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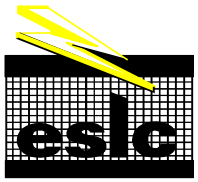
NRS 061-1:2012

Edition 2

OVERHEAD GROUND WIRE WITH OPTICAL FIBRE

Part 1: Product specification

This document does not have the status of a South African National Standard



This specification is issued by
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Table of changes

Change No.	Date	Text affected

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Foreword

This part of NRS 061 is a sectoral technical agreement as defined in SANS 1-1 and was prepared in accordance with the procedures in NRS 999.

This part of NRS 061 was prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC) and approved by it for use by supply authorities. This part of NRS 061 is based on an Eskom Transmission document (TRMSCAAD6:1998) compiled by Mr M Korber and Mr DC Smith.

This part of NRS 061 was prepared by a working group which, at the time of acceptance, comprised the following members:

DC Smith (Chairman)	Bervonne Consulting
DG Andrews	Trans Africa Projects
T Gosai	Eskom Transmission Technology
A Gouveia	Cape Town Electricity
B Jacobs	Eskom
V Naidu	Eskom Transmission Technology
V Nundlal (Project Leader)	Technology Standardization
V Rampersad	City Power

A Manufacturers' Interest Group (MIG) was also consulted on the contents of this part of NRS 061 and its comments were incorporated where the working group was in agreement. The MIG comprised the following members:

C Bolland	PreformedSA
C Horn	Letacla
T Oosthuizen	Umakhopower
A Soobramoney	Optipower

This edition supersedes NRS 061-1:2002.

NRS 061 consists of the following parts, under the general title *Overhead ground wire with optical fibre*:

Part 1: Product specification.

Part 2: Installation guidelines.

Annexes A and B are for information only.

Introduction

This part of NRS 061 has been prepared to establish and promote uniform requirements for overhead ground wire with optical fibre.

The Electricity Suppliers Liaison Committee expresses the wish that all supply authorities will adopt the requirements of this part of NRS 061 in so far as their particular conditions will permit. Any differences between the requirements of this part of NRS 061 and the corresponding purchaser's requirements should, as far as possible, be clearly indicated in schedules A and B which should, where appropriate, be submitted for consideration in future revisions of this part of NRS 061.

Keywords

optical ground wires.

Contents

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OVERHEAD GROUND WIRE WITH OPTICAL FIBRE

Part 1: Product specification

1 Scope

This part of NRS 061 specifies the essential mechanical and electrical characteristics, acceptance criteria and test requirements for metallic armoured optical ground wire (OPGW) for application with nominal voltages from 66 kV up to and including 765 kV.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of NRS 061. All documents are subject to revision and, since any reference to a document is deemed to be a reference to the latest edition of that document, parties to agreements based on this specification are encouraged to take steps to ensure the use of the most recent editions of the documents listed below. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

IEC 60794-4, *Optical fibre cables – Part 4: Sectional specification – Aerial optical cables along electrical power lines*

IEC 60889, *Hard-drawn aluminium wire for overhead line conductors.*

IEC 61232, *Aluminium-clad steel wires for electrical purposes.*

IEC 61395, *Overhead electrical conductors – Creep test procedures for stranded conductors.*

NRS 081, *Single-mode non-dispersion shifted optical fibres.*

SANS 60794-1-1/IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General.*

SANS 60794-1-2/IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures.*

SANS 60815-1/IEC/TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles.*

SANS 61089/IEC 61089, *Round wire concentric lay overhead electrical stranded conductors*.

TIA/EIA-598-A, *Optical fibre cable colour coding*.

3 Terms, definitions and abbreviations

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

3.1 Terms and definitions

approved
approval
approved in writing by the purchaser

drum length
completed cable drum length drawn from a pre-form during manufacturing

maximum allowable ovality
maximum allowable non-circularity of a cable or of its component, which is specified by the manufacturer

"no change in attenuation"
acceptance criterion for attenuation measurement that includes an allowance for measurement uncertainty which arises from measurement errors or calibration errors due to a lack of suitable referenced standards

optical ground wire
earth wire conductor with optical fibres embedded within a steel or aluminium earth wire

NOTE Optical ground wire is capable of carrying both lightning strikes and fault currents without detrimental effect to the optical fibre telecommunication facilities.

ovality
percentage ratio of diameters in accordance with the following formula:

