अनंतिम टेस्ट गाइड
टीईसी ७२०३१:२०२५

(सं: टीईसी/टीआई/एफए/सीडीएस-208/04/अगस्त-19 को अधिक्रमित करता है)

PROVISIONAL TEST GUIDE

TEC 72031:2025

(Supersedes No: TEC/TI/FA/CDS-208/04/AUG-19)

परमनेंटली लुबकेटेड एचडीपीइ टेलीकॉम डक्ट्स फॉर यूज एज़ अडंरग्राउंड ऑप्टकल फ़ाइबर केबल कंदइ्स

(जीआर सं: टीईसी ७२०३०: २०२५)

PERMANENTLY LUBRICATED HDPE TELECOM

DUCTS FOR USE AS UNDERGROUND OPTICAL FIBRE CABLE CONDUITS

(GR No.: TEC 72030:2025)

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 enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Permanently Lubricated HDPE Telecom ducts for use as Underground Optical Fibre Cable Conduits as per GR No TEC 72030:2025.

CONTENTS

A. HISTORY SHEET

Sl.No.	Standard / document *No.*	*Title*	*Remarks*
1	TEC/TI/FA/CDS-208/04/AUG-19	Permanently Lubricated HDPE Telecom ducts for use as Underground Optical Fibre Cable Conduits	First issue.
2	Provisional Test Guide TEC 72031:2025	Permanently Lubricated HDPE Telecom ducts for use as Underground Optical Fibre Cable Conduits	Second issue.

B. INTRODUCTION

The PLB HDPE ducts for use as underground optical fibre cable conduits, conforming to TEC Generic Requirements No. TEC 72030:2025 shall be offered for type evaluation along with factory tests conducted by the manufacturers at their premises and a copy of Instruction and Maintenance Manual.

The verification of component layout, bill of materials and documents etc. shall be carried out before commencing the performance tests. Clause wise performance tests shall be carried out as per this GR document.

All the necessary set-ups & instruments duly calibrated by an Authorized Lab. are to be provided by the manufacturer for testing.

All the basic test facilities & measuring equipment shall be provided by the manufacturer.

Note: Though every care has been taken to cover all the parameters of the GR correctly in this Test Schedule, yet to avoid any inadvertent error/ omission/ misprint, the testing officer shall ensure that all the parameters of the GR have been tested & verified in accordance with the provisions of the GR.

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)			
5	Any other relevant Information:-		

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

Sl. No.	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.	Vernier Caliper		dd/mm/yyy
2.	Screw Guage		
3.	Pie Tape		
4.	Traveling Microscope		
5.	ESCR Testing Machine		
6.	Differential Scanning Calorimeter for O. I. T		
7.	Universal Tensile Machine for T. S and I. C. F		
8.	Hydraulic Characteristics Testing Machine		

9.	Reversion Testing Machine (Hot Air Oven)		
10.	Muffle Furnace for Ash Content Test		
11.	Impact Testing Machine		
12.	Melt Flow Indexer		
13.	Any other test instrument required		

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 and Test No.:-

Sl No.	Clause No.	Parameters	Compliance with specifications	Remarks
1.	1.0	Scope: This document covers the requirement of permanently lubricated High Density Polyethylene ducts (PLB HDPE ducts) for use as underground cable conduits for optical fibre cables, suitable for cable installation by blowing technique.	For Information	
2.	2.0	**PRODUCT DESCRIPTION:**		
	2.1	The PLB HDPE duct shall consist of two concentric layers, the outer layer being HDPE; co-extruded with an inner layer of solid permanently lubricant, to reduce the Internal Co-efficient of Friction (ICF). The lubricant shall be of a solid layer of uniform thickness so formulated to provide a permanent, low friction boundary layer between the inner surface of the duct and OF cable. The lubricant layer shall be clearly visible in cross-section, concentric with the outer layer.	For Information	
	2.2	The PLB HDPE duct shall be supplied in a continuous length in coil form, suitable for shipping and handling purposes.	For Information	
		MATERIAL:		
	3.0	Two Layer Construction:		
	3.1	Outer layer: The base HDPE resin used for the outer layer of the PLB HDPE duct shall conform to any designation of IS: 7328 or to any equivalent standard meeting the following requirements. However, the manufacturers shall furnish the designation for HDPE resin as per IS: 7328, as applicable.		
	3.1.1	a) Density at 27 °C (When tested as per IS-2530 or IS: 7328)	Shall conform to any approved designation of IS 7328 or to any equivalent standard; Designation shall be recorded.	
		b) Melt flow rate at 190 °C & 5 kg load (When tested as per IS-2530)	0.940 to 0.958 g/cc	
		c) Tensile Strength at yield (When tested as per ASTM D 638 Type-IV specimens)	0.2 to 1.1 g/10 minutes	
		d) Elongation at Break (When tested as per		

