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TELECOMMUNICATION ENGINEERING CENTRE
(DEPARTMENT OF TELECOMMUNICATIONS)
K.L. BHAWAN, JANPATH, NEW DELHI –110001
(Transmission Division)

File No: TEC/T/OFC-25/91/2016

Dated: ~~22.06~~.2020
06/07/2020

AMENDMENT No.1

RISER OPTICAL FIBRE CABLE (For Indoor Application)
(GR No. TEC/GR/TX/OFC-025/01/MAR-17)

i) **Background:**

The GR for the Riser Optical Fibre Cable (For Indoor Application) (GR No. TEC/GR/TX/OFC-025/01/MAR-17) was issued in March 2017. The GR has been taken up for amendment as TEC was in receipt of request from M/s Sterlite Technologies Ltd., for the modifications/amendments in some clauses of the GR. The proposal to modify the GR was agreed by DCC. These modification/additions in the GR require issue of an amendment.

ii) **Amendment:**
The amended clauses of the GR shall be read as per Annexure (attached).

iii) **Date of effect:** This amendment will be applicable with immediate effect.

iv) **Remarks:** There is no change in TS&TP and category.

v) **Category for the incremental test fee in case of revision of TAC/IAC: Nil**

----------End of the Amendment ----------

(Ratna Thakur)
Director (T)

To,

1. Sr. DDG (TEC), New Delhi for information please.
2. DDG (T), New Delhi for information please.
3. DDG (RC), TEC, New Delhi.
4. ADG (DOC), TEC, New Delhi to circulate this information to all RTEC's.

ANNEXURE

Amendment in the GR of RISER OPTICAL FIBRE CABLE (For Indoor Application) (GR No. TEC/GR/TX/OFC-025/01/MAR-17)

The amended clauses of the GR shall be read as below:

3.0 Technical Requirements of Optical Fibres

Single Mode Optical Fibre, used in manufacturing this Fibre Cable shall be as per ITU-T Rec. **G. 657 A1/A2/B3**. The specification of optical fibres are mentioned below.

6.0 Safety Requirement:

New clause shall be added as below:

6.2 Flame Spread-Single cable

Objective: To test the resistance to vertical flame propagation for a single vertical optical fibre cable, under fire conditions.

Method: IEC/EN 60332-1-2.

Requirement: The cable shall pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50mm and charring shall not extend downwards to a point greater than 540mm from the lower edge of the top support.

वर्गीय आवश्यकताओं के लिए मानक

सं: टीईसी ८५२१०:२०१७

(पूर्व सं: टीईसी/जीआर/टीएक्स/ओएफसी-०२५/०१/मार्च-१७)

STANDARD FOR GENERIC REQUIREMENTS

No.: TEC 85210:2017

(Earlier No.: TEC/GR/TX/OFC-025/01/MAR-17)

राइजर ऑप्टिकल फ़ाइबर केबल

(फॉर इन्डोर एप्लीकेशन)

RISER OPTICAL FIBRE CABLE

(FOR INDOOR APPLICATIONS)

ISO9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI–110001, INDIA

www.tec.gov.in

Release 1: March, 2017

Price: Free of Cost

FOREWORD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centres (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This Standard pertains to Riser Optical fibre cable for Indoor applications. It defines the technical requirements of optical fibre cables to be used in building (indoor) for Riser application. These cables are tight-buffered or Micro-module construction containing 4 to 48 single-mode optical fibres. These fibres can be easily extracted from the cable (mid-span access) over a sufficient length for splicing with the drop cable.

CONTENTS

HISTORY SHEET

S. No.	*Standard GR No.*	*Title*	*Remarks*
1.	TEC/GR/TX/OFC-025/01/MAR-17	Generic Requirement for Riser Optical Fibre Cable	1st Release
2.	TEC 85210:2017	Standard for Generic Requirement of Riser Optical Fibre Cable	Document number and document name changed as per Revised Numbering Scheme of TEC for conversion of existing TEC document to Standard vide document No. 4-47/2019-RC/TEC dated 07.09.2020.

Note:

1. Since the documents have been renumbered as per revised numbering scheme, kindly refer the Mapping- Listing Table pertaining to old and revised document number available on TEC website www.tec.gov.in/. In case of further clarification, please contact at e mail id adgdoc.tec@gov.in
2. Inside the document, GR may be read as Standard for GR, IR as Standard for IR, SR as Standard for SR and TSTP as TEC Test Guide."

REFERENCES

SN	*Document No.*	*Title/Document Name*
1.	G/OFT-01/03 APR 2006	Specification for Tools For Installation & Operating the OFC & for Assembly of the Optical Fibre Splice Closures
2.	TEC/GR/TX/ORM-01/04/SEP-09	Specification for Raw Material
3.	TEC/GR/TX/FTB-02/02 APR-2010	Specification for Optical fibre Termination and distribution box
4.	G/CBD-01/02 NOV'94	Specification for Wooden Drums
5.	SD: QM 333 {March 2010}	Standard for Environmental testing of Telecommunication equipment
6.	ITU-T G. 657	ITU-T Recommandation
7.	GR-20 –CORE July 98	Generic Requirement for Optical Fibre cable (Bell core)
8.	GR-409-CORE (Issue-1) May 94	Test Method
9.	IEC 60793-1, IEC 60793-2-50	Test method for Optical Fibres
10.	ISO 9001:2008	International Quality Management System
11.	EIA 359-A & IEC Publication 304(4)	Color Standards
12.	EIA 455-104, EIA/TIA-455-181 EIA RS-455-37	Test Methods
13.	IEC 811-5-1, IEC 60794-1-2-E1 IEC 60794-1-2-E2, IEC 60794-1-2-E3, IEC 60794-1-2-E4, IEC 60794-1-2-E7, IEC 60794-1-2-E10, IEC 60794-1-2-E11, IEC 60794-1-2-F1, IEC 60794-1-2-F3, IEC 60794-1-2-F5, IEC 68-2-1	Test Methods
14.	UL-94-V-O/ISI -10810 (Part 53) ISI specification	

