वर्गीय अपेक्षाओं के लिए मानक

टीईसी ८५१३०:२०२६

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STANDARD FOR GENERIC REQUIREMENTS

No.: TEC 85130:2026

(Supersedes No. GR/OFC-16/01. JULY 2005)

माइक्रो डक्ट ऑप्टिकल फाइबर केबल

MICRO DUCT OPTICAL FIBRE CABLE

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली–110001, भारत

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FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of 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 Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This document pertains to Standard for Generic Requirements of Micro Duct Optical Fibre Cable for installation in micro-ducts.

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HISTORY SHEET

Sl. No	*Standard / Document No.*	*Title*	*Remarks*
1.	GR/OFC - 16/01. JULY 2005 (or TEC 85130:2005)	Micro Duct Optical Fibre Cable	Release 1
2.	TEC 85130:2026	Standard for Generic Requirements of Micro Duct Optical Fibre Cable	Release 2

REFERENCES

Sl. No	*Document No.*	*Title/Document Name*
1.	TEC 89010:2021	Standard for Generic Requirements for Raw Material for manufacturing of Optical Fibre Cable
2.	TEC 89060:2006	Standard for Generic Requirements for Tools For Installation & Operating the Optical Fibre Cable and for assembly of the Optical Fibre Splice Closures
3.	EIA-598-D, IEC 60304	Color Standards
4.	GR-20-CORE issue-4 July 2013	Generic Requirement for Optical Fibre Cable (Telcordia document)
5.	ITU-T G. 652 and G. 657	ITU-T Recommendations
6.	ISO 9001:2015 or latest issue	International Quality Management System
7.	IEC 60794-1-21-E3, IEC 60794-1-21-E4, IEC 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-F5, IEC 60794-1-22-F9, IEC 60794-1-23-G7, IEC 60794-1-22-F16, IEC 60794-1-219, IEC 60794-1-101, IEC-60794-1-102, IEC 60794-1-124, IEC 60794-1-219	Test Methods
8.	FOTP-104, FOTP-85A	
9.	ASTM D-566	Test Methods

Note: The ITU-T/IEC etc. standards and recommendations referred to in this document shall imply their latest versions.

CHAPTER - 1

1.0 Introduction :

This document describes the Standard for generic requirements of Micro duct Optical Fibre Cable for installation in micro-ducts through jetting (air assisted blowing) techniques. The Micro duct Optical Fibre Cable shall have low weight, small diameter and high flexibility.

Note: The terms “Micro duct optical fibre cable” and “Micro Cable” have been used interchangeably within this document.

2.0 Functional Requirements :

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

2.2 The Micro duct Optical fibre cable shall be able to work in saline atmosphere in coastal areas and should be protected against the adverse impact of environmental conditions.

2.3 Life of cable shall be at least 25 years. Necessary statistical calculations shall be submitted by the manufacturer. The cable shall meet the cable ageing test requirement.

2.4 It shall be possible to operate and handle the Micro duct optical fibre cable with tools as per Standard for GR No TEC 89060:2006 (latest release) and subsequent amendments, 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.

2.5 The Optical fibre cable supplied shall be suitable and compatible to match with the dimensions, fixing, terminating & splicing arrangement of the splice closure & vice versa.

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 :

Single Mode Optical Fibre used in manufacturing Optical fibre cables shall be as per ITU-T Rec. G. 652 D or G. 657 A1 or G.657 A2. The specifications of optical fibres are mentioned below

Note: G. 657 A1/ A2 Optical fibre used for manufacturing Micro Cable can be either 200µm fibre or 250µm fibre.

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.

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)

3.3 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)

3.4 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)

3.5 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)

3.6 Environmental Characteristic 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)

3.7 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)

3.8 Micro duct Optical Fibre Cable Construction Specifications for 6F, 12F and 24F:

Unitube designs have been considered for 6F, 12F and 24F, in this Standard for GR. The typical structural drawing for 12F Micro duct Cable is illustrated at Figure 1 below.

