates that the purchaser shall indicate his requirements, these requirements should also be specified in Schedule A.

The purchaser should set out his particular requirements and choices in his own schedule A.

A.2.3 Schedule B

The purchaser should draw up his own schedule B (based on the schedule B in the model form in annex B), and require the tenderer to fill in this schedule. By doing this, the tenderer will be stating compliance with this specification and will provide the information the purchaser has requested.

NOTE 1 Where this specification allows the purchaser to make a choice, the example of schedule A (in the model form in annex B) lists the preferred items/values/quantities. In the interests of standardization, purchasers are encouraged not to deviate from these preferences.

NOTE 2 When preparing his own schedule A and schedule B from the examples in the model form in annex B, the purchaser need only include the items he considers to be relevant or necessary.

NOTE 3 These schedules, when completed, become normative annexes to the enquiry specification

A.3 Commercial conditions

A purchaser will furthermore need to indicate the commercial conditions applicable and draw up a price schedule. Requirements for delivery, storage, packaging and marking should be included in this part of the enquiry.

A.4 Quality assurance

This specification does not cover the purchaser's possible requirements in respect of quality assurance, quality control, inspections, etc., since each purchaser needs to consider the criticality of the application of each component, and his own policy towards these matters. Purchasers are referred to SANS 9001 for guidance.

Annex A
*(concluded)***A.5 Testing**

Attention should be paid to the subject of tests and the related costs. Tests should be carried out by an accredited laboratory and tenderers should be requested to provide assurances in this regard.

Price schedules should be so drawn up and covering letters so worded that the costs of all services, such as tests, delivery and spares, are declared and allowed for in the tender.

Before type tests, routine tests and sample tests are carried out, the number of samples used and the frequency of sampling should be agreed upon with the supplier.

A.6 Revision of standards used as normative references

This specification, as has been indicated, is based on a set of defined standards, which might have been revised or amended. Most purchasers would, in principle, wish to employ the latest standards. The recommended approach is to secure an undertaking from a supplier to review the latest versions and amendments and to incorporate these where possible and agreeable to both parties. A blanket commitment to work to the "latest" versions of standards creates legal difficulties of interpretation and risks for both parties and should be properly assessed. This invariably cannot be done in the time available.

Draft SA Standard

Annex B

(informative)

Model form for schedules A and B

The schedules A and B in this annex are included in this specification for information only: they are intended to be guides to purchasers in the areas of format and specific technical requirements, to help them to prepare schedules that are applicable to a particular enquiry or tender.

Schedule A: Purchaser's specific requirements (to be completed by the purchaser)

A.1 Cable parameters

Accessories are required for the following cable.

Complete either checklist A.1.1 for paper cable or checklist A.1.2 for XLPE cable, and attach to the applicable completed schedule(s) B.

A.1.1 Checklist for paper cable parameters

System voltage kV	3,8/6,6		6,35/11		12,7/22		19/33	
Number of cores	Single-core			Three-core				
Conductor(s)	Copper			Aluminium				
Construction	Belted			Screened				
Conductor mm²		or	Range	to				
Metallic sheath	Plain lead			Lead alloy E				
Armouring	Single-core			AWA		None		
	Three-core			SWA		DSTA		None
Outer sheath	PVC		PE				NH	

A.1.2 Checklist for XLPE cable parameters

System voltage kV	3,8/6,6		6,35/11		12,7/22		19/33	
Number of cores	Single-core			Three-core				
Conductor(s)	Copper			Aluminium				
Construction	Single-core			Type A		Type B		
	Three-core			Type A		Type B		
Conductor mm²		or	Range	to				
Outer sheath	PVC		PE				NH	

Annex B

(continued)

A.2 Accessories required

The following type of accessory is required for the cable detailed in schedule A.1.

NOTE Tick one accessory type only; use a separate schedule A.2 for each type of accessory required.

Straight joint	
Transition joint	
Indoor termination	
Outdoor termination	
Trifurcating termination kit	
Unscreened separable connector (USC)	
Screened separable connector (SSC – for one cable termination)	
Extensible screened separable connector (SSC – for multiple cable terminations)	

A sample of the accessory is is not required

A.3 Accessory requirements

Sub-clause	Description		Schedule A
4.1.3.1.1	Main earthing conductor details if other than as specified		_____
4.1.3.1.2	Earth fault current rating if other than as specified		_____
4.1.4.3	Specific creepage distance (terminations only) if other than as specified		_____
4.1.4.4	Cable termination tail length (terminations only) if other than as specified		_____
4.1.6.1	Connection arrangement for type 2 cable terminations		_____
4.1.9.3	Alternative bushing interface (type 'A') for SSCs	Yes/no	_____
4.1.9.7	Type of lugs provided for separable connectors (crimp/torque shear)		_____
4.1.10.2	Number of cables to be terminated in tandem		_____
4.1.10.3	Indicate quantity of following accessories to be supplied for extensible SSCs: a) cable test rod b) portable earth connection c) live end seal d) blank inserts		_____ _____ _____ _____
4.1.11.3	Length of cable repair sleeve if other than as specified		_____
5.4.5	KIPTS natural aging test required?	Yes/no	_____