CHAPTER-1

1.0 Introduction:

This document describes the Standard of Riser Optical Fibre cable (for indoor applications) (Type-I & Type-II). Type-I cable has tight-buffered fibres whereas Type-II cable has Micromodule containing 4 fibres per module. These tight-buffer/modules can be easily extracted from the cable (mid-span access) over a sufficient length for splicing with the drop cable. These cables are suitable for interconnecting/drop/distribution cabling purpose within the high rise building and have an excellent flexibility required for routing through various turns/curves ensuring fast and easy installation. The Riser optical fibre cables shall be suitably protected with yellow colour LSZH (Low smoke zero Halogen) sheath. The Raw material used in the cable shall meet the requirements of the GR for Raw materials (GR No. TEC/GR/TX/ORM-01/04/SEP-09 and subsequent amendments, if any).

2.0 Functional Requirement:

2.1 The Tight buffering or Micro module of the fibres shall be done with LSZH or Nylon-12 and shall not get bonded with the outer sheath of LSZH material.

2.2 The design and construction of the cable shall be inherently robust and rigid under all conditions of installation, operation, adjustment, replacement, storage and transport.

2.3 It shall be possible to operate and handle the cable with tools as per GR No. GR/OFT-01/03. APR 2006 and subsequent amendment, if any. If any special tool is required for operating and handling the optical fibre cable, the same shall be provided along with the cable.

2.4 The Riser optical fibre cable shall be suitable and compatible with the dimensions, fixing, terminating and splicing arrangement of the Optical fibre

termination and distribution box (GR No. TEC/GR/TX/FTB-02/02 APR-2010 and subsequent amendments, if any).

2.5 The Riser optical fibre cable shall be flame retardant and meet the requirement of UL-94-V-0 / ISI 10810 (Part 53) specifications.

3.0 Technical Requirements of Optical Fibres:

Single Mode Optical Fibre, used in manufacturing this Fibre Cable shall be as per ITU-T Rec. G. 657 A1/A2. The specification of optical fibres are mentioned below.

3.1	Type of fibre (Wavelength band optimized nominal 1310 nm)	:	Single Mode Optical fibre conforming to (Section I (Type-V) of TEC GR No. TEC/GR/TX/ORM-01/04/SEP-09 or latest issue, if any).

3.2 Geometrical Characteristics

3.2.1	MFD	:	[8.8 - 9.2] ± 0.4μm for A1 8.6 ± 0.4 μm for A2
3.2.2	Cladding Diameter	:	125μm ± 0.7 μm
3.2.3	Cladding Non-circularity	:	≤ 0.8%
3.2.4	Core Clad concentricity error	:	≤ 0.5 μm
3.2.5	Diameter over primary coated with double UV cured acrylate.	:	242 ± 5 μm

Note: The thickness of colour coating may be over and above the values specified above, if the manufacturer adopts separate UV cured colouring process (to colour the un coloured fibres) other than the on line integrated colouring process (of secondary layer of primary coating) of the fibres, during fibre manufacturing.

3.2.6	Coloured Fibre coating diameter	:	252 ± 10μm
3.2.7	Coating / Cladding Concentricity	:	≤ 12 μm
3.2.8	Primary coating material	:	UV Acrylate
3.2.9	Secondary coating Diameter (Tight Buffer)	:	900 μm ± 5 %

Note:

1. The coloured fibre shall be secondary coated with transparent Nylon-12
2. The natural fibre can be color coated with colored LSZH.

3.2.9	Secondary coating Material (Tight Buffer) and colouring as per requirement	:	LSZH (Low Smoke Zero Halogen) or Nylon-12
3.2.10	Diameter of Micromodule	:	900 μm ± 5 %

Note:

1. The coloured fibres in the Micromodule shall be protected with colored LSZH.
2. The natural fibre can be color coated with UV curable resin.

3.2.11	Material of Micromodule and colouring as per requirement	:	LSZH (Low Smoke Zero Halogen)

3.3 Transmission Characteristics :

3.3.1 Attenuation :

a) Fibre attenuation before Cabling

SN	Parameter	A1 Fibre	A2 Fibre
I	At 1270 nm	≤ 0.40 dB/km	≤ 0.40 dB/km
ii	At 1310	≤ 0.34 dB/Km	≤ 0.35 dB/Km
iii	Between 1285 to 1360 nm	≤ 0.37 dB/Km	≤ 0.37 dB/Km
iv	Between 1360 – 1480nm	≤ 0.34 dB/Km	≤ 0.35 dB/Km
v	At 1490 nm	≤ 0.24 dB/km	≤ 0.24 dB/km
vi	Between 1480 to 1525 nm	≤ 0.34 dB/Km	≤ 0.34 dB/Km
vii	At 1550 nm	≤ 0.20 dB/Km	≤ 0.21 dB/Km
viii	Between 1525 to 1625 nm	≤ 0.24 dB/Km	≤ 0.24 dB/Km
ix	At 1625 nm	≤ 0.23 dB/km	≤ 0.23 dB/km

b) Fibre attenuation after cabling

SN	Parameter	A1 Fibre	A2 Fibre
i	At 1310 nm	≤ 0.36 dB/km	≤ 0.37 dB/km
ii	At 1490nm	≤ 0.26 dB/Km	≤ 0.26 dB/Km
iii	At 1550 nm	≤ 0.22 dB/Km	≤ 0.23 dB/Km
iv	At 1625 nm	≤ 0.25 dB/Km	≤ 0.25 dB/Km

Note:

1. Attenuation in the band 1380-1390nm shall be checked at every 2nm after Hydrogen ageing as per IEC 60793-2-50. Hydrogen ageing test is to be carried out by CACT, Bengaluru or any other recognized laboratory for type test.
2. Sudden irregularity in attenuation shall be less than 0.1 dB.
3. The spectral attenuation shall be measured on un-cabled fibre.

