TITLE	**SPECIFICATION FOR HEAVY DUTY DUCT FIBRE OPTIC CABLES**	REFERENCE **CP_TSSPEC_204**	REV **2**
		PAGE: **1** OF **21**	
		DATE: **MAY 2025**	

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FOREWORD

This standard was prepared by the following work group members:

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INTRODUCTION

City Power Johannesburg has undertaken to utilize the SABS support structures that monitor compliance with specification and quality of manufacture of cables. Therefore, City Power has used the NRS and SANS standards where applicable.

1 SCOPE

This specification covers City Power's requirements for single-mode fibre optic cables for underground installation in ducts and sub-ducts.

2 NORMATIVE REFERENCES

The following document contains provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the edition indicated was valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent edition of the document listed below.

ITU-T G.650, Definition and test methods for the relevant parameters of single-mode fibres

ITU-T G.652D, Characteristics of a single-mode optical fibre and cable

ITU-T G.657a1, Characteristics of a bending-loss insensitive single-mode optical fibre and cable

SANS/IEC 60793-1 Optical fibre Part 1: Generic specifications

SANS/IEC 60793-2 Optical fibre Part 2: Product specifications

IEC60794-1-2 Optical fibre Part1 of 2 Standards for Fibre optic test procedures2

SANS 6094-1-2 Optical fibre cables Part 1-2: Generic specification - Basic optical cable test procedures

IEC 60794-3-10, Outdoor cables- family specification for duct and directly buried optical

Telecommunication cable

SANS/IEC 60794, standards parts 1 to 3 for optic fiber cables and test procedures

SANS 61931:2004, Fiber optic — Terminology
BS 6234:1987, Specification for polyethylene insulation and sheath of electric cables

NRS 081:2005, Single-mode non-dispersion shifted fibre optical fibres

NRS 088 – 1, DUCT and Direct Buried Underground Optical cable

240-46264031, Fibre Optic Design Standard Part 2 - Substations

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

3 DEFINITIONS AND ABBREVIATIONS

The definitions and abbreviations in the above documents shall apply to this procedure

ITU: International Telecommunications Union

BS: British Standards institution

TIA-EIA Telecommunications Industry Standards and Electronic Industries Standards

FIBRE Optic fibre cable

4 REQUIREMENTS

4.1 General

4.1.1 The single-mode fiber shall meet and comply with all the requirements of SANS 60793-2-50:2008.

4.1.2 The fibre shall be a non-dispersion shifted single-mode fibre that is compatible with one thousand three hundred Nano metres (nm) and one thousand five hundred and fifty Nano metres wavelength windows.

4.1.3 The fibre shall have a lifespan of at least twenty years.

4.1.4 The fiber shall be resistant to ultra violet radiation and water penetration.

4.1.5 The fibres shall be of low water peak type. (Type B1.3 of SANS 60793-2-50) that is also referred to as “full spectrum fibre”.

4.1.6 The fibre shall have low Polarization Mode dispersion in compliance with ITU recommendation G.652.D.

4.1.7 The single mode fiber shall have the bending properties listed in ITU G.657a1 standard.

4.2 Cable strength and construction

4.2.1 The cable shall contain no metallic elements unless armouring is specified for a special application. The fiber cable design shall minimize hydrogen absorption in the fibers.

4.2.2 The cable shall be of loose tube construction and each loose tubes shall contain bundles with either four, six or eight fibres.

4.2.3 The cables shall have a total count of 24 and 48 fibres (24 and 48 cores).

4.2.4 The tubes and cable core shall be filled with a suitable water blocking material.

4.2.5 The cable shall have a tensile strength to at least withstand load of 0.6 x 9.81 x M x 2 Newton where M = mass of 1km of cable in kilograms.

4.2.6 The fiber strain shall not exceed 0.2% when the cable is subjected to this load and there shall be no damage to any component part of the cable

4.2.7 The design and the construction of the fiber shall include measures to minimize hydrogen adsorption.

4.2.8 The coated fiber or buffer shall be distinguishable by means of colour coding with different colours and the standard colours shall be used, as near as possible (reasonable match) to TIA/EIA-598-A standards.

