सत्यमेव जयते

अनंतिम टेस्ट गाइड

टीईसी ७२०४१: २०२५

PROVISIONAL TEST GUIDE

TEC 72041:2025

माइक्रोडक्ट फॉर इनडोर एंड आउटडोर एप्लिकेशनस

MICRODUCT FOR INDOOR & OUTDOOR APPLICATIONS

(STANDARD No.: TEC 72040:2025)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली–110001, **भारत**

TELECOMMUNICATION ENGINEERING CENTRE

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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 enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Microduct for Optical Fiber Cable for Indoor & Outdoor applications as per GR No. TEC 72040:2025.

CONTENTS

A. HISTORY SHEET

S.No.	*TSTP No.*	*Title*	*Remarks*
1	TEC 72041:2025	Microduct for Optical Fiber Cable for Indoor & Outdoor Appllications	First issue

B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Microduct for Optical Fiber Cable for Indoor & Outdoor applications as per GR No. TEC 72040:2025.

C. General information:

Sn.	General Information	Details *(to be filled by testing team)*	
1	Name and Address of the Applicant		
2	Date of Registration		
3	Name and No. of GR/IR/Applicant's Spec. against which the approval sought		
4	Details of Equipment		
	Type of Equipment	Model No.	Serial No.
(i)			
(ii)			
5	Any other relevant Information:-		

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

S. No.	Name	Designation	Organization	Signature
1.				
2.				
3.				

E. List of the Test Instruments:

S. No.	Name of the test instrument	Quantity	Make /Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team)*	Remarks
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

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

(a) <Equipment/product name> Configuration:

S.No.	Item	Details	Remarks (references parameter and value)

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 and Test No.:

Clause No.	*Content of the clause*	*Type of Test / Test No. etc.*
1.0	Introduction	
1.1	This document describes the Generic Requirements of Microduct for Optical Fibre Cable for Indoor & Outdoor applications. These Microducts are permanently lubricated High Density Polyethylene. It is a new concept of ducting the micro cables for carrying fibre to the home. Microducts are small diameter cable ducts used with the new generation of air blown Micro optical fibre cables. Indoor & outdoor installation of Microducts can be in various conditions like directly into the trench, existing pipes, aerial applications and access to buildings. There is broad interest in this technology by telecommunication installation companies and operators for the deployment of optical networks, because it helps in the reutilization and optimization of the space inside existing pipes (e.g., large ducts), as well as the minimization of civil works, the social impact and the cost of the plant.	Information
2.0	Functional and Technical	
2.1	Microducts shall be small ducts, in the range of 5mm - 16mm (OD), which can be blown into an empty duct.	Information
2.2	It shall be possible to place several Microducts into the larger empty ducts.	Information
3.0	Technical Requirements	
3.1.1	Permanently solid lubricated Microducts shall consist of two concentric layers. The Outer layer being High-Density Poly-ethylene (HDPE) for Outdoor application and Low Smoke Zero	Information / Physical verification

	Halogen(LSZH) for Indoor application, shall be co-extruded with the Inner layer of solid permanent lubricant to reduce the Internal co-efficient of friction (ICF). The configuration of the Microduct shall be smooth-out, micro-ribbed inside with a co-extruded permanent lubrication layer.	
3.1.2	The inner lubricant layer shall be so formulated to provide a permanent, low friction boundary layer between the inner surface of the duct and of micro cable. The lubricant layer shall be clearly visible in cross-section, concentric with outer layer. The life of Microduct shall not be less than 50 years. Note: Certificate from resin manufacturer shall be submitted in support of 50 years of life.	Physical verification Certificate from the manufacturer has to be obtained
3.1.3	Microducts shall be co-extruded tubes made up of an inner 'blowable' layer. The choice of tube size is dependent upon route configuration and length. All Microducts shall have a permanently bonded silicone pre-lubricated inner bore to reduce friction and enhance blowing performance.	Physical verification
3.1.4	Sheathing of Microducts: Several Microducts can be bundled together by HDPE sheath for Outdoor application (ODA) and LSZH for indoor application (IDA) in a single unit. Numbers and sizes of the Microducts shall be defined by Purchaser. Sheath thickness and tests on bundle is defined in Annexure-4. A single unit (bundle) may contain 2 to 32 Microducts.	Mechanical check
3.1.5	For indoor applications, false roofing & hazardous areas	Physical