Annex B*(continued)*

Schedule B: Particulars of accessory to be supplied (to be completed by tenderer)

B.1 Straight joint (for use on cable as detailed in checklist A.1.1 or A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.1.1	Joint type				
B.1.2	Manufacturer's reference number				
B.1.3	Joint suitable for use on cable detailed in table	A.1.1		A.1.2	
B.1.4	Joint can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.1.5	Maximum length of ferrule that can be accommodated	mm			
B.1.6	Method of armour support (XLPE only) (see 4.1.3.1.4)				
B.1.7	Method of filling of three-core cable joints (see 4.1.5.1)				
B.1.8	Details of identification tag (see 6.1(h))				
B.1.9	Approximate time required for preparation of cables	h			
B.1.10	Further time required to complete joint	h			
B.1.11	Special tools required for installation of joint	YES		NO	
B.1.12	If YES, list tools and part numbers	Tool		Part number	
B.1.13	Does joint kit include parts that have a limited shelf life	YES		NO	
B.1.14	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.1.15	Test report included (see B.10)?	YES		NO	

B.1.16	Sample included?	YES		NO	
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Annex B

(continued)

B.2 Transition joint (for connecting cables as detailed checklist in A.1.1 and A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.2.1	Joint type				
B.2.2	Manufacturer's reference number				
B.2.3	Joint can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.2.4	Maximum length of ferrule that can be accommodated	mm			
B.2.5	Method of armour support (XLPE only) (see 4.1.3.2.4)				
B.2.6	Method of filling of three-core cable joints (see 4.1.5.1)				
B.2.7	Details of identification tag (see 6.1(h))				
B.2.8	Approximate time required for preparation of cables	h			
B.2.9	Further time required to complete transition joint	h			
B.2.10	Special tools required for installation of transition joint?	YES		NO	
B.2.11	If YES, list tools and part numbers	Tool		Part number	
B.2.12	Does joint kit include parts that have a limited shelf life?	YES		NO	
B.2.13	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.2.14	Test report included (see B.10)?	YES		NO	
B.2.15	Sample included?	YES		NO	

Annex B*(continued)*

B.3 Indoor termination (for use on cable as detailed in checklist A.1.1 or A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.3.1	Indoor termination type				
B.3.2	Manufacturer's reference number				
B.3.3	Termination suitable for use on cable detailed in table	A.1.1		A.1.2	
B.3.4	Termination can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.3.5	Method of waterproofing provided for earthing conductors (see 4.1.3.1.3)				
B.3.6	Method of armour support (XLPE only) (see 4.1.3.2.4)				
B.3.7	Actual creepage distance (see 4.1.4.3)	mm			
B.3.8	Details of identification tag (see 6.1(h))				
B.3.9	Approximate time required for preparation of cables	h			
B.3.10	Further time required to complete termination	h			
B.3.11	Special tools required for installation of termination?	YES		NO	
B.3.12	If YES, list tools and part numbers	Tool		Part number	
B.3.13	Does termination kit include parts that have a limited shelf life?	YES		NO	
B.3.14	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.3.15	Test report included (see B.10)?	YES		NO	
B.3.16	Sample included?	YES		NO	

Annex B*(continued)*

B.4 Outdoor termination (for use on cable as detailed in checklist A.1.1 or A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.4.1	Outdoor termination type				
B.4.2	Manufacturer's reference number				
B.4.3	Termination suitable for use on cable detailed in table	A.1.1		A.1.2	
B.4.4	Termination can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.4.5	Method of waterproofing provided for earthing conductors (see 4.1.3.1.3)				
B.4.6	Method of armour support (XLPE only) (see 4.1.3.2.4)				
B.4.7	Actual creepage distance (see 4.1.4.3)	mm			
B.4.8	Details of identification tag (see 6.1(h))				
B.4.9	Approximate time required for preparation of cables	h			
B.4.10	Further time required to complete termination	h			
B.4.11	Special tools required for installation of termination	YES		NO	
B.4.12	If YES, list tools and part numbers	Tool		Part number	
B.4.13	Does termination kit include parts that have a limited shelf life?	YES		NO	
B.4.14	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.4.15	Test report included (see B.10 below)?	YES		NO	
B.4.16	Sample included?	YES		NO	

