अनंतिम टेस्ट गाइड

टीईसी ८५१४१:२०२५

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PROVISIONAL TEST GUIDE (Initial Draft)

TEC 85141:2025

(Supersedes No. TSTP/GR/OFC–17/01. JUN 2007)

धातु मुक्त ऑप्टिकल फाइबर केबल

(मानको सं.: टीईसी ८५१४०:२०२५)

METAL FREE OPTICAL FIBRE CABLE

(Draft Standard No.: TEC 85140:2025)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली–110001, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI–110001, INDIA

www.tec.gov.in

Release 2: ……, 2025

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 Test Guide for testing pertains to the test schedule and procedure for evaluating conformance/ functionality / requirements / performance of Standard for Generic requirements of Metal free Optical fibre cable.

CONTENTS

A. HISTORY SHEET

Sl.No	*TSTP / Document No.*	*Title*	*Remarks*
1.	TSTP/GR/OFC–17/01. JUN 2007	Test Schedule and Test Procedure of Metal free Optical fibre cable (G.652 D Fibre)	Release 1
2.	TEC 85141:2025	Test Guide for Standard for Generic Requirements of Metal free Optical fibre cable	Release 2

B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance/ functionality / requirements / performance of Standard for Generic requirements of Metal free Optical fibre cable as per Draft Standard No. **TEC 85140:2025**.

C. General information:

Name of the manufacturer/ : ----------
Trader/Supplier with address

Make, Model no. & Serial No. : ----------

General guidelines for the Testing Officer :

1. The testing officer must ensure before taking up the test that the manufacturer is fully equipped with required test facilities.
2. The Source of procurement, Make and Model No. of the instrument are required to be checked and mentioned.
3. The requirements of the clauses as per the GR shall be checked and the observation may be recorded against each clause in detail.
4. The test results against the clauses for which test facilities are not available, must be checked & observation to be noted.
5. Additional columns or rows, as required for recording of tests results, shall be added wherever it is necessary.
6. The testing officer must ensure that necessary certificates/undertakings are obtained against the clauses wherever permissible/required and shall be annexed with the test results. All the clauses are required to be commented.

D. Testing team: *(to be filled by testing team)*

Sno.	Name	Designation	Organization	Signature
1.				
2.				

E. List of the Test Instruments:

Sno.	Name of the test instrument	Make /Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team)*
1.	Patch Cord		
2.	Fiber Spool		
3.	OTDR		

F. Equipment Configuration Offered: *(to be filled by testing team)*

(a) <Equipment/product name> Configuration:

S.No.	Item	Details	Remarks

Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

(b) <Other equipment name> Configuration:

S.No.	Item	Details	Remarks

Relevant information like No. of cards, ports, slots, interfaces, size etc. may be filled as applicable for the product

G. Equipment/System Manuals: *(to be filled by testing team)*

Availability of Maintenance manuals, Installation manual, Repair manual & User Manual etc. (Y/N)

H. Clause-wise Test Type:

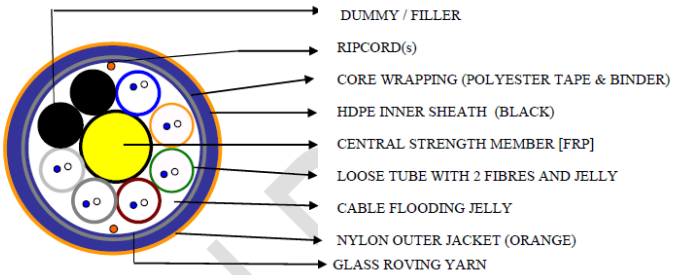
Chapter 1

Clause No.	*Clause*	*Type of Test / Test No. etc. **
1.0	**Introduction :** This document describes the Standard for Generic Requirements 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. 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).	Manufacturer compliance shall be checked and examined.
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.	Check as per the requirement of the clause and comment. The design shall also be checked. Undertaking shall also be submitted by manufacturer.
2.2	The optical fibre cable shall be able to work in a saline atmosphere in coastal areas and should be protected against corrosion.	Test certificate or undertaking may be obtained as per

		the requirement of the clause.
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 aging test requirement.	The calculation shall be checked & observations are to be noted.
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) and subsequent amendments, if any. If any special tool is required for operating and handling this optical fibre cable, the same shall be provided along with the cable.	The cable shall be checked by operating with the tools as prescribed in the Standard No. TEC 89060:2006 and observation to be noted. Undertaking shall also be submitted by the manufacturer.
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) and subsequent amendments, if any.	Check as per the requirement of the clause and comment.
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	Check as per the requirement of the clause.

