13-SDMS-02

REV. 00

SPECIFICATIONS

FOR

NON-METALLIC, TIGHT BUFFERED & RETRACTABLE, MICRO FIBER OPTIC CABLE FOR INTERNAL INSTALLATION

CONTENTS

1 Objectives

The aim of this document is to provide generic information on design & construction of Non-Metallic Tight Buffered & Retractable Micro Fiber Optic Cable, to be used for Indoor applications for SEC FTTX access network deployment by Distribution Department, Saudi Electricity Company (SEC), Saudi Arabia.

2 Scope

This document specifies the minimum technical requirements for design, engineering, construction, manufacture, inspection, testing and performance of Non-Metallic Tight Buffered & Retractable Micro Fiber Optic Cable which is intended to be used from Optical Termination Box (OTB) in the basement of Multi dwelling Unit (MDU) to Optical Network Terminal (ONT) inside the living room in MDUs, or from the compound wall Fiber Termination Box (FTB) to Optical Network Terminal (ONT) in SDU for SEC FTTX access network deployment by Distribution Department, Saudi Electricity Company (SEC), Saudi Arabia.

3 Applicable codes & standards

This Distribution Material Standard Specification shall be read in conjunction with the latest revision of Distribution General Specification titled "01-SDMS-01, Rev 01" which shall be considered as an integral part of this standard. This material standard specification shall also be read in conjunction with 48-TMSS-02 Rev. No. 01 as well as with the purchase order or contract schedules for the project, as applicable.

The latest revision/amendments of the following codes and standards shall be applicable for the equipment/material covered in this Distribution Material Standard Specification. In case of any conflict, the vendor/manufacturer may propose equipment/material conforming to one group of industry codes and standards quoted hereunder without jeopardizing the requirements of this standard specification.

- ASTM D5424 Smoke obscuration of insulating materials in a vertical tray configuration
- ASTM E662 Specific optical density of smoke generated by solid materials
- BS EN 61034 Measurement of smoke density of cables burning under defined conditions
- IEC 60793-1-1 Optical fibers – Part 1-1: Measurement methods and test procedures general and guidance
- IEC 60794-1 Optical fiber cables: Generic specifications
- EIA 440A Fiber optic terminology
- EIA/TIA 455 Standard test procedure for fiber optic cables, transducers, sensors, connecting & terminating devices, and other fiber optic components
- EIA 472 Sectional specification for fiber optic communication cables for underground and buried use

- IEEE 1222 All-dielectric self-supporting fiber optic cable
- IEEE 1594 Helically applied fiber optic cable systems (wrap cable) for use on overhead utility lines
- ITU-TG.652D Characteristics of single-mode fiber optic cables
- ITU-TG.657A2 Characteristics of Bend insensitive Single-Mode Optical Fiber
- IEC 60793-1-1 Optical fibres – Part 1-1: Measurement methods, test procedures general, and guidance
- IEC 60331-25 Optical fibre cables: Generic specifications
- IEC 60794-2 Indoor cables – Sectional specification.
- IEC 60794-2-10 Indoor optical fibre cables – specification for simplex and duplex cables.
- IEC 60794-2-20 Indoor FOC - specification for multi-fibre optical cables.
- IEC 60794-2-21 Indoor FOC – Detailed specification for use in premises cabling.
- IEC 60332-1 Flame retardant grade specifications for LSZH jackets Cables

4 Design & Construction Requirements

4.1 General requirements

4.1.1 The Non-metallic tight buffered & retractable fibre optic cable for internal installation shall meet or exceed the requirement of these specifications in all aspects.

4.1.2 Manufacturer's drawings are required in SDMS-01 (latest approved version) to show the outline of fibre optic cable, together with all pertinent dimensions. Tolerance of any variations in dimensions shall be according to relevant standards.