			20 N/mm² minimum More than 600%	
		ASTM D 638, Type-IV specimens) e) Flexural Modulus at 1% strain (When tested as per ASTM D 790) f) Hardness, Shore-D (When tested as per ASTM D 2240) g) Heat Deflection Temperature at 45 gms/mm² (When tested as per ASTM D 648) h) Environmental Stress Crack Resistance , when tested with 10% lgepal CO 0630 solution at 50 °C. (ASTM D 1693) i) Weathering in artificial UV light (Specimens shall be as per ASTM D 638 Type IV, cut from compression molded sheet) j) OIT (in Aluminium Pan) (test as per Annexure-I of this GR) k) U.V. Stabliser Content	690 N/mm² minimum Between 60 and 65 units 65°C minimum 96 hrs., when tested as per ASTM D 1693, No cracks 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 details of cycle time etc. refer Clause 4.22. 30 minutes minimum Hindered Amine Light Stabilizer. Minimum 0.15% when analyzed as per FT-IR method. (external agency report conforming to the requirement shall be submitted by vendor)	

3.	3.1.2 &3.1.3	<u>Inner Layer:</u> i) Material &Construction The inner lubrication material shall be of friction reducing, polymeric material which shall be integral with HDPE layer. In the finished PLB HDPE duct, the co-extruded inner layer of solid permanent lubricant shall be integral part with HDPE and shall be white in colour and clearly visible in crosssection 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. ii) Toxic/Dermatic hazards. The lubricant materials shall have no toxic or dermatic hazards for safe handling. iii) Density of the material of the inner layer material, at 27°C (IS 7328 or IS 2530).	Physical verification. The inner lubrication material shall be of friction reducing polymeric material. In the finished PLB HDPE duct, the coextruded inner layer of solid permanent lubricant shall be integral part with HDPE and shall be white in colour and clearly visible in cross-section of duct. . It shall be continuous all through. The inner layer material shall have no toxic or dermatic hazards for safe handling. 0.940 to 0.958 gms/cc	Test certificate obtained from approved lab.

4.	3.2	The raw material (s) used for the duct shall meet the following: a) The anti-oxidants 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) Single pass rework material of the same composition produced from the manufacturer's own production shall be used and it shall not exceed 10% in any case. d) The raw material used for extrusion shall be dried to bring the moisture content to less than 0.1%. e) 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. f) The raw material used in the manufacture 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. Note: Certificate from OEM/Manufacturer for the service life of the finished product and all its accessories including the life of permanent lubricant shall be submitted in support of 50 years of life. g) The ash content of the colour master batch shall not be more than 12% when tested as per method detailed below: Test Method for ash content: About one gram of the 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.	a to e : Shall confirm (See remarks in the next Column) f) Certificate from OEM/Manufacturer for the service life of the finished product and all its accessories including the life of permanent lubricant shall be submitted in support of 50 years of life. g: Not more than 12%	a to e: Certificate from the manufacturer has to be obtained for all the requirements.

5.	3.3	Source approval: The HDPE resin raw material used in the manufacture of ducts 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 clause 3.1.1	Verify availability of Certificate from CACT/TEC designated CAB/ Accredited laboratory if the material conforms to clause 3.1.1. .	
6.	4.1	Visual Inspection: The ducts shall be checked visually for ensuring good workmanship. The ducts shall be free from blisters, shrink holes, flaking, chips, scratches, roughness, break and other defects. The ducts shall be smooth, clean and round. The end shall be clearly cut and shall be square with axis of the duct.	The ducts shall be free from blisters, shrink holes, flaking, chips, scratches, roughness and other defects. The ducts shall be smooth, clean and round. The ends shall be cleanly cut and shall be square with axis of the duct.	
7.	4.2	Colour of the duct (IS: 9938) Stripes Material of the stripes.	Colour of the duct shall be Green, Orange, Blue, Yellow, Brown, Violet, Grey, Red. The colour of the duct shall be uniform throughout. Each duct shall contain four approximately equispaced, continuous, longitudinal stripes of width 3 mm minimum in white colour. The stripes shall be co-extruded during duct manufacturing. Shall be same as that of the base compound of the duct. Material has to be verified from the bags.	Certificate from the manufacturer has to be obtained.