$(d_1 – d_2) / (d_1 + d_2)$ %

where

d_1 is the maximum measured diameter of the cable, and

d_2 is the minimum diameter of the cable measured at the same cross-section as d_1

rated tensile strength
calculated breaking load of the OPGW construction

3.2 Abbreviations

MAO: maximum allowable ovality

OPGW: optical ground wire

OTDR: optical time domain reflectometer

PMD: polarization mode dispersion

RTS: rated tensile strength

4 Requirements

4.1 General

4.1.1 The OPGW shall contain the optical fibres and the necessary protective outer layer to prevent damage to the fibres due to mechanical elongation, bending, twisting, crushing forces and the effects of elevated temperatures due to fault currents. The OPGW should be mechanically constructed in such a way as to protect them against environmental degrading factors.

4.1.2 The stranded bare conductor shall consist of one or more layers of metal wires to provide materially the same electrical and mechanical characteristics as those of a conventional overhead ground wire.

4.1.3 Designs where any synthetic material containing the fibres is likely to be exposed to pollutants in the atmosphere or ultra-violet radiation from the sun (for example, where bird-caging of the outer layer of the conductor occurs as in the case of a single layer configuration) will not be accepted, unless otherwise approved by the customer.

4.1.4 The OPGW shall comply with all the requirements of IEC 60794-4. The cable shall be greased in accordance with SANS 61089, if necessary, and shall be specified in schedule A.

4.1.5 Unless otherwise specified in schedule A, the OPGW shall be designed to operate within specification under the following operating conditions:

a) pollution level (in accordance with SANS 60815-1): heavy;

b) maximum temperature: 50 °C;

c) minimum temperature: -10 °C;

d) maximum wind speed: 36 m/s; and

e) route altitude: 0 m to 2 000 m.

4.1.6 The following information shall be stated in schedule B:

a) the name of the manufacturer;

b) the place of manufacture; and

c) the manufacturer's reference number.

4.2 Construction

4.2.1 Optical fibre

4.2.1.1 Type of fibre

The type of fibre shall be in accordance with NRS 081 (G.652D).

4.2.1.2 Fibre carrier

The fibre characteristics shall be as specified in schedule A of NRS 081.

4.2.2 Armour

4.2.2.1 The OPGW armour, which is the conductor excluding the optical fibre carrier, shall be designed to

a) provide similar mechanical and electrical characteristics as a conventional shield wire, and

b) comply with the short-circuit current and lightning withstand requirements, as specified in schedule A.

4.2.2.2 The basic construction of the armour shall comprise bare metallic wires of unique or combined metals stranded in one or more layer(s). The stranding shall be made up of one or more layers and shall be any of the following materials:

a) galvanized steel (only in exceptional circumstances[1)]; or;

b) alloy in accordance with IEC 60889; or

c) aluminium-clad steel in accordance with IEC 61232, or

d) a combination of (a), (b) or (c) above.

The stranded wires shall be made of one or more layers, and can be of combined metal types in each layer. The stranding and wire diameter shall be specified in schedule B.

4.2.2.3 The direction of lay shall be reversed in successive layers.

4.2.2.4 The finished wires shall contain no joints or splices.

4.2.2.5 The wires shall be so stranded that, when the complete OPGW is cut, the strands shall maintain their original form and shall not spring apart, such that individual layers can easily be regrouped.

4.2.3 Crush resistance

During stringing, the conductor is subjected to side compression when it passes over metal pulleys or when clamps are installed. To endure these stresses, the OPGW shall have a high anti-crushing resistance. When tested in accordance with 5.1.2.2, there shall be no measurable permanent changes in optical attenuation at 1 550 nm, while any temporary change in attenuation shall be less than 0,1 dB.

4.2.4 Tensile performance

The OPGW shall be so designed that it can withstand a specified tensile load without deleterious influence on the optical fibres. When tested in accordance with 5.1.2.3, the change in attenuation shall be less than 0,05 dB/km from no load to 50 % of the RTS of the cable.

4.2.5 Cable deformation

During installation the OPGW cable shall be subjected to passing, under tension, over several metal pulleys.

The cable shall be so constructed that, when tested in accordance with 5.1.2.4, the ovality of the OPGW and its components shall remain under 10 % and there shall be no change in fibre attenuation at 1 550 nm before and after the test.

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1) Galvanized steel is not recommended due to potential corrosion problems that can arise in coastal and heavily polluted environments.

4.2.6 Stress-strain

When tested in accordance with 5.1.2.1, there shall be no visual change to the OPGW strands.

