परीक्षण मार्गदर्शिका

टीईसी ५२०११:२०२६

(सं: जी.आर/एसएलसी -०१/०२ टीएसटीपी-१ को अधिक्रमित करता है)

PROVISIONAL TEST GUIDE

TEC 52011:2026

(Supersedes No. GR/SLC-01/02.TSTP-1)

for

स्ट्रक्चर्ड लैन केबलिंग

Structured LAN Cabling

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-110001, भारत

TELECOMMUNICATION ENGINEERING CENTRE KHURSHID LAL BHAWAN, JANPATH, NEW DELHI–110001, INDIA www.tec.gov.in

Release 02: March 2026

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 Test Guide of testing pertains to detailed test schedule and procedure as required for evaluating conformance / functionality / requirements / performance of Structured LAN Cabling as per Standard for GR 52010:2026.

CONTENTS

A. History Sheet

S.No.	Standard/document No.	Title	Remarks
1.	GR/SLC-01/02.TSTP-1	TSTP for Structured LAN Cabling	
2	TEC 52011:2026	Test Guide for Structured LAN Cabling	Revision of GR by including cat 6A & onwards category LAN Cables

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B. INTRODUCTION

This document enumerates detailed test schedule and procedure for evaluating conformance / functionality / requirements / performance of Structured LAN Cabling as per TEC Standard. No TEC 52010:2026.

C. General Information:

S.No.	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 TEC Standard/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				

E. **List of the Test Instruments:**

S.No.	Name of the Test Instrument	Make/Model *(to be filled by testing team)*	Validity of calibration *(to be filled by testing team) (dd/mm/yyyy)*
1			

2			
3			
4			
5			
6			
7			
8			

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

(a) <Equipmment/Product Name> Configuration:

S.No.	Item	Details	Remarks

(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.	Clause	Type of test	Compliance
		Physical Verification / Declaration / Documentation / Report from Accredited Test Lab / Functional verification / Information / Lab Test (Test Reference)	Complied / Not Complied / Submitted / Not Submitted / Not Applicable (Indicate Annexure No for Test Results)
1.0 ~~Introduction~~Scope	This chapter defines the different structured LAN cabling methods that shall be deployed in the LAN cabling for different applications of Indian Telecom network. The structured LAN cabling is one of the important	Information ~~only~~	

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	requirements to allow the usage of multi-media and to support ~~speeds up to 1 Gbps in the LAN environment~~ high-speed application, 10/100/1000Mbps & 10Gbps over up-to 100meters and 25GBase-T/40GBase-T over up-to 30meter of structured cabling according to IEEE 802.3 international standards. ~~.~~ The structured cabling consists of elements like cables, faceplates, patch panels, outles and frames , etc. which shall conform to the standards mentioned in this document so that they can be used ~~for Gigabit transmissions.~~ above specified transmission speed.		

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1.1 Conformity to Standard	~~Check that t~~The Structured Cabling System should meet the following standards: a) ISO/IEC ISO 11081 : International standard for generic cabling for customer premises i. ANSI/TIA TSB 184A : Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling ii. ANSI/TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces iii. ANSI/TIA-606-B (administration) iv. ANSI/TIA-607-B: Telecommunications Grounding (Earthing) and Bonding for Customer Premises v. TSB-190: Guidelines on Shared Pathways and Shared Sheaths. vi. TSB-155-A: Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T vii. ANSI/TIA-1179: Healthcare	Declaration	

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	Facility Telecommunications Infrastructure Standard viii. ANSI/TIA-4966: Telecommunications Infrastructure for Educational Buildings and Spaces ix. TSB-162-A: Telecommunications Cabling Guidelines for Wireless Access Points. ~~a)~~**x.** TSB-184: Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling ~~b) TIA/EIA TSB-75 : Additional horizontal cabling practices for open office (August 1996)~~ ~~c) TIA/EIA TSB-95 (TBA end 1999): Additional transmission performance guidelines for 100 ohm 4-pair Category 5 Cabling~~ ~~d) b) TIA/EIA T568-BA Commercial Building Telecommunications cabling Standard (Category 5e cabling) - for characteristics specified up to~~		

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	~~100MHz and supports full duplex 1000 Base-T, 100 Base-TX , 10 Base-T.~~ ~~e) c) ANSI/TIA-568.2-ETIA/EIA – T568-B.2.1 Telecommunications cabling Standard (Category 6 cabling) - for characteristics specified up to 250MHz and supports full~~		
1.1 (b)	TIA/EIA – T568-B Commercial Building Telecommunications cabling Standard (Category 5e cabling) - for characteristics specified up to 100MHz and supports full duplex 1000 Base-T, 100 Base-TX , 10 Base-T.	Functional Verification	
1.1 (c)	ANSI/TIA-568.2-E Telecommunication standard up-to Cat6A & **onward** Cabling- for characteristics specified up-to 500MHz and supports full 10GBase-T, 1000Base-T,100Base-TX, 10Base-T.	Functional Verification	
	~~Duplex 1000 Base –T, 100 Base-TX, 10 Base-T. Telecommunication standard up-to Cat6A & **onward** Cabling- for~~	Functional Verification	

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	~~characteristics specified up-to 500MHz and supports full 10GBase-T, 1000Base-T,100Base-TX, 10Base-T.~~ d) The latest ISO/IEC-11801 and IEC 61156 -5 standard for Cat7/7A Cabling-for Characteristics specified up-to 600MHz for Cat7 and 1000MHz for Cat7A and supports full 10GBase-T, 1000Base-T, 100Base-TX, 10Base-T over 100meter and 25GBase-T with less than 30meter in Channel.		
1.2 Structured cabling.	~~Check that T~~the cabling design to the department LAN cabling should be as per the ~~TIA/EIA-T568-A standards / TIA/EIA-568-B standards~~ ANSI/TIA-568.2-E standards for Cat 5e/ Cat 6/ Cat6A & onwards & ISO/IEC-11801, IEC 61156-5 standard for Cat7/7A.	Functional Verification	
~~1.2.1~~	The structured cabling system design considerations is concerned with the following Seven ~~six~~ sub –systems.	Information	
(a) Building Entrance.	~~Check that~~ Building entrance should be the place where –in the interface equipment to the public network is positioned. The example for this is interface to the WAN through Routers/Leased lines etc.	Functional Verification	
(b) Equipment Room.	~~Check that T~~the equipment room ~~should~~ shall house the Active components for data ie the Server and in case of voice the EPABX . ~~Check that t~~The equipment room	Functional Verification	