3.3.2 Dispersion :

a) Total Dispersion

i. In 1285-1330 nm band : ≤ 3.5 ps/nm. Km

ii. In 1270-1340 nm band : ≤ 5.3 ps/nm. Km

iii. At 1550 nm : ≤ 18.0 ps/nm. Km

iv) At 1625 nm : ≤ 22.0 ps/nm. Km

Note: The dispersion in the 1250 nm – 1625 nm band at an interval of 10 nm, shall be measured and the test results shall be submitted.

b) Polarisation mode dispersion

SN	Parameter	A1 Fibre	A2 Fibre
i	Fibre (Uncabled)	≤ 0.1 ps/√Km	≤ 0.2 ps/√Km
ii	Cabled Fibre	≤ 0.3 ps/√Km	≤ 0.3 ps/√Km
iii	Link design value (Uncabled)	≤ 0.06 ps/√km	≤ 0.06 ps/√km

Note : Measurement on un cabled fibre may be used to generate cabled fibre statistics and correlation is established.

c) Zero Dispersion Slope : ≤ 0.092 ps/(nm^2.Km)

d) Zero dispersion wave length range : 1300-1324 nm

3.3.4 Cable Cut off wavelength : 1260nm Max.

3.4 Mechanical Characteristics:

3.4.1 Proof test for minimum strain level : 1 %
(Test method IEC-60793-1-30)

3.4.2 Peak Strippability force to remove primary coating of the fibre. : $1.3 \leq F \leq 8.9$ N

(Test method IEC-60793-1-32)

Note:

1. The force required to remove 30 mm ± 3 mm of the fibre coating shall not exceed 8.9 N and shall not be less than 1.3 N.
2. The secondary coated fibre shall be easily strippable so that primary and secondary coating can be removed separately.

3.4.3 Dynamic Tensile Strength (Test method IEC- 60793-1-31)

a) Un-aged : ≥ 550 (3.80 Gpa)

b) Aged : ≥ 440 (3.00 Gpa)

3.4.4 Dynamic Fatigue (Test method IEC- 60793-1-33): ≥ 20

3.4.5 Fibre Macro bend

(Test method FOTP–62/ IEC- 60793-1–47)

SN	Parameter	A1 Fibre	A2 Fibre
a)	Change in attenuation when fiber is coiled with 10 turns on 15mm radius mandrel	≤ 0.25 dB at 1550nm ≤ 1.0 dB at 1625nm	≤ 0.03 dB at 1550nm ≤ 0.1 dB at 1625nm
b)	Change in attenuation when fiber is coiled with 1 turn around 10mm radius mandrel	≤ 0.75 dB at 1550nm ≤ 1.5 dB at 1625nm	≤ 0.1 dB at 1550nm ≤ 0.2 dB at 1625nm
c)	Change in attenuation when fiber is coiled with 1 turn on 7.5mm radius mandrel		≤ 0.5 dB at 1550nm ≤ 1.0 dB at 1625nm

3.4.7 Fibre Curl (Test method IEC- 60793 – 1- 34) : ≥ 4 Meter radius of Curvature

3.5 Material Properties:

3.5.1 Fibre Materials:

a) The substances of which the fibres are made : To be indicated by the manufacturer

b) Protective material requirement:

i) The physical and chemical properties of the material used for the fibre primary coating and for single jacket fibre. : It shall meet the requirement of fibre stripping force as per clause No. 3.4.2

ii) The best way of removing protective coating material. : To be indicated by the manufacturer

c) Group refractive Index of fibre : To be indicated by the manufacturer

Note: The manufacturer shall indicate the variation in group refractive index of fibre during bulk production.

3.6 Environmental Characteristic of Fibre (Type test):

3.6.1 Operating Temperature (Test Method: IEC – 60793 – 1 - 52)

Temperature Dependence of Attenuation	:	- 60° C to +85° C
Induced Attenuation at 1550nm & 1625nm at -60°C to +85°C	:	≤ 0.05 dB/km

3.6.2 **Temperature – Humidity Cycling** (Test method: EIA/TIA-455-73)

Induced Attenuation at 1550nm & 1625nm at -10°C to +85°C and 95% relative humidity.	:	≤ 0.05 dB/km

3.6.3 **Water Immersion 23°C** (Test method: IEC- 60793 – 1 - 53)

Induced Attenuation at 1550 nm & 1625nm due to Water Immersion at 23 ± 2°C	:	≤ 0.05 dB/km

3.6.4 **Accelerated Aging (Temperature) 85°C:** (Test method IEC- 60793 – 1 - 51)

Induced Attenuation at 1550 nm & 1625nm due to Temperature Aging at 85 ± 2°C	:	≤ 0.05dB/km

3.6.5 **Retention of Coating Color:** (Test method IEC- 60793 – 1 - 51)

Coated Fiber shall show no discernible change in color when aged for relative humidity	:	30 days at 85°C with 95% humidity and then 20 days in 85°C dry heat.