4.1.3 The cable should be of low weight, small volume, Outer jacket with low friction, fire-retardant & non halogenated and having high flexibility. Here flexibility means of connecting users in a Multi Dwelling Unit (MDU). The mechanical design and construction of each unit shall be inherently robust and rigid under all condition of operation, adjustment, replacement, storage and transport.

4.1.4 Sample of the proposed fibre optic cable shall be provided to SEC for evaluation & approval.

4.2 Design Requirements

4.2.1 The minimum & maximum ambient temperature shall be between -10°C to +70°C, as specified in 48-TMSS-02, Rev. No. 01.

4.2.2 The fiber optic cable shall be strengthened, reinforced and sheathed to offer protection, rendering it suitable for installation indoor vertical &horizontal micro ducts.

4.2.3 The diameter of the thermoplastic or thermoset buffer coating shall be 900 ± 50 Microns for Non-metallic tight buffered fiber optic cable.

4.2.4 The diameter of the thermoplastic buffer coating shall be from 900 Microns to 4mm for Non-metallic retractable micro fiber optic cable. The coated fiber module shall have a low friction slip layer placed between the acrylate coating optic cable and the thermoplastic buffer cable for effective retraction of the fiber units

4.3 Optical Fiber Requirements

4.3.1 The fiber used shall have latest, optimized & enhanced properties with respect to fiber material & construction geometry.

4.3.2 The fiber material and its construction shall meet or exceed the nominal values as specified in Table -1

Table -1 Fiber Material & Construction Specification

Parameter		Requirement		
Material		Germanium doped silica glass or pure silica glass		
Mode field eccentricity		≤ 1 μm		
Cladding Outside Diameter		125 μm ±0 .7 μm		
Core centricity error		≤ 0.5 μm		
Cladding Non-circularity		1%		
Nominal coating diameter		In the range of 200 to 250 μm		
Macro bending Loss	Radius (mm)	15	10	7.5
	Number of turns	10	1	1
	Max. at 1550mm (dB)	0.03	0.1	0.5
	Max. at 1525 mm (dB)	0.1	0.2	1.0
Maximum continuous operating temperature without optical degradation		-10 + 70°C		
Maximum optical loss variation in		±0.05db/km		

temperature range of -10°C to +70°C	

4.3.3 There shall be no joints or splices in any optical fiber in any reel length of the complete optical cable.

4.3.4 Optical fibers shall be free of material and manufacturing defects, which would prevent them from meeting the requirements of this specification.

4.4 Optical Fiber Type

4.4.1 The fibres shall encompass all the features of enhanced dispersion upshifted Single-Mode fiber optimised for insensitive bending in accordance with ITU-T G.6527A2 or latest.

4.4.2 Optical fibres shall meet or exceed the requirement as specified in Table-2

Table -2 Dispersion Un-shifted Single-Mode fiber optimized for insensitive bending in accordance with ITU-T G.6527A2

ITU-T G.657 category A attributes				
Operating wave length	Maximum Attenuation Loss Per Km	Maximum Chromatic Dispersion	Cable Cut-off wavelength	Normal Mode Diameter (MFD)
1310 -1625 nm	0.27 dB/Km		1260 nm	8.6-9.5≤ µm at a wavelength 1310 nm
1550	0.21 dB/Km			

4.5 Cable construction requirements

4.5.1 General

4.5.1.1 All the cables material shall have zero halogen, flame retardance and low smoke emission characteristics in accordance with IEC fire safety standards (IEC 60332-1-1, IEC 60754-1 & IEC 61034-1).

4.5.1.2 The central fibre optic unit shall be designed to house and protect the fibres from damage due to forces such as crushing, bending, twisting, tensile stress and moisture, wide temperature variations, hydrogen evolution etc.

4.5.1.3 The fiber optic unit shall be of tight or semi tight buffered construction.

4.5.1.4 The LSZH sheath jackets shall be free from pinholes, joints, splits or any other defects.

4.5.1.5 All fiber optic cable shall have outer jacket with low friction coefficient for easy blowing or pulling through micro ducts.