8.	4.2.1	The colour of the inner layer	White	Certificate from the manufacturer has to be obtained.
9.	4.2.2	The colours of the duct, stripe and inner layer	Shall be identifiable under normal lighting conditions, and generally conform to IS-9938.	Certificate from the manufacturer has to be obtained.

10.	4.3	Dimensions: a) Outer diameter	110 mm + 1.0 mm 63 mm + 0.6 mm 50 mm + 0.5 mm 40 mm + 0.4 mm 32 mm + 0.3 mm	
		b) Wall thickness	15.0 mm ± 0.60 mm for 110/80 mm duct 6.5 mm ± 0.40 mm for 63/50 mm duct 4.0 mm ± 0.3 mm for 50/42 mm duct. 3.5 ± 0.2 mm for 40/33 mm duct. 3.0 mm ± 0.2 mm for 32/26 mm duct.	
		c) Thickness of Inner Layer	Min. 0.56 mm ‖ for 110/80 Max. 0.84 mm ‖mm duct Min. 0.36 mm ‖ for 63/50 Max. 0.54 mm ‖mm duct Min. 0.32 mm ‖ for 50/42 Max. 0.48 mm ‖mm duct Min. 0.28 mm ‖ for 40/33 Max. 0.42 mm ‖mm duct Min. 0.24 mm ‖ for 32/26 Max. 0.36 mm ‖mm duct	
		d) Standard length	1000 ± 100 meters for 50/42 mm, 40/33 mm, 32/26 mm duct	
		e) Maximum OD of optical fibre cable for installation by blowing technique.		

			500 meters ± 50 meters for 63/50 mm duct 200 meters ± 20 meters for 110/80 mm duct 40 mm (576 fibres) for 110/80 mm 25 mm (144 fibres) for 63/50 mm 18 mm for 50/42 mm 16 mm for 40/33 mm duct. 12 mm for 32/26 mm duct.	
11.	4.4	Optional pre-installed rope for the above standard length duct: The duct shall be supplied with pre-installed rope when so ordered by the purchasing authority. The rope shall be polypropylene, 4 mm in diameter for 32mm/26mm, 40mm/33mm, 50mm/42mm ducts and conform to IS: 5175, with a minimum slackness of 2%. The diameter of polypropylene rope in case of two other ducts for the sizes of 63mm/50mm & 110mm/80mm duct shall be 6mm diameter conforming to IS: 5175.	Diameter 4 mm in case of 50/42 mm, 40/33 mm, 32/26 mm, Diameter 6 mm in case of 110/80 mm & 63/50 mm, Shall conform to IS: 5175 with a minimum slackness of 2%.	Certificate from the manufacturer in respect of material has to be obtained.
Sl No	Clause No.	Description of the clause	Test Results	
			Value observed/reported in the Lab Test Report for Raw Material of the Product	Value observed/reported in the Lab Test Report for Raw Material of the Product

12.	4.5	Tensile Strength and Elongation: The sample taken from the PLB HDPE ducts when tested as per ASTM F 2160 (using type IV specimens of ASTM D 638) shall meet the requirements: Tensile Strength at yield --- Min. 20 N/mm²} When tested at a machine Elongation --- Min. 500% } speed of 50 mm/min.	Observed value as per Cl 3.1.1(c) Observed value as per Clause 3.1.1(d)	Observed Value as per Clause 4.5. observed value as per clause 4.5
Sl No.	**Clause No.**	**Parameters**	**Compliance with specifications**	**Remarks**
13.	4.6	Longitudinal Reversion test This test shall be carried out as per IS: 4984. For this purpose, a duct length of 200 mm shall be placed horizontally in an air-oven or a suitable liquid bath on a support at 110 ± 2°C for 60 minutes so that the dimensional changes in duct section are not impeded. After cooling to room temperature, the dimensional change of the duct section shall be measured in the longitudinal direction and the deviation from the initial length shall be calculated and stated in percentage. The dimensions shall not change by more than 3 percent in the longitudinal direction.	The dimensions shall not change by more than 3% in the longitudinal direction.	
Sl No	Clause No.	Description of the clause	Test Results	
			Value observed/reported in the Lab Test Report for Raw Material of the Product	Value observed/reported in the Lab Test Report for Raw Material of the Product