3.7 **Colour Qualification and Primary coating Test:**

3.7.1 **Colour Qualification Test:**

a. **MEK Rub Test (Methyle Ethyl Ketone):**

To be tested by using soaked (Solvent) tissue paper for ten strokes unidirectional on 10 cm length of fibre. No colour traces shall be observed on the tissue paper after testing.

b. Water immersion Test (Type Test):

To be tested for coloured fiber for 30 days. After the test Colour qualification, Attenuation measurement & Strippability test are to be taken.

3.7.2 Primary coating Test (Type Test):

a) Fourier Transform Infrared Spectroscopy (FTIR) Test:

To be tested to check the curing level of coating on the surface of natural fibre. The curing level shall be better than 90%.

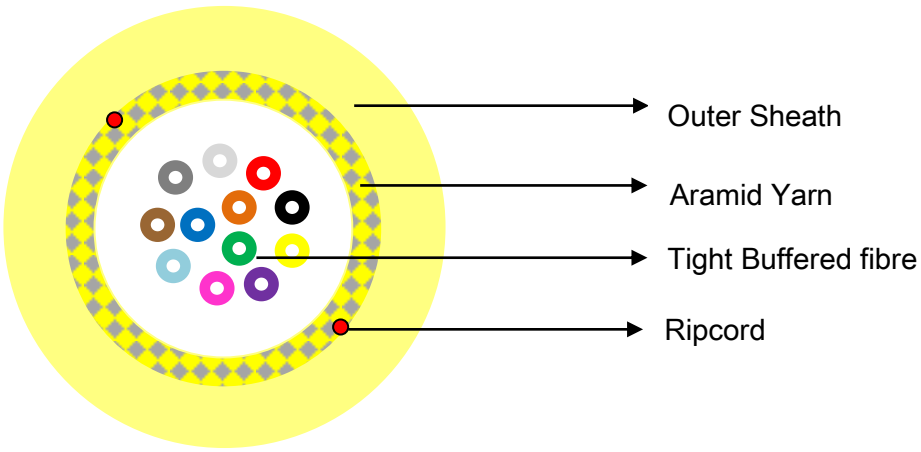
b) Adhesion Test:

To be tested by using soaked (Solvent) tissue paper for ten strokes unidirectional on 10 cm length of fibre. No coating shall be observed on the tissue paper after testing.

3.8 Riser Optical Fibre Cable (Tight Buffer) Construction Specifications (Type-I):

The cable shall be designed to the parameters mentioned in Annexure – I. The manufacturer shall submit design calculation and the same shall be studied and checked.

Typical Structure Drawing for 12F Riser Optical Fiber Cable



3.8.1 **Number of fibres:** 4, 6, 8, 12 & 24 Fibres

3.8.2 **Secondary Protection:**

The primary coated fibres shall be colour coated and tight buffered with LSZH or Nylon-12. The materials used for tight buffer coating shall be as per GR No. TEC/GR/TX/ORM-01/04/SEP-09 and subsequent amendments, if any

3.8.3 **Fibre Reinforcement**:

The tight buffered fibre shall be covered with Aramid yarn Reinforcement which shall be distributed evenly over the entire periphery. The quantity of the fiber reinforcement material (Aramid yarn reinforcement), used per Km length, shall be shall be sufficient enough to meet the tensile requirement as per Annexure- A.

3.8.4 **Outer Sheath:**

A circular sheath, yellow in colour, of LSZH (low smoke zero halogen), free from pinholes and scratches and other defects etc., shall be provided. Thickness of LSZH outer sheath shall be minimum of 1.0 mm.

3.8.5. **RIP Cord :**

a. One Single ply ripcords shall be provided in the cable which shall be used to open the outer sheath of the cable. It shall be capable of consistently slitting the sheath without breaking for a length of 1 meter at the installation temperature.
b. The ripcords used in the cable shall be readily distinguishable from any other components (e.g. Aramid Yarn) utilized in the cable construction.

3.8.6 **Cable diameter:**

The finished cable diameter shall be as per Annexure-A.

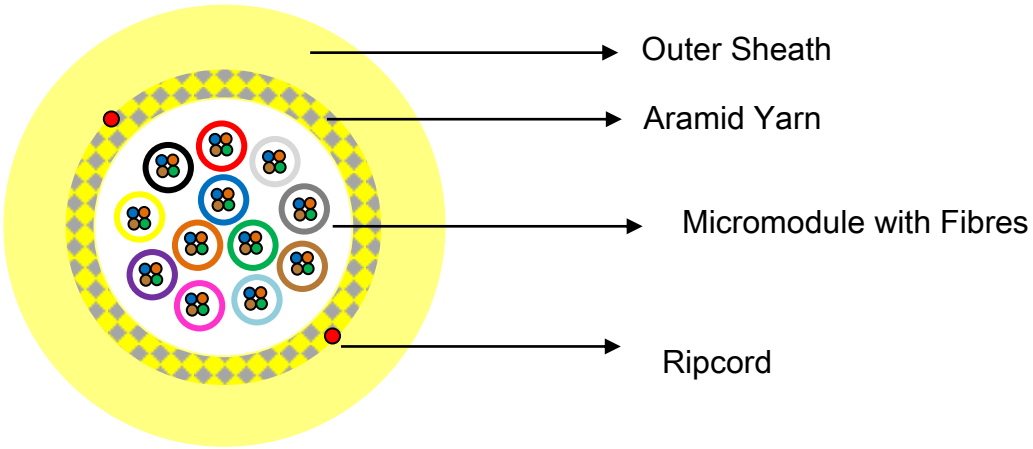
3.8.7 **Cable Weight:**

The nominal cable weight shall be as per Annexure-A.

