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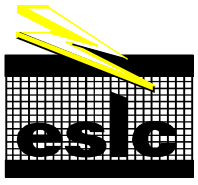
NRS 078-1:2014

Edition 2

LONG-SPAN ALL-DIELECTRIC SELF-SUPPORTING FIBRE OPTIC CABLES

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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User Group given in the foreword.

Table of changes

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Foreword

This part of NRS 078 was prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC).

This part of NRS 078 is based on TSP 0024:1994, which was compiled by DC Smith from Eskom.

This part of NRS 078 was prepared by a Working Group which, at the time of publication, comprised the following members:

D C Smith (Chairman)	Bervonne Consulting CC
Y Brijmohan	eThekwini Electricity
T Gosai	Group Technology
A Gouveia	City of Cape Town
B Jacobs	Eskom Line Engineering
S Modisenyane	Tshwane Municipality
V Naidu	Group Technology
V Nundlal (Project Leader)	Technology Standardization, Eskom
V Rampersad	City Power, Johannesburg
R Westwood	Eskom Telecommunications

A Manufacturers' Interest Group (MIG) was consulted on the contents of this part of NRS 078 and its comments were incorporated where the working group was in agreement. The MIG comprised the following members:

C Horn	Letacla
T Oosthuizen	Umakhopower
A Soobramoney	Optipower

NRS 078 consists of the following parts, under the general title *Long-span all-dielectric self-supporting fibre optic cables:*

Part 1: Long-span all-dielectric self-supporting fibre optic cables.

Part 2: Installation guidelines.

This document supersedes NRS 078-1:2004 (edition 1).

Annexes A and B are for information only.

Introduction

This part of NRS 078 has been prepared to establish and promote uniform requirements for long-span all-dielectric self-supporting cables.

The ESLC expresses the wish that all supply authorities will adopt the requirements of this part of NRS 078 in so far as their particular conditions will permit. Any differences between the requirements of this part of NRS 078 and the corresponding purchaser's requirements should, as far as possible, be clearly indicated in schedules A and B, which may be compiled using the draft schedules set out in annex B, and which should, where appropriate, be submitted for consideration in future revisions of this part of NRS 078.

Keywords

all-dielectric self-supporting cables.

Contents

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LONG-SPAN ALL-DIELECTRIC SELF-SUPPORTING FIBRE OPTIC CABLES

Part 1: Product specification

1 Scope

This part of NRS 078 specifies the essential mechanical, electrical and optical characteristics, acceptance criteria and test requirements for long-span all-dielectric self-supporting optic fibre cables for application with a nominal voltage up to and including 132 kV. This part of NRS 078 does not cover the parameters of the optical fibres to be incorporated in the cable, which will be detailed in a separate specification.

NOTE A guide to purchasers on preparing an enquiry is given in annex A and a model form for schedules A and B is given in annex B.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of NRS 078. 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.

ASTM D3349-12*, Standard test method for absorption coefficient of ethylene polymer material pigmented with carbon black.*

IEC 60068-1, *Environmental testing – Part 1: General and guidance.*

IEC 60068-2-5, *Environmental Testing – Part 2: Tests. Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing.*

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

IEEE 1222, *Standard for testing and performance for all-dielectric self-supporting (ADSS) fibre-optic cable for use on electric utility power lines*.

IEEE 1594, *IEEE standard for helically applied fibre optic cable systems (wrap cable) for use on overhead utility lines*.

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

NRS 081: 2012, *Single-mode non-dispersion shifted optical fibres.*

SANS 60793-1-44/IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength.*

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

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

SANS 62217/IEC 62217*, Polymeric HV insulators for indoor and outdoor use - General definitions, test methods and acceptance criteria.*

3 Terms, definitions and abbreviations

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

3.1 Terms and definitions

breaking tension
ultimate tensile strength
tensile load that will produce physical rupture of the cable

NOTE The maximum allowable tension should be less than 60 % of the breaking tension.

long-span ADSS cable

fibre optic cable that is capable of enduring aerial installation, provides long-term service and has no external tensile support

NOTE ADSS cable should be capable of being used for span lengths of 400 m or as otherwise agreed upon by the supplier and the customer.