4.5.1.6 All fiber optic cable shall have a minimum service life span of 25 years.

4.5.1.7 The fiber optic cable shall consist of Single Mode fibers conforming to ITU-T G.657A2 the technical parameters stipulated in this document.

4.5.1.8 Documentary evidence in support of guaranteed life span of cable & fiber shall be submitted by manufacturer for SEC approval.

4.5.2 Cable types

4.5.2.1 Two different types of cables are specified in this document:

a) Non-Metallic Tight Buffered Micro Fiber Optic Cable
b) Non-Metallic Retractable Micro Fiber Optic Cable

4.5.2.2 Their Mechanical characteristics are detailed in para. 4.5.8.2 in table 3.

4.5.3 Strength member

4.5.3.1 Non-Metallic Tight Buffered Micro fiber Optic Cable fiber modules shall have aramid yarn longitudinal strength members to surround and protect tight buffered.

4.5.3.2 Non Metallic Retractable Micro Fiber Optic Cable shall have two Glass Reinforced Plastic (GRP) rods longitudinal strength members to protect the buffered fiber modules.

4.5.3.3 The cable shall be designed with sufficient strength members to meet installation and service conditions so that the fibers are not subject to excessive strain.

4.5.4 Sheath / Jacket

4.5.4.1 The sheath shall be made from non-halogenated and fire retardant thermoplastic or thermoset material having an excellent quality for low smoke, low toxicity and low corrosion and shall pass or have the less values as specified in IEC Fire Safety standards.

4.5.4.2 The sheath shall be white or ivory, smooth, concentric, and shall be free from holes, splits, blisters and other surface flaws.

4.5.4.3 The sheath shall be extruded directly over the central fiber optic unit and shall also be non-hygroscopic.

4.5.4.4 The cable sheath design shall permit easy removal without damage to the optical fibres or fiber units.

4.5.5 Rip cord

4.5.5.1 Suitable rip cord(s) shall be provided to open the outer sheath of the cable.

4.5.5.2 The rip cord(s) shall be properly waxed to prevent wicking action and shall not work as a water carrier.

4.5.6 Secondary protection

4.5.6.1 The cables shall be of the tight or semi-tight construction.

4.5.6.2 The Secondary protection shall be made from made from non-halogenated and fire retardant thermoplastic or thermoset material having an excellent quality for low smoke, low toxicity and low corrosion and shall pass or exceed IEC Fire Safety Standards for low smoke, low toxicity and zero halogen .

4.5.6.3 The method of removal of the secondary protection shall be clearly described by manufacturer including the specific tools, if required.

4.5.7 Cable design & diagram

4.5.7.1 Manufacturer shall submit a detailed cable design & diagram for each type and size of cable. The detailed cable design & diagram shall contain the coding information used to identify the individual cable elements.

4.5.8 Cable mechanical /environmental characteristics

4.5.8.1 The cable temperature characteristics shall be as below:

- Operational - 10^{o}C to +70^{o}C
- Storage - 10^{o}C to +70^{o}C
- Installation - 10^{o}C to +70^{o}C

4.5.8.2 The mechanical characteristics of Non-metallic Retractable Micro Fiber Optic Cables & Non-metallic Tight Buffered Micro Fiber Optic Cables shall be as per Table 3:

Table 3 - Mechanical Characteristics for Non-metallic Tight Buffer & Retractable Micro Fiber Optic Cables

Fiber count	2	4	8	12	24	48
Min bending radius static (mm)	15	30	60	90	160	260
Min bending radius dynamic (mm)	20	40	80	120	240	480

Tensile Strength (Installation) N	100	100	150	150	300	450
Crush Resistance (100 mm)	500 N					
Impact Resistance (300 mm Radius)	5Nm					
Nominal Outer diameter (mm)	4	4	6	7.5	8	10

4.5.9 Fiber counts, Colour coding and fiber identification

4.5.9.1 Fiber count shall be 2 to 48 as required in Project Technical specification & Scope of work.

4.5.9.2 Individual optical fibers within a fiber unit and fiber units shall be identifiable in accordance with international standard for fiber optic colour coding scheme TIA-598-D as tabulated in Table-4.