3.9 Riser Optical Fibre Cable (Micromodule) Construction Specifications (Type-II):

The cable shall be designed to the parameters mentioned in Annexure–B. The manufacturer shall submit designed calculation and the same shall be studied and checked.

Typical Structure Drawing for 48F Indoor Riser Optical Fiber Cable



3.9.1 Micromodule:

The optical element composed of a group of primery coated fibres protected by a thermoplastic sheath of LSZH material, is called Micromodule. No filling compound shall be used. The materials constituting the sheath shall be as per GR No. TEC/GR/TX/ORM-01/04/SEP-09 and subsequent amendments, if any.

It shall be possible to remove the sheath manually by squeezing it between two fingers without pinching it with your finger nails, and pulling on each side of the required break point. Once the sheath has been broken, it shall slide easily over at least 10 cm to expose the end fibres. The fibres shall retain their mechanical strength after this operation. The dimension & physical characteristics of Micromodule design shall be as per Annexure – B.

3.9.2 **Number of fibres**: 4, 8, 12, 24 & 48 Fibres

3.9.3 **Fibre Reinforcement:**

The Micromodule shall be covered with Aramid Yarn Reinforcement which shall be uniformly and equally distributed on the entire periphery (circumference). The quantity of the fibre reinforcement material (Aramid yarn reinforcement) shall be sufficient enough to meet the tensile requirement as per Annexure- B.

3.9.4 **Outer Sheath**:

A sheath of LSZH (Low Smoke Zero Halogen) yellow in colour, free from pinholes and scratches and other defects etc. shall be provided. Thickness of LSZH outer sheath shall be minimum of 1.0 mm.

3.9.5 **Ripcord:**

a. One Single ripcords shall be provided in the cable which shall be used to open the outer sheath of the cable. It shall be capable of consistently slitting the sheath without breaking for a length of 1 meter at the installation temperature.

b. The ripcords used in the cable shall be readily distinguishable from any other components (e.g. Aramid Yarn) utilized in the cable construction.

3.9.6 **Cable diameter:** The finished cable diameter shall be as per Annexure-B.

3.9.7 **Cable Weight:** The nominal cable weight shall be as per Annexure-B.

3.10 Mechanical and Environmental Tests on Riser cables:

The mechanical performance of the cable shall be in accordance with & IEC 60794-1-2 and shall meet the other requirements of the cable as per specifications. The procedures and method of testing are described briefly below.

3.10.1 Tensile Strength Test:

Objective:

The purpose of this test is to measure the behaviour of attenuation as a function of load on the cable.

Test Method: IEC 60794-1-2-E1.

Test Conditions

The cable shall have sufficient strength to withstand a load of value T (N) = 660N (up to 12 fibre cable) and 1320 N (for 24/48 fibre cable). The load shall be sustained for 10 minutes. The attenuation shall be measured before and after completion of the test

Requirement:

There shall not be any permanent physical or optical damage to any component of the cable. The change in attenuation of each fibre shall be ≤0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.2 Compressive Strength Test (Crush Test):

Objective:

The cable designated for specific application shall be capable for withstanding a compressive load without exhibiting an increase in attenuation and physical damage.

Method: IEC 60794-1-2-E-3

Test Spec:

The cable is subjected to a load of 1000 N for Type-I / 500N for Type-II applied in between the plates of dimension of 100mm x 100mm for the duration of 10 minutes. The attenuation shall be measured before and after completion of the test.

Requirement:

There shall not be any optical and physical damage to the cable components. The change in attenuation of each fibre shall be ≤0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.3 Impact Test:

Objective:

The purpose of this test is to determine the ability of the cable to withstand sudden impact on the cable surface.

Method: IEC 60794-1-2-E4

Test Spec:

The cable shall have sufficient strength to withstand an impact caused by a mass weight of 25 Newton for Type-I / 12N for Type-II, when falls freely from a height of 0.5 meters. The radius R of the surface causing impact shall be 300 mm. 10 such impacts shall be applied at the same place. There shall not be any damage to the optical and physical components of the cable. The attenuation shall be measured before and after completion of the test.

Requirement:

The cable outer sheath shall be visually inspected for any splits or cracks. The change in attenuation of each fibre shall be ≤0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.4 Repeated Bending Test:

Objective:

The purpose of this test is to determine the ability of an optical fiber cable to with stand mechanical flexibility with out experiencing an increase in attenuation.

Method:

TIA-EIA 455-104

Test Specs:

The cable under test shall be tested for the flexibility; the cable sample of 5 m or longer length shall be taken to permit the power measurement. The following set up shall be used for the test:

Weight:	2.5Kg
Minimum Distance from Pulley centre to the Holding Device	216 mm
Minimum Distance from Weight to Pulley centre	457 mm
Pulley Diameter	20D
Angle of Turning	90º
No of Cycles	25
Time required for 25 Cycles	2 minutes

Requirement :

During the test there shall be no fiber break and no physical damage to the cable. The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.5 Torsion Test:

Objective:

The purpose of this test is to determine the cable withstanding the twist.

Method:

IEC 60794-1-2- E7

Test Specs:

The cable length of 2 meter shall be subjected to twist of ± 180º with tension on the cable of 50 N. The cycle comprises of twist of 180ºclock wise and anti clockwise from the start position. 10 Such cycles shall be performed on the cable. The twist shall not induce the attenuation. The attenuation shall be noted before and after the completion of the test. There shall not be any optical and physical damage to the cable components.

Requirement:

There shall be no cracks and tearing on the outer sheath of the cable. The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.6 Kink Test:

Objective:

The purpose of this test is to verify whether kinking of an optical fibre cable results in breakage of any fibre, when a loop is formed of dimension small enough to induce a kink on the sheath.

Method:

IEC 794-1-2-E10.