	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.	Test certificate or undertaking may be obtained as per the requirement of the clause
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:	Check as per the requirement of the clause and comment.
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.	Check as per the requirement of the clause and comment
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)	Record the observations.
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	Record the observations

	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)	Record the observations
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)	Record the observations
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)	Record the observations
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)	Record the observations

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**  	Check as per the requirement of the clause and comment.
3.8.1	**Secondary Protection** : The 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	Check as per the requirement of the clause and comment.
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)	Check as per the requirement of the clause and comment.
3.8.3	**Strength Member :** 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	Check as per the requirement of the clause and comment.

	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.	
3.8.4	**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.	Check as per the requirement of the clause and comment.
3.8.5	**Core Wrapping:** The main cable core 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.	Check as per the requirement of the clause and comment.
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.	Check as per the requirement of the clause and comment.
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 °C. The fibre	Check as per the requirement of the clause and comment.

	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 566. The filling and the flooding jelly compound shall be as per the Standard No TEC 89010:2021 (or latest release) and subsequent amendments, if any.	
3.8.8	**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. 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 and as per other details given in the Annexure –I.	Check as per the requirement of the clause and comment.
3.8.9	**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). Thickness of the sheath shall be uniform and shall not be less than 1.8 mm. The sheath shall be	Check as per the requirement of the clause and comment.

	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. **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. 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	
3.8.10	**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.	Check as per the requirement of the clause and comment.
3.8.11	**RIP Cord :** a) Two suitable rip cords shall be provided in the cable	Check as per the requirement of the

	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.	clause and comment.
3.8.12	**Cable diameter :** The finished cable diameter shall be as per Annexure –I.	Check as per the requirement of the clause and comment.
3.8.13	**Cable Weight :** The nominal cable weight shall be as per Annexure -I	Check as per the requirement of the clause and comment.
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.	Check and note down the observation in Table below

	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.	

Test Results:

Length code _____

Requirement:

1. Change in attenuation : ≤ 0.05 dB
2. Strain under load : ≤ 0.25%

Change in attenuation measurement:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

Strain Testing: The strain is monitored by using fibre strain tester. Fibre strain under load to be tested. Record the observations.

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 **Test Specs** : 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.). No. of cycles : 100	Check and note down the observation in Table below

	Duration : One minute (Nominal) **Requirement :** There shall be no perforation and loss of legibility of the marking on the sheath.	

Test Results:

Length Code	Load Applied	No. of cycles	Duration	Observation / Remarks
	650 gms	100 cycles	01 Minute	

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 $\leq$ 0.05 dB both for 1310nm and 1550nm wavelengths.	Check and note down the observation in Table below

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

4.4	**Impact Test :** **Objective**: The purpose 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	Check and note down the observation in Table below

	300 mm. 10 such impacts shall be applied on 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 $\leq$ 0.05 dB, both for 1310nm and 1550nm wavelengths.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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** : 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. : 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 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	Check and note down the observation in Table below

	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.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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.	Check and note down the observation in Table below

	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 $\leq$ 0.05 dB, both for 1310 nm and 1550 nm wave lengths.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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.	Check and note down the observation in Table below

	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.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

4.8	**Cable Bend Test :**	Check and note down the

	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.	observation in Table below

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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 :	Check and note down the observation in Table 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.	