4.5.9.3 The colour coding system shall be discernible throughout the design life of the cable. Colouring utilized for colour coding optical fibers shall be integrated into the fiber coating and shall be homogenous. The colour shall not bleed from one fiber to another and shall not fade during fiber preparation for termination or splicing.

4.5.9.4 Each cable shall have traceability of each fiber back to the original fiber manufacturer's fiber number and parameters of the fiber.

4.5.9.5 If more than the specified number of fibers is included in any cable, the spare fibers shall be tested by the cable manufacturer and any defective fiber shall be suitably bundled, tagged, and identified at the factory.

4.5.9.6 The colouring scheme shall be submitted along with the cable detailed design & drawing by manufacturer for SEC approval

Table-4 –Colour Coding of Fibers (TIA 598D)

Fibre core no.	Fibre base colour
1	Blue
2	Orange
3	Green
4	Brown
5	Grey (Slate)

Fibre core no.	Fibre base colour
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Pink (Rose)
12	Aqua
13	Blue/Black
14	Orange/Black
15	Green/Black
16	Brown/Black
17	Grey/Black
18	White/Black
19	Red/Black
20	Black/Black
21	Yellow/Black
22	Violet/Black
23	Pink/Black
24	Aqua/Black

5 Testing for complete FOC

5.1 The general conditions for Type (design) Testing, Factory Acceptance Testing & Site Acceptance Testing shall be in accordance with the following requirements.

5.2 SEC shall witness the type tests as required.

5.3 All type tests shall be conducted on the SEC approved Labs.

5.4 Type tests for Non-metallic Tight buffered and Retractable micro fiber Optic cable

5.4.1 The manufacturer shall submit along with their detailed Design & Drawing Specification with the earlier carried out type test reports and/or Third Party Independent Testing laboratory certificates for the offered fiber optic cable meeting the specified technical requirement.

5.4.2 The manufacturer shall submit the previously carried out type test report for the same design of cable for the tests listed below. The fiber should have been type tested as per relevant International standards for the tests listed below.

5.4.3 All type (design) tests prescribed in the relevant EIA/TIA or equivalent IEC standard shall be performed on the representative unit or on the first unit of every new design or rating to be supplied for SEC approval.

5.4.4 In lieu of the actual type (design) tests, certified test reports of type (design) tests performed on an identical unit may be submitted for SEC review and approval during the prequalification stage.

5.4.5 The type (design) tests are as mentioned in section 5.4.5.1 - 5.4.5.8.

5.4.5.1 Cable cut-off wavelength tests:

a) The cut-off wavelength of the cabled fiber shall be less than or equal to 1250nm.
b) Measurement shall be as specified in the relevant standard or in accordance with EIA/TIA-455-170.

5.4.5.2 Fluid penetration test:

a) Water ingress tests for cables designed for water blocking shall be performed for one meter cable sample for one hour in accordance with the requirements of EIA-455-82B or IEC 60794-1-FSB.
b) No water shall leak through the open end of 1 m sample. If the first sample fails, one additional 1m sample, taken from a section of cable adjacent to the first sample may be tested for acceptance. Water leakage from second sample shall constitute failure.

5.4.5.3 Compound flow (drip) test:

a) A 0.3 m sample of NFOC shall be tested in accordance with EIA/TIA-455-81b.
b) The sample shall be prepared per method A of EIA/TIA-455-81b. The filling and flooding compound shall not flow (drip or leak) at 65°C.

5.4.5.4 Vibration test:

a) Vibration test shall be carried out in accordance with EIA-455-11D.
b) Any significant damage to any component of the composite NFOC, permanent or temporary increase in optical attenuation greater than 1.0dB/km at 1310 nm or 1550 nm for single –mode fibers shall constitute failure.

