Government of India
Ministry of Communications
Department of Telecommunications
Telecommunication Engineering Centre
K.L. Bhawan, Janpath, New Delhi-110 001.
(Transmission Division)

File No. 1-18/2025-Tx/TEC

Dated: 10.06.2025

Subject: Revision of Generic Requirements(GR) of "Metal Free Optical Fibre Cable(G.652 D Fibre) (GR No. *GR/OFC-17/01. JUN 2007*)" – Inviting comments

In exercise of the powers conferred by rule 5(2) of the Telecommunications (Framework to Notify Standards, Conformity Assessment and Certification) Rules 2025, the draft Standard (Draft Standard No. TEC 85140:2025) in respect of revision of *GR/OFC-17/01. JUN 2007*, is enclosed herewith (**Annexure-I**) for stakeholder consultation. It is requested to go through the aforesaid enclosed draft Standard and offer your inputs/comments. The comments may please be furnished in the template sheet enclosed herewith as **Annexure-II**.

2. The comments/inputs may be furnished through email to *dirt2-tec-dot@gov.in* , *adet-tx-tec-dot@gov.in* , *ratx.tec-dot@nic.in* at the earliest and latest within sixty days please.

Enclosures:

(i) Draft Standard (Draft Standard No. TEC 85140:2025) (**Annexure-I**)
(ii) Template/Format sheet for providing comments(**Annexure-II**)

Mudita Chandra

(Mudita Chandra)
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To,

All Manufacturers & Stakeholders

Copy to:

1. **Sr DDG TEC**
2. **AD(IT), TEC** – with request for uploading on TEC website/Portal
3. **AD(IMP&TEP), TEC** – with request for uploading on TBT Enquiry Point

Annexure-I

वर्गीय आवश्यकताओं के लिए मानक

सं: टीईसी ८५१४०:२०२५०७

(सं: जीआर/ओएफसी-१७/०१. जून २००७ को अधिक्रमित करता है)

STANDARD FOR GENERIC REQUIREMENTS

No.: TEC 85140:202507(Initial Draft)

(Supersedes No.: GR/OFC-17/01. JUN 2007)

धातु मुक्त ऑप्टिकल फाइबर केबल

(जी.६५२ डी फाइबर)

METAL FREE OPTICAL FIBRE CABLE

(G.652 D Fibre)

ISO9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

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Release 21: ……..,2025 ~~June, 2007~~

~~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 document pertains to Standard for Generic Requirements of Metal free Optical fibre cable for underground installation in ducts.

CONTENTS

HISTORY SHEET

Sl. No	*Standard / Document No.~~Standard GR No.~~*	*Title*	*Remarks*
1.	GR/OFC - 17/01. JUN 2007	Metal Free Optical Fibre Cable (G.652 D Fibre)	1st release
2.	Standard No. TEC 85140:2025	Standard for Generic Requirements of Metal Free Optical Fibre Cable	2nd release

REFERENCES

Sl. No	*Document No.*	*Title/Document Name*
1.	TEC 87060:2024 ~~G/OAF-01/02. JUL 2005~~	Standard for Generic Requirements of ~~Specification for~~ Installation Accessories & Fixture For Self Supporting Metal Free Aerial Optical Fibre Cable
2.	TEC 89060:2006 ~~G/OFT-01/03. APR 2006~~	Standard for Generic Requirements of ~~Specification for~~ Tools For Installation & Operating the OFC & for Assembly of the Optical Fibre Splice Closures
3.	TEC 87080:2025 ~~G/OJC-02/02. SEP 2003~~	Standard for Generic Requirements of Splice Closure for Optical Fibre Cables ~~Specification for Optical Joint Closure~~
4.	TEC 89020:2011 ~~G/PTS-01/02. APR 2006~~	Standard for Generic Requirements of Specification Protection Sleeve Optical Fibre (Type-I & Type-II) ~~Specification for Protection Sleeve~~
	TEC 89030:2011	Standard for Generic Requirements of Splice Protection Sleeves for Ribbon Optical Fibre
5.	TEC 89010:2021 ~~G/ORM-01/03. MAR 04~~	Standard for Generic Requirements of Raw Material for manufacturing of

		Optical Fibre Cable. ~~Specification for Raw Material~~
6.	G/CBD-01/02. NOV 94	Generic Requirements of Wooden Cable Drum for Telecom Cables ~~Specification~~ ~~for Wooden Drums~~
7.	QM 333 (or TEC 14016:2010) {Latest issue}	Specification for Environmental testing of electronic equipment for transmission and switching use.
8.	ITU-T G. 652, G.657	ITU-T Recommendations
9.	GR-20 –CORE July 98	Generic Requirement for optical Fibre cable (Telcordia document) ~~(Bell core)~~
10.	~~IEC 60793-1~~	~~Test method for Optical Fibres~~
11.	ISO 9001:2015~~2000~~ or latest issue	International Quality Management System.
12.	EIA 598-D ~~359-A~~ IEC Publication 304(4)	Color Standards ~~Color Standards~~
~~13.~~	~~EIA 455-104,~~ ~~EIA/TIA-455-181,~~ ~~EIA RS-455-37~~	~~Test Methods~~
14.	IEC 811-5-1, IEC 60811-202, IEC 60793-1, IEC 60794-1-21- E1, IEC 60794-1-21-E2, IEC 60794-1-21-E3, IEC 60794-1-21-E4, 60794-1-21-E6, IEC 60794-1-21-E7, IEC 60794-1-21-E10, IEC 60794-1-21-E11, IEC 60794-1-22-F1, IEC 60794-1-22-F~~93~~, IEC 60794-1-22-F5, IEC 60794-1-23-G7, IEC 60794-1-403, IEC 60794-1-22-F16, IEC	Test Methods

	60794-1-219, IEC 62230	
	FOTP-89	Test Methods
	ASTM D-566, ASTM D-790 ASTM-1248, ASTM D-4565	Test Methods

CHAPTER - 1

PART I - TECHNICAL SPECIFICATION

1.0 Introduction :

This document describes the Standard for Ggeneric Rrequirements of Metal free Optical fibre cable (multi loose tube construction design) for underground installation in ducts. The optical fibre cable shall be suitably protected for the ingress of moisture by suitable water blocking materials. flooding jelly. The raw material used in the cable shall meet the requirements of the Standard for GR for raw materials (Standard No TEC 89010:2021 or latest release and subsequent amendments, if any. GR No. G/ORM-01/03. MAR 04).

2.0 Functional Requirements :

2.1 The design and construction of metal free optical fibre cable shall be inherently robust and rigid under all conditions of operation, installation, adjustment, replacement, storage and transport.

2.2 The optical fibre cable shall be able to work in a saline atmosphere in coastal areas and should be protected against corrosion.

2.3 Life of cable shall be at least 25 years. Necessary statistical calculations shall be submitted by the manufacturer., based upon life of the fibre and other component parts of the cable. The cable shall meet the cable aging test requirement.

2.4 It shall be possible to operate and handle the metal free optical fibre cable with tools as per Standard No TEC 89060:2006 (or latest release) GR No. G/OFT-01/03. APR 2006 and subsequent amendments, if any. If Any any special tool is required for operating and handling thise optical fibre cable, the same shall be

provided along with the cable.