Annex B*(continued)*

B.5 Trifurcating termination kit (for use on cable as detailed in checklist A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.5.1	Trifurcating termination kit type				
B.5.2	Manufacturer's reference number				
B.5.3	Kit can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.5.4	Approximate time required for preparation of cables	h			
B.5.5	Method of armour support (XLPE only) (see 4.1.3.2.4)				
B.5.6	Details of identification tag (see 6.1(h))				
B.5.7	Further time required to complete termination	h			
B.5.8	Special tools required for installation of kit?	YES		NO	
B.5.9	If YES, list tools and part numbers	Tool	Part number		
B.5.10	Does kit include parts that have a limited shelf life?	YES		NO	
B.5.11	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.5.12	Test report included (see B.10)?	YES		NO	
B.5.13	Sample included?	YES		NO	

Annex B*(continued)*

B.6 Unscreened separable connector (for use on cable as detailed in checklist A.1.1 or A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.6.1	Unscreened separable connector type				
B.6.2	Manufacturer's reference number				
B.6.3	Termination suitable for use on cable detailed in table	A.1.1		A.1.2	
B.6.4	Connector can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.6.5	Minimum recommended clearances (see 4.1.7.6)	Phase to earth		Phase to phase	
B.6.6	Approximate time required to complete separable connector part of termination	h			
B.6.7	Special tools required for installation of separable connector?	YES		NO	
B.6.8	If YES, list tools and part numbers	Tool		Part number	
B.6.9	Does kit include parts that have a limited shelf life?	YES		NO	
B.6.10	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.6.11	Test report included (see B.10)?	YES		NO	
B.6.12	Sample included?	YES		NO	

Annex B*(continued)*

B.7 Screened separable connector (for use on one cable as detailed in checklist A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.7.1	Screened separable connector type				
B.7.2	Manufacturer's reference number				
B.7.3	Separable connector can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.7.4	Extensible/non-extensible (see 4.1.9.1)				
B.7.5	Approximate time required for preparation of cables	h			
B.7.6	Further time required to complete installation of separable connector	h			
B.7.7	Special tools required for installation of connector?	YES		NO	
B.7.8	If YES, list tools and part numbers	Tool		Part number	
B.7.9	Does kit include parts that have a limited shelf life?	YES		NO	
B.7.10	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.7.11	Test report included (see B.10)?	YES		NO	
B.7.12	Sample included?	YES		NO	

Annex B*(continued)*

B.8 Extensible screened separable connector (for use on multiple cables as detailed in checklist A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.8.1	Screened separable connector type				
B.8.2	Manufacturer's reference number				
B.8.3	Separable connector can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.8.4	Approximate time required for preparation of cables	h			
B.8.5	Further time required to complete installation of separable connector	h			
B.8.6	Special tools required for installation of connector?	YES		NO	
B.8.7	If YES, list tools and part numbers	Tool		Part number	
B.8.8	Does kit include parts that have a limited shelf life?	YES		NO	
B.8.9	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.8.10	Test report included (see B.10)?	YES		NO	
B.8.11	Sample included?	YES		NO	

Annex B*(continued)*

B.9 Shrouds (for use on cable as detailed in checklist A.1.1 or A.1.2, to be attached to this schedule)

Ref.	Item	Details			
B.9.1	Shroud type				
B.9.2	Manufacturer's reference number				
B.9.3	Termination suitable for use on cable detailed in table	A.1.1		A.1.2	
B.9.4	Shroud can be used on cables with conductor size	Minimum	mm ²	Maximum	mm ²
B.9.5	Minimum clearances (see 4.1.6.6)	Phase to earth		Phase to phase	
B.9.6	Approximate time required to complete shrouded part of termination	h			
B.9.7	Special tools required for installation of shrouds?	YES		NO	
B.9.8	If YES, list tools and part numbers	Tool		Part number	
B.9.9	Does kit include parts that have a limited shelf life?	YES		NO	
B.9.10	If YES, list parts, shelf life and storage temperature	Part number		Shelf life	Storage temp. °C
B.9.11	Test report included (see B.10)?	YES		NO	
B.9.12	Sample included?	YES		NO	

Annex B
(concluded)

B.10 Details of test report (to be completed by tenderer and included with any of schedules B.1 to B.9)

Ref.	Item	Details			
		YES		NO	
B.10.1	Test cable identified in accordance with annex C?	YES		NO	
B.10.2	Connectors correctly identified?	YES		NO	
B.10.3	Accessory correctly identified?	YES		NO	
B.10.4	Bill of materials included?	YES		NO	
B.10.5	Installation instructions included?	YES		NO	
B.10.6	Test report provided in accordance with NRS 053?	YES		NO	

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Annex C

(normative)

Identification of cables to be used in tests (see 5.3.1.1)

C.1 Identification of SANS 97 paper cables (tick the appropriate boxes)