<table>
<tr><td></td><td>the Microduct shall be of LSZH material.</td><td>verification</td></tr>
<tr><td>3.2</td><td>Two layer construction: Microduct is two layer construction where outer layer is of HDPE for outdoor applications and of LSZH for indoor application. Inner layer material shall be of friction reducing, polymeric material, which shall be integral part of outer layer.</td><td>Physical verification</td></tr>
<tr><td>3.2.1A</td><td>Outer Layer for ODA: The base HDPE resin used for the outer layer of the Microduct shall conform to designation of IS-7328 or to any equivalent standard meeting the following requirements. However, the manufacturers shall furnish the designation for the HDPE resin as per IS 7328, as applicable.

<u>Table-1: Requirement for ODA</u>

<table>
<tr><td></td><td>Density</td><td>0.940 to 0.958 g/cc at 27° C when tested as per ASTM D1505 (IS: 2530 or IS: 7328)</td></tr>
<tr><td>b)</td><td>Melt Flow Rate (MFR)</td><td>0.2 to 1.1 g/10 minutes at 190° C & 5 kg load, when tested as per IS: 2530</td></tr>
<tr><td>c)</td><td>Tensile Strength at Yield</td><td>20 N/mm² minimum when tested as per ASTM D 638, Type-V specimens</td></tr>
<tr><td>d)</td><td>Elongation at break</td><td>>600% when tested as per ASTM D 638, Type-V specimens</td></tr>
<tr><td>e)</td><td>Flexural Modulus at 1%</td><td>690 N/mm² minimum,</td></tr>
</table>
</td><td>Physical verification/Lab Test Report</td></tr>
</table>

	strain	when tested as per ASTM D 790
f)	Hardness, Shore-D	Between 60 and 65 units, When tested as per ASTM D 2240
g)	Heat Deflection Temperature at 45g/mm²	65° C minimum, when tested as per ASTM D 648
h)	Environmental Stress Crack resistance (when tested with 10% Igepal, CO 0630 Solution at 50° C)	> 96 Hrs when tested as per ASTM D 1693 (No cracks)
i)	Weathering in artificial (UV) light (Specimens shall be as per ASTM D 638 Type-IV) and cut from compression moulded sheet.	After exposure for 720 hrs.,Tensile strength shall be tested. The variation shall not be greater than 20% compared to tensile strength obtained at c) above. For detail of cycle time etc., refer clause 4.19
j)	OIT (in Aluminium Pan) (Oxidation Induction Test)	30 minutes minimum, when tested as per Annexure-1
k)	UV Stabilizer Content	Hindered Amine Light Stabilizer minimum 0.15%, When analysed as per FT-IR method

Note: The raw material shall contain required additives such as

<table>
<tr><td></td><td>antioxidants, UV stabilizers etc. in the raw material itself, to meet the above parameters.</td><td></td></tr>
<tr><td>3.2.1B</td><td>Outer Layer for IDA: The base LSZH resin used for the outer layer of the Microduct shall conform the following requirements.
Table-2: Requirement for IDA
<table>
<tr><th>Sr. No.</th><th>PARAMETER</th><th>UNIT</th><th>REQUIRMENT</th><th>TEST METHOD</th></tr>
<tr><td>1</td><td>Melt Flow index at 190oC and 5 kg load</td><td>Gm/10min</td><td>1.0 to 3.0</td><td>IS 2530</td></tr>
<tr><td>2.</td><td>Density</td><td>Gm/cc</td><td>0.95 to 1.50</td><td>IS 7328</td></tr>
<tr><td>3.</td><td>Tensile strength at yield</td><td>N/mm2</td><td>Min 11</td><td>ASTM D 638</td></tr>
<tr><td>4.</td><td>Elongation at break</td><td>%</td><td>Min 40</td><td>ASTM D 638</td></tr>
<tr><td>5.</td><td>Limited Oxygen Index</td><td>%</td><td>Min 26</td><td>ASTM D 2863</td></tr>
<tr><td>6.</td><td>Hardness</td><td>Shore-D</td><td>Min 40</td><td>ASTM D 2240</td></tr>
<tr><td>7.</td><td>Halogen Acid Gas generation</td><td>mg/g</td><td>5</td><td>IEC 60754-1</td></tr>
<tr><td>8.</td><td>Halogen Acid Gas Emission:
pH:
Conductivity:</td><td>