maximum allowable tension
highest tensile load that may be applied to the cable without detriment to the cable's performance (optical performance, fibre durability) due to the strain

maximum operating tension
highest tensile load that can be applied to the cable for a long term without producing any strain to the fibres

routine test
quality control test performed during and after manufacture

strain margin

tensile load that the cable can sustain without exceeding the maximum designed allowable fibre strain

NOTE Zero strain margin is the tensile load the cable can sustain without strain on the fibres due to cable elongation.

type test
test required to prove the adequacy of the design

3.2 Abbreviations

ADSS: all-dielectric self-supporting

HV: high voltage

MAT: maximum allowable tension

MOT: maximum operating tension

PMD: polarization mode dispersion

UTS: ultimate tensile strength

4 Requirements

4.1 Fibre requirements

The number, type and required characteristics of the fibres to be used in the cable will be specified in schedule A.

4.2 Cable requirements

4.2.1 The cable shall contain no metallic elements. A circular cross-section is preferred.

4.2.2 The maximum acceptable mass per length (kg/km) of the finished cable, maximum allowable diameter and its maximum bending radius will be specified in schedule A.

4.2.3 For a stranded buffer tube designed cable, a maximum of 12 fibres shall be enclosed in a buffer tube which shall be filled with a suitable thixotropic gel. The "marker" buffer tube shall be red in colour and the "reference" buffer tube shall be green in colour. The remaining buffer tubes and “fillers”, if used, shall be transparent in colour.

4.2.4 For a central tube design ADSS cable with more than 12 fibres, a maximum of 12 fibres shall be bundled together by a coloured thread, and each separate bundle shall be clearly identifiable. The tube shall be filled with a suitable thixotropic gel.

4.2.5 The fibres shall be marked by a coloured coating with 12 different colours in accordance with EIA/TIA 598. The optical fibre colours shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. The colours shall not cause fibres to stick together.

4.2.6 The cabled cut-off wavelength shall be less than or equal to 1 260 nm as specified in schedule A.

4.2.7 Cables shall be resistant to ultraviolet radiation experienced on HV transmission lines. This capability shall be demonstrated by performing the type test in accordance with 6.2.11.

4.2.8 The cable shall be resistant to the effects of electric field strengths experienced on HV transmission lines. In order to achieve this requirement, the cable shall be provided with an anti-tracking sheath and shall be perfectly smooth without any cable markings to provide a possible inception point for corona discharge or dry-band arcing. The supplier shall specify the maximum sheath current that can be allowed to flow for a minimum of 1 000 h, before damage due to anticipated dry-band arcing. Type testing to prove this capability shall be in accordance with 6.2.12.

4.2.9 All the interstices of the cable shall be completely filled with a suitable compound to prevent water ingress of the cable. Test the cable in accordance with the test in 6.2.2. Details of the measures taken shall be provided in schedule B.

4.2.10 All measures taken to minimize hydrogen absorption in the fibres shall be provided in schedule B.

4.2.11 When tested in accordance with 6.2.3, the aerial cable used for span lengths of up to 400 m shall be installed in accordance with the manufacturer's recommended tension based on the spanning plan and tower configuration. Aerial cable shall be designed for a fibre strain not exceeding 0,2 % for the limiting span length, when subject to a transverse wind loading (at 15 °C) equal to 1 050 Pa on the projected cross-section (MAT). The maximum continuous load, with zero fibre strain, shall be specified in schedule B (MOT). The tensile performance of the cable, where snow loading is anticipated, shall be subject to negotiations between the supplier and the customer.

NOTE Longer span lengths are possible, but will require negotiation between the supplier and the customer as there will be significant changes to the mechanical properties of the cable.

4.2.12 When tested in accordance with 6.2.4, the cable shall have sufficient crush resistance capability to withstand a lo ad of 2 000 N.

4.2.13 When tested in accordance with 6.2.5, the cable shall be flexible enough to accommodate a minimum bending radius of 350 mm without damage or change of its optical properties.

4.2.14 When tested in accordance with 6.2.6, the cable shall be designed to withstand the specified degree of twisting without any damage to either the component parts of the cable or change to the optical transmission properties of the fibres.