System voltage kV	3,8/6,6		6,35/11		12,7/22		19/33	
Number of cores	Single-core				Three-core			
Conductor(s)	Copper				Aluminium			
Construction	Belted				Screened			
Conductor size	120 mm ²			150 mm ²			185 mm ²	
Metallic sheath	Plain lead				Lead alloy E			
Armouring	Single-core			AWA			None	
	Three-core			SWA		DSTA		None
Outer sheath	PVC			PE			NH	

C.2 Identification of SANS 1339 XLPE cables (tick the appropriate boxes)

System voltage kV	3,8/6,6		6,35/11		12,7/22		19/33	
Number of cores	Single-core				Three-core			
Conductor(s)	Copper				Aluminium			
Construction	Single-core			Type A			Type B	
	Three-core			Type A			Type B	
Conductor size	120 mm ²			150 mm ²			185 mm ²	
Outer sheath	PVC			PE			NH	

Annex D
(informative)

Impact test arrangement

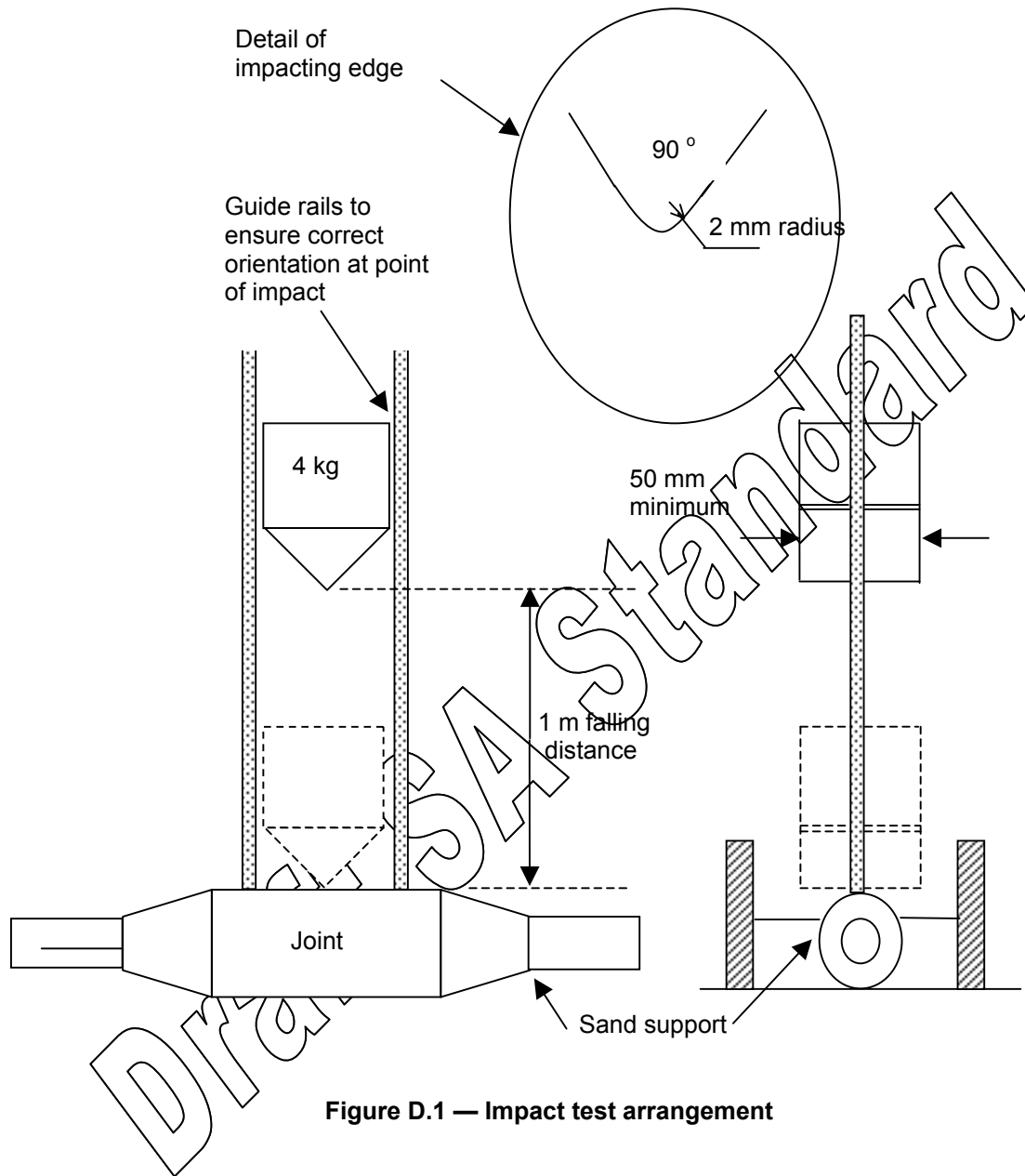


Figure D.1 — Impact test arrangement

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