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FIBRE TERMINATION AND DISTRIBUTION BOX
(FOR FTTH APPLICATIONS)

GENERIC REQUIREMENTS NO.TEC/GR/TX/FTB-02/02/APR-2010
(Supersedes GR No. GR/FTB-02/01. SEP 2005)

TEC

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HISTORY SHEET

Name of the Generic Requirements	No. of the Generic Requirements	Remarks
Optical Fibre Termination and Distribution Box	GR/FTB-02/01. SEP 2005	1st Issue
Fibre Termination and Distribution Box (For FTTH applications)	TEC/GR/TX/FTB-02/02/APR-2010	2nd Issue

CONTENTS

REFERENCES

TEC Standards:

1. TEC/GR/TX/ORM-01/04/SEP-09	Specification for Raw Material Used in Manufacturing of OFC
2. TEC/GR/TX/OFJ-01/05/NOV-09	Specification for Optical Fibre Jumpers and Adaptors
3. GR/PTS-01/02.APR.2006	Specification for Optical Fibre Splice Protection Sleeves
4. GR/OFT-01/03.APR.2006	Specification for Tools for Installation & Operating the OFC & for Assembly of the Optical Fibre Splice Closures

BSNL QA Documents:

1. QM 333 {Latest issue}	Specification for Environmental testing of electronic equipment for transmission and switching use.
2. QM 301 (Latest Issue)	Transmission Equipment General Documentation.
3. QM 118 (Latest Issue)	Quality and Reliability in product Design
4. QM 605 (Latest Issue)	

Other Standards (IEC/CISPR/ISO/ITU/ASTM/Bell Core):

1. IEC-60529	Degree of protection provided by enclosures (IP code)
2. ISO 9001:2000:	International Quality Management System.
3. BS EN ISO 2039-1: 1996	Ball indention method
4. ASTM –D 792, D 638, D 57-59, D 785-A	Test Methods
5. ITU-T Rec. G. 652, G.655, .656, G.657	Type of fibre

PART 1 - TECHNICAL SPECIFICATIONS

1.0 Introduction:

This document gives the Generic Requirements of Fibre Termination and Distribution Box (FTDB). The FTDB shall provide management of optical fibres of a cable or number of cables and optical splitter assemblies, with flexibility and reliability for an FTTX application. It shall provide management of fibres in a consistent and in a structured manner. It shall also provide facilities for reconfiguration of fibres, network expansion (through branching) and testing and shall able to store extra length of pigtails and fibres for rearranging, in case the need arise. The box shall have provision for cable termination and sealing requirements.

2.0 Functional Requirements:

2.1 The FTDB shall be suitable for all types of optical fibre cable structures adopting different construction practices. To accommodate optical fibre cable of different diameter (from 4mm to 14mm) suitable physical sealing arrangement has to be provided

2.2 Based on location of installation, number of fibres to be spliced and patching capacity, following types of termination and distribution boxes are defined:

2.2.1 Type-I: Subscriber Premises Box (SPB)

This type of box shall typically be installed in the subscriber's premises. Termination up to two fibres shall be possible on this box. Provision for holding splice should be available in the box. SPB termination can be done using pre-polished connectors also. This must be wall mountable. The adapters should be snap-fit type to provide protection as these are to be installed in subscriber's premises.

2.2.2 Type-II: Multi Dwelling Unit Box - Indoor (MDUB-I)

This type of box shall typically be installed on a floor of a building to cater to a small cluster of subscribers. A maximum of 13 cables shall be terminated in this box (1 incoming cable of 24F and 12 outgoing cables of 2F or other possible combinations provided number of outgoing fibres does not exceed 24). The box shall have a maximum patching capacity of 24 fibres. The fibres of incoming cable shall be distributed into outgoing cables either by directly splicing fibres of incoming cable to fibres of outgoing cable or splice the incoming cable to a pigtail and patch it to outgoing fibres with pre-polished connectors. The direct splicing option can also be used. The maximum splicing capacity shall be 24F and 12F splice organizer trays shall be provided to facilitate the same. This shall be wall mountable.