4.2.9 The optical fiber 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 fibers to stick together.

4.2.10 The fibers and other cable components shall not suffer permanent damage when subjected to a compression loads.

4.2.11 The fiber and component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped 4 complete turns for 10 cycles at room temperature, around a mandrel 12 times the diameter of the cable.

4.2.12 The cable shall withstand one impact of 20 Nm without any change to the optical transmission performance of any fiber, tested as per IEC60794-1-2 E4 with an anvil radius of 25 mm.

4.3 **Outer sheath**

4.3.1 The cable sheath shall be made of polyethylene in according to BS 6234 type 03.

4.3.2 The type of outer sheath material shall be a close-fitting, smooth-surfaced circular tube, free from pinholes and other defects.

4.3.3 The sheath shall be resistant to ultraviolet light and shall be compatible with outdoor installation

4.3.4 The colour of the sheath shall be either black or yellow in accordance with the order that shall be specified when the order is placed.

4.3.5 Armouring is not required. If armouring is specified for a special application, it shall be of the longitudinal corrugated steel tape type.

4.4 Tests

4.4.1 The fibre shall undergo all necessary test to determine and to confirm compatibility and compliance.

4.4.2 The fibre cable shall be tested at both 1310nm and 1550nm for attenuation, refractive index and dispersion.

4.4.3 The performed tests as well as the subsequent results, shall be in accordance with and comply with the following standards, water penetration test

a) Water penetration

Water penetration test detailed in test method F5B in SANS 60794-1-2 and test the cable between the core and the inner sheath.

b) Tensile strength

Test the cable in accordance with test method E1 in SANS 60794-1-2.

c) Crush resistance

Test the cable in accordance with test method E3 in SANS 60794-1-2.

d) Cable twist (torsion)

Test the cable in compliance with test method E7 in SANS 60794-1-2

e) Impact resistance

Test the cable in accordance with test method E4 in SANS 60794-1-2.

f) Temperature cycling

Perform this test in accordance with test method F1 in SANS 60794-1-2.

g) Compound flow (drip)

Test the cable in accordance with test method E14 in SANS 60794-1-2

h) Repeated bending test

Test the cable in accordance with test method E6 in SANS 60794-1-2

i) Bend test

Test the cable in accordance with test method E11 in SANS 60794-1-2

j) Tension loading test

Test the cable in accordance with test method E1 in SANS 60794-1-2

5 PACKAGING AND TRANSPORTATION

HDD fibre optic cables shall be supplied on drums suitably protected for transport and the cable ends shall be sealed to prevent the ingress of moisture. The exact length/s required will be specified at the time of ordering.

During transportation, right tools shall be used to avoid damaging the package and to handle with ease. Cables shall be protected from moisture; kept away from high temperature and fire sparks; protected from over bending and crushing; protected from mechanical stress and damage

6 MARKING AND LABELLING

6.1 The following information shall appear in legible and indelible marking on the outside of the drum

6.1.1 The manufacturer's name or trademark;

6.1.2 The year and the month of manufacturing

6.1.3 Cable type and size;

6.1.4 Drum length, and net weight

6.1.5 Roll-direction

6.2 The following information shall appear in legible and indelible marking at one meter intervals on the outside of the cable

6.2.1 The manufacturer's name and trademark

6.2.2 Year of manufacturing

6.2.3 Type of fiber (S3 single mode 1310/1550)

6.2.4 Number of fibers

6.2.5 Meter position

7 DOCUMENTATION

7.1.1 Full technical design, construction and functional details of the fibre shall be submitted.

7.1.2 All instruction manuals, type test documents and the results shall be provided.

7.1.3 Two copies of each test shall be supplied with each drum.

7.1.4 The documents shall be shall be in English and sufficiently detailed to enable interpretation and use by City Power staff.

8 TRAINING

The suppliers shall provide technical support on system and equipment queries for the duration of the contract.