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	should also house the Main Building Cross Connect connecting various floors of the building.		
(c) Backbone Cabling	~~Check that t~~The backbone cabling ~~should~~ shall consist of cables connecting the various floors of the building . ~~Check that~~ T~~t~~he type of cable used ~~should~~ shall be either Multi pair Category-5e or 4 pair Cat6/Cat6a UTP/STP~~25 pair UTP~~ Cable or preferably be of Fibre optic cable.	Functional Verification	
(d) Telecommunications Closet.	~~Check that~~ T~~t~~he telecommunications Closet should be placed in each floor which is a consolidation point for the Horizontal Cabling termination that interfaces with the Backbone cabling. Check that the telecommunication closet ~~should~~ shall also house the active equipment such as the Hubs/Switches catering to that particular floor.	Functional Verification	

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(e) ~~——~~Horizontal Cabling	~~Check that T~~the horizontal Cabling should consist of cables connecting the Telecommunication Closet to the Work area Telecommunication Outlet/Information Outlet. ~~Check that the~~The ~~cable~~ cable type used ~~should be either~~shall be Category6 or onwards~~,~~ 4 pair UTP/STP cable or 50/ 125 µm multi-mode fiber optic cable.	Functional Verification	
	~~Or Category 5e, 4 Pair UTP cable or a 2 core 62.5 / 125 µm multi mode fiber optic cable.~~		
(f) Work Area :	~~Check that t~~The work area should consist of the Telecommunications Outlet/Information Outlet wherein the horizontal cabling is terminated. ~~Check that T~~the patch cord connecting the Telecommunication outlet/Information outlet to the node ~~is~~shall also form the part of the Work Area.	Functional Verification	
(g) Administration Sub System	ANSI/TIA-606-D is a standard that establishes the guidelines for the administration of telecommunications infrastructure in commercial buildings. Its primary goal is to ensure that all	Functional Verification	

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	components of a structured cabling system are properly identified and documented to simplify maintenance, troubleshooting, and future upgrades.		
1.2.1 Category 6, 6A, 7, 7A, 8 Cables.	The Transmission performance of Cat 6 is better than Cat 5e Cable. a) The characteristics for Cat 6 Channel are specified (requires a positive PSACR) up to 200 MHz. and tested to 250 MHz.(ref.: Annex 1) ~~a 2)~~ Characteristics for Cat 6 Cable are specified (requires a positive PSACR) up to 250 MHz._(ref: Annex 2) b) The Cat 6 link and channel requirements are backward compatible to Cat 5e. c) The Category 6 standard has specifications for patch cords and connectors that are intended to assure interoperable Cat 6 performance (ref.: Annex 3). d) Category 6 cables are covered under TIA/EIA -T568-B standar~~5~~ds. e) Category 6A cables shall	Information	

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	comply to the electrical and mechanical requirements of the latest standard ANSI/TIA-568.2-E (ref: Annex-1, Annex-2, Annex-3) f) Category 7/7A Cables support higher bandwidth applications, shall comply to the requirements of latest ISO/IEC-11801 standard (ref: Annex-4, Annex-5). g) Category 8 Cables, shall comply to the requirements of ANSI/TIA-568.2-E. Cat8 channel length is restricted to **30 meters** (24 meters of horizontal cabling and up to 6 meters of patch cords). Cat8 requires shielding (typically S/FTP-Shielded/Foiled Twisted Pair) to mitigate Alien Crosstalk (AXT) and Electromagnetic Interference (EMI) at high frequencies. It is primarily used for Switch-to-Server connections in data centers (Top-of-Rack or End-of-Row configurations) where the 30-meter limit is sufficient. ~~d)~~		

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1.2.2 Backbone Cabling	~~Check that T~~the backbone cabling for the Cat 6 &Cat 6A as per latest standard ~~the EIA/ TIA-T568-A 5e or EIA/TIA-T568-B.2.1~~ANSI/TIA-568.2-E ~~Cat6~~ provides interconnection between telecommunications closets, equipment rooms, and entrance facilities. ~~Check that~~ It ~~it~~ consists of the backbone cable , intermediate and main cross- connects, mechanical terminations and patch cords or jumpers for backbone-to-backbone cross connection.	Functional Verification	
	Check the types and distances as referred in the following table:		

Cabling Types	Backbone Distance (Max)
100 ohm UTP/STP 22 AWG to 24 AWG	800 meter for voice
(American Wire Gauge) 100 Ohm	90 meters for Data
Multi-mode 650/125 µm Optical fiber	2000 meter
Single-mode optical Fiber	3,000 meter

It is recommended to use 23AWG conductor for better PoE performance

~~Cabling Types Backbone Distance (Max)~~

~~100 ohm UTP 22 AWG : 800 meter for To-26AWG Voice~~

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	~~(American Wire Gauge) 100 Ohm : 90 meters For Data Multi-mode 62.5/125 µm Optical fiber : 2,000 Meters Single-mode 8.3 / 125µm optical Fiber : 3,000 meters~~		
1.2.3 Horizontal Cabling	~~Check that t~~The Horizontal Cabling system for the as per the latest standard ANSI/TIA-568.2-~~ETIA/ EIA-T568-A~~ Cat~~-~~ 5e,Cat 6 & onwards & latest ISO/IEC-11801 and IEC 61156-5 for Cat7/7A ~~Standard or Cat 6 Standard~~ extends from the telecommunications outlet in the work area (or workstation) to the horizontal cross connect in the telecommunications closet. ~~Check that T~~the following media types should be used as options for horizontal cabling, each extending a maximum distance of 90 meters: a) 4-pair 100 Ohm UTP cable (24 AWG or 23 AWG solid conductors). b) 2 fiber ~~62.5~~50 / 125 µ meter Optical fiber cable.	Functional Verification	

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1.2.3.1	The horizontal cable shall meet the following requirements:		
1.2.3.1 (a)	Horizontal cables shall be NEXT compliant - 4 pair UTP/STP cable (unshielded twisted pair UTP/STP) of category 5e or category 6 standard, to connect each telecommunication outlet (TO) or consolidation point (CP) to the backbone sub-system on the same floor.	Functional Verification	
1.2.3.1 (b) ~~1.2.3.1~~	~~Check that the horizontal cable meets the following requirements:~~ ~~(a) Horizontal cables shall be NEXT compliant - 4 pair UTP cable (unshielded 5e or category 6 standard, to connect each telecommunication outlet (TO) or consolidation point (CP) to the backbone sub-system on the same floor.~~ ~~(b)~~ The UTP cable shall be of 24 AWG minimum for cat 5e and 23 AWG minimum for cat 6 cable bare solid copper conductors insulated with polymer jacketed ~~high density, PE sheath ,~~ ~~jacketed~~ with Fire retardant PVC/LSZH &UV PE. The insulated conductors shall be twisted into Pairs , with pair	Functional Verification	