2.2.3 Type-III: Multi Dwelling Unit Box - Outdoor (MDUB-O)

This type of box shall typically be installed outdoors to cater to subscribers occupying a small cluster of single residential units or small buildings. A maximum of 13 cables shall be terminated in this box (1 incoming cable of 24F and 12 outgoing cables of 2F or other possible combinations provided number of outgoing fibres does not exceed 24). The box shall have a maximum patching capacity of 24 fibres. The fibres of incoming cable shall be distributed into outgoing cables either by directly splicing fibres of incoming cable to fibres of outgoing cable or splice the incoming cable to a pigtail and patch it to outgoing fibres with pre-polished connectors. The direct splicing option shall rarely be used. The maximum splicing capacity shall be 24F and 12F splice organizer trays shall be provided to facilitate the same. This shall be wall or pole mountable.

2.2.4 Type-IV: Fibre Distribution Hub - Indoor (FDH-I)

2.2.4.1 This type of box shall typically be installed in the basement of a building to connect feeder and distribution cables through optical splitters in a FTTX network application**.** The Indoor Fibre Distribution Hub (FDH-I) shall be designed to manage the fibre optic cables and passive optical splitter assembly. This shall provide a vital cross-connect/interconnect interface for optical transmission signals and shall support the architectural flexibility of FTTX. The box shall provide mechanical protection for cables, splices, connectors and passive optical splitter assembly. In addition, the box shall be designed to accommodate a range of fibre counts (upo 96 fibres) and support installation of pigtails and splitters.

2.2.4.2 The FDH-I shall have the incoming fibre cable spliced at the bottom most splice tray and the spliced pigtails shall be patched to the splitter input at the distribution panel. The pigtails shall be permanently patched to distribution panel and shall be spliced to the cables coming from each MDU. The output from the splitter assembly shall be patched to the distribution panel, enabling the interconnection efficiently. The individual pigtails in the front and rear must be manageable with proper cable routing. Patching fields shall not be disturbed while accessing the splices or splitter assemblies.

2.2.4.3 The entire internal assembly holding the distribution panel, pigtails, splitter assemblies and patch cords shall allow simultaneous access depending on where they are terminated/connected. No damage to the fibre connectivity should be caused by thisoperation.

2.2.4.4 FDH-I shall have capacity for multiple12 fibre splice trays for upto108 (96+12) fibre splicing. Splice trays shall be fixed such that they are easily accessible. Provision shall be made to fix these firmly to the box

2.2.4.5 FDH-I shall have a facility to house upto 12 nos of splitter modules. These splitter modules shall be easily accessible without disturbing the patching and splicing area. Splitter module shall have input and output cables terminated on SC/PC or SC/APC type of fibre connectors. The splitter shall be housed in a plastic housing.

2.2.4.6 Suitable identification labeling shall be provided on the box.

2.2.4.7 FDH-I shall be Wall Mounted/Floor mounted

2.2.5 Type-V: Fibre Distribution Hub -Outdoor (FDH-O)

2.2.5.1 The Outdoor Fibre Distribution Hub Box is required in the Outside Plant (OSP) environment for connecting Optical cables and splitters. The box shall be installed in the FTTX network to facilitate a particular fibre serving area that includes mid-rise buildings, single residential unit and MDU structures. These boxes shall be floor mounted and shall provide environmental and mechanical protection for cables splices, connectors and optical splitter assemblies. The Outdoor Fibre Distribution Hub shall be designed to manage fibre optic cables and passive optical splitter assembly found at the OSP. These boxes shall be used to connect feeder and distribution cables through optical splitters in a FTTX network application. This shall provide a vital cross-connect/interconnect interface for optical transmission signals at the OSP and shall support the architectural flexibility of FTTX. The box shall provide mechanical protection for cables, splices, connectors and passive optical splitter assembly. In addition, the box shall be designed to accommodate a range of fibre counts (upto 96 fibres) and support installation of pigtails and splitters.