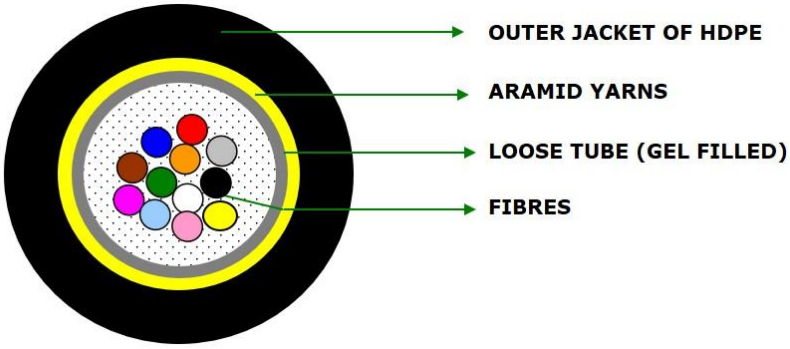

Figure 1: Typical structural drawing for 12 Fibre Micro Cable

3.8.1 Secondary Protection : The coated fibres may be protected by loose packaging within a tube, which shall be filled with thixotropic jelly.

3.8.2 Number of fibres : 6,12, 24

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

3.8.3 Filling compound : The filling compound used in the loose tube shall be compatible to fibre and secondary protection of fibre of the cable. The drip point of the cable shall not be lower than +70°C. The fibre movement shall not be constrained by stickiness and shall be easily removable for splicing. Reference test method to measure drop point of the jelly shall be as per ASTM D 566. The filling jelly compound shall be as per the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any.

3.8.4 Reinforcement : The Micro duct optical fibre cable shall be reinforced with Aramid Yarn in the periphery over loose tube. The Aramid Yarn shall be uniformly and

equally distributed on the entire periphery (circumference) of the loose tube. The Aramid Yarn shall be as per Section-XVII of Standard No. TEC 89010:2021 (or latest release) and the subsequent amendments, if any.

3.8.5 **Outer Sheath:** A jacket of High Density Polyethylene(HDPE)(UV stabilized) material black in colour, free from pin holes, scratches and other defects etc., shall be provided over and above the Aramid reinforcement. The HDPE sheath shall be uniform and shall have smooth finish.

3.8.6 **Cable diameter :** The maximum value of finished cable diameter shall be as per Annexure-I.

3.8.7 **Cable weight :** The maximum value of cable weight shall be as per Annexure-I.

3.9 Micro duct Optical Fibre Cable Construction Specifications for 48F , 72F, 96F,144F and 288F :

Multi-tube designs have been considered for 48F, 72F, 96F, 144F and 288F, in this Standard for GR. The typical structural drawing for 72F,144F and 288F Micro Cable is illustrated at Figure 2, Figure 3 and Figure 4 below, respectively.