5.4.5.5 Crush test and impact test:

a) A crush and an impact tests shall be performed in accordance with IEC 60794-1-2-E3 and IEC60794-1-2-E4.

b) A permanent or temporary increase in optical attenuation value greater than 0.02 dB change in sample at 1310 nm or 1550 nm for single mode fibers shall constitute failure.
c) Rated strength test on completed Note breaking strength of the completed NFOC shall not be less than the specified rated breaking strength of the NFOC unless the failure occurs in the gripping device.
d) If the failure occurs in the grip, the test value must not be less than 95% of the specified rated breaking strength.

5.4.5.6 Tensile loading and bending test:
a) Tensile loading and bending tests shall be performed on cable sample in accordance with r IEC 60794-1-2 E1 and IEC 60794-1-E6.
b) Any visual damage to the conductor strands or permanent or temporary increase in optical attenuation greater than 0.2 dB/km at 1310 nm or 1550nm for single mode fibers shall constitute failure.

5.4.5.7 Micro bending measurement shall be made in accordance with EIA/TIA-455 or equivalent IEC standards

5.4.5.8 Fire Safety Tests :

Fire Safety Test shall be made for verifying fire retardant & LSZH characteristics of Non-metallic Tight buffered and Retractable cables for indoor applications as per following standards.
a) Flame retardant results shall meet or exceed the fire & safety requirement as specified in IEC 60332-1-1.
b) Halogen gas toxicity test results shall meet or exceed the required as specified in IEC 60754-1.
c) Smoke density test results shall meet or exceed the required as specified in IEC 61034-1.

5.5 Cable routine (production) tests

5.5.1 All routine (production) tests prescribed in the relevant EIA/TIA or equivalent IEC standards shall be performed on all units prior to delivery for SEC approval.

5.5.2 The routine tests consists of the optical acceptance test:
a) Attenuation test shall be performed on each fiber of each individual reel in accordance with EIA/TIA 455-61A or IEC 60793-I-CIC.
b) Measurement shall be made from both directions if accessible and the results shall be averaged. Attenuation loss values exceeding those specified shall constitute failure.

5.6 Fiber type tests

5.6.1 All type (design) tests prescribed in the relevant EIA/TIA or equivalent ICE standards shall be performed on the representative unit or on the first unit of every new design or rating to be supplied for SEC approval..

5.6.2 In lieu of the actual type (design) tests, certified test reports of type (design) tests performed on an identical unit shall be submitted, or the cable manufacturer shall submit reports in the form of batch test reports furnished by the core manufacturer, provided that the core supplied for SEC approval and the core manufacturer is listed in the SEC approved list.

5.6.3 All the required test reports shall be submitted for SEC review and approval during the bidding stage.

5.6.4 The Type (design) tests are as follows in Sections 5.6.4.1 – 5.6.4.10.

5.6.4.1 Attenuation variation with wavelength:

a) The measurement shall be made in accordance with EIA/TIA 455-78B or IEC 60793-1-CIA.
b) The spectral width of the source shall be less than 10 nm.
c) The attenuation coefficient of un-shifted single mode fibers for wavelength between 1285 nm and 1310nm shall not exceed the attenuation coefficient at 1330 by more than 0.1dB/km.

5.6.4.2 Attenuation with bending:

a) Attenuation with bending measurements shall be made in accordance with EIA/TIA 455-62A or IEC 60793-1-c11.
b) The two attenuation with bending requirements are measured by winding 100 turns of fiber on a collapsible reel or removable mandrel of 75mm ± 2 mm diameter and by wrapping a single turn of fiber around a 32 ± 0.5 mm diameter mandrel.
c) Attenuation shall not exceed 0.5 dB at 1310 nm and 1550 nm.

5.6.4.3 Temperature cycling test:

a) Temperature cycling measurement shall be made in accordance with EIA/TIA 455-3B or IEC 60793-1-D1, using test condition A, -10°C to + 70 °C, 2 cycles.
b) The change in attenuation between extreme operational temperatures for single mode fibers shall not be greater than 0.05dB/km at 1310nm and 1550nm.