2.2.5.2 The FDH-O shall have the incoming fibre cable spliced at the bottom most splice tray and the spliced pigtails shall be patched to the splitter input at the distribution panel. The pigtails shall be permanently patched to distribution panel and shall be spliced to the cables coming from each MDU. The output from the splitter assembly shall be patched to the distribution panel, enabling the interconnection efficiently. The individual pigtails in the front and rear must be manageable with proper cable routing. Patching fields shall not be disturbed while accessing the splices or splitter assemblies.

2.2.5.3 The entire internal assembly holding the distribution panel, pigtails, splitter assemblies and patch cords shall allow simultaneous access depending on where they are terminated / connected. No damage to the fibre connectivity should be caused by this operation.

2.2.5.4 FDH-O shall have capacity for multiple12 fibre splice trays for upto108 (96+12) fibre splicing. Splice trays shall be fixed such that they are easily accessible. Provision shall be made to fix these firmly to the boxe.

2.2.5.5 FDH-O shall have a facility to house upto 12 nos of splitter modules. These splitter modules shall be easily accessible without disturbing the patching and splicing area. Splitter module shall have input and output cables terminated on SC/PC or SC/APC type of fibre connectors. The splitter shall be housed in a plastic housing.

2.2.5.6 Suitable identification labeling shall be provided on the box.

2.2.5.7 FDH-O must be Floor mountable

2.2.6 Optical Splitter (As per GR/PON-01/02 April 2008)

Passive Optical splitter bank must include 1xN, 2xN (with 1 & 2 representing number of input ports and N several output ports). The fibre types used in the manufacturing of passive optical splitter, connectors shall be compliant with ITU-T Rec.G.652. The overall lowest possible maximum insertion loss (dB) for a splitter and connector shall be as per the above GR. These splitters shall be placed in a housing and shall have connectorized input and output to be used in FDH-O and FDH-I.