2.5 The metal free optical fibre cable supplied shall be suitable and compatible to match with the dimensions, fixing, terminating & splicing arrangement of the splice closure & vice versa. The cable supplied shall also meet other requirement of splice closure as per ~~(~~Standard No TEC 87080:2025 (latest release) ~~GR No.GR/OJC-02/02. SEP 03)~~ and~~&~~ subsequent amendments, if any.

2.6 The manufacturer shall submit an undertaking that the optical and mechanical fibre characteristics shall not change during the life time of the cable against the manufacturing defects.

2.7 It is mandatory that the Optical fibre cable supplied in a particular route is manufactured from a single source of optical fibres.

3.0 Technical Requirements of Optical Fibres :

Single Mode Optical Fibre used in manufacturing optical fibre cables shall be as per ITU-T Rec. G. 652 D and G. 657 A1. The specifications of optical fibres are mentioned below:

3.1 Type of fibre ~~(~~Wavelength band optimized nominal 1310 nm): :
Single mode as per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any.

~~Single mode (Section -I of the GR No.GR/ORM-01/03. MAR 04 and subsequent amendments, if any)~~
~~(Wavelength band optimized nominal 1310 nm)~~

3.2 Geometrical Characteristics of fibre :
As per Section-I of the Standard No. TEC 89010:2021(or latest release) and

subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~3.2.1 Nominal MFD~~

~~For matched clad : 8.8-9.8 µm~~

~~3.2.2 Nominal Cladding Dia. : 125 µm ± 1.0 µm~~

~~3.2.3 Cladding Non-circularity : ≤ 1%~~

~~3.2.4 Mode field concentricity error : ≤ 0.6 µm~~

~~3.2.5 Diameter over primary coated with double UV cured acrylate. : 245 µm ± 10 µm~~

~~(Shall be measured on un coloured fibre)~~

~~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.~~

3.3 Transmission Characteristics of fibre :

As per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~3.3.1 Attenuation :~~

a) Fibre attenuation before Cabling

i) At 1310 nm : ≤ 0.34 dB/Km
ii) Between 1285 to 1360 nm : ≤ 0.37 dB/Km
iii) Between 1480 to 1525 nm : ≤ 0.34 dB/Km
iv) At 1550 nm : ≤ 0.21 dB/Km
v) Between 1525 to 1625 nm : ≤ 0.24 dB/Km

b) Water Peak Attenuation before cabling

Between 1360 – 1480nm : ≤ 0.34 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 (annexed). Hydrogen ageing test is to be carried out by CACT, Bangalore.
2. Sudden irregularity in attenuation shall be less than 0.1 dB
3. The spectral attenuation shall be measured on un-cabled fibre.
4. The Spectral attenuation in the 1250 nm–1625 nm band shall be measured at an interval of 10nm and the test results shall be submitted.

c) Fibre attenuation after cabling

i) At 1310 nm : ≤ 0.36 dB/km
ii) At 1550 nm : ≤ 0.23 dB/Km
iii) At 1625 nm : ≤ 0.26 dB/Km

d) Water Peak Attenuation after cabling

i) At 1383nm : ≤ 0.34 dB/Km

ii) Between 1360 – 1480nm : ≤ 0.34 dB/Km

Note: Water Peak Attenuation after cabling shall be measured either at 1383nm or between 1360 -1480nm.

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

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

b) Polarization mode dispersion at 1310 & 1550 nm
i) Fibre : ≤ 0.2 ps/√ km
ii) Cabled Fibre : ≤ 0.3 ps/√ 'km

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

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

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

3.3.3 Cut off wavelength for fibres used in cables : 1320 nm Max.

Note - The above cut off wavelength is w.r.t. 2M sample length of fibre.

~~3.3.4 Cable Cut off wavelength : 1260nm Max.~~

3.4 Mechanical Characteristics of fibre :

As per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~3.4.1 Proof test for minimum strain level : 1%~~

~~3.4.2 Stripability force to remove primary coating of the fibre. : 1.3 ≤ F ≤ 8.9 N~~

~~Note: 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.~~

~~3.4.3 Dynamic Tensile Strength~~

~~a) Un-aged : ≥ 550 KPSI (3.80 Gpa)~~

~~b) Aged : ≥ 440 KPSI (3.00 Gpa)~~

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

~~3.4.5 Static Fatigue (Test method IEC- 60793 - 1) : ≥ 20~~

~~3.4.6 Change in attenuation measured at 1550 nm when fibre is coiled with 100 turns on 30 +1.0 mm radius mandrel : ≤ 0.05 dB.~~

~~3.4.7 Fibre Curl (Test method as per IEC 60793-1) : ≥ 4 meters radius of curvature~~

~~3.4.8 Fibre micro bend (1 turn-around 32 +0.5 mm diameter mandrel) : ≤ 0.5dB at 1550 nm~~

3.5 Material Properties of fibre :

As per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~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 coating 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)~~ :

As per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~3.6.1 Operating Temperature~~

~~(Test Method IEC – 60793 – 1-52)~~

~~Temperature Dependence of Attenuation : - 60° C to +85° C~~

~~Induced Attenuation at 1550 nm at -60°C to +85° C : ≤ 0.05 dB/km~~

~~3.6.2 Temperature – Humidity Cycling~~

~~(Test method FOTP -73)~~

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

~~3.6.3 Water Immersion 23°C~~

~~(Test method IEC- 60793 – 1 -53)~~

~~Induced Attenuation at 1550 nm 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 due to~~

~~Temperature Aging at 85 ± 2°C : ≤ 0.05 dB/km~~

~~3.6.5 Retention of Coating Color~~

~~(Test method IEC- 60793 – 1 - 51)~~

~~Coated Fiber shall show no discernible : 30 days at 85°C with~~

~~change in color, when aged for 95% Humidity and then~~

~~relative humidity. 20 days in~~

~~85°C dry~~

~~heat.~~

3.7 Colour Qualification and Primary coating Test :

As per Section-I of the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any. All the parametric values shall be as per the Standard for GR for raw materials (Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any)

~~3.7.1 Colour Qualification Test :~~

~~a) MEK Rub Test (Methyle Ethyl Ketone Test) :~~

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

~~b) Adhesion Test :~~

~~To be tested by using soaked (Solvent) tissue paper for ten strokes unidirectional on 10 cm length of fibre.~~