4.2.7 Impact

When tested in accordance with 5.1.2.5, there shall be no measurable permanent changes in optical attenuation at 1 550 nm, while any temporary change in attenuation shall be less than 0,1 dB.

4.2.8 Aeolian vibration

The optical attenuation increase shall be less than 0,05 dB/km at 1 550 nm and when tested in accordance with 5.1.2.6, any significant damage to the components of the cable shall constitute failure of the test.

NOTE This will impact the PMD performance of the cable and hence operation at the highest bit rates.

4.2.9 Conductor creep

When tested in accordance with 5.1.2.7, the manufacturer shall submit records of a long-term (>1 000 h) elongation test, with extrapolation to 15 years of an OPGW sample tensioned at 20 % RTS.

4.2.10 Temperature cycle

4.2.10.1 When tested in accordance with 5.1.2.8, the changes in attenuation over the last four cycles shall not exceed 0,10 dB/km from the mean. The mean attenuation shall be defined as the average attenuation encountered at 20 °C over the last 4 cycles. See figures 1(a) and 1(b).

4.2.10.2 A temperature cycle shall be:

Starting temperature in chamber = + 20 °C

4.2.10.3 First and three subsequent cycles (see figure 1(a)):

a) T_A is −10 °C

b) T_B is +50 °C

Soak time t_1: see table 1

4.2.10.4 Last cycle (see figure 1(b))

a) T_{A1} is −10° C

b) T_{A2} is −20° C

c) T_{B1} is +50° C

d) T_{B2} is +70° C

Soak time t_1: see table 1

The cooling and heating processes shall be as rapid as possible, appropriate to the capabilities of the environmental chamber.

Table 1 — Soak time t_1

1	2
Sample mass kg	**Soak time t_1** h
Under 0,35	0,5
0,36 to 0,7	1
0,8 to 1,5	2
1,6 to 15	4
16 to 100	8
101 to 250	12
251 to 500	14
Over 501	16