14.	4.7	Environmental Stress Crack Resistance : The test specimen cut from the PLB HDPE ducts(for ≤ 50 mm outer dia duct) or from compression molded sheet from the material of finished duct(for more than 50 mm outer dia duct), shall meet the environmental stress cracking as described in ASTM D-1693, when tested with 10% lgepal (CO 630) solution at 50 ± 1°C for 96 hours. There shall be no failure/cracks.	observation for test as per clause 3.1.1(h) There shall be no failure.	observation for test as per clause 4.7

Sl No.	Clause No.	Parameters	Compliance with specifications	Remarks
15.	4.8	Impact Strength: The test has to be carried as per IS: 12235 (Part-9). A sample duct 150 mm in length shall be placed on a heavy rigid block whose faces are at an angle of 120°. A striker with a hemispherical nose of 13 mm radius and loaded to a total weight of 10 kg shall be allowed to fall freely in a suitable vertical guides through a height of 1.5 m before striking the duct. The line of fall of the striker shall coincide with the diameter of the duct. The duct shall not crack or split.	The duct shall not crack or split.	
16.	4.9	Crush Resistance: Samples of duct of 150 mm ± 2 mm in length shall be subjected to a dead load of not less than 50 kg for one minute and shall be allowed to recover for 5 minutes. The deflection with load on and after recovery period shall not exceed 10% and 2% respectively.	The deflection with load on and after recovery period shall not exceed 10% and 2% respectively.	
17.	4.10	Mandrel Test: A 150 mm long mandrel of diameter, 3 mm less than the internal diameter of the duct shall be passed through a 5 metre length of duct, freely throughout the length, when the duct is bent to a radius of 5 metres.	The mandrel shall pass through a 5 meter length of duct freely throughout the length.	
18.	4.11	Ovality Test: Ovality is the difference between maximum outside diameter and the minimum outside diameter at the same crosssection of the duct, at 300 mm away from the end. The ovality for 50/42 mm & 40/33 mm shall not exceed 1.4 mm and the ovality for 32/26 mm ducts shall not exceed 1.3 mm, when measured as per IS: 4984. The ovality for 110/80 mm shall not exceed 2.2 mm and the ovality for 63/50 mm ducts shall not exceed 1.5 mm.	Max. 1.4 mm for 50/42 mm and 40/33 mm duct. Max. 1.3 mm for 32/26 mm duct. Max. 1.5 mm for 63/50 mm Max. 2.2 mm for 110/80 mm	

19.	4.12	Coil Set: The PLB HDPE duct shall unroll off the drums without snaking or waving having zero coil set. Thus, the duct shall lay straight into the trench without recoiling. For this purpose, when a minimum length of 50 metres duct taken from the coil and laid on the ground, it shall be straight without any bends or kinks and without deformation, except 5 metres from each end.	It shall be straight without any bends or kinks and without deformation, except 5 meters from each end.	

Sl No	Clause No.	Description of the clause	Test Results	
20.	4.13	Oxidation Induction Test (O.I.T) when tested with a copper pan as per the method in Annexure-I.	Value observed/reported in the Lab Test Report for Raw Material of the Product	Value observed/reported in the Lab Test Report for the finished product"
			observed value as per Clause 3.1.1(j)	value observed as per clause 4.13

The tests suggested against clause 4.13,Clause 4.5 and Clause 4.7 do cover the requirements for Finished Product. Similar type of Test are also conducted on the raw material used,as per the requirements suggested under clause 3.1.1 In all these tests that are suggested for finished product, Test Values observed for corresponding test(s) {which were conducted for the raw material} are taken as reference for comparison and evaluate the performance as well as to determine the stability.