5.6.4.4 Attenuation at the water peak:

a) For un-shifted single mode fiber, the attenuation coefficient at the water peak found within 1383 nm shall not exceed 0. 34 dB/km.
b) The attenuation coefficient of un-shifted single mode fibers for wavelength between 1285 nm and 1310nm shall not exceed the attenuation coefficient at 1330 by more than 0.1dB/km.

5.6.4.5 Mode field diameter:
a) Mode field diameter shall be measured in accordance with EIA-455-174.
b) The measurement wavelength as a minimum shall be 1310 + 20 nm for dispersion un-shifted single mode fibers.
c) The nominal mode field diameter (MFD) for dispersion-un shifted single-mode fibers shall be 9-10µm ± 5% at 1300-1323nm.

5.6.4.6 Concentricity error:
a) Core-to-Clad concentricity error measurements shall be mad in accordance with EIA/TIA 455 or ICE 60793-1-A2.
b) Concentricity error- the offset between the center of the core and the center of the cladding shall be < 1.0 micron.

5.6.4.7 Cladding diameter:
a) Cladding Diameter and non-circularity error measurements shall be in accordance with EIA/TIA 455 or IEC 60793-1-A2.
b) Cladding diameter - the cladding outside diameter shall be 125.0 microns ± 2.0% microns. Cladding non circularity – the cladding non circularity shall be <2%.

5.6.4.8 Fiber tensile proof test:
a) Individual fibers shall be proof tested in accordance with EIA/TIA 455-31C, or IEC 60793-1-B1.
b) All fibers shall be subjected to a minimum proof stress of 0.35 GN/m2 for one second equivalent by the fiber manufacturer (100% testing).

5.6.4.9 Chromatic dispersion:
a) Dispersion measurements shall be made in accordance with EIA/TIA 455-168B or IEC 60793-1-C5C.

5.6.4.10 Coating diameter:
a) Coating diameter measurements shall be made in accordance with EIA/TIA 455-55c, or IEC60793-1-A3 as a sample test for each contract.
b) Coating diameter - the nominal coating diameter for loose buffer shall be 250 microns

5.7 Fiber routine (production) tests

5.7.1 All routine (productions) tests prescribed in the relevant EIA/TIA or equivalent IEC standards shall be performed on all units prior to delivery to SEC.

5.7.2 The routine tests are as follows in Sections 5.7.2.1 – 5.7.2.2

5.7.2.1 Attenuation coefficient:

a) Single mode fiber attenuation measurements shall be made in accordance with EIA/TIA 455-78B.
b) Spectral attenuation shall be modeled according to ITU-T-G.657A2 if OTDRs are used, measurements shall be made from both directions and the results shall be averaged if accessible.
c) The attenuation coefficient shall be 0.34 dB/km or less at 1300 nm and 0.25 dB/km or less at 1550 nm wavelength.
d) All the traces (hard copies) shall provide at least the following information other than the standard data provided by the OTDR.

i. For the graphical representation of the trace, sufficient acquisition time shall be set OTDR for the straight line of the graph. Hazy lines due to insufficient acquisition time shall constitute failure.
ii. All traces shall clearly identify fiber number, binder colour (group identifier) and fiber colour.
iii. All traces shall be furnished with the fiber-ID and the drum/reel number and physical length of the cable ordered for cross reference.

5.7.2.2 Fiber point defects:

a) Attenuation uniformity shall be measured in accordance with EIA/TIA 455-59 or IEC 60793-1-C1C. Measurement shall be made bi-directionally, if accessible and there results shall be averaged.
b) The attenuation of the fiber shall be distributed uniformly throughout its length such that there are no discontinuities in excess of 0.1 dB for single mode fiber.