4.2.15 The cable shall have an impact resistance capability such that, when tested in accordance with 6.2.7 with a single impact of 20 nm, there shall be no permanent change to the optical transmission performance of any fibre.

4.2.16 The cable shall be resistant to the effects of aeolian vibration such that the attenuation increase shall be less than 0,5 dB/km at 1 550 nm when tested in accordance with 6.2.8, and subjected to a minimum of 100 million vibration cycles with a frequency equal to that produced by a 4,5 m/s wind. Any significant damage to the components of the cable will constitute failure.

4.2.17 A galloping test shall be carried out in accordance with 6.2.9. Any damage that might affect the mechanical performance of the cable or that might cause permanent or temporary increase in optical attenuation greater than 1,0 dB/km of the tested fibres at 1 550 nm for single-mode fibres and at 1 300 nm for multimode fibres, will constitute failure.

4.2.18 The creep characteristics shall be established by testing the cable in accordance with 6.2.10.

4.2.19 When tested in accordance with 6.2.13, the changes in attenuation over the last four cycles shall not exceed 0,1 dB/km from the mean. The mean attenuation shall be defined as the average attenuation encountered at 20 °C over the last four cycles. See figures 1(a) and 1(b).

4.2.20 A temperature cycle shall be:

Starting temperature in chamber: + 20 °C

4.2.20.1 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

4.2.20.2 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

4.2.20.3 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 t1

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

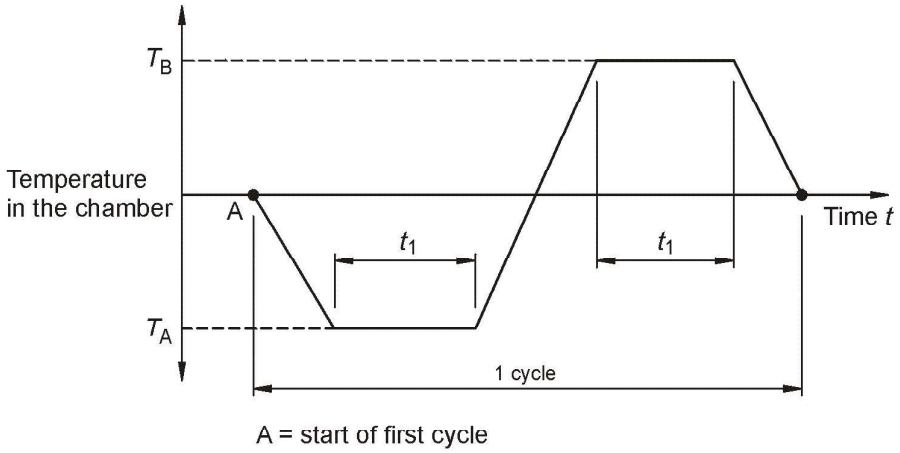

Figure 1 (a) — First cycle(s) procedure

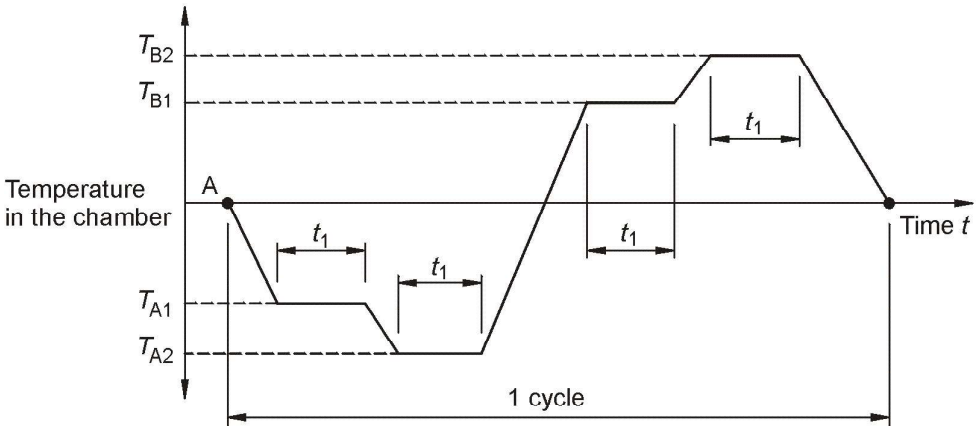

Figure 1 (b) — Last cycle procedure

Figure 1 — Temperature cycle

4.2.21 When tested in accordance with 6.2.14, a compound flow test shall be performed at an ambient temperature of 40 °C. The cable shall comply with the requirements of 17.5 in SANS 60794-1-2:2003.