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	balanced for attenuation. It is recommended to include a new jacket material type along with Fire Retardant PVC/LSZH (in conformance to IEC 60332-1-2) & for indoor application like Healthcare, Offices, Malls, indoor stadium or other facilities with dense human occupancy fire rating should complied to IEC 60332-3		
1.2.3.1 (c)	The UTP/STP cable shall be run using a star topology format from the cross connect at the floor distributor (FD)/ Telecommunication Closet (TC) administration subsystem on each floor to every individual telecommunication outlet. A 4 pair UTP/STP cable shall be run from the cross connect at the floor distributor (FD) administration subsystem on each floor to a consolidation point (CP) on the same floor.	Functional Verification	

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1.2.3.1 (d)	The 4-pair Cat6A & onward (as per latest standard ANSI/TIA-568.2-E) & Cat7/7A cabling (as per latest standard ISO/IEC 11801 and IEC 61156-5) UTP/STP cable shall be able to meet 100mt Horizontal Cable Alien Crosstalk performance and all application support as per the Annexure 6 from the Floor Distributor (FD) wiring closet to the telecommunications outlet at the work area	Functional Verification	
1.2.3.1 (e)	Each run of cable from the cross connect at the floor distributor (FD) and the telecommunication outlet shall be continuous without any joints or splices except for the open office design , when a consolidation point (CP) , is proposed	Functional Verification	
1.2.3.1 (f)	The length of each individual run of fixed horizontal cable from the administration subsystem (FD) on each floor to the telecommunication outlet shall not exceed 90 meters (at 20 degree Celsius, if the temperature is 40 degrees the length shall not cross 84 meters & If the temperature is 60degree Celsius the cable length shall not exceed 75 meter for UTP type and 84 meter for Shielded Type).	Functional Verification	

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1.2.3.1 (g)	The Cable design shall be such that they are installation stress proof.	Functional Verification	

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1.2.3.1 (h)	~~Pairs , with pair balanced for attenuation. The twist ratio shall be between 12 twist per feet to 30 twist per feet; with different for all the pairs.~~ ~~(c) The UTP cable shall be run using a star topology format from the cross connect at the floor distributor (FD) administration outlet. A 25 pair UTP cable shall be run from the cross connect at the floor distributor (FD) administration subsystem on each floor to a consolidation point (CP) on the same floor.~~ ~~(d) The 4 pair UTP cable shall be able to meet EIA/TIA 568 B Cat 6 Specification. It must be proven to ensure as mentioned in Annex 4 from the Floor Distributor (FD) wiring closet to the telecommunications outlet at the work area..~~ ~~(e) Each run of cable from the cross connect at the floor distributor (FD) and the telecommunication outlet shall be continuous without any joints or splices except for the open office design , when a consolidation point (CP) , is proposed.~~ ~~(f) The length of each individual run of fixed horizontal cable from the~~	Functional Verification	

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	~~administration subsystem (FD) on each floor to the telecommunication outlet shall not exceed 90 meters (at 20 degree Celsius, if the temperature is 40 degrees the length shall not cross 84 meters).~~ ~~(g) The Cable design shall be such that they are installation stress proof.~~ ~~(h)~~ The 4 pair UTP/STP cable shall meet or exceed the following		

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	Specifications i. ANSI~~TIA~~/EIA 568-A/B Commercial Building Telecommunications Cabling Standard ii. ANSI/TIA~~/EIA~~ 568-~~B.~~2-E standard Cat 6 & onwards, latest standard ISO/IEC 11801 and IEC 61156-5 for Cat 7/Cat 7A Cable Specifications Mentioned in Annexure2,4,5. iii. All application as per Annexure 6~~4~~. iv. Conductor DC Resistance (Max) : ~~28.6Ω/1kft~~9.38Ω/100 meter@20C v. DC Resistance unbalanced (Max): 5% vi. Insulation Resistance (Min): 5000MΩ/1kft@20C vii. Mutual Capacitance		

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	(Typical):- ~~15pF/ft~~5.6nF/100 meter; viii. Characteristics impedance: 100+/- 5%Ω@100 MHz ix. Typical Cable Skew : ~~4~~5 nsec /100 Meters. x. Flame Retardant: as per IEC 60332- 1-2 or IEC 60332-2 or IEC 60332-3 (As per purchaser requirement based on field application).		
1.2.4. Telecommunication closet.	Check that each piece of UTP cabling connecting a device to a hub should be no longer than 90 meters for the reasons given below : a) Attenuation b) Interference c) Noise ~~c~~)d) Propagation Delay	Functional Verification	
1.2.4.1	Check that the UTP/STP connecting hardware used in the patch cords per 100 meters (Channel includes cable with connectors plus patch cord) @ 20	Functional Verification	

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	° C ~~should~~ shall meet the Attention and NEXT (Near End Cross Talk) specifications defined in the TIA / EIA recommendations. (i) All Indoor Category/LAN cables used in projects should be compliant to latest ANSI/TIA-568-2.E and ISO/IEC-11801 and IEC 61156-5 Permanent link Performance 90 meter. (ii) For outdoor Category/LAN cables used in projects should be compliant to latest ANSI/TIA-568-2.E and ISO/IEC-11801 and IEC 61156-5 permanent link length from 50 to 70 meter permanent Link performance. Purchaser may specify the exact cable requirement for the outdoor category based on the application, as per the options mentioned in the Clause 2.2.9(b) under purchaser requirement		
1.2.4.2	~~Check that the~~The ~~-~~termination method for UTP/STP connecting hardware should utilize the Insulation Displacement Contact (IDC) method.	Declaration	

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1.2.4.3	Check that outlets are securely mounted. Check that outlet boxes with un-terminated cables must be covered and marked. Check that performance markings are provided to show the applicable Transmission category and should be visible during installation (to Cat 6/Cat 6a on-wards) in addition to safety markings. Check that installed connectors are protected from physical damage and moisture.	Functional Verification	
1.2.5 **Work Area System**	Check that Work Area system should consist of wiring or interconnect that connects active terminal devices to telecommunication outlets such as face plates, connectors, patch cards and terminal leads needed to make connections.	Functional Verification	

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1.2.5.1. Faceplate :	Check that faceplate should meet the following requirements: **a)** Shall have the ability to fit a dust cap or shutter to prevent dust and dirt getting into the outlet for single, ~~and~~ dual, Quad or Hexa outlets outlets. **b)** shall have clear label for application identification **c)** Shall be able to have 1,2,3,4,6 or 12 outlets **d)** Shall have options for vertical style or horizontal style. **e)** The faceplate housing the UTP/STP connector modules shall have no visible mounting screws. **f)** The faceplate housing the UTP/STP connector modules shall have aperture plugs to cover any unused openings in the faceplate. **g)** The faceplate housing the UTP/STP connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present of future network needs such as audio , video, coaxial and optical fiber applications.	Functional Verification	
1.2.5.2 Telecommunication Outlets	Check that the telecommunication outlets should meet the following requirements: **a)** All telecommunication outlets	Functional Verification	