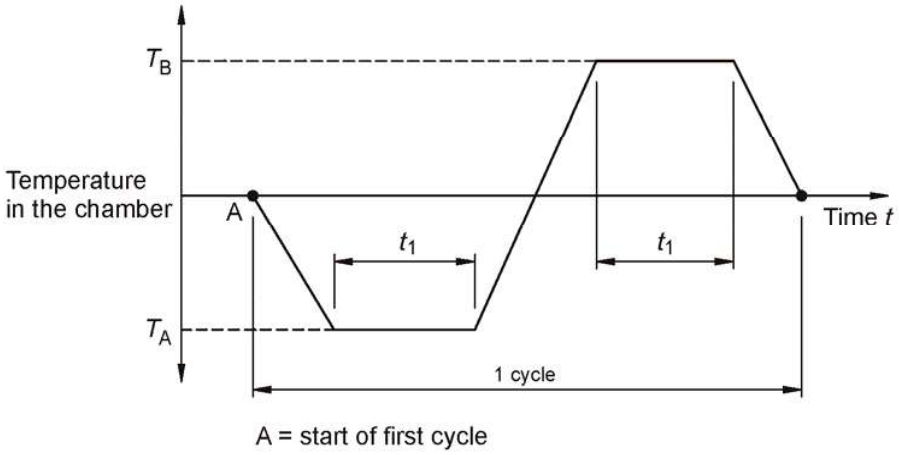

Figure 1 (a) — First cycle(s) procedure

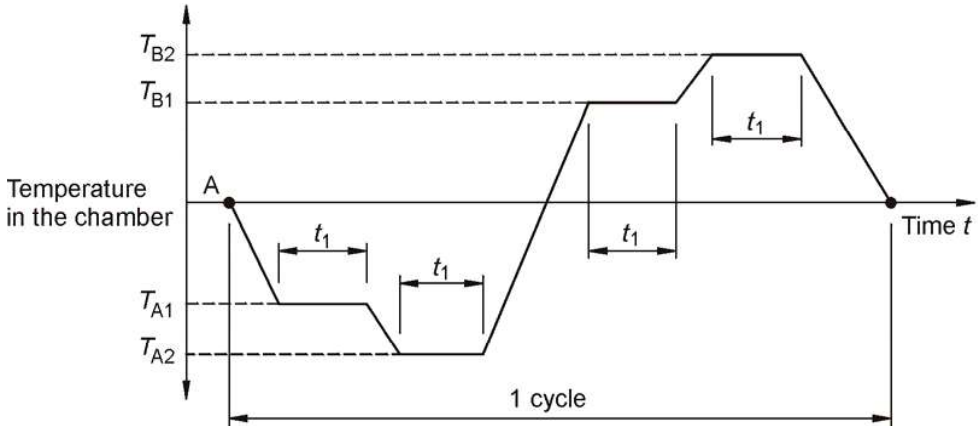

Figure 1 (b) — Last cycle procedure

Figure 1 — Temperature cycle

4.2.11 Short-circuit current

When tested in accordance with 5.1.3.1, any temporary increase in attenuation shall be less than 0,1 dB/km at 1 550 nm, while any permanent increase shall be considered a failure. Bird-caging or breaking of the conductor strands shall also be considered as failure of the test.

4.2.12 Resistance

The cable resistance shall be in accordance with the resistance rating curve in figure 2, with a maximum allowable tolerance of ± 5 %.

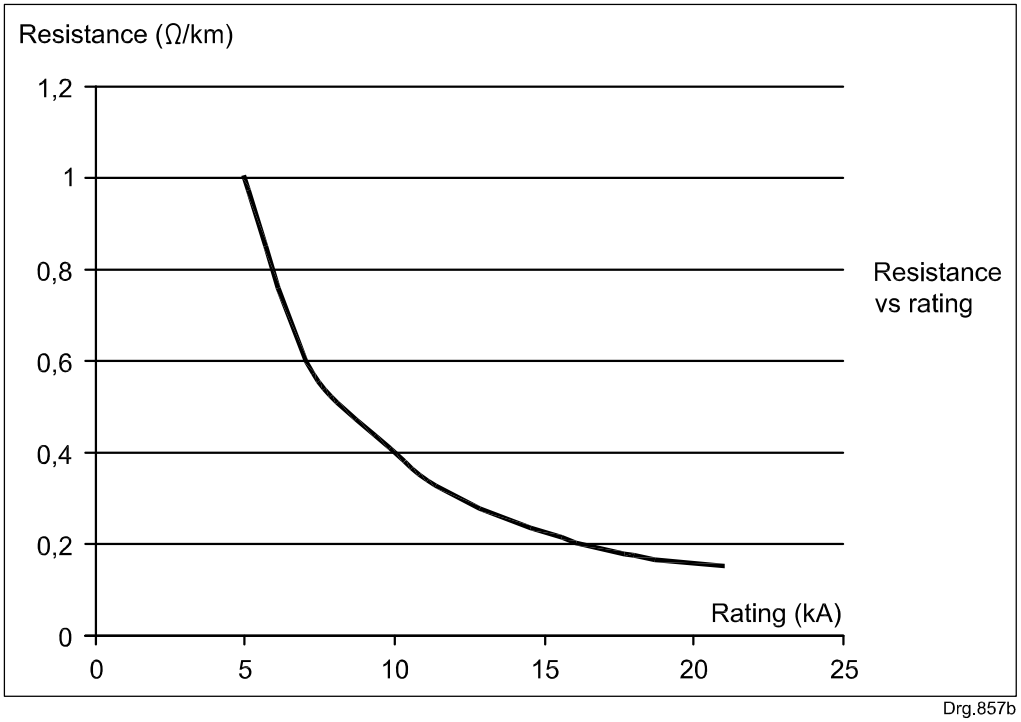

Figure 2 — OPGW resistance rating curve

4.2.13 Lightning

When tested in accordance with 5.1.3.2, no severed strands shall be visible and the remaining strength of the OPGW sample shall be at least 90 % of the original RTS. There shall be no measurable permanent change in fibre attenuation at 1 550 nm.

4.2.14 Routine test

When tested in accordance with 5.2, each fibre shall be measured for continuity and length, while the cable is on a drum, before delivery.

4.2.15 Sample test

When tested in accordance with 5.3, sample tests shall be performed to ensure that the material used and the manufacturing processes are without defect.

4.3 Design information

4.3.1 Optical aspects

4.3.1.1 The required number of loose buffered single mode fibres to be incorporated in the cable will be specified in schedule A. Each fibre shall be uniquely identified in an approved manner in accordance with TIA/EIA 598-A.

4.3.1.2 The fibre carrier design shall be such that no moisture shall be able to penetrate and come in contact with the fibres.