Test Results:

A) Cable length code:

Temperature: Ambient

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

B) Cable length code:

Temperature: - 20 °C

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

C) Cable length code:

Temperature : - 10 °C

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

D) Cable length code:

Temperature : + 60 °C

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

E) Cable length code:

Temperature : + 70 °C

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

F) Cable length code:

Temperature : Ambient

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

4.10	**Cable Ageing Test (Type Test) :** **Objective** :To check the cable material change dimensionally as the cable ages. Method : IEC 60794-1-22-F9	Check and note down the observation in Table below

	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 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.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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 **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.	Check and note down the observation in Table below

Test Results:

Length code No.	End	Date	Time In	Date	Time Out	Observation / Remarks
Sample no 1	Top					
	Bottom					
Sample no 2	Top					
	Bottom					

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 $\leq$ 0.05 dB, both for 1310 nm and 1550 nm wavelength. The sheath shall not show any cracks visible to the naked eye.	Check and note down the observation in Table below

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

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	Check and note down the observation in Table below as well as cable diameter change/kink introduced if any

	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.	

Test Results:

Length Code No.	Observation	Remarks

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).	Check and note down the observation in Table below

	Requirement : The change in attenuation of the fibre after the test shall be $\leq$ 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.	

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

<table>
<tr>
<td>4.15</td>
<td>
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 ± 2^0 C for 120 hours before testing.

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

Requirement :
<table>
<tr><th rowspan="2">Sheath Material</th><th colspan="2">Minimum Yield Strength</th><th rowspan="2">Minimum Elongation (%)</th></tr>
<tr><th>(MPa)</th><th>(psi)</th></tr>
<tr><td>HDPE un-aged</td><td>16.5</td><td>2400</td><td>400</td></tr>
<tr><td>HDPE aged</td><td>12.4</td><td>1800</td><td>375</td></tr>
</table>
</td>
<td>Check and note down the observation in Table below</td>
</tr>
</table>

Test Results:

Colour of Loose tube	Colour of Fibre	Initial Reading		Final Reading		Change in Attenuation (dB)		Observation / Remarks
		1310 nm	1550 nm	1310 nm	1550 nm	1310 nm	1550 nm	

4.16	**To 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.	Check and note down the observation in Table below

	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 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.	

Test Results a:

Length Code No.	Observation	Remarks

Test Results b:

Length Code No.	Observation	Remarks

4.17	**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.	Check and note down the observation in Table below

	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 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 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 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.	

Test Results a:

Length Code No.	Observation	Remarks

Test Results b:

Length Code No.	Observation	Remarks

4.18	**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).	Check and note down the observation in Table below

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

Test Results:

Length Code No.	Observation	Remarks

4.19	**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.	Check and note down the observation in Table below

Test Results:

Length Code No.	Observation	Remarks

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.	The method of imprinting (Indenting) and its quality must be checked as per the requirement of the GR and also the accuracy of the sequential marking shall be checked by standard measuring scale at three different places. It shall meet the requirement of the clause.
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	The contrast colour shall be checked & noted and the method

	surface. The colour used must withstand the environmental influences experienced in the field:	of imprinting (Indenting) must be checked as per the requirement of the clause.
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	This shall be checked as per the requirement of the clause and the observation to be noted.
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	The requirement of the clause shall be checked in detail and the observation to be noted.

	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.	The tensile strength requirement shall be checked with pulling eye and its coupling system along with the anti-twist device shall be checked and noted.
5.3	**The nominal drum length:**	
5.3.1	Length of OF Cable in each drum shall be 2 Km / 4Km / 8Km / 10Km . 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.	Check as per the requirement of the clause and comment.
5.3.2	The fibres in cable length shall not have any joint.	This shall be examined for each fibre and observations to be noted. A certificate /undertaking may be obtained for the bulk production.