Test Specs.:

The sample length shall be 10 times the minimum bending radius of the cable The sample is held in both hands, a loop is made of a bigger diameter and by stretching both the ends of the cable in opposite direction, the loop is made to the minimum bend radius so that no kink shall form. After the cable comes in normal condition, the attenuation reading is taken.

Requirement:

The kink should disappear after the cable comes in normal condition. The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.7 Low and High Temperature Cable Bend Test (Type Test):

Objective:

The purpose of this test is to determine the ability of an optical fibre cable to withstand bending at low and high temperatures, which might be encountered during cable placement.

Test Method: EIA-RS-455-37A

Test Specs:

The cable under test shall be wrapped to 4 turns on the 20D (D- cable diameter) diameter mandrel. The cable shall be tested at -20º and +70ºC for 12hours each.

Test Temperature	-20º and +70ºC
Mandrel Diameter	20D (D- diameter of cable)
No of Turns	4 Turns
Duration of Test	12 hours at each temperature
Acceptance	Visual test for the damage of the sheath

Requirement:

Sheath shall not show any cracks and damages visible to the naked eye when examined whilst still wrapped on the mandrel. There shall be no permanent physical damage to the cable. The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.8 Temperature Cycling (Type Test):

Objective:

To determine the stability behaviour of the attenuation of a cable subjected to temperature changes, which may occur during storage, transportation and usage.

Method:

IEC 60794-1-2-F1

Test Conditions:

The permissible temperature range of the cable for storage and operation shall be -20°C to +70°C. The rate of change of temperature during the test shall be 1° per minute approx. The cable shall be subjected to temperature cycling for 12 hours at each temperature as given below:

TA2 Temperature:	-20°C.
TA1 Temperature:	-10°C.
TB1 Temperature:	+60°C.
TB2 Temperature:	+70°C.

The test shall be conducted for 2 cycles at the above temperatures. The cable must be able to withstand the temperature cycling without degradation beyond permissible limits.

Requirement:

The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.9 Cable aging Test (Type Test):

Objective:

To check the cable material change dimensionally as the cable ages.

Method:

After completion of temperature cycle test, the test cable shall be exposed to 85 ± 2 degree C for 168 hours. The attenuation measurements are to be made after stabilization of the test cable at ambient temperature for 24 hours.

Requirement:

The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

Note:

The attenuation changes are to be calculated with respect to the base line attenuation values measured at room temperature before temperature cycling.

3.10.10 Damp Heat test (Type Test):

Purpose :

To check the effects on the cable for use and /or storage under conditions of high relative humidity at a constant temperature for a given period.

Method :

IEC 68-2-1

Test Conditions:

a) Temperature : 40°C

b) Relative Humidity : 93% to 95%

c) Exposure time : 4 days.

Requirement :

The attenuation shall be measured before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.11 Minimum Bending Radius of the cable (Cable Bend Test):

Objective:

The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated flexing. The procedure is designed to measure optical transmittance changes and requires an assessment of any damage occurring to other cable components.

Method:

IEC 60794-1-2-E11

Test Specs.:

a) Loaded : 5D (D is the diameter of the cable)

b) Unloaded : 10D (D is the diameter of the cable)

Requirement :

The cable shall not suffer any physical damage under the above conditions. Sheath shall not show any cracks visible to the naked eye when examined whilst still wrapped on the mandrel. The attenuation shall be measured

before and after completion of the test. The change in attenuation of each fibre shall be ≤ 0.1 dB at 1310nm, 1550 nm and 1625nm wavelengths.

3.10.12 Cable Marking :

Objective:

To check the durability of the cable marking.

Test method :

As per section-6 of GR-409-Core (Issue-2) Nov 2008

Test Procedure:

A marked cable specimen shall be soaked in tap water at a temperature of 23± 5°C for a period of 24 hours. The sample shall be then subjected to the marking durability test. (To check the printing the sample shall be rubbed with a dry paper. There shall not be any change in the printing /marking.)

3.10.13 Check of easy removal of sheath:

Objective:

Check of the easy removal of sheath of the fibre optic cable by using normal sheath removal tool.

Procedure:

To check easy removal, the sheath shall be cut in circular way and the about 300 mm length of the sheath should be removed in one operation. It should be observed during sheath removal process that no undue extra force is applied and no component part of the cable is damaged. One should be able to remove the sheath easily.

4.0 Engineering Requirements:

4.1 Cable Marking :

4.1.1 A suitable marking, which can last long, shall be applied in order to identify this cable from other cables. The marking on the cable shall be indelible of durable quality and at regular intervals of one meter length. The accuracy of the sequential marking must be within -0.25% to +0.5% of the actual measured length. The sequential length markings must not rub off during normal installation and in life time of optical fibre cable. The total length of the cable supplied shall not be in negative tolerance.

4.1.2 The marking shall be in black colour over the sheath and shall be done by ink jet printing method. It must clearly contrast with the surface. The colour used must withstand the environmental influences experienced in the field. The marking on the cable shall be permanent, insoluble in water and shall be legible for duration of cable life.

4.1.3 The type of legend marking on the cable shall be as follows :

a) Company Legend
b) Legend containing telephone mark & international acceptable Laser symbol
c) Type of cable: Riser Cable
d) Type of Fibre : G.657A1/A2 fibre
e) Number of Fibres
f) Year of manufacture
g) Sequential length marking
h) Purchaser's Identification
i) Diameter of cable

4.2 Cable ends :

4.2.1 Both cable ends (the beginning end and end of the cable reel) shall be sealed and readily accessible. Minimum 5 meter of the cable of the beginning end of the reel shall be accessible for testing. Both ends of the cable shall be kept inside the drums and shall be located so as to be easily accessible for the test. The drum (conforming to GR No. G/CBD-01/02 Nov. 94 and subsequent amendments, if any) should be marked to identify the direction of rotation of the drum. Both ends of cable shall be provided with cable pulling (grip) stocking. The diameter of the cable shall also be marked on the cable drum.