4.3.1.3 The fibre carrier shall be designed to minimize hydrogen absorption by the fibres.

4.3.1.4 The cable shall be designed such that when the cable is installed in accordance with the manufacturer's instructions, no fibre shall be under any strain when the cable is subjected to operating conditions.

4.3.1.5 There shall be no measurable long-term optical attenuation change due to the temperature rise associated with fault current flowing in the earth wire or a lightning strike on the earth wire.

4.3.1.6 There shall be no fibre splices in any individual drum length of OPGW.

4.3.2 Mechanical and electrical characteristics

4.3.2.1 The following mechanical and electrical characteristics of the OPGW shall be specified in schedule B:

a) Mechanical characteristics:

1) conductor material;

2) nominal cross-section;

3) actual cross-sectional area;

4) maximum overall diameter;

5) maximum mass per metre of cable;

6) rated tensile strength (RTS);

7) initial modulus of elasticity;

8) final modulus of elasticity;

9) maximum drum length;

10) direction of lay of outer layer; and

11) diameter of outer strands.

b) Electrical characteristics:

1) short-circuit 1 s current rating;

2) d.c. resistance at 20 ^{o}C/km; and

3) continuous current-carrying capability.

4.3.2.2 Full details of the cable construction shall be provided in schedule B, including details of the measures taken to minimize hydrogen absorption and water ingress by the fibres.

4.4 Samples

4.4.1 If a sample is required, it shall be stated in schedule A.

4.4.2 Correctly labelled samples that reflect the item number from schedule A and the name of the tendering company shall be delivered to the purchaser's nominated offices not later than a week before the closing date of the tender.

4.4.3 The sample length shall be 1 m, unless otherwise specified in schedule A. Samples of overhead optical ground wires submitted shall be similar to the items offered.

4.4.4 Tenderers are required to note that tender documents shall not be included in parcels that contain samples.

4.4.5 The purchaser reserves the right to submit samples to such tests as deemed reasonable and necessary.

4.4.6 Unsuccessful tenderers shall collect their samples within one month of being notified that their tenders have not been successful, failing which, they shall be deemed to have waived all rights to the samples and such samples not collected after one month from the date of such notification, shall become the property of the purchaser for environmentally safe disposal at his discretion.

5 Tests

5.1 Type tests

5.1.1 General

The OPGW shall successfully pass the type tests in 5.1.2 and 5.1.3. Type testing of a fibre optic cable may be waived if type test results of cables of the same design and similar rating are available. Full type tests on the OPGW offered shall be required if a contract is placed with a specific supplier and the design proposed is significantly different to that tendered.

Copies of these type test reports shall be a prerequisite for tender compliance and shall be provided as part of the tender document. Suppliers are requested to provide copies of all type test reports on tests performed on both the fibre and cable.

5.1.2 Mechanical tests

5.1.2.1 Stress-strain test

Perform a stress-strain test to prove the capability of the OPGW under load conditions. Perform the test in accordance with SANS 61089, and use the measuring techniques specified in SANS 60794-1-1. Perform the test on samples of at least 10 m in length (the end fittings used shall be the system fittings), unless otherwise specified by the purchaser. Check for compliance with 4.2.6.

5.1.2.2 Crush test

Perform the crush test in accordance with the method specified in SANS 60794-1-2 (method E3).

Perform the test by "sandwiching" the OPGW between two 50 mm × 50 mm flat plates and applying a load of 10 kN for 1 min. Measure the optical attenuation at 1 550 nm and check for compliance with 4.2.3.

5.1.2.3 Tensile performance test

This test is intended to determine the optical unit's performance under a tensile load. Perform the test using load conditions in accordance with SANS 61089, and the measuring techniques as specified in method E1 in SANS 60794-1-2. Check for compliance with 4.2.4.

5.1.2.4 Sheave test

5.1.2.4.1 General

Use pulleys of diameter as agreed upon between the purchaser and the manufacturer and test method E18B in method E18 in SANS 60794-1-2.

Subject the OPGW cable to passing under tension over several metal pulleys and measure the ovality of the cable and attenuation at 1 550 nm.

5.1.2.4.2 Test set-up

Terminate the test sample at each end with suitable end fittings. Ensure that the test length of the optical fibre is a minimum of 100 m. Measure the optical fibre attenuation using a light source and power meter connected to either end of the test fibre. An OTDR may be used, but determine the minimum optical fibre length by the characteristics of the OTDR.