~~c) 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 :~~

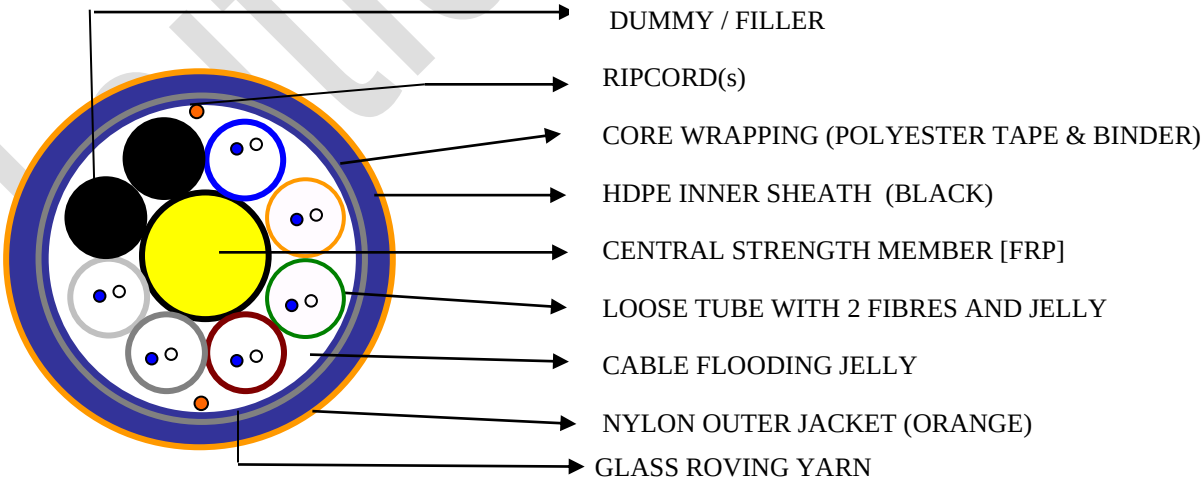
~~a) Fourier Transform Infrared Spectroscopy (FTIR)Test :~~

~~To be tested to check the curing level of coating on the glass. The curing level shall be better than 90%.~~

3.8 Optical Fibre Cable Construction Specifications:

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

TYPICAL STRUCTURAL DRAWING FOR 12 FIBRE OF CABLE



3.8.1 Secondary Protection :

The ~~primary~~ coated fibres shall be protected by loose packaging within a tube, which shall be filled with thixotropic jelly. The tube dimensions shall be as per Annexure – I

3.8.2 Number of fibres : 6,12,24 or 48

(Type approval for a cable shall be issued depending upon the no. of fibres in the cable)

3.8.3 Strength Member :

3.8.3.1 Solid FRP non - metallic strength member shall be used in the center of the cable core. The strength member in the cable shall be for strength and flexibility of the cable and shall have anti buckling properties. The FRP shall keep the fibre strain within permissible values. The strength member shall be as per the Standard No. TEC 89010:2021(or latest release) and the subsequent amendments, if any. The size of FRP shall be as per Annexure - I.

3.8.3.2 ~~Impregnated Glass Fibre Reinforcement are used to achieve the required tensile strength of the optical fibre cables over the cable core to provide peripheral reinforcement along with Solid Rigid FRP Rod in the centre of cable core. These flexible strength members shall be of water blocking type. The use of Solid Rigid FRP Rod(s) is mandatory in Optical Fibre cable design. Impregnated Glass Fibre Reinforcement used shall be equally distributed over the periphery of the cable core. The quantity of the Impregnated Glass Fibre Reinforcement used per km length of the cable along with its dimensions shall be indicated by the manufacturer. The specification of the glass roving shall be as per as per Section XII of GR no. G/ORM-01/03. MAR 2004 and as per other details given in the annexure –I.~~

3.8.4 **Cable Core Assembly :**

The primary coated fibres in loose tubes, stranded together around a central strength member (solid FRP rod) using helical or reverse lay techniques, shall form the cable core. The dimension of FRP and stranding pitch shall be as per annexure -I~~1~~.

3.8.5 **Core Wrapping:** The main cable core ~~containing fibres~~ shall be wrapped by a layer/layers of Polyester foil/tape. The Polyester foil/ tape shall be as per Section-X of Standard No. TEC 89010:2021(or latest release) and the subsequent amendments, if any. The Nylon/polyester binder thread shall be used to hold the tape, if required. The nylon/polyester binder thread shall be as per Section-IX of Standard No. TEC 89010:2021(or latest release) and the subsequent amendments, if any. The core wrapping shall not adhere to the secondary fibre coating and shall not leave any kink marks over the loose tubes.

3.8.6 **Moisture barrier (protection)**: The main cable core (containing Tube/FRP & Core wrapping) shall be protected by thixotrophic flooding compound (Jelly) having properties of non hygroscopic dielectric material.

3.8.7 **Filling and flooding compound:** The filling/flooding compound used in the loose tube and in the cable core shall be compatible to fibre, secondary protection of fibre, core wrapping and other component parts of the cables. The drip point shall not be lower than +70 ~~degree C~~°C. The fibre movement shall not be constrained by stickiness and shall be removable easily for splicing. The test method to measure drop point shall be as per ASTM D 5665~~6~~. The filling and the flooding jelly compound shall be as per the Standard No TEC 89010:2021 (or latest release) ~~GR no. G/ORM - 01/03. MAR 2004~~ and subsequent amendments, if any.

Glass Reinforcement:

Impregnated Glass Fibre Reinforcement are used to achieve the required tensile strength of the optical fibre cables over the cable core to provide peripheral reinforcement along with Solid Rigid FRP Rod in the centre of cable core. These flexible strength members shall be of water blocking type. The use of Solid Rigid FRP Rod(s) is mandatory in Optical Fibre cable design. Impregnated Glass Fibre Reinforcement used shall be equally distributed over the periphery of the cable core. The quantity of the Impregnated Glass Fibre Reinforcement used per km length of the cable along with its dimensions shall be as per Annexure – I. ~~indicated by the manufacturer~~. The specification of the glass roving shall be as per as per Section XII of TEC 89010:2021(or latest release) and the subsequent amendments, if any ~~GR no. G/ORM-01/03. MAR 2004~~ and as per other details given in the Aannexure –I.

3.8.8 Inner Sheath :

A non Metallic moisture barrier sheath may be applied over and above the cable core. The core shall be covered with tough weather resistant High Density Polyethylene (HDPE) sheath, black in color (UV stabilized). ~~The colour shall confirm to Munsell colour standards.~~ Thickness of the sheath shall be uniform and shall not be less than 1.8 mm. The sheath shall be circular, Smooth, free from pin holes, joints, mended pieces and other defects. Reference test method to measure thickness shall be as per IEC 60811-202.~~189 para 2.2.1 and para 2.2.2.~~

Note : HDPE material, black in colour, from the finished cable shall be subjected to following tests (on sample basis) and shall confirm to the requirement of the material as per as per Section III of Standard No. TEC

89010:2021(or latest release) and the subsequent amendments, if any. ~~the GR no. G/ORM-01/03. MAR 2004 :~~

i) Density
ii) Melt Flow Index
iii) Carbon Black Content
iv) Carbon Black Dispersion
v) ESCR
vi) Moisture Content
vii) Tensile Strength and Elongation at break
viii) Oxidative Induction time
ix) Absorption Coefficient
x) Brittleness Temperature

3.8.9 Outer Jacket (Sheath) :

A circular sheath/Jacket of not less than 0.65 mm thick of Polyamide-12 /Nylon–12 material orange in colour, free from pin holes, scratches and other defects etc. shall be provided over and above the HDPE sheath. The Nylon Jacket shall have smooth finish.