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	Shall be universal RJ45 type b) The outlet shall be NEXT compliant (as per Annex 3) ISDN 8-position/ 8-conductor standard type and shall be capable of receiving conventional 4,6 and 8 pin jack/ plug of 22/23/24 AWG solid wire. c) Shall have Surface or flush mounted single or dual/Quad sockets d) Shall be able to support all application as per Annexure 64. e) Shall be made from high-impact, flame –retardant, UL-rated 94 V-0O thermoplastic f) Shall meet or exceed ~~ISO/IEC 11801 Class E, EN 50173 Cat~~ exceed latest ANSI/TIA-568-2.E and ISO/IEC 11801 and IEC 61156-5 Cat.6/ Cat 6A on-wards components Specifications ~~g)~~ g) ~~Shall apply the cross-over lead concept using cross talk techniques to Crosstalk (NEXT) performance of 43 dB @ 100MHz for Cat 5E and 54 dB @ 100 MHz.~~ The telecommunication outlet shall be of the insulation displacement connector (IDC) wiring termination. IDC termination shall have as Straight		

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	configuration when connecting with the cable conductor to improve termination hold ~~h)~~ h) ~~The telecommunication outlet shall be of the insulation displacement connector (IDC) wiring termination. Minimum of 4 mechanical forces shall be applied to the axis of the wire to provide a reliable and stress free resistant connection. IDC termination shall have a Straight configuration when connecting with the cable conductor to improve termination hold.~~ ~~i)~~ The Outlet shall have a built in mechanism to prevent pair untwist of more than ¼ inch as specified by TIA/EIA. i) The IDC contact element shall be spring special crass with 5µm Nickel plating to reduce Oxidation of IDC & contact and sharper termination of copper cable, angularity of copper cable , angularity arranged across the axis of conducting wire to maximize the gas tight connection. The contact range Shall be 5 µm Nickel-plated to ensure minimum oxidization impact.		

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	j) ~~Shall be 5 µm Nickel-plated to ensure minimum oxidization impact.~~ ~~k)~~ The insulation displacement connectors of the outlets shall accept two insulated solid conductors of 22 to 24 AWG of the same size. ~~j~~k) The RJ45 jack offered shall confirm to EIA-T568A or EIA-T568B wiring schemes. ~~m~~)l) The RJ45 jack technology shall be Lead – frame type to have high reliability and better frequency compensation. ~~n~~)m) The telecommunication outlet shall meet the following electrical performance:- **i.** RJ Interface resistance : 20 m Ω **ii.** Insulation resistance 100 MΩ at 500 VDC **iii.** Contact resistance of 20 mΩ maximum (1 mΩ typical) **iv.** Current rating of 2A at 20 deg. C per IEC Publication 512-3. Test 5b. ~~o)~~ n) The telecommunication outlet shall meet the following mechanical performance		

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	: **i.** Insertion life of Level B reliability to IEC 603-7 **ii.** Plug/ jack contact force: 100 g minimum per contact using FCC-approved plug. **iii.** Plug retention force~~:~~: 30 lb (133 N) minimum. **iv.** Temperature range : -20 to 70 deg.C.		
1.2.6. Modular Jack connector.	ANSI/TIA~~/ EIA –~~T568-A/B defines four basic modular jack styles. The 8-position and 8-position keyed modular jacks are commonly referred as RJ-45 (Registered Jack) connector and keyed RJ45 . The 6-position modular jack is commonly referred as RJ11. RJ45 is the standard connector for unshielded twisted pair cabling. Check that RJ 45 is a plastic connector with eight pins and it allows	Informatio ~~o~~n & Functional Verificatio n ~~only~~	

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	Insertion in only one way. Check the jack wiring specification is as per the Universal Service Ordering Codes (USOC).		
1.2.7. Patch Cord.	Check that the Patch Cord shall~~l~~ meets the following requirements: **(a)** Shall consist of 8 solid/Stranded copper conductors terminated with RJ 45 plugs at both ends. **(b)** Shall meet transmission performance and comply to latest ~~EIA~~ANSI/TIA 568~~2-E-B.2~~ and ISO/IEC 11801 -CAT 6 minimum standard for patch cord testing (as per Annexure 3). **(c)** Factory terminated with options for 1.2 meter, upto 12.8 meters with a long flexible boot and in different colors. The boot material should be injected into the plug to retain the position of the conductors. The Boot shall be with inbuilt bend radius ~~property at least 2" long with built in bend radii maintaining technology~~. **(d)** Shall have Characteristics impedance of 100Ω +/- 15%@ 100 MHz. ~~(e)~~ the patch cord shall have a	Functional Verification	

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	inbuilt design properties ~~central cross web~~ to reduce cross talk and (e) improve strength. (f) Flame Retardant: as per IEC 60332-1 (Purchaser may specify better flame retardant compliance to higher IEC 60332-2 or IEC 60332-3, if required)		
1.2.8 Patch Panel.	Check that rack mounted patch panels should be used for termination of copper cables or rack mount fiber termination unit shall be used for termination of optical fiber cable.	Functional Verification	
1.2.8.1	Check that patch cords are provided for cross-connections to facilitate Moves, Adds and Changes (MACs). Check that they should be able to support up to Category 6 and CAT 6A onwards applications and shall be NEXT compliant.	Functional Verification	
1.2.8.2	Check that the cross connect module should be (a) Fire -retardant , molded plastic	Functional Verification	

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	Modules UL 94 VO rate , consisting of horizontal index strips termination of Cat5 25 pair module to ensure ease of re-termination in case of wrong pair termination or **(b)** NEXT compliant RJ 45 Modular jack panel. **(c)** 10/25 pair disconnection module for incoming voice or 8/10/25 pair disconnection module for all data services.		
1.2.9 **Termination Module.**	Check that the termination module should be able to accommodate over 200 repeated insertions without incurring permanent deformation and it should pass the reliability test of no more than one contact failure in 1000 connections.	Functional Verification	
1.2.9.1	Check that the termination module is of the disconnection type to minimize wiring termination and allow test cords to isolate the cabling system for testing purposes.	Functional Verification	
1.2.9.2	Check that the wiring module should be able to accommodate 22-26 AWG cable conductors. Check that the termination module is accessible from front without any contact element exposed.	Functional Verification	