5.1.2.4.3 Test conditions

The general test conditions are as follows:

a) a pulling angle (α): 30°, unless otherwise agreed upon between the purchaser and the manufacturer;

b) a tensile load: 15 % of RTS, unless otherwise agreed upon between the purchaser and the manufacturer;

c) the number of cycles:10 (one cycle being forwards and backwards); and

d) the sheave diameter: to be agreed upon between the purchaser and the manufacturer.

5.1.2.4.4 Test procedure

Pull an OPGW of minimum length 5 m through the sheave for the required number of cycles. Before the first pull, mark the beginning, the midpoint and the end of this length. Measure the optical attenuation throughout the test. After the test, determine the ovality of the OPGW and its components and compare these values with the relative MAO at each of the marked points. Check for compliance with 4.2.5.

5.1.2.5 Impact test

Perform the impact test in accordance with SANS 60794-1-2 (method E4). Perform the test by placing the end of a 20 mm diameter steel mandrel on the OPGW, and dropping a 4 kg weight from a height of 100 mm onto the mandrel. Repeat 20 times. Check for compliance with 4.2.7.

5.1.2.6 Aeolian vibration test

The objective of this test is to assess the fatigue resistance of the OPGW under characteristic wind-induced vibration.

Ensure that the test length of the OPGW is at least 100 m. Subject the test sample to a minimum of 10^7 vibration cycles at the nearest resonant frequency produced by a 4,5 m/s wind. Maintain the peak-to-peak amplitude of the antinode at a level equal to one third of the conductor diameter. Perform a final optical test at least 2 h after completion of the vibration test. Check for compliance with 4.2.8. See method E19 in SANS 60794-1-2.

5.1.2.7 Conductor creep test

Perform the conductor creep test in accordance with IEC 61395. Check for compliance with 4.2.9.

5.1.2.8 Temperature cycle test

Loosely coil a length of cable (minimum 200 m). A drum is not required but, if a drum is used, ensure there is a maximum of two layers of cable on the drum. Expose the length of cable to the temperature changes, and ventilate the barrel of the drum.

Place the cable in an environmental chamber. Ensure the temperature of the chamber is capable of programmable cycling between -20 °C and +70 °C.

Ensure that the cable ends are outside the chamber and the fibres are spliced in cascade so as to achieve an optical fibre path length of between 1 000 m and 2 000 m. Place a temperature probe between the two layers of cable. Record the measurements of the temperature probe on a chart together with the trace of the chamber's temperature. See method F1 in SANS 60794-1-2.

Couple the fibre to optical measurement equipment of stability such that a change of 0,05 dB/km can be reliably recorded over a period of one week.

Subject the cable to five complete cycles. Monitor the attenuation of the cable, record it for the duration of the test and measure it at both 1 550 nm and 1 310 nm. Check for compliance with 4.2.10.

5.1.2.9 Water penetration tests

Perform the water penetration tests on the fibre carrier in accordance with the methods specified in SANS 60794-1-2 (method F5), unless otherwise specified in schedule A.

5.1.3 Electrical tests

5.1.3.1 Short-circuit test

The objective of the short-circuit test is to appraise the effect of the instantaneous temperature rise on the optical characteristics of the fibres which is caused by short-circuit conditions.

Ensure that the ambient temperature during the test is the maximum temperature specified in schedule A (see item B.1). See method H1 in SANS 60794-1-2.

Subject the sample under test to current pulses in such a way that the OPGW will be allowed to cool to within 5 ºC from the ambient temperature between the current pulses. Continuously monitor the optical attenuation of the test fibres. Check for compliance with 4.2.11.

5.1.3.2 Lightning test

Perform the lightning test by subjecting the mid-point of a 10 m long sample of OPGW to a simulated lightning strike. Perform this test in accordance with method H2 in SANS 60794-1-2. Use the test parameters in table 2 depending on the class of cable as specified in schedule A.

Table 2 — Test parameters

1	2	3	4	5
Cable	**Class 0**	**Class 1**	**Class 2**	**Class 3**
Current (A)	100	200	300	400
Duration (s)	0,5	0,5	0,5	0,5
Charge transfer (C)	50	100	150	200

Apply an arc of length greater than 50 mm.

Evaluate the fibre attenuation by measuring the end-to-end attenuation when all the fibres in the cable have been concatenated. Check for compliance with 4.2.13.