4.3 Nominal Length of the Cable :

4.3.1 Length of OF Cable in each drum shall be 500 m, 1 Km, 2 Km or as per the order. ± 5% variation in length of optical fibre cable (in each drum) may be acceptable.

4.3.2 The fibres in cable length shall not have any joint.

4.3.3 The drum shall be marked with arrows to indicate the direction of rotation.

4.3.4 Packing list supplied with each drum shall have at least the following information:

a) Drum No.
b) Type of cable
c) Physical Cable length
d) No. of fibres
e) Length of each fibre as measured by OTDR
f) The Cable factor - ratio of fibre / cable length
g) Attenuation per Km. of each fibre at 1310 & 1550 nm
h) User's / Consignee's Name
i) Manufacturer's Name, Month, Year and Batch No.
j) Group refractive index of fibres

k) Purchase Order No.

l) Cable ID

4.4 Colour coding in the OF Cable :

4.4.1 The colorant applied to individual fibres shall be readily identifiable throughout the life time of the cable and shall match and conform to the MUNSELL color standards (For EIA standard EIA-598-C) and also IEC Publication 304 (4).

4.4.2 Colour Coding Scheme for Tight Buffer Riser Cable (TYPE – I)

Depending upon the number of fibres in the cable (which depends on the cable capacity), the color of the tight buffer fibres are serially chosen from the column no. II of the following table.

Colour Coding for Tight Buffer Fibre			
No. of Fiber I	Tight buffered fibre identification II	No. of Fiber I	Tight buffered fibre identification II
1	Blue	13	Blue with Single Strip
2	Orange	14	Orange with Single Strip
3	Green	15	Green with Single Strip
4	Brown	16	Brown with Single Strip
5	Slate	17	Slate with Single Strip
6	White	18	White with Single Strip
7	Red	19	Red with Single Strip
8	Black	20	Light Green with Single Strip
9	Yellow	21	Yellow with Single Strip
10	Violet	22	Violet with Single Strip
11	Rose/Pink	23	Rose/Pink with Single Strip
12	Aqua	24	Aqua with Single Strip

Note:

1. For Ring Marking on Tight Buffer, the marking shall be done with a black ink on the Tight Buffer. It must be stable in time with no risk of transfer from one Tight Buffer to another.

2. For Ring Marking on Tight buffered fibres with transparent (Natural) Nylon-12, the marking shall be done with Black ink on colored fiber. Moreover, Colour coding for fibre no. 20 (Light Green with Single Strip) shall be replaced with Natural fiber with Single Strip.

4.4.3 Colour Coding Scheme for Micromodule Riser Cable (TYPE - II)

i) Depending upon the number of fibres in the micromodule (which depends on the cable capacity), the colour of the fibres is serially chosen from the column no. II of below table. Last fibre in the Micromodule shall be of natural color, while the rest of fibres are colored.

Colour Coding of Fibres in Micromodule	
No. of Fiber (I)	Fibre Colour identification (II)
1	Blue
2	Orange
3	Green
4	Natural

ii) Depending upon the number of micromodules in the cable (which depends on the cable capacity), colour of micromodule are serially chosen from the column no. II of below table:

Colour Coding of Micromodule	
No. of Micromodule (I)	Micromodule Colour identification (II)
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Pink/Rose
12	Aqua

5.0 Quality requirements:

5.1 The cable shall be manufactured in accordance with the international quality standards ISO 9001-2000 for which the manufacturer should be duly accredited. The Quality Manual shall be submitted by the manufacturer.

5.2 Raw Material:

5.2.1 The cable shall use the raw materials approved against the GR TEC/GR/TX/ORM-01/04/SEP-09 and the subsequent amendment issued, if any.

5.2.2 Any other material used shall be clearly indicated by the manufacturer. The detailed technical specifications of such raw materials used shall be furnished by the manufacturer at the time of evaluation/testing.

5.2.3 The raw materials used from multiple sources is permitted and the source / sources of raw materials (Type and grade) from where these have been procured shall be submitted by the manufacturer.

5.2.4 The manufacturer can change the raw material from one approved source to other approved source with the approval of QA wing of purchaser. In case of change of source/grade of SM Optical Fibre, the call for fresh evaluation/testing shall be decided by QA wing of purchaser.

5.2.5 The material used in optical fibre cable must not evolve hydrogen that will affect the characteristics of optical fibres.

Note: A test certificate from a recognised laboratory or institute may be acceptable.

5.3 Cable Material Compatibility:

Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer and other cable materials that are in direct contact with identified components within the cable structure (This shall be tested as per clause no. 6.3.4 of Telecordia document GR-20-CORE issue 2, July 1998).

Note: The tests may be conducted in house (if facility exist) or may be conducted at CACT or any other recognized laboratory. The test certificate may be accepted and the tests may not be repeated subsequently, in next type approvals, if the raw material used is of same make and grade.

6.0 Safety Requirement:

6.1 The material used in the manufacturing of the Riser optical fibre cables shall be non-toxic and dermatologically safe in its life time and shall not be hazardous to health. The manufacturer shall submit MSDS (Material safety Data Sheet) for all the material used in manufacturing of OF Cable to substantiate the statement.

CHAPTER – 2

7.0 Documentation:

7.1 Complete technical literature in English with detailed cable construction diagram of various sub-components with dimensions, weight & test data and other details of the cable shall be provided.