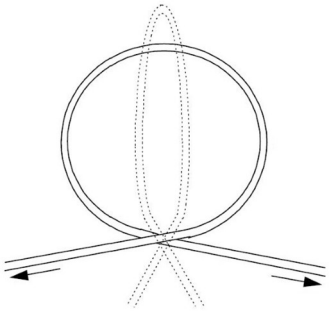
pH</td><td>

>4.3
<10</td><td>

IEC 60754-2</td></tr>
</table></td><td>Physical verification/Lab Test Report</td></tr>
</table>

3.2.2	**Inner Layer:** The inner lubrication material shall be of friction reducing, polymeric material, which shall be integral part of outer layer. The lubricant materials shall have no toxic or dermatic hazards for safe handling. In the finished Microduct, the co-extruded inner layer of solid permanent lubricant shall be integral part of outer layer and shall be white in colour and clearly visible in cross-section of duct. The inner layer of solid permanent lubricant shall be continuous all through and shall not come out during storage, usage and throughout the life of the duct.	Physical verification
4.0	**Performance Test Requirements** The Microduct shall meet the following test requirements	Information
4.1	**Visual Inspection:** The Microducts shall be checked visually for ensuring good workmanship. The Microducts shall be free from blisters, shrink holes, flaking, chips, scratches, roughness, break and other defects. The Microducts shall be smooth, clean and round. The ends shall be cleanly cut and shall be square with axis of the Microduct.	Physical verification
4.2	**Tensile Performance:** **Test conditions:** Method: Generally, to IEC 60794-1-21, Method E1 Microduct length under tension: >1 m Tensile load on Microduct: 1 × W; W-Weigh of 1Km Microduct. Duration of load: 10 min **Observation**: Under visual examination, without magnification, there shall be no damage after the test and the test shall pass the inner clearance test (Annex 3).	Testing as per IEC 60794-1-21, Method E1

4.3	**Crush Performance:** Test conditions: Method: IEC 60794-1-21, Method E3A Sample length: 250 mm Load: 500N Duration time: 1 min Recovery time: 1 h **Observation:** Under visual examination, without magnification, the Microduct shall show no damage. After the recovery time the Microduct shall pass the inner clearance test (Annex 3) and there shall be no splitting or permanent damage. The imprint of the plate is not considered as mechanical damage.	Testing as per IEC 60794-1-21, Method E3A
4.5	**Torsion** Test conditions: Method: IEC 60794-1-2, Method E7 Maximum gauge length: 2 m Rotation: 180^0 clock wise and 180^0 anti-clock wise. Number of cycle : 10 **Observation**: Under visual examination without magnification there shall be no damage to the Microducts. The Microduct shall pass the inner clearance test (Annex 3) and there shall be no splitting or permanent damage.	Testing as per IEC 60794-1-2, Method E7
4.6	**Kink Test** Test conditions: Method: IEC 60794-1-21, Method E10 Minimum diameter: 20 × OD The purpose of this test is to determine the minimum loop	Testing as per IEC 60794-1-21, Method E10

	diameter at the onset of the kinking of a Microduct. Sample: The sample length shall be sufficient to carry out the specified test. Procedure: Testing shall be in accordance with standard atmospheric conditions. A loop shall be made (see in below Figure). The diameter of the loop shall be reduced to the onset of kinking by pulling slowly on the two ends. The forces at the bottom of the loop shall be applied in one plane. Observation: Under visual examination, without magnification, there shall be no damage to the Microducts after the test and shall pass the inner clearance test (Annex 3). The Microduct shall attain the required minimum diameter without kinking. 	
4.7	Bend Test: Test conditions Method: IEC 60794-1-21, Method E11B Minimum diameter: 40 × OD Number of Cycles: 3 Observation: Under visual examination, without magnification, there shall be no damage to the Microducts after the test and shall pass the inner clearance test (Annex 3).	Testing as per IEC 60794-1-21, Method E11B