5.2 Routine tests

The purchaser shall require an inspector to be present when these final measurements are performed. The purchaser's attendance shall not relieve the supplier of his responsibility for the satisfactory performance of the cable during subsequent testing at site, and thereafter, up to the end of the warranty period.

5.3 Sample tests

The following sample tests shall be done:

a) on wire before stranding:

– in accordance with IEC 60889 and IEC 61232;

b) on the completed cable:

1) cross-sectional area;

2) overall;

3) surface condition;

4) lay ratio and direction of lay; and

5) d.c. resistance.

6 Marking, labelling, packaging and documentation

6.1 Marking and labelling

Each reel shall be labelled with at least one water-resistant tag that contains the following minimum information:

a) the name of the manufacturer;

b) the place of manufacture;

c) the size of the OPGW and the number of fibres;

d) the shipped length of the OPGW (standard or specified);

e) the gross tare and net weight;

f) the drum number;

g) the order or the contract number (or both);

h) the type of cable;

i) the destination;

j) the stock code;

k) the words " Not to be laid flat" unless the manufacturer guarantees that the drum or reel may be laid flat without damage to the OPGW;

l) an arrow or the words "Roll this way" to indicate the direction in which the drum or reel is to be rolled in order to prevent the OPGW from unwinding, unless the manufacturer guarantees that the drum or reel may be rolled in either direction without damage to the OPGW; and

m) the outer end of the cable shall be accessible for testing purposes.

6.2 Packaging

6.2.1 OPGW shall be supplied tightly and uniformly wound onto wooden cable reels. The supplier shall determine the optimal cable drum lengths for the OPGW installation. The purchaser will provide the correct line profiles etc., to the supplier and invite the supplier to perform a site survey if deemed necessary.

The supplier shall specify the maximum drum length of the OPGW, and the total mass of the drum including the maximum length of the OPGW cable in schedule B.

6.2.2 The reel shall be constructed in such a way that the OPGW will not be damaged during shipping and handling. Wooden battens shall be fitted around the periphery of the drum to ensure adequate protection. The outer layer of the OPGW on the reel shall be protected by a water-resistant wrapping over the exposed surface, to prevent ingress of moisture and dirt during shipping and handling.

6.2.3 Each end of the OPGW shall be properly sealed to prevent the ingress of moisture into the optical fibre unit during shipment or storage, i.e. a heat shrink end-cap shall be used for sealing.

6.3 Documentation

6.3.1 If so specified in schedule A, the following information shall be provided:

a) an index of the documentation;

b) type test reports;

c) routine test reports;

d) details of the cable design; and

e) details of fibre numbering and colour coding.

6.3.2 All documentation required shall be provided in a ring file with a hard cover that can be opened flat on any page, and that complies with the following requirements:

a) all documentation, including type test reports, shall be supplied in triplicate, in English;

b) all documentation shall be in standard A4 size;

c) any drawings and descriptions included shall be in standard A4 size. Larger drawings shall be folded in a single panel along the 210 mm axis; and

d) different sections of the documentation shall be separated by means of thumb-tag file separators;

e) documentation in electronic format shall also be accepted, subject to approval.

Annex A
(informative)

Guide to purchasers on preparing an enquiry

A.1 General

A model form for schedules A and B 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 part of NRS 061, provide the tenderers with details of his particular requirements, and set out the information he requires the tenderers to provide, as indicated below.

A.2 Schedules

A.2.1 General

The model form for purchasing schedules 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 part of NRS 061, to assist in compiling the schedules.

Where the text of any referenced standard stipulates that the purchaser shall indicate his requirements, the requirements should also be specified in schedule A. The purchaser should set out specific requirements and choices in his own schedule A.

NOTE 1 In the interests of standardization, purchasers are encouraged not to deviate from these preferred items, values and quantities listed in schedule A.

NOTE 2 The purchaser need include only the items he considers to be relevant or necessary when preparing schedule A and schedule B.

NOTE 3 The purchaser's schedule A, when completed, is intended to be issued as the technical schedule of an enquiry specification.

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 request the tenderer to fill in this schedule. By doing this, the tenderer will be stating compliance with this part of NRS 061 and will be providing the information requested by the purchaser.

NOTE These schedules, when completed, are intended to form the technical schedules of a tender submission and the subsequent contract, if applicable.

A.3 Commercial conditions

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

Annex A
(concluded)

The purchaser should state a requirement for a utility-wide licence agreement for all equipment software offered, and a requirement for future revisions of software to be supplied free of charge.