7.2 All aspects of installation, operation, maintenance and fibre splicing shall also be covered in the handbook. The pictorial diagrams of the accessories (with model no. and manufacturer name) supplied along with the cable as package shall be also be submitted. A hard as well as soft copy of the manuals shall be provided.

8.0 Guidelines for Purchaser:

8.1 The purchaser may ask for Type-I (Tight Buffered) or Type-II (Micro-module) Riser Optical Fibre cable as per their requirements. Moreover, type of fibre (G.657.A1 or G.657.A2) may also be decided by purchaser.

8.2 G.657.A1 fibre is more compatible to G.652.D fibre than G.657.A2 fibre but G.657.A2 fibre has better bending properties than G.657.A1 fibre. Therefore, G.657.A2 fiber may be used for the fibre route having too many sharp bends.

8.3 Mechanical strength of Type-I (Tight buffer) Riser cable is better than the Type-II (Micro module) Riser cable as the Diameter and Weight of Type-I cable is more than the Type-II cable. However, Type-II (Micro module) cable requires comparatively less installation time due to easiness in Micro module stripping & its termination.

8.4 The Purchaser may conduct Attenuation measurement tests at a single wavelength (1550nm) during Bulk production.

8.5 Purchaser may conduct Field trial for Type-II (Micro module) Riser optical fibre cable before bulk procurement.

9.0 Procedures for the issue of Approval certificate for Lower Fibre Count Cables

The manufacturer may seek approval certificate for Lower Fibre Count Cables against this GR without conducting the actual tests on the cables only when he is having valid approval certificate for higher fibre count of cable against this GR.

The manufacturer seeking approval certificate for the Lower Fibre Count cable shall apply afresh and submit the documents as per the prescribed approval procedure along with

- List of Raw Materials used, the make and grade of the raw material and the certificate of source approval issued by CACT or any other recognized laboratory along with the details of the raw materials used in the manufacturing of the higher fibre count cable for which he is holding valid approval certificate. Both the raw materials shall be compared and are required to be of same make and grade.
- Samples of at least 5 cable reels (1 Kms each approx.) for each lower fibre count cable.

Any additional information as required may be sought from the manufacturer and the manufactured cable may be inspected at the manufacturer's premises. After all the above requirements are met, the approval certificate may be issued to the lower fibre count of the cable based upon the test results and other details submitted by the manufacturer. The tariff in each case shall be as applicable for category – II.

The following shall be mentioned in the remarks column of the Approval Certificate to be issued for the lower fibre count of the cable:

“This certificate is issued on the basis of certificate No. _____ dated _____ for _____ fibre count cable”.

The validity of the certificate for lower fibre count cables shall be coterminous to the validity of approval certificate of higher fibre count cable.

The above procedure shall be applicable only for the approval of Riser Optical Fibre Cable against this GR and subsequent amendments, if any.

ANNEXURE –A

CABLE DESIGN PARAMETER FOR TIGHT BUFFERED RISER OPTICAL FIBRE CABLE (TYPE-I)

The following parameters of the component parts of the cable are to be taken into account while designing and manufacturing the Riser optical fibre cables of the required fibre count. These parameters shall be checked during evaluation of the OF cables.

Sr. No	Parameter	Unit	4F	6F	8F	12F	24F
1	Tight Buffer Diameter	µm	900±50	900±50	900±50	900±50	900±50
2	No. of TBF	No	4	6	8	12	24
3	Aramid Yarns	Kg/Km	2.6	2.6	2.6	2.6	5.5
4	Cable Diameter	mm	5.5 ± 0.5	6.0 ± 0.5	6.5 ± 0.5	7.5 ± 0.5	9.5 ± 0.5
5	Nominal cable weight	Kg/km	30	35	45	50	80

ANNEXURE – B

CABLE DESIGN PARAMETER FOR MICROMODULE RISER OPTICAL FIBRE CABLE (TYPE-II)

The following parameters of the component parts of the cable are to be taken into account while designing and manufacturing the Riser optical fibre cables of the required fibre count. These parameters shall be checked during evaluation of the OF cables.

Sr. No	Parameter	Unit	4F	8F	12F	24F	48F
1	Micromodule Diameter	µm	900±50	900±50	900±50	900±50	900±50
2	No of Fibre Per Micromodule	No	4	4	4	4	4
3	No of Micromodule	No	1	2	3	6	12
4	Aramid Yarns	Kg/Km	2.6	2.6	2.6	5.5	5.5
5	Cable Diameter	mm	5.5 ± 0.5	6.5 ± 0.5	7.0 ± 0.5	8.0 ± 0.5	9.5 ± 0.5
6	Nominal cable weight	Kg/km	30	35	40	45	60

LIST OF ABBREVIATIONS

ASTM	-	American Society for Testing and Materials
BIS	-	Bureau of Indian Standards
BSNL	-	Bharat Sanchar Nigam Ltd.
EIA	-	Electronic Industry Association
FOTP	-	Fibre Optic Test Procedure
FRP	-	Fibre Reinforced Plastic
GPa	-	Gega Pascal
IEC	-	International Electro -Technical Commission
ISO	-	International Standard Organisations
ITU-T	-	International Telecommunication Union – Transmission
KPSI	-	Kilogram per sq. inch
LSZH	-	Low smoke zero halogen
MFD	-	Mode Field Diameter
Nm	-	nanometer
OF	-	Optical Fibre
ps	-	Pico second
Ps/nm	-	pico second/ nano meter
QA	-	Quality Assurance
QM	-	Quality Manual
RMS	-	Route Mean Square
UL	-	Underwriters Laboratory
UV	-	Ultra Violet