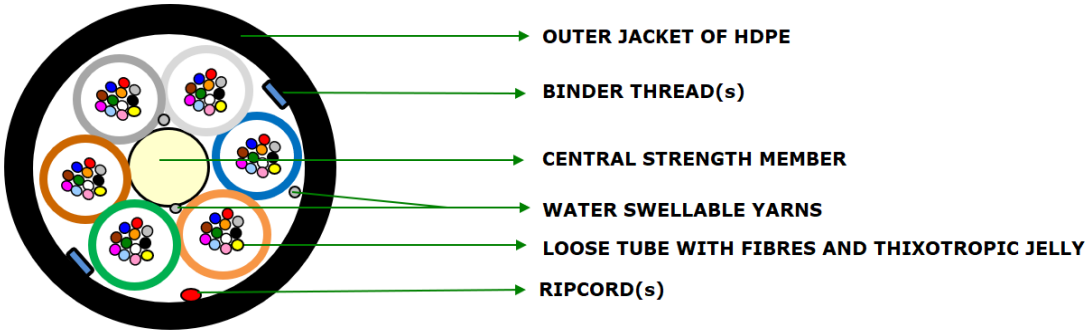

Figure 2: Typical structural drawing for 72 Fibre Micro Cable

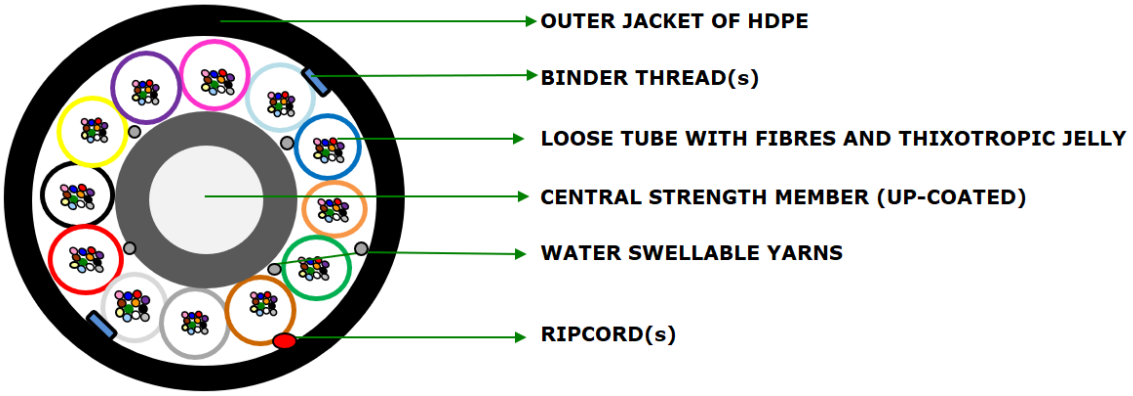

Figure 3: Typical structural drawing for 144 Fibre Micro Cable

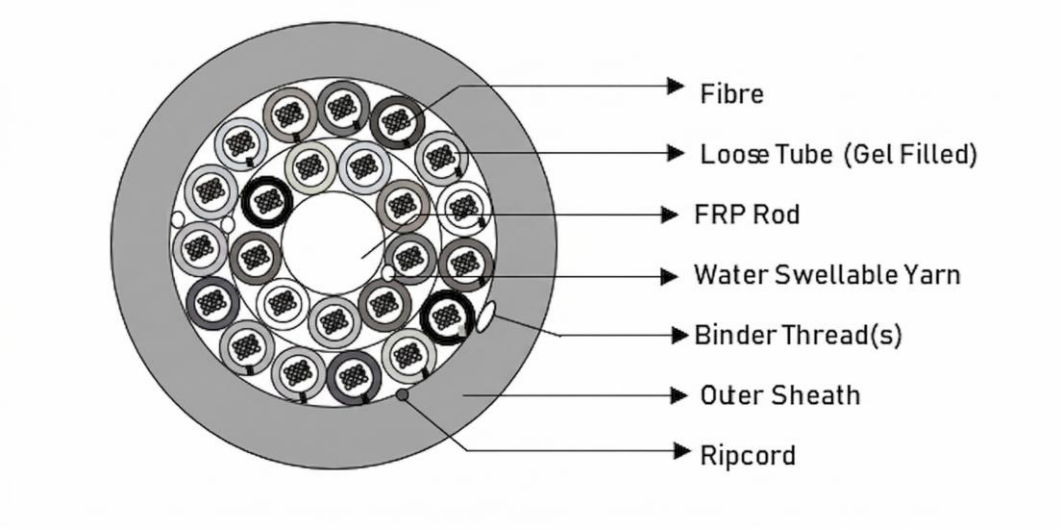

Figure 4*: Typical structural drawing for 288 Fibre Micro Cable

(***Note:** Colour coding of loose tubes within this 288 fibre Micro Cable may vary from manufacturer to manufacturer)

3.9.1 Secondary Protection : The coated fibres may be protected by loose packaging within tube, which shall be filled with thixotropic jelly.

3.9.2 Number of fibres : 48 or 72 or 96 or 144 or 288

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

3.9.3 **Strength Member :** Solid FRP non-metallic strength member shall be provided in the center of the cable core. The strength member in the cable shall be for strength and flexibility to the cable and shall have anti buckling properties. The FRP shall keep the fibre strain within permissible values.The strength member(FRP) shall be as per the Standard No. TEC 89010:2021(or latest release) and the subsequent amendments, if any. The central strength member (FRP) of 144F Micro Cable shall be PE up-coated to maintain the circularity, while the central strength members corresponding to 48F/72F/96F/288F Micro Cable shall not require any such up coating.

3.9.4 **Moisture barrier (protection) over FRP:** The water swellable yarns shall be binded/ present over FRP. The specification of WS yarn shall be as per Section-XIX of Standard No. TEC 89010:2021(or latest release) and the subsequent amendments, if any.

3.9.5 **Filling compound :** The filling compound used in the loose tube shall be compatible to fibre and secondary protection of fibre of the cable. The drip point of the cable shall not be lower than +70°C. The fibre movement shall not be constrained by stickiness and shall be easily removable for splicing. Reference test method to measure drop point of the jelly shall be as per ASTM D 566. The filling jelly compound shall be as per the Standard No. TEC 89010:2021(or latest release) and subsequent amendments, if any.