3.8.10 RIP Cord :

a) Two suitable rip cords shall be provided in the cable which shall be used to open the HDPE sheath of the cable. The rip cords shall be placed diametrically opposite to each other. It shall be capable of consistently slitting the sheath without breaking for a length of 1 meter at the installation temperature. The rip cords (3 ply & twisted) shall be properly waxed to avoid wicking action and shall not work as a water carrier.

b) The rip cord used in the cable shall be readily distinguishable from any other components utilized in the cable construction.

3.8.11 Cable diameter : The finished cable diameter shall be as per Annexure –I.

3.8.12 Cable Weight : The nominal cable weight shall be as per Annexure -I

4.0 Mechanical Characteristics and Tests on Optical Fibre Cable :

4.1 Tensile Strength Test:

Objective : This measuring method applies to optical fibre cables which are tested at a particular tensile strength in order to examine the behavior of the attenuation as a function of the load on a cable which may occur during installation.

Test Method : IEC 60794-1-21-E1.

Test Specs. : The cable shall have sufficient strength to withstand a load of value T(N) = 9.81 x 2.5 W Newtons or 2670 N whichever is higher (where W-mass of 1 Km of cable in Kg). The load shall be sustained for 10 minutes and the strain on the fibre and the attenuation shall be monitored.

Requirements : The load shall not produce a strain exceeding 0.25% in the fiber and shall not cause any permanent physical and optical damage to any component of the cable . The attenuation shall be noted before strain and after the release of strain. The change in

attenuation of each fiber after the test shall be ≤ 0.05 dB both for 1310nm & 1550 nm wavelengths.

~~**Note :** The value of necessary correction factor (K factor) of used fibre (under measurement) taken into account by the cable manufacturer during fibre strain measurement shall be indicated by the manufacturer for correction to be made in the results such obtained, if applicable.~~

4.2 Abrasion Test :

Objective : To test the abrasion resistance of the sheath and marking printed on the surface of the cable.

Test Method : IEC-60794-1-21-E2 ~~or by any other international test method (ETSI).~~

The cable surface shall be abraded with needle (wt. 150 gm) having diameter of 1 mm with 500 grams weight (Total weight more than equal to 650 gms.).

Test Specs : No. of cycles : ~~50~~100

Duration : One minute (Nominal)

Requirement : There shall be no perforation and loss of legibility of the marking on the sheath.

4.3 Crush Test (Compressive test):

Objective: The purpose of this test is to determine the ability of the optical fibre cable to withstand crushing.

Test Method : IEC-60794-1-21-E3.

Test Specs : The fibers and component part of the cable shall not suffer permanent damage when subjected to a compressive load of 2000 N applied, between the plates of dimension 100 X 100 mm. The load shall be applied for 60 Seconds. The attenuation shall be noted before/after the completion of the test.

Requirement :The change in attenuation of the fibre after the test shall be ≤ 0.05 dB~~,~~ both for 1310nm and 1550nm wavelengths.

4.4 Impact Test :

Objective: The purpose ~~if~~ of this test is to determine the ability of an optical fiber cable to withstand the impact.

Test Method : IEC 60794 -1- 21-E4

Test Specs : The cable shall have sufficient strength to withstand an impact caused by a mass weight of 50 Newton, when falls freely from a height of 0.5 meters. The radius `R' of the surface causing impact shall be 300 mm. 10 ~~Ten~~ such impacts shall be applied ~~at~~ on different places typically spaced not less than 500mm apart ~~the same place~~. The attenuation shall be noted before and after the completion of the test.

Requirement : The change in attenuation of the fibre after the test shall be ≤ 0.05 dB, both for 1310nm and 1550nm wavelengths.

4.5 Repeated Bending Test :

Objective : The purpose of the test is to determine the ability of an optical fiber cable to withstand repeated bending.

Test Method : ~~EIA-455-104~~ IEC 60794-1-21-E6

Test Specs. : The cable sample shall be of sufficient length (5 m minimum) to permit radiant power measurements as required by this test. Longer length may be used, if required.

Parameters :

a) Weight : 5 Kg or as per FOTP-104 whichever is higher

b) Minimum distance from Pulley centre to holding device : 216 mm

c) Minimum distance from Wt. to Pulley centre : 457 mm

d) Pulley Diameter. ~~(D - cable diameter)~~ : 20 D (D - cable diameter)

e) Angle of Turning : 90°

f) No. of cycles : 30

g) Time Required for 30 cycles : 1 minutes to 2 minutes

h) Length of Cable sample : 5m (minimum)

Requirement : During the test no fiber shall break and the attenuation shall be noted before and after the completion of the test. The change in attenuation of the fibre after the test shall be less ≤ 0.05 dB, both for 1310 and 1550nm wavelengths.

4.6 Torsion Test :

Object : The purpose of this test is to determine the ability of an optical fibre cable to withstand torsion.

Method : IEC 60794-1-21-E7.

Test Specs. : The length of the specimen under test shall be 2 meters and the load shall be 100 N. The sample shall be mounted in the test apparatus with cable clamped in the fixed clamp, sufficiently tight, to prevent the movement of cable sheath during the test. One end of the cable shall be fixed to the rotating clamp, which shall be rotated in a clock wise direction for one turn. The sample shall then be returned to the starting position and then rotated in an anti-clock wise direction for one turn and returned to the starting position. This complete movement constitutes one cycle. The cable shall withstand ten such complete cycles. The attenuation shall be noted before and after the completion of the test.

Requirement : The cable shall be examined physically for any cracks, tearing on the outer sheath and for the damage to other component ports of the cable. The twist mark shall not be taken as damage. The change in attenuation of the fibre after the test shall be ≤ 0.05 dB, both for 1310 nm and 1550 nm wave lengths.

4.7 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 60974-1-21-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 change in attenuation of the fibre after test shall be ≤ 0.05 dB, both for 1310 nm & 1550 nm wavelengths.

4.8 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 60794-1-21-E11 (Procedure-I).

Test Specs. : The fibre and the component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and

unwrapped 4 complete turns of 10 complete cycles around a mandrel of 20 D, where D is the diameter of the cable. The attenuation shall be noted before and after the completion of the test.

Requirement : The change in attenuation of the fibre after the test shall be ≤0.05 dB, both for 1310 nm and 1550 nm wavelengths. The sheath shall not show any cracks visible to the naked eye, when examined whilst still wrapped on the mandrel.

4.9 Temperature Cycling (Type Test) :

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

Method : IEC 60794-1-22-F1. (To be tested on Standard cable length of drum i.e 2 Km ± 5% .)

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

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

The test shall be conducted for 2 cycles at the above temperatures.

Requirement : The change in attenuation of the fibre under test shall be ≤ 0.05 dB, both for 1310 nm and 1550 nm wavelengths for the entire temperature range.

4.10 Cable aging Test (Type Test) :

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

Method : IEC 60794-1-22-F9

~~Method~~Test Specs : At the completion of temperature cycle test, the test cable shall be exposed to 85 ± 2 ~~degree C~~°C for 168 hours. The attenuation measurement at 1310 & 1550 nm wave length to be made after stabilization of the test cable at ambient temperature for 24 hours.