4.2.22 The ADSS cable's design shall be such that it can be safely installed using common installation methods and practices, making use of the specific hardware defined by the supplier. This capability shall be proved by the cable's performance in the sheave test specified in 6.2.15 and the hardware fitting compatibility test specified in 6.2.16.

5 Environmental requirements

The ADSS cable shall be operated under the following environmental operating conditions:

a) maximum temperature: 50 °C;

b) minimum temperature: - 10 °C;

c) altitude: 2 500 m (above sea level);

d) relative humidity: 100 %;

e) maximum barometric pressure: 104 kPa; and

f) minimum barometric pressure: 76 kPa.

NOTE The level of surface pollution of the sheath is dependent on prevailing conditions.

6 Tests

6.1 Optical tests

Perform the following tests on the cable once the cable has been placed on the drum before delivery:

Measure each fibre for continuity, length and attenuation coefficients as specified in schedule A.

Check each fibre for any point discontinuities (nothing in excess of 0,1 dB is permitted).

Measure the fibre cut-off wavelength and show it to be less that the operating wavelengths specified in schedule A.

Confirm the fibre colour in accordance with EIA/TIA 589 or as agreed upon between the supplier and the customer.

PMD of the fibres shall be shown to be within the limits specified in schedule A when measured in accordance with SANS 60793-1-44.

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

6.2 Mechanical tests

6.2.1 General

The mechanical tests in this part of NRS 078 are considered type tests. The customer may be prepared to review the results of similar tests which the supplier may have performed in the past and possibly waive the requirements for one or more of the tests specified in this part of NRS 078.

6.2.2 Water penetration

The cable, when tested between the core and inner sheath, shall fulfil the requirements of the water penetration test detailed in test method F5B of SANS 60794-1-2:2003. Check for compliance with 4.2.9.

6.2.3 Tensile strength

Test the cable in accordance with test method E1 in SANS 60794-1-2. Apply the load, determined for a 400 m span from the requirements of 4.2.11, for 10 min and monitor the strain of the fibre. Perform the test with the hardware to be used in the final installation. Check for compliance with 4.2.11. After completion of the tensile/strain performance test, test the cable, together with the hardware to be used for the actual installation, to destruction to determine the system UTS. Provide this information in schedule B.

6.2.4 Crush resistance

Ensure that the fibres and component parts of the cable do not suffer permanent damage when subjected to compression loads. Perform the test as described in test method E3 in SANS 60794-1-2. The two flat plates shall have dimensions 50 mm × 50 mm. Apply the load for 1 min. Check for compliance with 4.2.12.

6.2.5 Cable bending

Ensure that the fibres and component parts of the cable do not suffer permanent damage when the complete cable is tested in accordance with test method E11 in SANS 60794-1-2. Check for compliance with 4.2.13.

6.2.6 Cable twist

Ensure that the fibres and component parts of the cable do not suffer permanent damage when the cable is tested in accordance with test method E7 in SANS 60794-1-2. Check for compliance with 4.2.14.

6.2.7 Impact resistance

Test the cable in accordance with test method E4 in SANS 60794-1-2.: Check for compliance with 4.2.15.

6.2.8 Aeolian vibration

Test the cable in accordance with test method E19 in SANS 60794-1-2. Terminate a minimum of 20 m of cable at each end using a dead-end grip. Support the cable at mid-span using a standard suspension unit tensioned between 15 % and 25 % of the UTS. Support the cable in such a way that the active sag angle is 1,5°. Check for compliance with 4.2.16.

6.2.9 Galloping

Test the cable in accordance with 4.1.1.5 of IEEE 1222:2011. Terminate a minimum of 40 m of cable at each end using a dead-end grip. Support the cable at mid-span using a suspension unit tensioned to 2 % of cable UTS. Check for compliance with 4.2.17.