3.9.6 **Cable Core Assembly:** The coated fibres in loose tubes stranded together around a central strength member using helical or reverse lay techniques, shall form the cable core. The water swellable yarns may also be provided over the cable core, if required. The polyester/Nylon binder thread shall be used to hold the cable core assembly.

3.9.7 **Outer Sheath :** A jacket of High Density Polyethylene(HDPE)(UV stabilized)

material, black in colour, free from pin holes, scratches and other defects etc., shall be provided over the cable core assembly. The HDPE sheath shall be uniform and shall have smooth finish.

3.9.8 **Cable Diameter :** The maximum value of finished cable diameter shall be as per Annexure-II.

3.9.9 **Cable Weight :** The maximum value of cable weight shall be as per Annexure-II.

3.9.10 **RIP Cord:**

a) One suitable ripcord shall be provided in the Multi-tube Micro 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 ripcord used in the cable shall be readily distinguishable from any other components utilized in the cable construction.

3.10 Mechanical Characteristics and Tests on Optical Fibre Cable :

3.10.1 Tensile Strength Test:

Objective : To test the tensile strength of Micro Cables 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 60794-1-101

Test Specs. : The cable shall have sufficient strength to withstand a load of value T(N) = 9.81 x 1 W (where W-mass of 1 Km of cable in Kg). The load shall be sustained for 10 minutes and the strain

on the fibre shall be monitored.

Requirement: The load shall not produce a strain exceeding 0.25% in the fibre and shall not cause any permanent physical and optical damage to any component of the cable. The attenuation shall be noted before and after the release of load. The change in attenuation of each fibre after the test shall be ≤ 0.05 dB, both for 1310nm & 1550 nm wavelengths.

3.10.2 Abrasion Test :

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

Test Method : IEC 60794-1-102

Test Specs :

(i) **For sheath abrasion (Similar to Method E2A of IEC) :** The cable surface shall be abraded with needle (wt. 150 gm) having diameter of 1mm with 4N load.

No. of cycles : 50 (when applied on sheath surface, but not marking)
Duration : One minute (Nominal)

(ii) **For printing/ marking abrasion (Similar to Method E2B of IEC) :** The above method or Wool felt method as directed in IEC may be considered. A sample of cable containing markings shall be laid between the two parts of the wool felt or between the wool felt and a supporting surface. In either case, the wool felt shall wipe the printed section of the cable. The wool felt shall be thoroughly impregnated with water. The

normal force of 5 N (or as given in the detail specification) shall be applied to the markings on the sample which is moved back and forth over a length of 100 mm.

No. of cycles: 6 to 12 (when applied on marking)
Duration: One minute (Nominal)

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

3.10.3 Crush Test (Compressive test):

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

Test Method : IEC 60794-1-21-E3

Test Specs : The fibres and component parts of the cable shall not suffer permanent damage when subjected to a compressive load of 500 N for unitube design and 1000 N for multi-tube design, applied between the plates of dimension 100 X 100 mm. The load shall be applied for 60 seconds. 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.

3.10.4 Impact Test :

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

Test Method: IEC 60794-1-21-E4

Test Specs: The cable shall have sufficient strength to withstand an impact caused by mass weight of 2 Newton, when falls freely from a height of 0.5 meters. The radius R of the surface causing impact shall be 300 mm. Three such impacts shall be applied on the cable at different places typically spaced not less than 500mm apart. 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.

3.10.5 Repeated Bending Test :

Objective : The purpose of the test is to determine the ability of Micro duct optical fibre cable to withstand repeated bending.

Test Method : 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 : For unitube micro cable: FOTP-104
For multi-tube micro cable: 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 : 20 D
(D - cable diameter)

e) Angle of Turning : 90°

f) No. of cycles : 30

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

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

Requirement : During the test no fibre 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.

3.10.6 Torsion Test :

Objective: The purpose of this test is to determine the ability of Micro duct 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 20N or FOTP-85A, whichever is higher. 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 parts 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 wavelengths.

3.10.7 Kink Test :

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

Method : IEC 60794-1-21-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 and 1550 nm wavelengths.

3.10.8 Cable Bend Test :

Objective : The purpose of this test is to determine the ability of Micro duct 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 jacket shall not show any cracks visible to the naked eye when examined whilst still wrapped on the mandrel.

3.10.9 Temperature Cycling (Type Test) :

Objective : To determine the stability behaviour of the attenuation of Micro 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 ≤ 0.15 dB, both for 1310 nm and 1550 nm wavelengths for the entire range of temperature.