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1.2.9.3	Check that the components of the wire termination module should meet the Category 5e/6 standards.	Functional Verification	
1.2.9.4	Check that the termination module should be 25 pair module with IDC contact element and fully compliant to latest ANSI/TIA~~/EIA~~ 568-2-E IEC61156-5~~-B.2~~ Category 6 onwards requirement.	Functional Verification	
1.2.9.5	Check that the IDC contact element should be spring special brass with 0.5 micron Nickel plating . ~~Check that the contact range should be 5 micron silver-plated to ensure maximum reliability.~~	Functional Verification	
1.2.9.6	Check that the Termination module shall have the option of mounting on wall or a 19' rack.	Functional Verification	
1.2.9.7	Check that the Termination module shall be able to accept Category 6 & onwards ~~-~~jumper wire solution for Cross connect or Modular patch cords.	Functional Verification	

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1.2.10: Modular Jack Panel.	~~Check that~~ Modular Jack panel should meet the following requirements: a) The panel shall be fully flexible and able to accept Category 6, Category 5e/6/6A onwards RJ45 jack, Multi media Outlets, and Fiber modules. **b)** Should have a mechanism to hold the cable at the back, like a metal bar or plate ~~b)~~c) The panel shall come empty and can be loaded as per the requirement. ~~**c) The panel shall come empty and can be loaded as per the requirement.**~~ **d)** The panel shall be able to accept upto 24 RJ45 jacks in a 1U space. **e)** The panel shall be mountable on a 19" rack f) The panel shall have a large front labeling space to facilitate port identification. **g)** The panel shall have a 16-gauge sheet metal construction and the module holder shall be of UL 94V-0, black, fire-retardant plastic construction.	Functional Verification	

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1.2.11: Rack Mount Fiber Termination Unit.	The~~Check that the~~ 19" rack mount fiber termination unit ~~should~~ shall provide cross- connect , interconnect or splicing capabilities.	Functional Verification	
1.2.11.1	~~Check that the~~The 19" rack mount fiber termination unit ~~should~~ shall consist of a frame mountable housing for terminating and / or splicing fiber optic cables and allow for organization of the fiber optic interconnects. ~~Check the~~The assembly ~~should~~ shall have rear slots for cable entry , with grommets fiber retainers for holding buffered fiber in place and fiber storage guide for maintaining bend radius.		
1.2.11.2	~~Check the~~The 19" rack mounting unit ~~should~~ shall be either 12 or 24 ports for one rack unit (1RU) and come with a removable lid for access and can be either a fixed position unit or have a Swing able tray to improve access.	Functional Verification	
1.2.11.3	~~Check that the~~The adapter plates are pre loaded for ST (Straight Tip) , SC (Subscriber Connector) Simplex, SC duplex and LC Simplex or Duplex couplings, and the adapter plates should be installed to angled through adapters to the left or to the right of the panel , this	Declaration	

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	improves the patch cord management and provides safety from possible damage to the eye from active fibers.		
1.2.12 **Patch Cords.**	~~Check that p~~Patch cords ~~should~~ shall be used for cross-connection and inter-connection of termination modules, patch panels and fiber termination unit. ~~a)~~ The patch cord shall be available in 1 , 2 and 4 pair versions with length of 1.2 a) through 12.8 meters. **b)** The type of patch cord shall depend on the termination module used, i.e. 8-pair termination module, patch panel or a rack mount fiber termination unit. **c)** The patch cord shall have built in exclusion features to prevent accidental polarity reversals and split pairs. It shall have a latching mechanism to prevent accidental dislodging of the plug for the termination module or modular jack panel (e.g RJ45) ~~d)~~ The patch cord shall provide air-tight connection for cross-connection	Functional Verification	

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	for **d)** cross-connection and shall comply with proposed Cat.5E and/or Cat 6 & onwards requirement and Power SUM NEXT requirement.(ref.:Annex 1 to 53) **e)** Patch Cords for Patch Panel shall be used for the Moves, Adds and Changes and only hard wire		
	Jumper shall be needed for the permanent wring of the modules, thereby providing better cable management.		

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1.2.13: **Fiber Patch Cord.**	~~Check for the~~The ~~-~~Fiber Patch Panel Cord shall meet the following requirements. **a)** Shall consists of one or two single, tight buffered , single-mode/multi-mode graded index fibers~~ with a 62.5 micron or OM3 core and 125 micron cladding~~ . For single mode, it shall be ITU-T G.657.A1 or A2 or B3 and for multi mode fibre (refer to section I TEC GR 89010:2021), it shall be OM2 or OM3. **b)** The fiber patch shall be used for optical cross connects and interconnects. **c)** The fiber ~~cladding~~ unit shall be covered by aramid yarn and jacket of flame retardant PVC/LSZH. **d)** The fiber patch cord shall be factory terminated with ST (Straight Tip), SC (Subscriber Connector), LC or hybrid ceramic connectors at each end. **e)** The fiber patch cord shall meet the following specifications: i. Minimum band radius 90° at min 25.4 mm. ii. Operating temperature:-42 to +75°C iii. Loss : 0.75~~5~~ db / mated connector. iv. Return loss maximum -45db.	Functional Verification	

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	v. Cable Outer diameter: 3mm maximum. vi. Tip material : Ceramic.		
1.3: The UTP/STP copper cables	Check for theThe UTP/STP copper cables meet the following requirements:- **(a)** Shall be CM or CMR, LSZH, or,CM-ST1 or CMP, or CMPR rated depending on purchaser requirements. form. **(b)** Shall consists of 223 to -24 AWG, twisted pair copper conductor with UL approved insulator. (b)	Functional Verification	

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	(c) Fire retardant PVC Sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants. **(d)** The insulation shall be made from polyolefin for ruggedness. **(e)** Available in the form of 2 Pair-25 pairs for for Cat 5e UTP/STP cable and 4pair for cat6/cat6a/cat7/cat7a &cat8.-		
	Min Cat5 UTP cable. **(f)** The UTP/STP multi pair cable shall meet the following electrical specifications:- i. EIAANSI/ TIA 568.2-E A commercial wiring standard. ii. All applications as per Annexure 64. iii. The Mutual capacitance of a category 5e, 6 or 6A horizontal cable pair at 1 kHz, measured at or corrected to a temperature of 20 °C, shall not exceed 5.6 nF per 100 m (328 ft).(at) 1Khz: 22 nF/ 1000 feet. iv. Dc resistance–: 9.3 Ω per 100 m measured at or corrected to a temperature of 20 °C. (Ohms / 1000 feet : 28.6 v. Characteristics Impedance : 100 ohms + / - 15% @ 10.0 MHz	Functional Verification	