9 QUALITY MANAGEMENT

A Quality management system shall be set up in order to assure the quality of HDD cables during design, development, production and servicing. Guidance on the requirements for a Quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

10 HEALTH AND SAFETY

A Health and Safety plan shall be set up in order to ensure proper management and compliance of the HDD cables during installation, operation, maintenance, and decommissioning phases. Guidance on the requirements of a Health and Safety plan may be found in ISO 45001:2018 Standards. This is to ensure that the asset conforms to standard operating procedures and City Power SHERQ Policy. The details shall be subject to agreement between City Power and the Supplier.

11 ENVIRONMENTAL MANAGEMENT

An Environmental management plan shall be set up in order to ensure the proper environmental management and compliance of the HDD cables during their entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning as well as disposal phases). Guidance on the requirements for an Environmental management system may be found in ISO 14001:2015 Standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to Environmental standards and City Power SHEQ Policy

Annex A – Bibliography

Eskom: TSP0025:1994 Specification for Single Mode Fibre Optic Duct Cable

Annex B - Revision information

DATE	REV. NO.	NOTES
May 2018	0	First issue.
May 2018	1	Updated workgroup members
		Normative references; replaced *ITU-652 with ITU 652D*
		Normative references; added ITU 657a1
		Normative reference; added SANS 6094-1-2
		Normative reference; added IEC60794-1-2
		Added clause 4.1.7
		Added sub clauses 4.4.3(a) to 4.4.3(j)
May 2025	2	General editing Annexure D added

Annex C - Technical schedules A and B: Items 1 & 2 - Single-mode Fibers.
SAP No. 1552 & 1553: CAB FIBRE 24/48SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
		Name of OEM	XXXX	
1	4.1.1	The single-mode comply with all the requirements of SANS 60793-2-50:2008.	Requirement	
2	4.1.2	The fibre shall be a non-dispersion shifted single-mode fibre as to clause 4.1.2	1300nm 1550nm	
3	4.1.3	The fibre shall have a lifespan of as to clause 4.1.3	=>20 years	
4	4.1.4	The fibre shall be resistant to ultra violet radiation and water penetration as to clause 4.1.4	Requirement	
5	4.1.5	The fibres shall be of low water peak type as to clause 4.1.5	Type B1.3	
6	4.1.6	The fibre shall have low Polarization Mode dispersion.	G.652.D	
7	4.1.7	The single mode fiber shall have the bending properties listed in ITU G.657a1 standard	G.657a1	
		CABLE STRENGTH AND CONSTRUCTION		
8	4.2.1	The cable shall contain no metallic elements unless specified.	Optional	
9	4.2.2	The cable shall be of loose tube construction and each loose tubes shall contain bundles	Requirement	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Items 1 & 2 - Single-mode Fibers.
SAP No. 1552 & 1553: CAB FIBRE 24/48SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
10	4.2.4	The tubes and cable core filled with a suitable water blocking material.	Powder or Gel	
11	4.2.5	The cable shall have a tensile strength as to clause 4.2.5	Requirement	
12	4.2.6	The fibre strain below 0.2% when subjected to load as to clause 4.2.6	Requirement	
13	4.2.7	Include measures to minimize adsorption as to clause 4.2.7	Requirement	
14	4.2.8	distinguishable by means of standard colour coding as to clause 4.2.8	EIA-598	
15	4.2.9	Colours shall be stable during temperature cycling, not fade, not smear nor stick as to clause 4.2.9	Requirement	
16	4.2.10	Resistant to compression loads as to clause 4.2.10	Requirement	
17	4.2.11	Shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped as to clause 4.2.11	Requirement	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Items 1 & 2 - Single-mode Fibers.
SAP No. 1552 & 1553: CAB FIBRE 24/48SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
18	4.2.12	Withstand impact without any change to the optical transmission performance as to clause 4.2.12	IEC60794-1-2 E4	
		Outer sheath		
19	4.3.1	The cable sheath shall be made of polyethylene in according to.as to clause 4.3.1	BS 6234	
20	4.3.2	The type of outer sheath material shall be a close-fitting, as to clause 4.3.2	Requirement	
21	4.3.3	The sheath shall be resistant to ultraviolet light and shall be compatible with outdoor installation as to clause 4.3.3	Requirement	
22	4.3.4	The colour of the sheath shall be either black or yellow as to clause 4.3.4	Requirement	
23	4.3.5	Armoring shall be of the longitudinal corrugated steel tape type as to clause 4.3.5.	Requirement	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorized Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Items 1 & 2 - Single-mode Fibers.
SAP No. 1552 & 1553: CAB FIBRE 24/48SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
		Name of OEM	XXXX	
		Tests		
24	4.4	The fibre shall undergo all the required tests as to clause 4.4	Requirement	
25	4.4	Test certificates	Requirement	
26	5	Packaging and Transportation as to clause 5	Requirement	
27	6	Marking and labelling as to clause 6	Requirement	
28	7	Documentation requested in clause 7	YES	
29	8	Is training offered as requested in clause 8	YES	
30	9	Quality Management program in place?	YES	
31	10	Environmental management program	YES	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorized Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Items 1 & 2 - Single-mode Fibers.
SAP No. 1552 & 1553: CAB FIBRE 24/48SM G652D HDD
Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub-clause of CP_TSSPEC_204	Proposed deviation