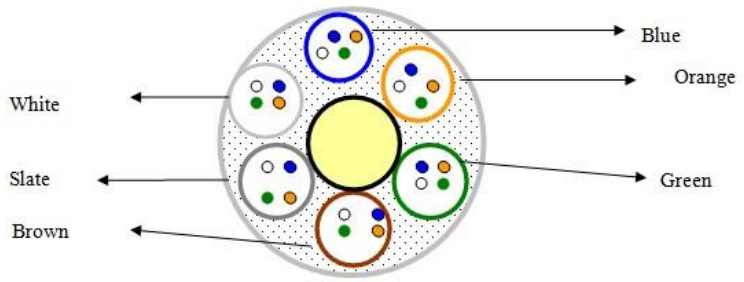
5.3.3	The drum shall be marked with arrows to indicate the direction of rotation.	Check as per the requirement of the clause.
5.3.4	Packing list supplied with each drum shall have at least the following information: a) Drum No. b) Type of cables c) Physical Cable length d) No. of fibres e) Length of 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	The packing list shall be checked as per the requirement and observation to be noted.
5.4	**Colour coding in the O.F. 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) or IEC Publication 304 (4).	Check as per the requirement of the clause and comment.
5.4.2	**Colour Coding Scheme :** When the loose tubes are placed in circular format, the	The colour coding identification method shall be checked &

	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 . Last one of the fibres in a tube shall be of natural color, while the rest of fibres are colored.	observation to be noted as per the requirement of the clause.

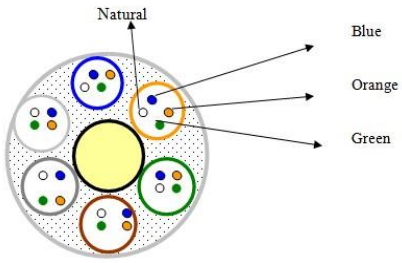
Table -2 : Colour Coding scheme of the Optical Fibre within Loose tube

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

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)  (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 (or latest issue) for which the manufacturer should be duly accredited. The Quality Manual shall be submitted by the manufacturer.	Check as per the requirement of the clause and verify the validity of the ISO certificate.
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) 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.	Check as per the requirement of the clause and comment.
6.2.2	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	The details of the materials shall be taken and checked.

	manufacturer at the time of evaluation/testing.	
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 .	The details shall be obtained from the manufacturer and checked.
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 . The change of source/grade of SM Optical Fibre and/or design of cable shall 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.	This shall be checked as per the requirement of the clause.
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.	Certificate to be obtained as per the requirement of the clause.
6.2.6	The material used in optical fibre cable must not evolve hydrogen that will affect the fibre loss. **Note:** A test certificate from a recognized laboratory or institute may be acceptable.	Certificate/Undertaking may be obtained as per the requirement of the clause.

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, 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 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.	Check as per the requirement of the clause and comment. Certificate may be obtained.
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.	The details may be obtained & checked. Certificate/undertaking may be obtained.

Clause No.	*Clause*	*Type of Test / Test No. etc. **
8.0	**Documentation :**	
8.1	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.	Details submitted by the manufacturer shall be checked as per the requirement of the clause.
8.2	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.	Details submitted by the manufacturer shall be checked as per the requirement of the clause
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.	Compatibility issues may be quantified by bidirectional splice loss and MFD

		mismatch between the fibres if any.
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	

Note: Manufacturer shall provide at least two cable drums (of 2 Kms each approx.) for testing with regard to issue of approval certificate.

***** *Physical Check/Declaration/Documentation/ Report from Accredited test lab/ Functional verification / Information / Test No.*

I. SUMMARY OF TEST RESULTS

GR/IR No._____

TSTP No._____

Equipment name & Model No._____

Clause No.	*Compliance (Complied /Not Complied / Submitted/Not Submitted / Not Applicable)*	*Remarks / Test Report Annexure No.*

[Add as per requirement]

Date:

Place: *Signature & Name of TEC testing Officer /*

** Signature of Applicant / Authorized Signatory*

**** Section J as given above is also to be submitted by the Applicant/ Authorised signatory as part of in-house test results along with Form-A. The Authorised signatory shall be the same as the one for Form 'A'.***

Template for submitting comments/inputs on draft Test Guide
(Draft Test Guide No. TEC 85141:2025)

Name of Manufacturer/Stakeholder:

Organization:

Contact details:

Clause No.	Clause	Comments	Other Remarks, if any

Note: The comments/inputs on the draft Test Guide (Draft Test Guide No. TEC 85141:2025) may be provided in the above format vide email to **dirt2-tec-dot@gov.in** , **adet-tx-tec-dot@gov.in** and **ratx.tec-dot@nic.in**