4.8	Microduct route verification test: Test shall be conducted as per Annexure-3	Testing as per Annexure 3 of the GR or Test Report
4.9	Microduct pressure withstand Test: Test conditions Sample Length: 250mm to 750mm. Method: IEC 60794-1-22, Method F13. Observation: a. All Microducts shall resist an air pressure of at least 2.5 × the installation pressure (8Kg/cm2) at a temperature of 20 °C for a period of 0.5 h. a. All Microducts shall resist a proof test pressure of at least 1.3 ×the installation pressure (8Kg/cm2) at a temperature of room temperature for a period of 2h. After the test, under visual examination, without magnification, there shall be no damage to the Microducts.	Testing as per IEC 60794-1-22, Method F13
4.10	Heat Reversion test: Test is to be carried out as per IS: 4984. A sample of Microduct of approximately 200 mm shall be placed horizontally in the hot air oven for 30 minutes at 110 +/-2^{O}C so that the dimensional changes in the Microduct section shall not be impeded. After cooling at room temperature, the dimensional change in the Microduct section shall be measured in the longitudinal direction & the deviation from the initial length shall be calculated & stated in the percentage. The dimensions shall not change by more than 3% in the longitudinal direction.	Testing as per IS: 4984
4.11	Environmental Stress Crack Resistance Test (ESCR): The test has to be carried out as per ASTM – D 1693. The specimen cut from the Microduct shall be bent into a U shape around a mandrel of	Testing as per ASTM D1693

	diameter 10 times to the outside diameter of the Microduct. The bent portion of the U shall be placed in a solution of 10% Igepal (CO–630) at 50 +/-2^{O}C for 96 hours. The Microduct shall show no signs of cracks.	
4.12	**Oxidation Induction Test:** The induction time in oxygen when tested with an Aluminium pan as per method in Annexure-1, shall not be less than 30 minutes.	Testing as per Annexure-1 of the GR or Test Report
4.13	**Internal Co-efficient of Friction**: The Internal Co-efficient of Friction when tested, as per the method given in Annexure 2, shall not exceed 0.06**,** when tested with respect to Nylon jacketed unarmoured Microduct Optical Fibre cable depending on the size of Microduct.	Testing as per Annexure-2 of the GR
4.14	**Ovality Test:** Ovality is the difference between maximum outside diameter and the minimum outside diameter at the same cross-section of the Microduct, at 300mm away from the end. The ovality for Microduct, when measured as per IS-4984, shall not exceed as per the table shown in clause No. 3.2.3.	Testing as per IS: 4984
4.15	**Density of Finished Microduct :** The density of the Outdoor Microduct shall be between 0.940 and 0.958 gms/cc at 27°C and shall not differ from that of the raw material by more than 0.003 gm/cc and the density of the Outdoor Microduct shall be between 0.95 and 1.5 gms/cc at 27°C and shall not differ from that of the raw material by more than 0.020 gm/cc, when tested as per ASTM D 1505 (1S:2530 or IS:7328). The same test method shall be used for determining the density of the raw material as well as the completed Microduct. The test will be conducted by collecting raw material from the hopper during extrusion and finished Microduct made from the same material.	Testing as per ASTM D1505 / IS:2530 or IS:7328

<table>
<tr><td>4.16</td><td>Melt Flow Rate (MFR) of Finished Duct: The change in the MFR caused by processing of raw material into Microduct, i.e. the difference between the measured value for the outer layer material from the Microduct and measured value for the raw material shall not be more than 30%, when tested as per ASTM D 1238 (IS:2530). The test will be conducted by collecting raw material from the hopper during extrusion and finished duct made from the same material.</td><td>Testing as per ASTM D1238 / IS:2530</td></tr>
<tr><td>4.17</td><td>Ash Content: The Ash Content of Microduct for outdoor application shall not be more than 0.3% when tested as per method outlined in clause No. 6.1. This test is not applicable to Microduct for indoor application since the material is LSZH.</td><td>Physical verification</td></tr>
<tr><td>4.18</td><td>Test for fading of colours of Microduct: The Microduct shall be tested for the fading of colours as per ASTM D 1712. There shall be no discolouration.</td><td>Testing as per ASTM D1712</td></tr>
<tr><td>4.19</td><td>UV Stabiliser Test (ODA Microduct): The test shall be conducted on specimens taken (as per type V of ASTM D 638) from the Microduct. The aging shall be done with UV-B lamps at a typical irradiance of 0.63 W/m²/nm as per cycle No. 2 of ASTM G 154.