6.2.10 Creep

Carry out this test in accordance with IEC 61395. Use a 10 m sample at 25 % UTS for 1 000 h to establish elongation characteristics versus time. Check for compliance with 4.2.18.

6.2.11 UV and solar radiation resistance

Where the cable jacket has carbon black as a UV inhibitor, test the cable in accordance with ASTMD3349-06-1 or an equivalent national standard. The cable shall show a minimum absorption coefficient of 320 (absorbance/metre).

Where other cable UV blocking systems are employed, the cable shall meet the equivalent UV performance of carbon black at 320 (absorbance/meter) or meet the performance requirements stated in IEC 60068-1.

In the case of solar radiation testing, apply IEC 60068-2-5, Procedure C, in line with the requirements specified in 5.2.1.8 of IEEE 1594:2008.

After testing, carry out a tensile test on the cable samples to measure tensile strength and elongation at break. After the test, a minimum of 60 % of the tensile strength shall be retained, and there should be no surface grazing or discoloration. Check for compliance with 4.2.7.

6.2.12 Electrical withstand capability of the sheath (tracking test)

Test the cable in accordance with the requirements in 9.3.3 of SANS 62217:2013 at a minimum level of 20 kV/mm. Carry out the test in the salt fog conditions specified in 9.3.3 of SANS 62217:2013 and maintain for a test duration of a minimum of 1 000 h. Inspect the outer sheath after the test period and deem the sample to comply if no evidence of tracking or erosion of the sheath is found. In addition, ensure that there is no more than two flash-overs during the duration of the test. Check for compliance with 4.2.8

6.2.13 Temperature cycling

Test the cable in accordance with test method F1 in SANS 60794-1-2:2003. Check for compliance with 4.2.19.

6.2.14 Compound flow (drip)

Test the cable in accordance with test method E14 in SANS 60794-1-2:2003. Check for compliance with 4.2.21.

6.2.15 Sheave test

Perform this test to verify that the installation of the cable will not damage or degrade its performance. Test the cable in accordance with method E18, procedure 3 or 4 of SANS 60794-1-2 and check for compliance with the requirements in 9.4.2 of SANS 60794-4:2004. Check for compliance with 4.2.22.

6.2.16 Hardware fitting compatibility test

Types of hardware fittings shall be approved between the customer and the supplier and their compatibility shall be verified as specified in 9.12 of SANS 60794-4.2004. Check for compliance with 4.2.22. On request, the supplier shall provide samples of hardware fittings to the customer for independent testing, or alternatively, allow the customer to witness testing at a facility agreed upon between the customer and supplier.

7 Routine tests

Subject the cable to all the manufacturer's standard tests. Provide the details of the test performance and the test results to the customer. The manufacturer is required to keep all routine test certificates for a period of three years. These certificates shall be available on request of the customer.

8 Marking, labelling and packaging

8.1 Marking and labelling

8.1.1 All marking and labelling shall be in English.

8.1.2 The following information shall be clearly and permanently marked on the bedding layer of the cable at intervals of 1 m:

a) the name of the manufacturer;

b) the year of manufacture;

c) the type of fibre (coded);

d) the number of fibres; and

e) any information as required by the purchaser.

The coding for the fibre type shall be as specified in schedule A.

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

a) the manufacturer's name;

b) the place of manufacture;

c) the ADSS size and the number of fibres;

d) the ADSS shipped length (standard or specified);

e) the gross tare and net weight;

f) the drum number;

g) the order/contract number;

h) the type of cable;

i) the destination;

j) the stock code (if specified);

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 ADSS;

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 ADSS from unwinding) unless the manufacturer guarantees that the drum or reel may be rolled in either direction without damage to the ADSS. The outer end of the cable shall be accessible for testing purposes; and

m) any additional information required by the user.

8.2 Packaging

8.2.1 Long-span ADSS cables shall be supplied tightly and uniformly wound onto either wooden or returnable steel cable reels. The wound length of the long-span ADSS cable on each reel shall be specified in schedule B.

8.2.2 The reel shall be of such construction that no damage to the long-span ADSS cable will occur during shipping and handling. The outer layer of the long-span ADSS cable 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.

8.2.3 Each end of the long-span ADSS cable shall be properly sealed to prevent the ingress of moisture into the optical fibre unit during shipment or storage.