3.10.10 Cable aging Test (Type Test) :

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

Method : IEC 60794-1-22-F9

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

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

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

3.10.11 Water Penetration Test (Type Test) :

Objective : The aim of this test is to ensure that installed Micro duct optical fibre cable will not allow water passage along its length.

Method : IEC 60794-1-22-F5

Test Specs. : A circumferential portion of the loose-tube/cable end for unitube/multi-tube Micro Cable respectively, shall face the water head. The water tight sleeve shall be applied over the loose-tube/cable, respectively. The cable shall be supported horizontally and one meter water head, containing sufficient quantity of water soluble fluorescent dye for the detection of seepage, shall be applied over the loose-tube/cable respectively, for a period of 24 hours, at ambient temperature.

Requirement : No dye shall be detected at the end of the 3m length loose-tube/cable sample respectively, when examined with ultraviolet light detector.

3.10.12 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 diameter 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.

3.10.13 Check of 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 towards 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 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 on the Loose Tube**

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 outside diameter 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.

3.10.14 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) Drip test on the cable

Objective: The purpose of this test is to determine the ability of jelly in the optical fibre 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's for 5 cm from open end of the sample. Then the sample is kept vertically with open end downwards in the oven for 24 hours at 70°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.

3.10.15 Check of removal of sheath by ripcord:

Objective : To check the removal of sheath of the Micro duct optical fibre cable by using normal sheath removal tools or Rip cord.

Procedure : The rip cord should be accessed for around 10 cm using sheath removal tools. After having access to the rip cord, it should be checked for its capability of consistent slitting the sheath for minimum 1 m without breaking. It should be observed during sheath removal process that no undue extra force is applied and no component part of the cable is damaged. The fibres should be accessible without breaking.

3.10.16 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 be 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 jacket and other markings of the cables. (Test method no. ISO175).

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

3.10.17 Blowing Test:

Objective: To determine the ability of the Micro Cable to be blown inside a micro-duct.

Method: IEC 60794-1-124

Test Specs: The test route should be designed as per the IEC 60794-1-124 Method A or B. The Micro cable should be tested for blowing in to the specified micro-duct (as per the appropriate Duct Fill Ratio or specified by the user) using jetting method.

Requirement: The cable shall be able to be blown to minimum of 1000 m within 25 minutes maximum. The cable physical surface should not be damaged. The change in attenuation of the fibre after test shall be ≤ 0.05 dB/km, at 1550nm wavelength.

4.0 Engineering Requirements :

4.1 Cable Marking :

4.1.1 Marking on Micro Cable shall be of durable quality. It shall be marked at one meter intervals in contrast colour inkjet printing over the black HDPE Sheath. The accuracy of the sequential marking must be within -0.25% to +0.5% of the actual measured length. The markings on the cable must not rub off during normal installation.

4.1.2 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 cable i.e. Micro Cable
d) Type of Fibre
e) Number of Fibres
f) Year of manufacture
g) Sequential length marking
h) Purchaser's Identification
i) Cable ID

4.1.3 Cable Ends:

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. Both ends of cable shall be provided with end cap.

4.2 The nominal drum length:

4.2.1 Length of Micro duct optical fibre cable in each drum shall be 2Km /4 Km/ 8Km/ 10Km and shall be supplied as per the order. The variation in length of Micro duct 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.

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

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

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

a) Drum No.
b) Type of cables
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

4.3 Colour coding in O.F. Cables & Unit Identification :

4.3.1 The colorant applied to individual fibres shall be readily identifiable throughout the lifetime of the cable and shall match and conform to the MUNSELL Color Standards (EIA-598-D) and also IEC 60304. The colour coding and identification scheme being adopted by manufacturer should be unambiguous and user friendly.

5.0 Quality Requirements :

5.1 The cable shall be manufactured in accordance with the international quality standards ISO 9001-2015 (or latest issue) 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 Standard for GR No TEC 89010:2021 (or latest release) 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 test certificate issued by any Conformity Assessment Body (CAB) recognized by TEC or NABL accredited lab, shall be submitted by the manufacturer.

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. The change of source / grade of SM Optical Fibre and/or design of cable shall call for fresh type approval/certification. The clauses 9.2 and 9.3 of this Standard for GR shall facilitate the clause 5.2.4 of this Standard for GR, in order to simplify the certification process and to avoid repetitive testing.

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

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

5.2.6 The HDPE black in colour used for outer sheath/ jacket shall be UV stabilised.

Note: A 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.