Table-4
<table><tr><td>Lamp</td><td>------</td><td>UV-B lamp</td></tr><tr><td>Cycle</td><td>------</td><td>4 hrs. UV exposure at 60° C
4 hrs. Condensation at 50° C</td></tr><tr><td>Total cycle time</td><td>------</td><td>720 hrs.</td></tr><tr><td>Reference</td><td>------</td><td>ASTM D 638 (Type IV specimens)</td></tr></table>
After aging, the specimens shall be tested for tensile strength at a speed of 50 mm/minute. The variation compared to the value</td><td>Testing as per ASTM D638 & G154</td></tr>
</table>

	obtained before aging as in clause 4.2 shall not be more than 20%. Note: This test is not applicable for indoor application (LSZH)	
4.20	Identification Markings: The Microduct shall be prominently marked with indelible ink with ink jet printing, with the following information at intervals every meter to enable identification of the Microduct. The size of ink markings shall be distinct, clearly and easily visible. a) Service Provider / Purchaser's Cable Microduct b) Telephone /Purchaser's emblem c) Manufacturer's name (also can be in abbreviated form) d) Microduct with size e) Machine number/Specific serial number of the Microduct f) Date of manufacture (DD/MM/YYYY) g) Sequential length marking at every meter with arrow mark in ascending order h) In case of bundled Microduct, individual Microduct identification number shall be as per Annexure-4.	Physical Verification
4.21	Anti Rodent Test: The test detailed in Annexure-5. Effect of anti-rodent chemical on LSZH chemical is not tested. Since LSZH is a regulatory requirement, it is preferred over anti-rodent requirement in Microducts for indoor applications. However purchaser may specify anti rodent requirement for Microduct for outdoor applications.	Testing as per Annexure-5 of the GR
5.0	Engineering Requirements	
5.1	Colour of the Microduct (ODA Microduct): The Microducts shall be made in eight colours viz. Green, Orange, Blue, Yellow, Brown, Violet, Grey and Red. The colour of the duct shall be uniform throughout. The	Information

	purchasing authority shall specify the colours of the duct ordered for.	
5.1.1	The colour of the Outdoor application Microduct shall be identifiable under normal lighting conditions and shall conform to IS: 9938.	Information
5.1.2	In the two layer construction the inner layer (Solid Lubricant) shall be white in colour.	Information
5.2	The length of the Microduct in reel (wooden/metal/plywood) shall be 2 Km ± 10 % / 4Km ± 5% and shall be supplied as per the order. The variation in length of Microduct, as specified above (in each drum), shall be acceptable. It shall be suitably packed for shipping and handling purposes.	Information
6.0	Quality Requirements	
6.1	Material	For information
6.1.1	The raw material used for Outdoor application Microduct shall meet the following requirements: a) The antioxidants used shall be physiologically harmless. b)None of the additives shall be used separately or together in quantities as to impair long term physical and chemical properties of the duct. c)The raw material used for extrusion shall be dried to bring the moisture content to less than 0.1%. d)Suitable UV stabilizers shall be used for manufacture of the duct to protect against UV degradation, when stored in open for a minimum period of 8 months. e)The raw material used in the manufacturing of the duct shall be such that the service life of the duct and all its accessories can be expected to be more than 50 years including the life of permanent lubricant.	(a) to (f) – Declaration