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	(optional for ~~except~~ 4 Pairs) vi. Electrical specification as per Annex 2,4,5.		
1.4 Optical fiber requirements :			
1.4.1	Cable must be Armoured/Unarmoured Single Mode (ITU-T G.657) ~~(OM1)~~, Multi mode (~~OM1,~~ OM2 or OM3) color coded fibers, jelly filled/jelly free color coded loose tubes, around the dielectric central strength member, jelly filled, plastic tape , dielectric strength member and outer FRPE/LSZH ~~PE~~ jacket for indoor - outdoor use and shall be tight buffered with color-coded PVC/LSZH/any suitable Polymer material for identification for multi-core fib~~r~~er optic cable ~~(OM1 , OM2 , OM3 , and OS1)~~ for indoor use.	Functional Verification	
~~1.4.2 Fiber Specification OM1 (62.5/125 Multimode)~~	~~Check the Specifications mentioned in clause 1.4.2 of the GR.~~		

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<td>1.4.~~23~~ Fiber Specification OM2 (50/125 Multimode)</td>
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<table>
<tr><th>ITEMS</th><th>UNITS</th><th>SPECIFICATION 50/125 Multi-Mode</th></tr>
<tr><td>Attenuation</td><td>dB/km</td><td>≤ 2.5 at 850nm
≤ 0.8 at 1300nm</td></tr>
<tr><td>Bandwidth</td><td>MHz.km</td><td>≥ 500 at 850nm
≥ 500 at 1300nm</td></tr>
<tr><td>Numerical Aperture</td><td>-</td><td>0.200 ± 0.015</td></tr>
<tr><td>Core Diameter</td><td>µm</td><td>50 ± 2.5</td></tr>
<tr><td>Core Non-circularity</td><td>%</td><td>≤ 6.0</td></tr>
<tr><td>Cladding Diameter</td><td>µm</td><td>125 ± 1</td></tr>
<tr><td>Cladding Non-circularity</td><td>%</td><td>≤ 2</td></tr>
<tr><td>Core/Cladding Concentricity Error</td><td>µm</td><td>≤ 3.0</td></tr>
<tr><td>Coating Diameter (uncolored)</td><td>µm</td><td>245 ± 10</td></tr>
<tr><td>Proof Test</td><td>Kpsi</td><td>≥ 100</td></tr>
</table>
~~Check the Specifications mentioned in clause 1.4.3 of the GR.~~
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<td>Undertaking</td>
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<tr>
<td>1.4.~~34~~ Fiber Specification OM3 (50/125 Multimode)</td>
<td>~~Check the Specifications mentioned in clause 1.4.4 of the GR.~~
<table>
<tr><th>ITEMS</th><th>UNITS</th><th>SPECIFICATION OM3 Multi Mode</th></tr>
<tr><td>Typical Attenuation</td><td>dB/km</td><td>≤ 2.5 at 850nm
≤ 0.8 at 1300nm</td></tr>
<tr><td>Bandwidth</td><td>MHz.km</td><td>≥ 2000 at 850nm
≥ 500 at 1300nm</td></tr>
<tr><td>10 Gigabit Ethernet Link length.</td><td>meters</td><td>300</td></tr>
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</td>
<td>Undertaking</td>
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Operating Temperature	℃	-40 to +70.
Core/Cladding Concentricity Error	μm	≤ 2
Coating Diameter	μm	245 ± 10
Proof Test	Kpsi	≥ 100

1.4.~~5~~4 Fiber Specification ~~OS1 (9/125~~ Single mode) (ITU-T G.657 A1, A2 or B3)	~~Check the Specifications mentioned in clause 1.4.5 of the GR.~~ As per Section-I (Type IV & Type V) of TEC GR 89010: 2021 on Raw Materials used in Manufacturing of Optical Fibre Cable	Functional Verification	

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1.4.~~56~~ CABLE CONSTRUCTION – Outdoor Armoured Type	~~Check the Specifications mentioned in clause 1.4.6 of the GR.~~ The construction of the cable shall be in accordance with Table below. For detailed mechanical and environmental properties, annexure – 8 shall be referred	Functional Verification	

ITEMS	DESCRIPTION
Number of Fibers	4/6/12/24
Type of Fiber	Multimode OM2, OM3 or Single Mode G.657.A1/A2/B3 or G.657D
No. of Fibers per Tube	Max. 12
Loose Buffer tube material	PBT (Polybutylene Terephthalate)/Any Suitable Thermoplastic material
Loose Buffer Tube Diameter	Nom. 2.4 mm
Filling Compound in Loose Buffer Tube	Thixotropic Jelly Compound
Water Blocking Material	Water Blocking Tape / Thixotropic Jelly Compound
Central Strength Member	FRP (Fiber Reinforced Plastic)
Core Wrapping Tape	Plastic Tape (To provide heat barrier and good forming of core)
Dielectric Strength Member	Glass yarn
Armor	Steel Tape Armoring
Outer Jacket material	Black FRPE/LSZH
Thickness	Min.1.25 mm, Nom. 1.8mm

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<tr><td>1.4.~~7 6~~ FIBER AND LOOSE BUFFER TUBE IDENTIFICATION</td><td>The~~Check the Specifications mentioned in clause 1.4.7 of the GR.~~ color code of the loose buffer tubes and the individual fibers within each loose buffer tube shall be in accordance with Table below.
<table>
<tr><th>No. of Fibers/ Loose Buffer Tubes</th><th>Color</th><th>No. of Fibers/ Loose Buffer Tubes</th><th>Color</th></tr>
<tr><td>1</td><td>Blue</td><td>7</td><td>Red</td></tr>
<tr><td>2</td><td>Orange</td><td>8</td><td>Black</td></tr>
<tr><td>3</td><td>Green</td><td>9</td><td>Yellow</td></tr>
<tr><td>4</td><td>Brown</td><td>10</td><td>Violet</td></tr>
<tr><td>5</td><td>Gray</td><td>11</td><td>Pink</td></tr>
<tr><td>6</td><td>White</td><td>12</td><td>Aqua</td></tr>
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1.5 ~~4.8~~ Equipment Room System/Entrance Facility	~~Check that 10~~25 pair ~~disconnect~~IDC type terminal module to terminate incoming trunk cables, outgoing trunk cables to PABX and PABX Extension lines / cables should be provided. Check that each of them should have lighting over-voltage protection with arrestors, which should be in 1 pair or ~~10~~ 25 pair form. The gas tube protector units should meet the following standards : a) DC breakdown voltage (at 100V/sec): 230 V ± 20% b) Surge Breakdown Voltage (at 100V/ micro sec): 500 Volts c) Insulation Resistance : Min 10,000 MΩ d) DC Holdover Voltage: Max 135 Volts e) Capacitance (1 MHz) : Max 3.0 p F	Functional Verification	
1.6~~4.9~~ Channel performance	~~Check that~~ channel ~~performance is~~ based on ISO 11801 Class D and E and Proposed ANSI/TIA~~/EIA~~ 568-B.2~~A-5 draft 12~~ ~~Cat 5E~~Cat 6 channel specifications.(ref: Annex-1 of GR TEC52010:2026)	Functional Verification	
2.1 SCOPE:	This document specifies the generic requirements for the structured cabling components which are to be used for LAN wiring for different	Information only	