A.4 Assurance

This part of NRS 061 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.

A.5 Testing

Attention should be paid to the subject of testing and the related costs. Tests should be carried out by an accredited laboratory and tenderers should be required to provide formal assurances (formal documentation) 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 provided 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 Revisions of standards used as normative references

This part of NRS 061, as has been indicated, is based on a set of defined standards or specifications, which might have been revised of amended. All standards and specifications are regularly reviewed and amended, and most purchasers would, in principle, wish to employ the latest standards or specifications. However, in some cases a blanket commitment to work to the "latest" versions of standards or specifications might create legal difficulties of interpretation and risks for both parties. For example, if a new edition of a referenced standard is about to be approved or published during the tendering process, there could be misinterpretation as to which edition of the referenced standard is applicable.

To avoid such misinterpretation, the purchaser should obtain an undertaking from the supplier to identify the editions and amendments of the referenced standards and specifications applicable during the tendering process. Where so agreed, if applicable, these specific editions and amendments would become the basis of the subsequent contract.

Annex B
(informative)

Model form for schedules A and B

The model form is provided as a convenient aid to purchasing. Guidance on preparing an enquiry using this form is given in annex A.

Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment to be supplied (to be completed by tenderer)

Item	Clause	Description		Schedule A	Schedule B
B.1	4.1.4	Grease conductor in accordance with SANS 61089?	Yes/No	_____	xxxxxxxxxx
	4.1.5	Pollution level, if other than heavy		_____	xxxxxxxxxx
		Maximum temperature, if other than 50 °C	°C	_____	xxxxxxxxxx
		Minimum temperature, if other than –10 °C	°C	_____	xxxxxxxxxx
		Maximum wind speed, if other than 36 m/s	m/s	_____	xxxxxxxxxx
		Route altitude, if other than 2 000 m	m	_____	xxxxxxxxxx
	4.1.6	Name of manufacturer		xxxxxxxxxx	_____
		Place of manufacture		xxxxxxxxxx	_____
		Manufacturer's reference number		xxxxxxxxxx	_____
B.2	4.2.1.1	Type of fibre in accordance with NRS 081 (G.652D)	Yes/No	xxxxxxxxxx	_____
		If no, state fibre type		xxxxxxxxxx	_____
	4.2.2.1	OPGW 1 s current rating	kA	_____	_____
	4.2.2.2	Stranding and wire diameter		xxxxxxxxxx	_____
B.3	4.3.1.1	Number of fibres		_____	xxxxxxxxxx
	4.3.2.1	Conductor material		xxxxxxxxxx	_____
		Nominal cross-section		xxxxxxxxxx	_____
		Actual cross-sectional area		xxxxxxxxxx	_____
		Maximum overall diameter		xxxxxxxxxx	_____
		Maximum mass per metre of cable	kg/m	xxxxxxxxxx	_____
		Rated tensile strength (RTS)		xxxxxxxxxx	_____
		Initial modulus of elasticity		xxxxxxxxxx	_____
		Final modulus of elasticity		xxxxxxxxx	_____
		Maximum drum length		xxxxxxxxx	_____
		Direction of lay of outer layer		xxxxxxxxxx	_____
		Diameter of outer strands		xxxxxxxxxx	_____
		Short-circuit 1 s current rating		xxxxxxxxxx	_____
		DC resistance at 20 °C/km	Ω	xxxxxxxxxx	_____
		Continuous current-carrying capability	A	xxxxxxxxxx	_____
	4.3.2.2	Complete details of cable construction, including measures to minimize hydrogen absorption and water ingress.		xxxxxxxxxx	_____
B.4	4.4.1	Is a sample required?	Yes/No	_____	xxxxxxxxxx
	4.4.3	Length of sample, if not 1 m		_____	xxxxxxxxxx
B.5	5.1.3.2	Specify class of cable 0, 1, 2 or 3		_____	xxxxxxxxxx
B.6	6.2.1	Maximum drum length of OPGW		Xxxxxxxxxx	_____
		Mass of drum including max. length of OPGW cable		xxxxxxxxxx	_____
B.7	6.3	Is documentation required?	Yes/No	_____	xxxxxxxxxx

Bibliography

SANS 9001/ISO 9001, *Quality management systems – Requirements.*

SABS – Standards Division

The objective of the SABS Standards Division is to develop, promote and maintain South African National Standards. This objective is incorporated in the Standards Act, 2008 (Act No. 8 of 2008).

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