	f)No rework material shall be used during Microduct Manufacturing. g) Ash Content of Colour Master Batch: The Ash Content of Colour Master Batch shall not be more than 12%, when tested as per Method given below: Test Method for Ash Content: About 1 gm of colour Master Batch sample, under test, shall be taken and dried at 105° C for two hours in a platinum or glazed porcelain or silica or quartz crucible. The weight of the sample shall be noted. Subsequently, the sample with the crucible shall be transferred to a muffle furnace maintained at 600 ± 50° C and allowed to remain there for three hours. The ash content may be calculated as a percentage of the weight of the original sample. Note: The HDPE resin raw material used in the manufacturing of Outdoor application Microducts shall have source approval of CACT/ TEC designated CAB/Accredited laboratory. The source approval for the HDPE resin raw material will be granted by CACT/ TEC designated CAB/Accredited laboratory if the material conforms to above clause No.3.2.1A.	(g) Lab Test Report
6.1.2	The raw material used for indoor application Microduct shall meet the following requirements: a) None of the additives shall be used separately or together in quantities as to impair long term physical and chemical properties of the duct. b) The raw material used for extrusion shall be dried to bring the moisture content to less than 0.1%. c) Suitable UV stabilizers shall be used for manufacture of the duct to protect against UV degradation, when stored in open for	Lab Test Report

	a minimum period of 8 months.	
7.0	Microduct Accessories	
7.1	The following accessories are required for joining the Microducts and shall be supplied along with the ducts. The manufactures shall provide complete design details, procedure for method of installation and type/grade of the material used for the accessories. The required quantity shall be indicated by the Purchasing Authority in the purchase order. a) Plastic Coupler : The coupler shall be of Push-fit type having Push-Lock mechanism, which enables them to be installed on Microducts without pre-dismantling. It is used to couple two Microducts. The design of this shall be simple, easy to install and shall provide air tight and water tight leak proof joint between the two Microducts. The coupler shall ensure that the two Microducts are butted smoothly without any step formation in the inner surface. The joining shall meet the air pressure test of 12 kg/cm^2 for a minimum period of 2 hours without any leakage. b) End Plug: The end plug shall be Push-fit type. This is for sealing the ends of empty ducts, prior to installation of Optical Fibre Microcable and shall be fitted immediately after laying of duct, to prevent the entry of any dirt, water, moisture, insects etc into ducts. End Plug shall be tested for air tightness with a pressure of 1 bar for 30 minutes. For carrying out the test, suitable length of duct shall be taken. c) End Cap: This cap, made of hard rubber/suitable plastic material, shall be fitted onto both ends of duct coil after manufacturing the duct. This shall avoid entry of dust, mud and rain water into the duct during the transit and storage.	Physical verification for accessories mentioned at a), b) and c).

	Test for Accessories : Pulling force required to pull out two pieces of Microduct joined by coupler: The test may be conducted by loading the coupler joined by two pieces of Microduct for 15 minutes using a dead load or by using Universal Tensile machine. The minimum pulling force required shall be as below. Table-5 Microduct Size (mm) / Pulling Force required (Kgf) 5/3 — 9 7/4 — 13 10/6 — 25 12/8 — 30 14/10 — 35 16/12 — 40 Ageing Test for Accessories: The accessories, viz., coupler, and End plug covered in clause 7.1 of the GR shall be subjected to an ageing test. In this test, the accessory under test shall be installed on a piece or pieces of Microduct as the case may be. It shall then be tested for tightness as per the GR and it shall pass the test. The accessory thus installed shall then be aged in an air circulating oven at 70 ± 2° C for 168 hours. At the end of the period, it shall be allowed to cool to room temperature and then be tested for tightness as per the GR and it shall pass the test. Tools for Accessories : The following additional tools are required for joining of the	Tests for Accessories in respect of Pulling Force, Air Tightness, Ageing Test as per lab report or witness testing as per TEC extant procedures / guidelines and in compliance to the requirement mentioned in the respective clause, if any.