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	applications usage in the Indian Telecom network.		
2.2	**General Requirements**		
2.2.1 Engineering Requirements :	Check that the system should meet the following engineering requirements: **a)** The equipment shall be fully solid State and adopt state of the art technology **b)** The equipment shall be compact, composite construction and lightweight . The actual dimensions and weight of the equipment shall be furnished by the manufacturers. **c)** All connectors shall be reliable low loss and standard type so as to ensure failure free operations over long operations. The warranty shall be provided by the OEM vendor to customer and shall be administered in India. ~~The connectors and cable shall provide 20 years standards compliance warranty and 15 to 25 years. On line warranty for one year for the structured cabling system from the certified practical completion date shall be provided.~~The duration of the	Functional Verification	

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	warranty shall be for a minimum of 15- 25 years and shall cover the cabling system performance, application assurance as per the TIA and ISO installation best practices recommendations ~~d~~D) All cables shall be of Gigabit Ethernet ready standards (EiA/TIA 568.2-E ~~A/568B-~~ Cat 5e/Cat 6 on-wards – standards). **e)** Each terminal block and individual tags shall be numbered suitably with clear identification code and shall correspond to the associated wiring drawings.		

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2.2.2 Operational Requirement (ORE):	Check that the system should meet the following maintenance & operational requirements: **a)** The equipment shall be designed for continuous operation. **b)** The equipment shall be able to perform satisfactorily without any degradation at an altitude upto 3000 meters above mean sea level. **c)** The design of the equipment shall not allow plugging of a module in the wrong slot or upside down. **d)** Special tools required for wiring shall be provided along with the equipment. ~~e)~~ The Hardware and software components shall not pose any **e)** problems in the normal functioning of all network elements wherever interfacing with Indian Telecom network for voice, data and transmission systems, as the case may be	Undertaking	
	f) Field Implementations best practices **i)** Untwisting dramatically affects NEXT and RL – the less untwist the better – right up to the termination point.	Functional Verification	

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	ii) Cable should not be pulled through a length of conduit exceeding 30m (100 ft) Limit 90º bends in conduit to 2 iii) Avoid laying cable near noise sources, such as; electrical wiring, electric motors, fluorescent lighting, copiers and other EMI/RFI (Radio frequency Interference) devices iv) Avoid laying cable in areas with excessive moisture such as damp basements and areas where steam will form condensation on the cable<br~~Functioning of all network elements wherever interfacing with Indian Telecom network for voice, data and transmission systems, as the case may be.~~		
2.2.3 QUALITATIVE REQUIREMENTS (QR):	Check that the system should meet the following qualitative requirements: a) The supplier / manufacturer shall manufacturer with international quality standards ISO 900~~1~~2 for which the manufacturer shall be duly accredited. The quality plan describing the quality assurance system followed by the manufacturer shall conform to the guidelines given by CGM QA from time to time and shall be submitted. b) The equipment locally manufactured in India shall be as per guidelines issued by Chief General	Functional Verification	

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		Manager, Quality Assurance Wing of the BSNL vide Documents No. QM 118, QM 205, QM 206, QM 210 and QM 301. **c)** The equipment shall meet the environmental requirements as per category A of Standard for Environmental testing of Telecommunication equipment TEC 14016:2010~~QM-333/Issue- 1/Sept 1990.~~ **d)** All components used shall be as per approval procedures prescribed by BSNL in document QM-324.~~approval procedures prescribed by BSNL in document QM-324.~~ **e)** Marking and identification of the equipment , sub assemblies , PCBs etc. shall be as per guidelines given in para 5.1.7 Quality Assurance Telecom~~shall be as per guidelines given in para~~ Document QM 351/Issue 2 / Jan.'95.~~5.1.7 Quality Assurance – Telecom Document QM 351/Issue 2 / Jan.'95.~~ **f)** The MTBF (Mean Time Between Failure) and MTTR (Mean Time To Restore) predicted and observed values shall be furnished along with calculations~~–~~ by the manufacturer.		

2.2.4 Other Requirements:	Check that wherever, the standardized documents like ITU-T, IETF, QA and TEC documents are referred, the latest issue and number with the amendments should be applicable.	Information	
2.2.5 Electromagnetic Compatibility (EMC) Requirements:	~~Refer to the clause 3(f) under purchaser requirements Check that Equipment should conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished: Conducted and radiated emissions: To comply with Class A of CISPR 22 { 2003} "Limits and methods of measurement of radio disturbance characteristics of Information Technology equipment"; Electrostatic discharge: To comply with IEC 61000-4-2 {2001}"Testing and measurement techniques of Electrostatic~~	~~Information Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the EMC requirements test results.~~	

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	discharge immunity test" under following test levels: Contact discharge level 2 {± 4 kV}; Air discharge level 3 {± 8 kV}; Fast transients common mode (burst): To comply with IEC 61000-4-4 {1995 with Amendment 1 (2000) and Amendment 2 (2000)}" Testing and measurement techniques of electrical fast transients/ burst immunity test" under Level 2 {1 kV for DC power lines; 1 kV for signal control lines}; Immunity: IEC 61000-4-3{2002}Radiated RF Electromagnetic Field Immunity test under test level 2 (test field strength 3 v / m) for general purposes in frequency range 80 MHz to 1000 MHz and under test		

	~~level 3 (10 v / m) for protection against digital radio telephones in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 2.0 GHz.~~ ~~e) Surges line to earth coupling and line to line coupling : To comply with IEC 61000-4-5{2001} Test & Measurement techniques for Surge immunity tests" under test levels of 0.5 kV for line to line coupling and 1kV for line to earth coupling ;~~ ~~f) Radio frequency common Mode: To comply with IEC 61000-4-6 {2001}"Immunity to conducted disturbances, induced by radio frequency fields" under the~~		

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	test level 2 {3 V r.m.s.} clamp injection method for DC lines and Signal Control lines. Note (ii): For tests for checking compliance to above EMC requirements, the methods of measurements shall be in accordance with TEC standard No. SD/EMI-02/02 Sep 2001 and the references mentioned therein. Alternatively, corresponding relative Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (f) and TEC standard No. SD/EMI-02/02 Sep 2001. The details of IEC/CISPR and corresponding Euro Norms are as follows: IEC/CISPR Euro Norm CISPR22 EN55022		

	~~IEC61000-4-2 EN61000-4-2~~ ~~IEC61000-4-3 EN61000-4-3~~ ~~IEC61000-4-4 EN61000-4-4~~ ~~IEC61000-4-5 EN61000-4-5~~ ~~IEC61000-4-6 EN61000-4-6~~		