5.3 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. 6.3.3 of Telecordia document GR-20-CORE issue 4, July 2013 or as per IEC 60794-1-219).

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

6.1 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

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 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.

8.0 Information for the Procurer/User:

8.1 It is suggested that the Optical fibre cable used/deployed in a particular route is manufactured from a single source of optical fibres.

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

8.3 The Micro Cable construction and design parameters values(dimensions of loose tube, sheath thickness, quantity of the Aramid Yarn, etc.) may vary as per manufacturer designs and customization, however the finished Micro Cable must meet the requirements as specified in this Standard for GR. The procurer/user may ask for micro cable with customized design values to meet their specific needs, provided the given Micro Cable meets the requirements as specified in this Standard for GR.

9.0 Procedure for issue of Approval Certificate

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

9.2 Single Mode Optical Fibre used in manufacturing optical fibre cables shall be as per ITU-T Rec. G.652 D or G.657 A1(200µm fibre or 250µm fibre) or G.657 A2(200µm fibre or 250µm fibre). 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.

9.3 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.

9.4 The clauses 9.2 and 9.3 shall be read in conjunction with the clause 5.2.4

ANNEXURE – I

Cable Design Parameter for 6,12 and 24 fibres

The following parameters of the component parts of the Micro duct Optical fibre cable (6,12 and 24 fibres) are to be taken in to account while designing and manufacturing the cable of the required fibre count. These parameters shall be checked during evaluation of the Micro duct Optical fibre cables:

S.No	Parameter	Unit	G. 652 D or G. 657 A1 or G.657.A2 (250µm fibre)			G. 657 A1/ A2 (200µm fibre)		
			6 Fibre Micro Cable	12 Fibre Micro Cable	24 Fibre Micro Cable	6 Fibre Micro Cable	12 Fibre Micro Cable	24 Fibre Micro Cable
1	Cable diameter (maximum)	mm	4	4	4	3.4	3.4	3.8
2	Cable weight (maximum)	Kg/km	12	12	15	11	11	14
3	Proposed duct size(ID)	mm	6	6	6	6	6	6
4	Cable to be tested at defined load for fibre strain value of	%	0.25	0.25	0.25	0.25	0.25	0.25

ANNEXURE – II

Cable Design Parameter for 48, 72, 96,144 and 288 fibres

The following parameters of the component of the Micro duct Optical fibre cable (48, 72, 96, 144 and 288 fibres) are to be taken in to account while designing and manufacturing the cable of the required fibre count. These parameters shall be checked during evaluation of the Micro duct Optical fibre cables:

S.No	Parameter	Unit	G. 652 D or G. 657 A1 or G.657 A2 (250µm fibre)					G. 657 A1/ A2 (200µm fibre)				
			48 Fibre Micro Cable	72 Fibre Micro Cable	96 Fibre Micro Cable	144 Fibre Micro Cable	288 Fibre Micro Cable	48 Fibre Micro Cable	72 Fibre Micro Cable	96 Fibre Micro Cable	144 Fibre Micro Cable	288 Fibre Micro Cable
1	Cable diameter (maximum)	mm	5.8	5.8	6.3	8.3	9.7	5	5	6	7.9	8.5
2	Cable weight (maximum)	Kg/km	32	32	43	65	80	25	25	39	57	72
3	Proposed duct size (ID)	mm	8	8	8	10	12	8	8	8	10	10
4	Cable to be tested at defined load for fibre strain value of	%	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

ABBREVIATIONS

ASTM	- American Society for Testing and Materials
CAB	- Conformity Assessment Body
CACT	- Component Approval Centre for Telecommunications
dB	- Decibel
EIA	- Electronic Industry Association
FRP	- Fibre Reinforced Plastic
FOTP	- Fibre Optic Test Procedure
GR	- Generic Requirements
HDPE	- High Density Polyethylene
IEC	- International Electro -Technical Commission
ISO	- International Organization for Standardization
ITU-T	- International Telecommunication Union – Telecommunication Standardization Sector
KV	- Kilo Volt
KM	- Kilo meter
MFD	- Mode Field Diameter
MSDS	- Material Safety Data Sheet
N	- Newton
OF	- Optical Fibre
OTDR	- Optical Time Domain Reflectometer
PE	- Polyethylene
QA	- Quality Assurance
SM	- Single Mode
TEC	- Telecommunication Engineering Centre
UV	- Ultra Violet
µm	- micrometer
°C	- Degree Celsius