Requirement : The increase in attenuation allowed ≤ 0.05 dB at 1310 nm & 1550 nm

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

4.11 Water Penetration Test (Type Test) :

Objective : The aim of this test is to ensure that installed jelly filled Metal Free Optical Fibre cable will not allow water passage along its length.

Method : IEC 60794-1-22-F5 ~~(Fig. B) 1992.~~

Test Specs. : A circumferential portion of the cable end (with HDPE sheath, after removing the nylon jacket) shall face the water head. The water tight sleeve shall be applied over the cable. The cable shall be supported horizontally and two meter water head containing sufficient quantity of water soluble fluorescent dye for the detection of seepage, shall be applied on the HDPE sheath for a period of 7 (seven)~~–~~ days, at ambient temperature. No other coloured dye is permitted.

Requirement : No dye shall be detected when the end of the 3m length cable sample is examined with ultraviolet light detector. ~~The cable sample under test shall be ripped open after the test and then it shall be examined for seepage of water into the cable and the distance to be noted. It shall not be more than 20 cm.~~

4.12 Flexural Rigidity Test on the optical fibre cable (Type Test) :

Objective : To check the Flexural Rigidity of the metal free optical fibre cable .

Method : To be tested as per ASTM D –790

Test Specs : The fibre and the component parts of the cable shall not suffer permanent damage in the cable when subjected to Flexural

Rigidity Test as per the above method. The attenuation shall be noted after and before the completion of the test.

Requirement : The change in attenuation of the fibre after the test shall be ≤ 0.05 dB, both for 1310 nm and 1550 nm wavelength. The sheath shall not show any cracks visible to the naked eye.

4.13 Test of Figure of 8 (Eight) on the cable (Type Test) :

Objective : Check of easiness in formation of figure of 8 of the cable during installation in the field.

Test Method : 1000 meter of the cable shall be uncoiled from the cable reel and shall be arranged in figure of 8 (eight) shape. The dimensions of each loop of the figure of 8 shall be maximum 2 meters.

Requirement : It shall be possible to make figure of 8 of minimum 1000 meters of the cable uncoiled from the cable reel, without any difficulty. No visible damage shall occur.

4.14 Static Bend test (Type Test) :

Objective : To check the cable under Static bend

Method : As per the clause no 4.8 of the GR or alternatively as per ASTM D790.

Test Specs : The cable shall be subjected to static bend test. The optical fibre cable shall be bend on a mandrel having a diameter of 10 D (D - is diameter of the cable).

Requirement : The change in attenuation of the fibre after the test shall be ≤ 0.05 dB both for 1310 nm and 1550 nm wavelength. Sheath shall not show any cracks visible the naked eye when examined whilst still wrapped on the mandrel.

~~4.15 Fibre curl (Type Test) :~~

~~**Objective** : To determine the fibre curl of the fibres of the Metal free optical fibre cable.~~

~~**Method** : IEC 60793 –1-34 , FOTP III~~

~~(Measurement of the deviation on the 10mm free fibre using Dual Beam differential laser triangulation is conducted. Two laser spots accurately separated on the fibre sample by 10mm, are recorded on a linear CCD array during motorized rotation of the fibre. The fibre is held in a special mandrel with fast loading and simple fibre location.)~~

~~**Requirement** : It shall be ≥ 4 meter radius of curvature~~

4.16 Cable Sheath Yield Strength And Ultimate Elongation :

Objective: To check the yield strength and elongation of polyethylene (HDPE) cable sheath.

Test Method : FOTP-89 or ASTM D1248 Type III Class.

Test Condition :

1) Sample shall be taken from a completed cable (The nylon to be removed for this test). The aged sample shall be conditioned at 100 $\pm$ 2^0 C for 120 hours before testing.

2) The cross-head speed shall be 50 mm per minute.

Requirement :

Sheath Material	Minimum Yield Strength		Minimum Elongation (%)
	(MPa)	(psi)	
HDPE un-aged	16.5	2400	400
HDPE aged	12.4	1800	375

4.17 To check of the quality of the loose tube (containing optical fibre) (Type Test) :

a. Embrittlement Test method

This test method is based on bending by compression and reflects embrittlement much better than the other tensile tests. This test is independent of wall thickness of the loose tube.

Sample : The minimum length of the test sample depends on the outside diameter of the loose tube and should be 85 mm for tubes upto 2.5 mm outside dia. The length of the bigger tubes should be calculated by using the following equation :

$$Lo > 100 \times \sqrt{\frac{(D^2 + d^2)}{4}}$$

Where Lo = Length of tube under test.

D = Outside dia of loose tube.

d = Inside dia of loose tube.

Procedure : Both the ends of a buffer tube test sample may be mounted in a tool, which is clamped in jaws of a tensile machine which exerts a constant rate of movement. The movable jaw may move at a rate of 50 mm per minute toward the fixed jaw. Under load, the tube will bend so that it is subjected to tensile and compressive stresses. The fixture for holding the tube should be designed in a manner that the tube might bend in all directions without further loading.

Requirement: The tube should not get embrittled. No kink should appear on the tube up to the safe bend ~~dia~~ diameter of tube (15 D), where D is the outside diameter of the loose tube. There should also not be any physical damage or mark on the tube surface.

b. Kink Resistance Test method :

Objective : To safeguard the delicate optical fibres, the quality of the loose tube material should be such that no kink or damage to the tube occur while it is being handled during installation and in splicing operations.

Method: IEC 60794-1-23-G7

Procedure : To check the kink resistance of the loose tube, a longer length of the loose tube is taken (with fibre and gel), a

loop is made and loop is reduced to the minimum bend radius of loose tube i.e. 15 D (where D is the out side dia. of the loose tube). This test is to be repeated 4 times on the same sample length of the loose tube.

Requirement : No damage or kink should appear on the surface of the tube.

4.18 Drainage Test for loose Tube and Drip test on the cable (Type Test) :

a) Drainage Test for loose Tube

Sample Size : 30 cm tube length.

Test procedure :

i. Cut the tube length to 40 cm.

ii. Fill the tube with the tube filling gel ensuring that there are no air bubbles and the tube is completely full.

iii. Place the filled tube in a horizontal position on a clean worktop and cut 5 cm from either end so that the finished length of the sample is 30 cm.

iv. Leave the filled tube in a horizontal position at an ambient temperature for 24 hrs.

v. The sample tube is then suspended vertically in an environment heat oven over a weighed beaker. It is left in the oven at a temperature of 70° C for a period of 24 Hrs.

vi. At the end of the 24 Hrs period the beaker is checked and weighed to see if there is any gel in the beaker.

Requirement :

i. If there is no gel or oil in the beaker the tube has PASSED the drainage test.

ii. If there is gel or oil in the beaker the tube has FAILED the drainage test.

b) New clause : Drip test on the cable

Objective: The purpose of this test is to determine the ability of jelly in the O.F. cable to withstand a temperature of 70 °C.