Sl No.	**Clause No.**	**Parameters**	**Compliance with specifications**	**Remarks**

21.	4.14	Hydraulic Characteristics: The duct shall be tested for internal pressure creep rupture test IS:4984. For this purpose, a sample length of 10 times the outside diameter of the duct shall be taken. At the end of the test, the sample shall not show signs of localized swelling or leakage and shall not brust during the test duration. The test showing failure within a distance equivalent to the length of end cap from the end shall be disregarded and the test repeated. The test temperatures and the duration of the test shall be as per clause 4.14 of the GR.	The sample shall not show any swelling on leakage and shall not burst during the test duration.	
22.	4.15	Internal Co-efficient of Friction (applicable to 32/26mm, 40/33mm, 50/42mm & 63/50mm ducts): The Internal Co-efficient of Friction when tested as per the method in Annexure-2, shall not exceed following value as mentioned below: - For Nylon Jacketed unarmoured OFC: 0.06 Max. for HDPE PLB Ducts. - For HDPE Jacketed unarmoured OFC : 0.20 Max. for HDPE PLB Ducts.	Max. 0.06 for Nylon Max .2 for HDPE	
23.	4.16	Identification Markings: The duct shall be prominently marked with indelible ink, with the following information at intervals every metre to enable identification of the pipe. The size of ink markings shall be distinct, clearly and easily visible.	Shall be prominently marked with indelible ink at intervals of every meter to enable identification of the pipe. The size of ink	

		• Service Provider/Purchaser cable duct • Telephone Emblem (specific to purchaser) • Manufacturer's name (also can be in abbreviated form) • Name of the duct with size For marking machine number/specific Serial No. of the duct and date of manufacture, a composite number as mentioned below would be used. A composite no. shall be given in the format PXXSSSS DDMMYY, where – P-plant id X- Machine Number, YY- Year of manufacture, MM- Month of manufacture, DD - Date of manufacture, SSSS - Serial No. of the duct length manufactured in machine number X. Along with the above composite number, sequential marking at every metre shall be done for each duct length.	markings shall be distinct, clear and easily visible.	
24.	4.17	<u>Optical Fibre Cable Blowing Test (applicable to 32/26mm, 40/33mm, 50/42mm & 63/50mm ducts):</u> For this test an optical Fibre Cable of a diameter nearest to the diameter indicated in clause 4.3 (e) of the GR; relevant to the size of duct under test shall be installed by blowing of the cable in a length of 1 km of the 32/26mm, 40/33mm , 50/42mm duct and 500 meter of the 63/50mm duct. The duct shall be laid with bends in the horizontal and vertical planes and a raise in the middle as detailed in the Figure-1. The 1 km section shall include two couplings and 500 meters section shall include two coupling at suitable locations as shown in the Figure 1 and figure 2 respectively. The OFC shall then be blown out. It shall be inspected for any visual damage. The OFC shall then be blown in again. It shall possible to blow in the Optical Fibre Cable through the 1 km duct, each time in not more than 35 minutes, for 32/26mm, 40/33mm & 50/42mm ducts and through 500 meters 63/50mm duct as decided by purchaser. There shall be no visible damage to OFC.	Blowing in of OF cable through the 1 km duct on each occasion shall be completed, in not more than 35 minutes, for 32/26mm, 40/33mm & 50/42mm ducts and through 500 meters 63/50mm duct as decided by purchaser. There shall be no visible damage to OFC	

		The test will be conducted on two samples out of the five submitted for Type Approval.		

Sl No	Clause No.	Description of the clause	Test Results	
			Value observed/reported in the Lab Test Report for Raw Material of the Product	Value observed/reported in the Lab Test Report for Raw Material of the Product
25.	4.18	Density: The density of the duct 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 gms/cc, when tested as per IS:2530 or IS: 7328. The same test method shall be used for determining the density of the raw material as well as the completed duct. The test will be conducted by collecting raw material from the hopper during extrusion and finished duct made from the same material.	gms/cc at 27° C Density of the completed duct (IS:2530/IS:7328) :0.940 to 0.958 gms/cc Compare the density of raw material and completed duct . It shall not differ by more than 0.003 gms/cc The same test method shall be used for determining the density of the raw material as well as completed duct. Average density of two samples of duct shall be taken for this purpose. The test shall be conducted by collecting raw material from the hopper during extrusion and finished duct made from the same material.	gms/cc at 27° C