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Item No. 1

SAP No. 1552: CAB FIBRE 24SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
		Name of OEM	XXXX	
		HDD Cable Construction		
1	4.2.3	Number of single mode fibres in cable	24	
2	4.2.2	Number of fibres per tube		
3		Number of loose tubes		
4		Diameter	mm	
5		Weight	kg/km	
6		Minimum bending radius		
7		Maximum installation tension (Where fibre strain does not exceed 0,2 %)		
8		Outer Sheath	Polyethylene	
9		Operating temperature range	-10 to +40C	
10		Crush resistance (100*100mm plates)	>=2000	
11		Impact resistance (2Nm, 25mm anvil)	>= 10	
12		Water penetration resistance	comply	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

Tender Number: _____

Tenderer’s Authorized Signatory: _____
Name in block lettersSignature

Full name of company: _____

Technical schedules A and B: Item 1
SAP No. 1553: CAB FIBRE 24SM G652D HDD
Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub-clause of CP_TSSPEC_204	Proposed deviation

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B: Item No. 2

SAP No. 1552: CAB FIBRE 48SM G652D HDD

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_204	Description	Schedule A	Schedule B
		Name of OEM	XXXX	
		HDD Cable Construction		
1		Number of single mode fibres in cable	48	
2		Number of fibres per tube		
3		Number of loose tubes		
4		Diameter	mm	
5		Weight	kg/km	
6		Minimum bending radius		
7		Maximum installation tension (Where fibre strain does not exceed 0,2 %)		
8		Outer Sheath	Polyethylene	
9		Operating temperature range	-10 to +40C	
10		Crush resistance (100*100mm plates)	>=2000	
11		Impact resistance (2Nm, 25mm anvil)	>= 10	
12		Water penetration resistance	Comply	

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorized Signatory: _____
Name in block lettersSignature

Full name of company: _____

Technical schedules A and B: Item 2
SAP No. 1553: CAB FIBRE 48SM G652D HDD
Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.		
Item	**Sub-clause of CP_TSSPEC_204**	**Proposed deviation**

Note: Ticks, Cross [√, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block lettersSignature

Full name of company: _____

ANNEXURE D – STOCK ITEMS

Item	SAP No.	SAP Short Description	SAP Long Description
1	1552	24 SM G652D FIBRE	HDD FIBRE OPTIC CABLE; TYPE/MODEL DESIGNATION: 24 SINGLE MODEL ITU G.652.D FIBRES; MATERIAL: POLYETHYLENE SHEATHED; HEAVY DUTY DUCT TYPE FOR UNDERGROUND INSTALLATION IN 40 OR 32mm SUB-DUCT; SUPPLEMENTARY FEATURES: METAL FREE.CP_TSSPEC_204
2	1553	48 SM G652D FIBRE	HDD FIBRE OPTIC CABLE; TYPE/MODEL DESIGNATION: 48 SINGLE MODEL ITU G.652.D FIBRES; MATERIAL: POLYETHYLENE SHEATHED; HEAVY DUTY DUCT TYPE FOR UNDERGROUND INSTALLATION IN 40 OR 32mm SUB-DUCT; SUPPLEMENTARY FEATURES: METAL FREE.CP_TSSPEC_204