Method: IEC 60794-1-22-F16

Test Specs.: Take a sample of 30 cm length of the cable with one end sealed by end cap. Remove outer jacket, binder tapes for 5 cm from open end of the sample. Clean the jelly. Then the sample is kept vertically with open end downwards in the oven for 24 hours at 70o C with a paper under the sample.

Requirement: Examine the paper placed below the cable inside the oven for dripping of the jelly after 24 hours. There should be no jelly drip or oily impression on the paper.

4.19 Check of easy removal of sheath :

Objective : Check of the easy removal of sheath of the optical fibre 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).

Note : Easy removal of both the outer jacket and the inner sheath shall be checked separately.

4.20 Check of Effect of aggressive media on the cable surface (Acidic and alkaline behavior) (Type Test) :

Procedure : To check the effect of aggressive media, solution of PH4 and PH10 shall are made. The two test samples of the finished cable, each of 600 mm in length, are taken and the ends of the samples are sealed. These test samples are put in the PH4 and PH10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc on the sheath and other markings of the cables. (Test method no. ISO175).

Requirement : The sample should not show any effect of these solution on the sheath and other marking of the cable.

~~PART II - GENERAL REQUIREMENTS~~

5.0 Engineering Requirements :

5.1 Cable Marking :

5.1.1 A long lasting suitable marking shall be applied in order to identify this cable from other cables. The cable marking shall be imprinted (indented). 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.

5.1.2 The marking shall be in black colour over the orange colour nylon jacket and shall be done by hot foil indentation method. It must clearly contrast with the surface. The colour used must withstand the environmental influences experienced in the field:

5.1.3 The type of legend marking on O.F. cable shall be as follows:

a) Company Legend
b) Legend containing telephone mark & international acceptable Laser symbol
c) Type of Fibre – G.652 D/ G.657 A 1
d) Type of cable
e) Number of Fibres
f) Year of manufacture
g) Sequential length marking
h) User's identification
i) Cable ID

5.2 **Cable Ends:**

5.2.1 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 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 (or latest release) 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 and the anti twist device (free head hook). The wooden drums shall be properly treated against termites and other insects during transportation and storage. The manufacturer shall submit the methodology used for the same.

5.2.2 An anti twist device (Free head hook) shall be provided attached to the both the ends of the cable pulling arrangement. The arrangement of the pulling eye and its coupling system, along with the anti twist system, shall withstand the prescribed tensile load applicable to the cable.

5.3 **The nominal drum length:**

5.3.1 Length of OF Cable in each drum shall be 2 Km ~~± 5 %~~ / 4Km ~~± 5%~~ / 8Km ~~± 5%~~ / 10Km ~~± 5%~~. and shall be supplied as per the ~~-~~order. The variation in length of optical fibre cable in each drum shall be ± 5% to ±10%, as decided by the purchaser . Purchaser may at their discretion procure shorter length cable drum as per their requirement. ~~; as specified above (in each drum), shall be acceptable.~~

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

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

5.3.4 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

5.4 Colour coding in the OF Cable :

5.4.1 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-D~~359-A~~) or IEC Publication 304 (4).

5.4.2 Colour Coding Scheme :

When the loose tubes are placed in circular format, the marking to indicate the loose tube no. "1" shall be in blue colour followed by loose tube no.2 of orange and so on for other tubes as per the colour scheme given below at Table-1 and complete the circular format by placing the dummy /fillers at the end.

Table -1 : Colour Coding scheme of Loose tube

Loose tube No./Sequence	Loose tube identification
1	Blue
2	Orange
3	Green
4	Brown
5	Slate

6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose/Pink
12	Aqua

Depending upon the number of fibres in a loose tube (which depends on the cable capacity), the fibres within each loose tube are serially chosen starting from blue colour as per the colour scheme given below at Table-2 ~~from the column no. II of the following table~~. Last o~~O~~ne of the fibres in a tube shall be of natural color, while the rest of fibres are colored.

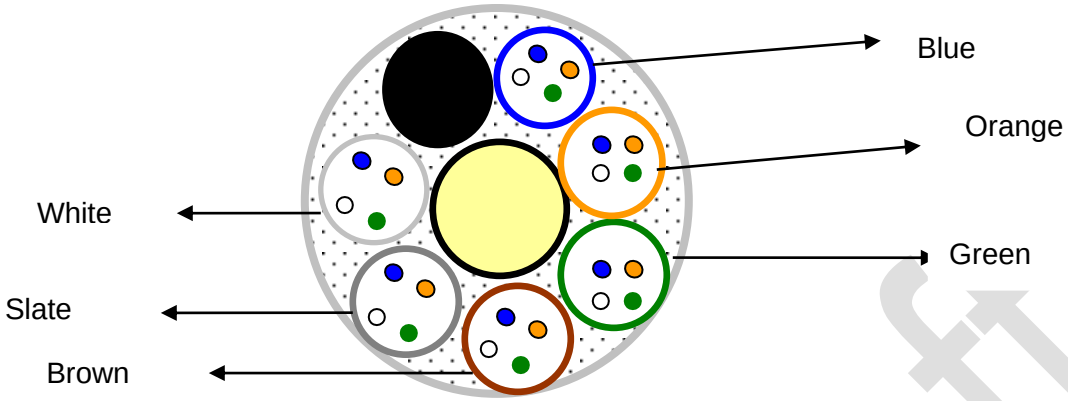
Table -2 : Colour Coding scheme of the Optical Fibre within Loose tube

Fibre No./Sequence within loose tube	Fibre identification
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose/Pink
12	Natural

~~Table -1 : Colour Coding scheme of the Optical Fibres & Loose tube~~

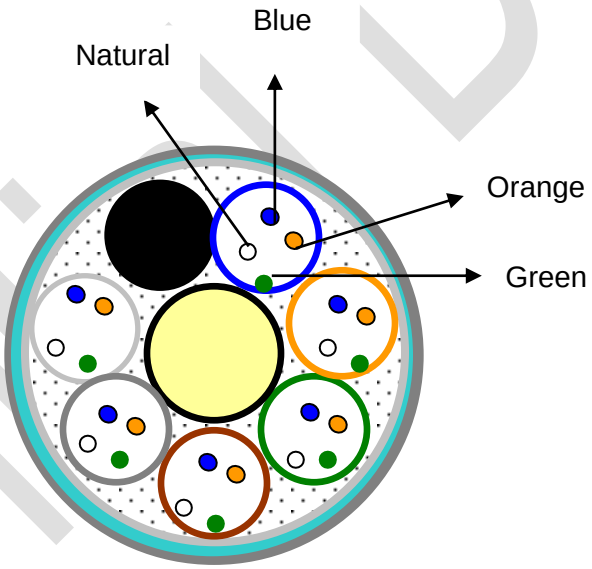
~~No.of Fibers/Buffer tube~~ ~~I~~	~~Fiber identification~~ ~~II~~	~~Loose tube identification~~ ~~III~~
~~1~~	~~Blue~~	~~Blue~~
~~2~~	~~Orange~~	~~Orange~~
~~3~~	~~Green~~	~~Green~~
~~4~~	~~Brown~~	~~Brown~~
~~5~~	~~Slate~~	~~Slate~~
~~6~~	~~White~~	~~White~~
~~7~~	~~Red~~	~~Red~~
~~8~~	~~Black~~	~~Black~~
~~9~~	~~Yellow~~	~~Yellow~~
~~10~~	~~Violet~~	~~Violet~~
~~11~~	~~Rose/Pink~~	~~Rose/Pink~~
~~12~~	~~Aqua/Natural~~	~~Aqua~~

Color coding of Loose Tubes for 24 fibres (Refer Table 1)



(Loose Tube Colour: Blue, Orange, Green, Brown, Slate, White)

Color coding of 24 Fibres within Loose Tubes (Refer Table-~~-~~2 ~~1~~)



(Fiber Colour : Blue , Orange, Green, Natural)

6.0 Quality Requirements :

6.1 The cable shall be manufactured in accordance with the international quality standards ISO 9001-2015 ~~2000~~(or latest issue) for which the manufacturer should be duly accredited. The Quality Manual shall be submitted by the manufacturer.