26.	4.19	Melt Flow Rate (MFR): The change in the MFR caused by processing of raw material into duct, i. e. the difference between the measured value for the outer layer material from the duct and measured value for the raw material shall not be more than 30%, when tested as per IS: 2530. The test will be conducted by collecting raw material from the hopper during extrusion and finished duct made from the same material	(observed Test value as per Clause 3.1.1(c) Compare the MFR of raw material and outer layer of completed duct. The difference between the measured value for the outer layer material from the duct and measured value for the raw material shall not be more than 30% The average MFR of two ducts shall be taken as MFR of the duct. The test shall be conducted by collecting raw material from the hopper during extrusion and finished duct made from the same material.	(observed Test value)
27.	4.20	Ash content: (For test method refer C1.3.2 (g)	(observed Test Value as per Clause 3.2(g) Shall not be more than 0.3%	(observed Test value)

28.	4.22	UV Stabliser Test: The test shall be conducted on specimens taken (as per type IV of ASTM D 638) from the duct. 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 Lamp UV-B lamp Cycle 4hrs. UV exposure at 60°C 4 hrs. Condensation at 50°C Total cycle time 720 hrs Reference ASTM D 638 (Type IV specimens) After aging the specimens shall be tested for tensile strength at a speed of 50 mm/minute. The variation compared to the value obtained before aging shall not be more than 20%."	Value observed as per Clause 4.5 After ageing for 720 hrs. the samples shall be tested for tensile strength at a speed of 50 mm/min. The variation in tensile strength compared to the tensile strength before ageing shall not be more than 20%.	value observed as per clause 4.22

Sl No.	Clause No.	Parameters	Compliance with specifications	Remarks
29.	4.21	Test for fading of colours of duct: The duct shall be tested for the fading of colours as per ASTM D 1712. There shall be no discolouration.	There shall be no discolouration.	

30.	5.1	PLB HDPE DUCT Accessories: a) Plastic Coupler:(Push-fit / Compression type) It is used to couple two ducts. The design of this shall be simple, easy to install and shall provide air tight and water tight joint between the two ducts. The coupler shall ensure that the two ducts are butted smoothly without any step formation in the inner surface. The jointing shall meet the air pressure test of 15 kg/cm² for a minimum period of 2 hours without any leakage. The material of the coupler shall be as per clause 3.1.1 of the GR. Either Screw-fit (also called Compression type) OR Push-fit Couplers, meeting the above requirements may be used. Manufacturer shall furnish the complete engineering drawings of the various components used & material specifications. This will be recorded for that manufacturer for future verification. Installation instructions also shall be provided by the manufacturer. Note: Both sides of the coupler shall be marked with the manufacturers name by engraving and that the ends of the (opening for entry of duct) shall be covered with removable caps, to prevent the entry of foreign matter while not in use. Pressure test: The jointing shall be tested for pressure of 15 kg/cm² for a minimum period of 2 hours.	These shall be supplied along with the ducts. The manufacturer shall provide complete design details, installation method and type/grade of the material used for the accessories. No part of it shall be made of metal (Physical verification). Shall conform. The coupler shall ensure that the two ducts are butted smooth with out any step formation in the inner surface. The material of the coupler shall be as per clause 3.1.1 of the GR. Shall conform. Shall conform. There shall be no leakage. These shall be fitted for sealing the ends of the empty ducts, prior to installation	Note down whether the coupler offered is Pushfit type or Compression type. Verify the Manufacturer's name marking on the coupler by engraving. Also verfy the availability of removable caps for both the ends.

		b) End Plug: This is for sealing the ends of the empty ducts, prior to installation of the OF cable and shall be fitted immediately after laying of the duct, to prevent the entry of any dirt, water, moisture, insects/rodents etc. <u>Pressure test:</u> It shall be tested for air tightness with a pressure of 1 bar for 30 minutes. For carrying out the tests for the above accessories, suitable length of duct shall be taken. c) <u>Cable Sealing Plug</u>: <u>Pressure test</u>: It shall be tested for air tightness with a pressure of 1 bar for 30 minutes. For carrying out the tests for the above accessories, suitable length of duct shall be taken. d) End Cap:	of the OF cable and shall be fitted immediately after laying of the duct, to prevent the entry of any dirt, water, moisture,insects/rodents etc. Shall conform. There shall be no leakage. This is used to seal the ends of the ducts perfectly, after the cable is installed in the duct, to prevent the entry of dirt, water, moisture, insects/rodents etc. This is required at all places where cable has come out of the duct either for jointing or entry into the building as required. The sealing plug shall be capable of accommodating standard sizes of optical fibre cable taking into account the variation in diameter due to tolerance limits, etc. Shall conform. There shall be no leakage. 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.	