2.2.6 **Safety Requirements:**	The equipment shall conform to relevant safety requirements as per IS/IEC 62368-1:2018 or Latest as prescribed under Table no. 1 of the TEC document 'SAFETY REQUIREMENTS OF TELECOMMUNICATION EQUIPMENT": TEC10009: 2024. The manufacturer/supplier shall submit a certificate in respect of compliance to these requirements~~Safety Requirements:~~	Certificate from accredited Lab	
~~2.2.6.1~~	~~The operating personnel shall be protected against shock hazards as per IS 8473 (1993) – Guide on the effects of current passing through the human body equivalent to IEC publications 479-1 (1984). The manufacturer/supplier shall submit a certificate in respect of compliance to these requirement.~~	~~Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the safety requirements test results.~~	

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~~2.2.6.2~~	~~The equipment shall conform to IS 13252 (1992) – "Safety of information technology equipment including electrical business equipment" {equivalent to IEC publication 950 (1986) and IEC 215 (1987) "Safety requirements of Radio transmitting equipment" {for Radio equipment only}. The manufacturer/supplier shall submit a certificate in respect of compliance to this requirement.~~	~~Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the safety requirements test results.~~	
2.2.7: DOCUMENTATION.	Check that all technical documents should be in English language ~~both in CD-ROM and~~ in hard copy. A soft copy or QR code shall also be provided both in Hindi and English.	Declaration	
2.2.7.1	Check that the documents should Comprise of: 1. System description documents 2. Installation, Operation and Maintenance documents 3. Training documents 4. Repair manual	Declaration	

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2.2.7.2 **System description documents.**	Check that the following system description documents should be supplied along with the system. **a)** Cabling and wiring diagrams. **b)** Adjustment procedures, if there are any field adjustable units. **c)** Spare parts catalogue – including information on individual component values, tolerances, etc. enabling procurement from alternative sources.	Declaration	
2.2.7.3 **Operational documents.**	Check that the following Operational document shall be made available. **a)** Installation manuals and testing procedures. **b)** Precautions for installation. operations and maintenance. **c)** Safety measures to be observed in handling the	Declaration	

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	equipment. **d)** Fault location and trouble shooting instructions including fault dictionary. **e)** Test jigs and fixtures required and procedures for routine maintenance, preventive maintenance and unit / card / sub-assembly replacement. **f)** Emergency action procedures		
2.2.7.4 **Repair Manual:**	Check for the following **a)** List of replaceable parts used **b)** Detailed ordering information for all the replaceable parts. **c)** Procedure for trouble shooting and sub-assembly replacement **d)** Test fixtures and accessories for repair **e)** Systematic trouble shooting charts (fault tree) for all the probable faults with their remedial actions	Declaration	

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2.2.8: INSTALLATION	Check for the following. **a)** All necessary interfaces, connectors, connecting cables and accessories required for satisfactory installation and convenient operations shall be supplied. Type of connectors, adopters to be used shall be in conformity with the interfaces defined in this GR. **b)** It shall be ensured that all testers, tools and support required for carrying out the stage by stage testing of the equipment before final commissioning of the network shall be supplied along with the equipment. **c)** All installation materials, consumables and spare parts to be supplied.	Functional Verification	

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	d) All literature and instructions required for installation of the equipment testing and bringing it to service shall be made available in English language. **e)** All cable labels shall be machine typed labeled at each end 100 mm from the termination point (Refer: *Administration Standard for Commercial Telecommunications Infrastructure* (ANSI/TIA-606-A). **f)** The cabling system shall be planned and the routing shall be selected to ensure system integrity and performance, and it shall not present problems to maintenance access. **g)** All cables trays, catenaries and ductworks required to complete the installation shall be supplied. **h)** All necessary penetrations and access between floors and sealing of the same after installation shall be carried out by the supplier. Support of all		

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	cabling within the false space or under raised flooring by steel cable tray, trunking and /or duct, catenary wires, fixed by approved hanger and methods shall be done. **i)** Cables shall be neatly bundled into a neat group (50 cables per bundle). **j)** Maintain at all times a minimum of 150 mm spacing from parallel runs of electrical cabling and 300 mm from fluorescent lights. All telecommunication cables shall cross electrical cables at right angles. **k)** Shall support adequately all the cabling that is vertically installed. **l)** Shall provide and use screwed moulded plastic bushes to protect cable, with the use of locknuts inside the trunking or tray work to ensure bush remaining securely in place.		

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	m) Shall ensure that the tray shall be thoroughly cleaned of an any extraneous material, such as cable scraps, dust, dirt and construction debris after the installation is completed. n) Shall provide proper protective earthing for all the cable trays and catenary wires. o) Shall ensure that the cables are secured with plastic or Velcro cable ties on cable trays and / or catenaries. p) Shall not have free protrusion of sharp edges where cabling is done in free spaces. q) Shall have cables installed using a bending radius not less than eight (8) times the overall diameter of the cable. The hauling tension shall not exceed 11.3 Kg. r) Any Single pull shall be restricted to not more than two		

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	(2) 90 degrees bends, in conduit and ducts. ~~End of Document~~		
3. Purchaser Requirements	**a)** Purchaser may decide the appropriate flame retardant capability of horizontal Cabling as per IEC 60332- 1-2 or IEC 60332-2 or IEC 60332-3, As mentioned in clause 1.2.3.1 **b)** Purchaser may specify the exact cable requirement for the outdoor category based on the application, mentioned under clause 1.2.4.1 **c)** Purchaser may decide the appropriate flame retardant capability of Patch Cord as mentioned in clause 1.2.7 (f) **d)** Purchaser may decide the appropriate type of UTP/STP copper cables as mentioned in clause 1.3 (a) **e)** For standalone Structured LAN cables, no EMI/EMC tests are applicable. However, if the purchaser requires EMI/ EMC compliance, the same shall be tested & demonstrated at the equipment level like LAN Switch, Router, CCTV Camera etc,	Information	

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	with structured LAN cables connected as per the Standard No. TEC 11016:2016 from any TEC accredited LAB & reports of compliance shall be submitted in such cases		

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I. TEST SETUP & PROCEDURES:

1. Test No.	
2. Test Details	*Name and Other relevant details*
3. Test Instruments Required	1. <Name> 2.
4. Test Setup	
5. Test Procedure	*Testing Steps may be written here…..* 1. …….. 2. …….. 3. ……..
6. Test Limits	(*if any*)
7. Expected Results	1. ……..<values>…… 2. ……..<values>…… 3.

Further Test Setup & Procedures may be added as per requirement

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J. SUMMARY OF TEST RESULTS

TEC Standard No. .....

TEC Test Guide No. .....

Equipment name & Model No. .....

Clause No.	*Compliance* *(Compiled /Not Compiled /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'.***

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