6.2 Raw Material:

6.2.1 The cable shall use the raw materials approved against the Standard No TEC 89010:2021 (or latest issue) ~~GR No. GR/ORM-01/03. MAR. 04~~ and the subsequent amendments issued, if any. The list and details of the Raw Materials used, the make and grade of the raw material and valid certificate of source approval issued by CACT or any other Conformity Assessment Body (CAB) recognized by TEC, shall be submitted by the manufacturer.

6.2.2 ~~The material used, other than above~~ Any other materials use~~,~~ 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. ~~Type Approval.~~

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

6.2.4 The manufacturer can change the raw material from one approved source to other approved source with the approval of QA, wing of purchaser ~~BSNL~~. The ~~In case of~~ change of source/grade of SM Optical Fibre and/or design of cable shall ~~,~~ ~~the~~ call for fresh type approval/certification. The clauses 10.2 and 10.3 of this Standard for GR shall facilitate the clause 6.2.4 of this Standard for GR, in order to simplify the certification process and to avoid repetitive testing. ~~TSEC shall be decided by QA, BSNL.~~

6.2.5 The HDPE, Black in colour used for sheath shall be UV stabilized.

Note: Test certificate from CACT or any Conformity Assessment Body(CAB)

recognized by TEC may be acceptable for the UV stability of the HDPE sheath material. Source Approval Certificate(SAC) issued by CACT against Standard No. TEC 89010:2021(or latest release) for the HDPE raw material used, indicating UV stabilized grade, may also be acceptable in this respect.

~~a recognized laboratory or institute may be acceptable for UV stability test of the HDPE sheath material.~~

6.2.6 The material used in optical fibre cable must not evolve hydrogen that will affect the fibre loss.

Note: A t~~T~~est certificate from a recognized laboratory or institute may be acceptable.

6.3 Cable Material Compatibility :

Optical fibre, buffers/core tubes, and other core components shall meet the requirements of the compatibility with buffer/core tube filling material(s) and/or water-blocking 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 4~~2~~, July 2013 or as per IEC 60794-1-219). ~~July 1998).~~

Note : The tests may be conducted in house (if facility exist) or may be conducted at CACT any Conformity Assessment Body(CAB) recognized by TEC.~~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.

7.0 Safety Requirements:

7.1 The material used in the manufacturing of the Optical fibre cables shall be non-toxic and dermatologically safe in its lifetime 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.

Note: Latest issue of the Standards mentioned in the GR, may be referred.

CHAPTER - 2

~~8~~7.0 Documentation:

~~8~~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.

~~8~~7.2 All aspects of cable 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.

9.0 New clause: Information for the Procurer/User:

9.1 It is suggested that the Optical fibre cable supplied in a particular route is manufactured from a single source of optical fibres.

9.2 User shall check for compatibility issues that may arise because of different fibre types and MFD mismatch.

10.0 New clause: Procedure for issue of Approval Certificate

10.1 The approval certificate against this Standard for GR shall be issued subsequent to successful testing against the clauses of this Standard.

10.2 Single Mode Optical Fibre used in manufacturing optical fibre cables shall be as per ITU-T Rec. G.652 D or G.657 A1. The manufacturer having a valid approval certificate against this Standard for GR for cable of specific fibre count and specific fibre type, may also seek approval certificate for cable having same fibre count but different fibre type, provided the manufacturer gets testing done for all corresponding and concerned parameters. This will be applicable when there is change only in the fibre type while all other cable design parameters and fibre count remain the same.

10.3 The manufacturer having valid approval certificate against this Standard for GR for cable with higher fibre count and specific fibre type, may seek approval certificate for cable with lower fibre count without conducting actual tests, provided that all cable design parameters including the fibre type being same.

10.4 The clauses 10.2 and 10.3 shall be read in conjunction with the clause 6.2.4.

~~8.0 Safety Requirement:~~

~~The material used in the manufacturing of the metal free 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~~.

~~9.0 Field Trial Test :~~

~~Field trial test for cables is to be conducted for four weeks in integration with FDMS for minimum 10 Km of cable route. The cable shall be laid in the field of~~

Telecom network and installed along with the FDMS equipment of the purchaser. The FDMS equipment shall be as per the latest GR for cables. Any problem noticed in terms of increase in loss or change in cable/ fibre characteristics shall be corrected / incorporated by the cable supplier and re-offered for A/T. Carrying successful A/T of the cable shall be essential for the Type Approval Certificate.

Annex B
(Informative)

HYDROGEN AGEING

Technical note: This test is under consideration and evaluation for category B 1.3 fibres. It is not intended for specification of other fibre categories.

Select a fibre specimen at least 1 km long. After spooling the fibre to a test configuration that minimises the effect of winding on attenuation at λ_y nm, measure the attenuation coefficient of the specimen at 1240 nm and at λ_y nm. This measurement gives the baseline attenuation for the specimen. Expose the fibre to 0.01 atmospheres of hydrogen at room temperature. During this exposure, monitor the attenuation coefficient of the specimen at 1240 nm. This wavelength is indicative of the molecular hydrogen present in the specimen. Constructing the change in attenuation as the monitored results minus the baseline value, continue exposure until the 1240 nm attenuation changes by $\geq$ 0. 03 dB/km. At this time, the attenuation increase at λ_y may be considered fully saturated, and the specimen may be removed from the hydrogen atmosphere. After at least 14 days in the normal laboratory environment, measure the attenuation coefficient of the fibre at λ_y using methods A, B or C of IEC 60793-1-40.