8.2.4 Long-term storage shall be in accordance with the manufacturer’s requirements.

9 Documentation

9.1 At the time of tender, the supplier shall provide:

a) details of the cable construction and design including colour coding information to enable positive identification of each fibre;

b) results of type tests (type tests performed on similar cables can be submitted for approval); and

c) details of all the manufacturer’s tests performed to ensure quality of manufacturing.

9.2 After delivery of the cable, the supplier shall provide:

a) details of the “as-built” cable construction and design including colour coding information to enable positive identification of each fibre;

b) results of all routine tests; and

c) details of the characteristics of all fibres used in the cable, on request from the customer.

9.3 All documentation required in 9.1 and 9.2 shall be provided in hard-cover ring files and on CD which comply with the following requirements:

a) the paper shall be of A4 size;

b) the files shall be of a construction that can open flat at any page;

c) any drawings and descriptions included shall conform to the A4 series (295 mm × 220 mm). Larger drawings shall be folded in a single panel, along the 220 mm axis of the standard A4 size. Drawings that have to be folded in two directions shall not be included;

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

e) the language used shall be English.

9.4 The number of copies of documentation required will be specified in the contract documentation.

9.5 The drawings of the cable construction shall indicate the following:

a) all dimensions of the various components;

b) the cross-sectional area of the aramid strength member;

c) the thermal coefficient of the cable;

d) Young's modulus of the cable; and

e) the mass per length of the cable.

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 part of NRS 078, provide the tenderer with details of any 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 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 078, to assist in compiling the schedules.

Where the text of any referenced standard 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 request the tenderer to fill in this schedule. By doing this, the tenderer will be stating compliance with this part of NRS 078 and will be providing the information the purchaser has requested.

NOTE 1 Where this part of NRS 078 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 include only 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

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

Annex A
(concluded)

A.4 Quality assurance

This part of NRS 078 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 existing 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 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 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 078, 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.

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: Guarantees and particulars of equipment to be supplied (to be completed by tenderer)

Item	Sub-clause	Description		Schedule A	Schedule B
B.1	4.1	Number of fibres		_____	xxxxxxxxxxx
B.2	4.1	Type of fibre		As in NRS 081	xxxxxxxxxxx
B.3	4.2.2	Mass per length of cable	kg/km	< 200	_____
B.4	4.2.2	Cable diameter	mm	≤ 15	_____
B.5	4.2.2	Maximum bending radius		250 mm	
B.6	4.2.6	Cabled cut-off wavelength	nm	≤ 1 260 nm	_____
B.7	4.2.7	Details of measures taken and tests performed		xxxxxxxxxxx	_____
B.8	4.2.8	Anti-tracking sheath		Yes	xxxxxxxxxxx
B.9	4.2.8	Sheath tracking performance (maximum permitted leakage current under heavy pollution conditions, 100 kΩ/m longitudinal resistance). As given in IEEE 1222	mA	xxxxxxxxxxx	_____
B.10	4.2.9	Details of measures against water penetration		xxxxxxxxxxx	_____
B.11	4.2.10	Details to minimize fibre hydrogen absorption		xxxxxxxxxxx	_____
B.12	4.2.11	Maximum design span length	m	400 (or as otherwise agreed)	
B.13	4.2.11	Ultimate tensile strength (UTS)	kN	≥ 35,0 (or as specified for specific application)	_____
B.14	4.2.11	Maximum working load (where fibre strain does not exceed 0,2 % in the fibres) (MAT)	kN	xxxxxxxxxxx	_____
B.15	4.2.11	Maximum continuous load (fibre under no strain) (MOT)	kN	xxxxxxxxxxx	_____
B.16	4.2.18	Long-term creep		xxxxxxxxxxxx	
B.17	5	Compliance with environmental requirements		Yes	xxxxxxxxxxx
B.18	6.2.1	Type test reports available If not available, specify date of availability		Yes/no	_____
B.19	6.2.12	Details of electrical design tests performed to prove withstand capability of cable		xxxxxxxxxxx	_____
B.20	8.2.1	Wound length	m	xxxxxxxxxxx	_____
B.21	9.1	Details of cable construction		xxxxxxxxxxx	_____

Bibliography

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

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