	ducts and installation of Microduct optical fibre cable. These items can be procured as per the Manufacturer/Supplier's specification, as and when required by the Purchasing Authority. Microduct Cutter: This is required to cut the Microduct ends squarely without any burr or notch. Blowing Equipment: The equipment used for installing optical fibre cable by blowing technology shall be capable of pushing 1 km (minimum) cable into the duct with powerful air stream generated by a compressor. The compressor shall have the following characteristics: Pressure : : Min. 8 bar Max. 12 bar Flow rate : : 10 m^3/minute The mechanical feeder of the equipment shall not cause any damage to the sheath/jacket of the Microduct optical fibre cable. Note: It shall also be possible to pull the Microduct optical fibre cable manually over shorter sections (up to 200 meters).	
7.4	Following accessories shall be supplied along with the Microduct/Km: Coupler - 4 nos. End Plug - 2 nos. Cable sealing plug - 4 nos. End Caps - 4nos. However the required quantity of accessories shall be indicated by the purchasing authority.	Physical verification

8.0	Acceptance Tests : The acceptance tests shall be carried out on samples selected from the lot as per Table-A for Dimensional and Visual requirements. The requirements for Tensile Performance, Crush Performance, Impact Test, Torsion, Kink Test, Bend Test, Microduct route verification test, Microduct pressure withstand Test, Heat Reversion test, Environmental Stress Crack Resistance Test (ESCR), Oxidation Induction Test, Internal Co-efficient of Friction, Ovality Test, Density of Finished Microduct, Melt Flow Rate (MFR) of Finished Duct, Ash Content, Test for fading of colours of Microduct, UV Stabiliser Test and Identification Markings shall be carried out as per Table-B. Note: The Acceptance Tests and the Sampling plan can be modified by the purchaser at his discretion at any point of time.	Lab Test Report
9.0	Type Approval/ Technical Specification Evaluation:	
9.1	All the tests mentioned in this document shall be carried out on the 5 standard lengths (2000mtrs) of Microducts and the samples must pass these tests before according the Type Approval/TSEC. The supplier shall furnish 5 standard lengths for carrying out these tests for according Type Approval/TSEC. Bulk manufacturing and supply shall start only after issue of Type Approval/TSEC. The Type Approval certificate/TSEC shall clearly indicate the Type/Grade/Source of High-Density Polyethylene raw material, the Size of the Microduct and the Construction of the Microduct, i.e. Two layer.	Evaluation to be done as per TEC extant procedures / guidelines.
9.2	OEMs/Manufacturers shall inform the purchaser whenever grade/source of raw material(s) is changed, along with valid source approval certificate in accordance with the provision of clause 3.2 above.	Declaration

	In case, the grade/source of raw material(s) like HDPE resin or Solid Lubricant, is changed, the OEM/ Manufacturer shall obtain Fresh Type Approval Certificate (TAC) /TSEC, on furnishing compliance to the following incremental tests: i) Impact strength; ii) Crush Resistance; iii) Environmental Stress Crack Resistance; iv) Oxidation Induction Test; v) Density and Melt Flow Rate. However, the purchaser may specify the exact requirement of incremental tests in modification of above tests, if any. Type Approval Certificate/TSEC shall be issued for each grade/source of raw material in accordance with the above-mentioned incremental test(s) as applicable. Further initially issued TAC/TSEC in respect of particular source of raw materials shall remain valid till its validity Period.	
9.3	The product shall be subjected to Field Trial test, as mentioned below, before issue of the first Type Approval/TSEC to any manufacturer. Field Trial Installation Test: The manufacturer should demonstrate blowing of 1 km of Micro cable in the Microduct with no deterioration in the fibre cable characteristics. Successful demonstration of the above shall be essential for the Type Approval Certificate/TSEC.	Physical verification
10.0	Storage	
10.1	All the materials shall be stored in the manufacturer's premises in such a manner that it will not affect the performance of the product.	Declaration

11.0	Packing and Delivery:	
11.1	The store shall be supplied in coils of suitable size for delivery in such a manner that they arrive at their destination in a safe and undamaged condition and will permit the loading, unloading and handling the stores using standard moving equipment. The minimum inner bending diameter of the Microduct on reel shall be 25 times the outer diameter of the duct.	Declaration
12.0	The quality requirement of the manufacturing system. The item shall be manufactured in accordance with International quality standards ISO 9001: 2015 for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system followed by the manufacturer would be required to the submitted.	Declaration

I. TEST SETUP & PROCEDURES:

Please refer to test setup as per various BIS/Relevant standard.

J. SUMMARY OF TEST RESULTS

GR 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'.*

End of Document