5.8 Field acceptance testing

5.8.1 Upon receipt of the Non-metallic Tight buffered and Retractable micro fiber Optic cable for indoor applications from the manufacturer, the purchaser shall at his option, perform acceptance tests in order to verify that the optical characteristics of the fiber meet the order requirements and to determine if optical fibers have been damaged during shipment.

5.8.2 The results of these tests and the manufacture's certified quality control information, which is attached to each reel, shall be compared to the fiber requirements specified in the purchase order.

5.8.3 The tests shall be performed and documented by the use of optical time domain reflectometer (OTDR). The end of the cable shall be sealed after completion of these tests in order to prevent entry of moisture into the optical fiber. Tests shall be performed from both ends and results shall be averaged.

5.8.4 The following tests shall be performed in accordance with EIA/TIA-455 or equivalent IEC standards.

5.8.4.1 Fiber continuity: Continuity checks of each fiber may be made to determine if any fiber is broken or any attenuation irregularities exist.

5.8.4.2 Attenuation: Total attenuation for the entire reel length and attenuation per kilometer should be measured on each fiber. Attenuation uniformity shall meet the requirements of section 5.6.4.4.

5.8.4.3 Fiber length: The fiber length may be measured using the OTDR. The index factor to be used in this measurement should be furnished by the fiber manufacturer. A check should be made to verify received reel numbers and lengths correspond to ordered quantities.

6 Packing and shipping

6.1 In addition to the applicable items of 01-SDMS-01, Rev 01, the following packing and shipping instructions are applicable in accordance with SEC 48-TMSS-02, Rev.01

6.2 Progressive length on the cable shall be marked at 1 m (one meter) intervals.

6.3 The Non-Metallic Tight Buffered & Retractable Fiber Optic Cable ends shall be sealed with a waterproof, heat shrinkable plastic or elastomeric end cap with adhesive type sealing compound. Non-Metallic Tight Buffered & Retractable Fiber Optic Cable ends shall be properly secured to the reel.

6.4 The Non-Metallic Tight Buffered & Retractable Fiber Optic Cable shall be delivered without splices, on standard sized non-returnable wood drums properly packed and lagged externally to prevent the cable from possible damage during transportation. Wood lagging shall be used and have a minimum thickness of 19 mm.

6.5 For all Non-Metallic Tight Buffered & Retractable Micro Fiber Optic Cable purchases, the standard order length shall be 2000 meters. For Non-Metallic Tight Buffered & Retractable FOC intended for turnkey projects, the order length shall be as specified by SEC.

6.6 Reel markings

6.6.1 Non-Metallic Tight Buffered & Retractable Micro Fiber Optic Cable reels/drums shall be marked in legible and indelible letters giving the following particulars:

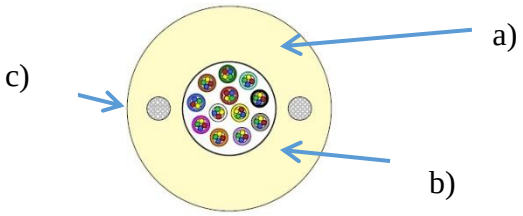
a) Number of optical fibers
b) Non-metallic fiber optic cable description
c) Length and weight of Non-Metallic Tight Buffered & Retractable Micro Fiber Optic Cable on reel
d) Gross weight
e) Dimensions of reel
f) Manufacturer’s name and country of origin
g) SEC purchase order number/contract number
h) Serial number of reel
i) SEC stock number in 10 cm high bold numerals
j) Direction of rolling of reel

6.6.2 All markings shall appear on both sides of the reel. Reel marking locations shall be shown in Specified Figure.

6.6.3 Non-Metallic Tight Buffered & Retractable Fiber Optic Cable reel identification shall include any additional information & labelling as required by SEC shipping instructions.