31.	5.2	Pulling force required to pull out two pieces of duct joined by coupler: The pulling force required shall be a minimum of 800 kgf for 110/80 mm duct, 550 kgf for 63/50 mm duct, 450 kgf for 50/42 mm duct, 320 kgf for 40/33 mm duct and 250 kgf for 32/26 mm duct. The test may be conducted by loading the coupler joined by two pieces of duct for 15 minutes using a dead load."	Min. 800 kgf for 50 mm duct Min. 550 kgf for 50 mm duct Min. 450 kgf for 50 mm duct Min. 320 kgf for 40 mm duct Min. 250 kgf for 32 mm duct	
32.	5.3	Ageing Test for Accessories: The accessories, viz., coupler, end plug and cable scaling plug covered in Clause 5.1 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 duct 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.	It shall pass the tightness test as per clause. (Aged for 168 hrs. in air circulating oven at 70°C ± 2°C)	

33.	5.4	Additional Tools: a) <u>Rotary Duct Cutter:</u> This is required to cut the duct ends squarely without any burr or notch. b) <u>C-Spanner:</u> This is required to tighten Plastic Coupler properly so as to ensure air/water tightness as specified above, in case of compression type coupler. c) <u>Chamferring Tool:</u> This is required to give slight chamfer to the ends of PLB Ducts, to facilitate installation of coupler for jointing purpose. d) <u>Blowing Equipment:</u> 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 optical fibre cable. **Note:** It shall also be possible to pull the OF cable manually over shorter sections (up to 200 metres) which will be described in the Engineering Instructions.	As per manufacturer/supplier's specification. As per manufacturer/supplier's specification. As per manufacturer/supplier's specification. As per manufacturer/ supplier's specification.	C-Spanner is required only for compression type couplers.
34.	6.0, 6.1, 6.2,6.3& 6.4	Type Approval/Technical specification evaluation: (Refer clauses , 6.1, 6.2 , 6.3& 6.4)	Type Approval/Technical specification evaluation shall be done as per plan detailed in clause , 6.1, 6.2 6.3 & 6.4	

35.	7.0 7.1 7.2 7.3	ACCEPTANCE TEST: The acceptance tests shall be carried out on samples selected from the lot as per Table-1 for Dimensional and Visual requirements. The requirements for Tensile Strength & Elongation, Reversion Test, Environmental Stress Crack Resistance, Impact Strength, Crush Resistance, Oxidation Induction Test, Hydraulic Characteristics and Internal Coefficient of Friction shall be carried out as per Table-2. In addition to measuring wall thickness and testing for internal co-efficient of friction at the ends, these two parameters shall be checked at any point between the ends by cutting the duct at intermediate points. The duct thus cut can be supplied to the field with an additional coupler. The dimensions and breaking load of rope shall be checked when duct is supplied with pre-installed rope. The acceptance tests and the sampling plan can be modified by the Service provider/purchaser at his discretion at any point of time.	Acceptance test shall be done as per procedure outlined in clause 7.0, 7.1, 7.2 & 7.3	
36.	8.0	Storage	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.	

37.	9.0	<u>Packing and Delivery</u> Bending diameter of the coiled duct.	The store shall be supplied in coils of suitable size for delivery in such a manner that they arrive their destination in a safe and undamaged condition and will permit the loading, unloading and handing the stores using standard moving equipment. The minimum inner bending diameter of the coiled duct shall be 18 times the outer diameter of the duct.	
38.	10.0	Quality requirements 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 be submitted**.**	The documents pertaining to ISO 9001:2015 accreditations may please be called for and verified. 1. The item should be manufactured in accordance with international quality standards ISO 9001: 2015. 2. The manufacturer should be duly accredited for the same. 3. The manufacturer should have a quality plan describing the quality assurance system.	

1. The type approval tests/Technical Specification Evaluation tests shall be carried out as per sampling plan outlined in clause no. 6.0, 6.1, 6.2, 6.3 of the GR.
2. For tensile strength test and all tests involving tensile strength, the average tensile strength of five samples shall be taken.

3. The raw material shall contain required additives such as anti-oxidants, UV stabilizers etc., in the raw material itself so as to meet the above parameters

I. TEST SETUP & PROCEDURES:

Please refer to test setup as per various BIS standard.

J. 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.***

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'.***