~~**NOTE 1** This is a type test performed periodically to ensure that the manufacturing process reliably yields fibre with acceptable ageing characteristics. For example, 10 fibre samples may be tested every six months.~~

~~**NOTE 2** This test is not appropriate for hermetically coated fibre.~~

~~**NOTE 3** For non-hermetic fibres, typical hydrogen exposure time is from four to six days.~~

Procedures for the issue of Type Approvals of Metal Free Optical Fibre Cables (G. 652 D Fibre) against GR No. GR/OFC-17/01. JUN 2007

For the issue of TAC/TSEC for Low Fibre Count of Metal Free Optical Fibre Cables (G.652 D Fibre) against GR No. GR/OFC-17/01. JUN 2007 to the manufactures having valid TAC/TSEC for higher fibre count of Metal Free Optical Fibre cables against this GR without conducting the actual tests on the cable, following is stated :

i) The manufacturer may seek Type Approval of Metal Free Optical Fibre Cables (G.652 D Fibre) against GR No. GR/OFC-17/01. JUN 2007 for the respective fibre count of 6, 12, 24 & 48 fibres.

ii) The Metal Free Optical Fibre Cables (G.652 D Fibre) against GR No. GR/OFC-17/01. JUN 2007) are grouped into following three groups :

a) Group No. I Fibre cables of 48, 24, 12, & 6 Fibres.

b) Group No. II Fibre cables of 24, 12, & 6 Fibres.

c) Group No. III Fibre cables of 12 & 6 Fibres.

iii) The manufacturer may seek Type Approval of **Lower Fibre Count Cable** mentioned in the respective group. To qualify, the manufacturer must have TAC/TSEC for highest fibre count cable in the particular group.

iv) The manufacturer seeking Type Approval for the **Lower Fibre Count** based upon the fact that he is having TAC/TSEC for higher fibre count cable shall be required to submit the following :

1) Application in prescribed forms as per the existing Type Approval Procedures.

2) Compliance statement against each clause of the GR along with construction design details with dimensions.

3) The manufacturer shall have manufacture at least 3 cable reels (of 2 km each approx.) of the particular fibre count of the cable for which application for the issue of TAC/TSEC is made. The sample of the cable shall be submitted by the manufacturer at the time of seeking TAC/TSEC of lower fibre count of cable.

4) A separate application is required to be submitted for the issue of TAC/TSEC of each type of **lower fibre count** of cable.

5) The manufacturer shall submit the actual test results (of the manufactured cable) against each clause of the GR (and as per the requirement of the latest test schedule applicable to the GR). Mere mentioning the word **"Complied"** may not be accepted.

6) The list of the **Raw Materials** used, the make and grade of the raw material and the certificate of source approval issued by CACT along with the details of the Raw Materials used in the manufacturing of the higher fibre count OF cable for which he is holding valid TAC/TSEC. Both the raw materials shall be compared and are required to be of same make and grade.

The required information from the manufacturer may be sought (regarding manufactured OF Cable) and the manufactured Optical Fibre Cable may be inspected at the manufacturer's premises. After all the above requirements are met, the TAC/TSEC may be issued to the lower fibre count of the cable in the respective group based upon the test results and other details submitted by the manufacturer.

The tariff in each case is fixed as category – II. The first such case may be referred to HQ group for study and any change in the procedure required if any.

It is proposed that the following is mentioned in the Remarks column of the TAC/TSEC while it is issued for the lower fibre count of the cable :

``This TAC/TSEC is issued on the basis of TAC/TSEC No. _____ dated _____ for _____ fibre count cables.

The validity of the Type Approval Certificate for Lower Fibre Count Cables shall be restricted to the validity of TAC/TSEC of higher fibre count cables.

The above procedure shall be applicable only to the approval of Metal Free Optical Fibre Cables (G.652 D Fibre) against GR No. GR/OFC-17/01. JUN 2007 and subsequent amendments, if any.

Annexure – I

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

S. no.	Parameter	Unit	6 Fibre OF cable	12 Fibre OF cable	24 Fibre OF cable	48 Fibre OF cable
1	FRP Rod EAA Coated	mm	3.0+0.1/-0.0	3.0+0.1/-0.0	3.0+0.1/ -0.0	i) 3.5+0.1/-0.0 (Jacketed) ii) 4.6+0.1/-0.0 (Un-Jacketed)
2	FRP up jacketing thickness	mm	0	0	0	0.55
3	Tube ID(min)	mm	1.2	1.2	1.5	1.8
4	Tube OD	mm	1.8± 0.1	1.8± 0.1	2.3± 0.1	2.7± 0.1
5	No of fibre /tube	No	2	2	4	6
6	Color of fibre		BL, Nat	BL, Nat	BL,OR,GR, Nat	BL,OR,GR, BR,SL Nat
7	Fibre packing density	%	12 (Max.)	12 (Max.)	14 (Max.)	14 (Max.)
8	No of loose tubes	No	3	6	6	8
9	Colour of loose tubes		BL,OR,GR	BL,OR,GR, BR,SL,WH	BL,OR,GR, BR,SL,WH	BL,OR,GR, BR,SL,WH, Red,BK
10	No of dummy	No	5	2	1	0
11	Tube stranding lay over length	mm	100-120	100-120	100-120	125-150

12	Glass flex (Impregnated glass roving) Qty (min) ~~based on young modulus of > 65000 N/mm^2 and it shall be of water blocking type.~~	Kg/km	3.8	3.8	5.4	14.91
13	Cable diameter	mm	12.4 ± 0.5	12.4 ± 0.5	13.4± 0.5	16.5 ± 0.5
14	Nominal cable weight	Kg/km	124-140	124-140	145-161	210-232
15	Cable to be designed to Fibre strain value of.	%	0.1	0.1	0.1	0.1
16	Excess fibre length	%	0.65	0.65	0.65	0.70
17	Cable to be tested at defined load for fibre strain value of.	%	0.25	0.25	0.25	0.25

Note : The manufacturer shall submit the design calculations which shall be cross checked.

LIST OF ABBREVIATIONS

ASTM	-	American Society for Testing and Materials
BIS	-	Bureau of Indian Standards
CAB	-	Conformity Assessment Body
CACT	-	Component Approval Centre for Telecommunications
dB	-	decible
~~DTS~~	-	~~Department of Telecom Services~~
EIA	-	Electronic Industry Association
ESCR	-	Environmental Stress Crack Resistance
FOTP	-	Fibre Optic Test Procedure
FRP	-	Fibre Reinforced Plastic
~~Gpa~~	-	~~Gega Pascal~~
HDPE	-	High Density Polyethylene
IEC	-	International Electro -Technical Commission
~~IS~~	-	~~Indian Standards~~
ISO	-	International Standard Organisations
ITU-T	-	International Telecommunication Union – Telecommunication Standardization Sector ~~Transmission~~
~~KPSI~~	-	~~Kilogram per sq. inch~~
KV	-	Kilo Volt
MFD	-	Mode Field Diameter
MSDS	-	Material Safety Data Sheet
~~Nm~~	-	~~nanometer~~
N	-	Newton
OF	-	Optical Fibre
OTDR	-	Optical Time Domain Reflectometer
~~Ps/nm~~	-	~~pico second/ nano meter~~
~~Ps~~	-	~~pico second~~

QA	-	Quality Assurance
QM	-	Quality Manual
~~RMS~~	~~-~~	~~Route Mean Square~~
~~SMOF~~	~~-~~	~~Single Mode Optical Fibre~~
UV	-	Ultra Violet
µm	-	micrometer
°C	-	Degree Celsius

ANNEXURE-II

Comments on draft Standard (Draft Standard No. TEC 85140:2025)

Name of Manufacturer/Stakeholder:

Organization:

Contact details:

Clause No.	Clause	Comments	Other Remarks, if any