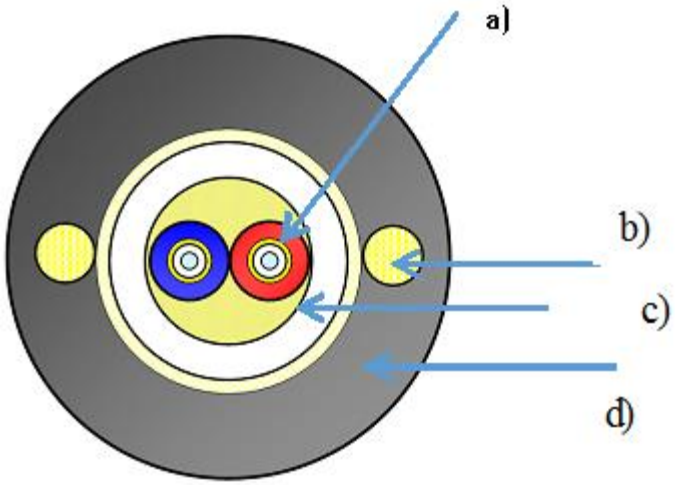
7 Appendix

7.1 Typical cross section for Non-metallic Retractable Micro Fiber Optic Cable



Legend: a) 900 Microns Colored buffered fiber with Easy stripping, Retracting & blowing b) Glass Reinforced Plastic Longitudinal strength Member c) White or Ivory LSZH Outer sheath

7.2 Typical Cross Section for Non-metallic Tight Buffered Micro Fiber Optic Cable (2 F):



Legend: a) 900 Microns Colored buffered fiber, b) Glass Reinforced Plastic Longitudinal strength Member c) Dielectric Strength Reinforcement Member d) White or Ivory LSZH Outer sheath

8 Data schedule

<Blank data schedule provided here. To be updated by vendor>

Technical data shedule of xx/xx/xx fiber (G.657A2)

Non Mettalic Tight Buffered & Retractable design, single sheath, unarmoured Micro optical fiber cable suitable for Indoor installation

Fiber optic cable containing xx-SMF in full compliance with ITU-T G 657A2. The offered cables should be fully compliant to the relevant IEC specifications.

- Up to xxx enhance low water peak single mode fibers in full compliance with ITU-T-G657A2.
- Glass Reinforced Plastic or Aramid yarn Longitudinal Strength Member.
- Outer Sheath/Jacket fire retarded LSZH white
- Application:
  - Inside Duct pulled or blown
- Special features:
  - Single layer stranded construction
  - Flexible buffer tubes provide easy fiber routing inside closure

Description	'A'	'B'	'C'
Mechanical characteristics:			
Temperature Range (IEC 60794-1-2-F1)			
Laying and Installation			
Operation			
Transport and Storage			
Cable Bending Radius (IEC 60794-1-2-E11A)			
During Installation (Full Load)			
Installed (No Load)			
Repeated Bending (IEC 60794-1-2-E6)			
Tensile Force (IEC 60794-1-2-E1)			
Torsion Resistance (IEC 60794-1-2-E7)			
Crush Resistance (IEC 60794-1-2-E3)			
Impact Resistance (IEC 60794-1-2-E4)			
Kink Resistance (IEC 60794-1-2-E10)			
Water Penetration (IEC 60794-1-2-F5B)			
Fire Safety Test (IEC 60332-1-1, IEC 60754-1,IEC 61034-1)			
Optical characteristics:			
Fiber used in the cable manufacturing fully comply to ITU-T-Rec G 657 A2			

at 1310 nm			
at 1550 nm			
Color coding (for 1F to 24F)			
Colour of Tight Buffered fibres (24F) :			
Cable construction details			
Primary Coated Fiber			
Buffered Fiber Module			
Longitudinal Strength Member			
Rip Cords			
Outer Sheath			
Delivery information			
Nominal Cable Weight (Kg/Km)			
Nominal Cable Diameter (mm)			
Standard Length per Drum (Mtr)			
Cable sheath marking			
Cable drum packing			
Arrow showing the direction, the drum can be rolled.			
Country of origin			
The manufacturer's name			
Number of fibers			
Nominal cable length in meters			
Net and gross weight			
Drum number			
Customer's name and destination			