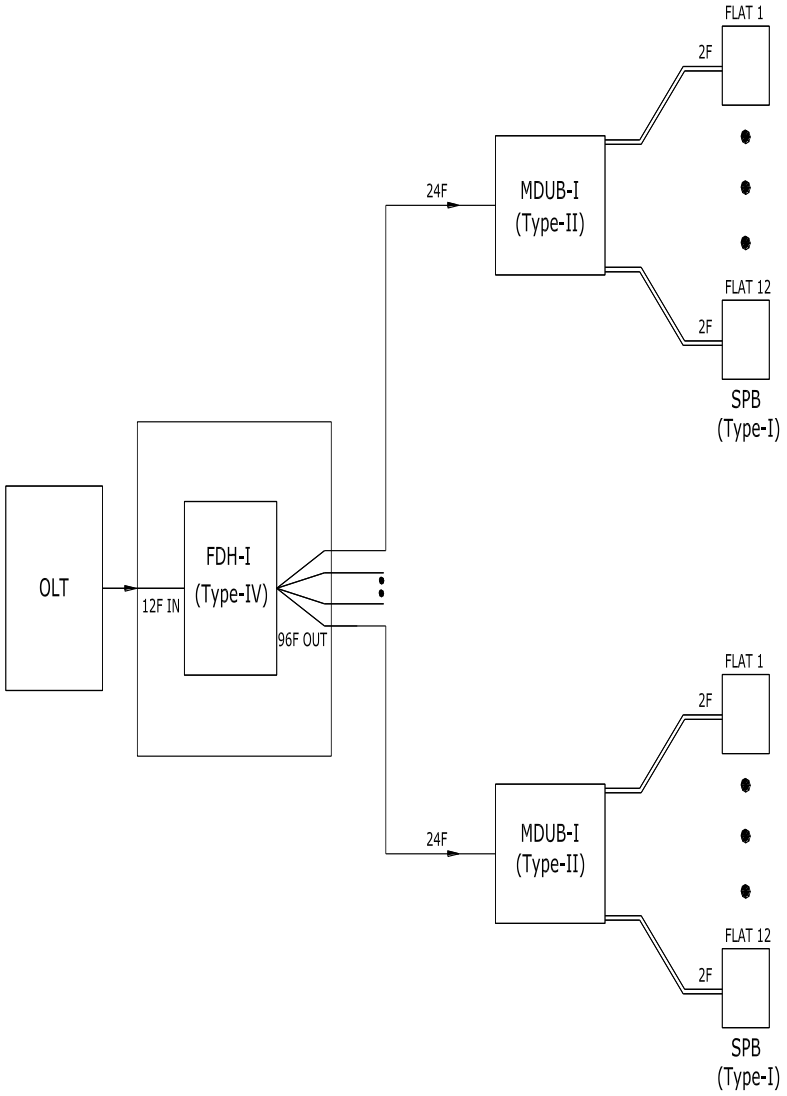

Fig. 1: Typical example of distribution on a building floor

Note:

1. In the above diagram, MDUB (Type-II) shows 12 outgoing cables of 2F. It can be any combination of cables depending on the actual site requirements provided the total number of outgoing fibres does not exceed 24.
2. The FDH-I (Type IV) will house splitter modules. It will have 12 incoming fibres and upto 96 outgoing fibres.

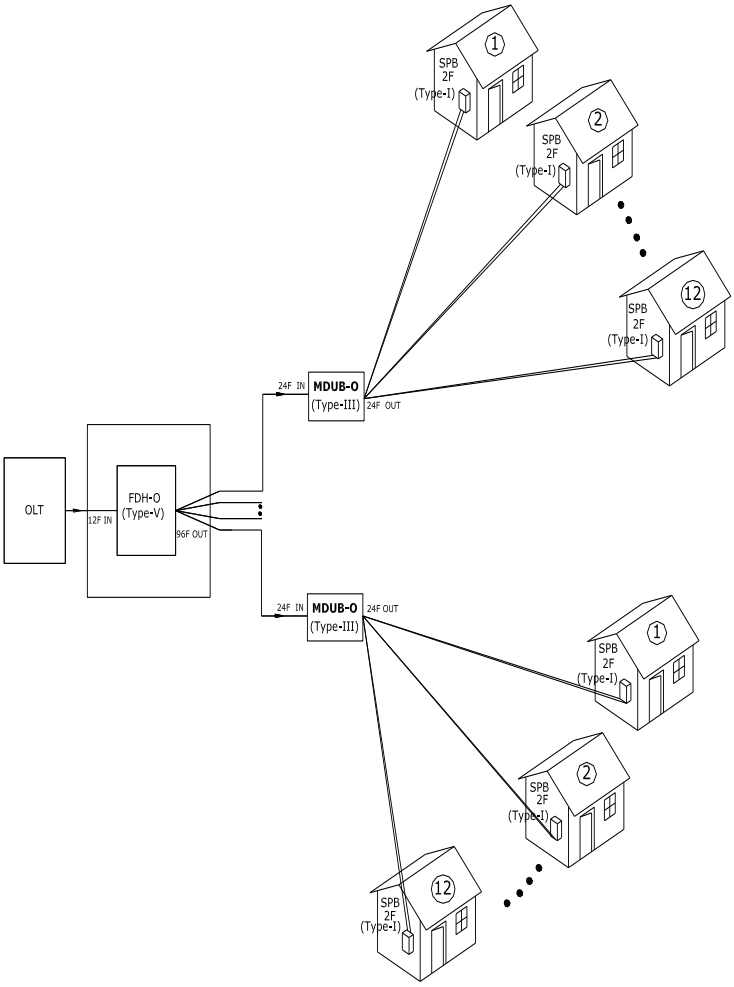

Fig. 2: Typical example of distribution on a single residential unit cluster

Note:

1. In the above diagram, MDUB (Type-III) shows 12 outgoing cables of 2F. It can be any combination of cables depending on the actual site requirements provided the total number of outgoing fibres does not exceed 24.
2. The FDH-I (Type V) will house splitter modules. It will have 12 incoming fibres and upto 96 outgoing fibres.

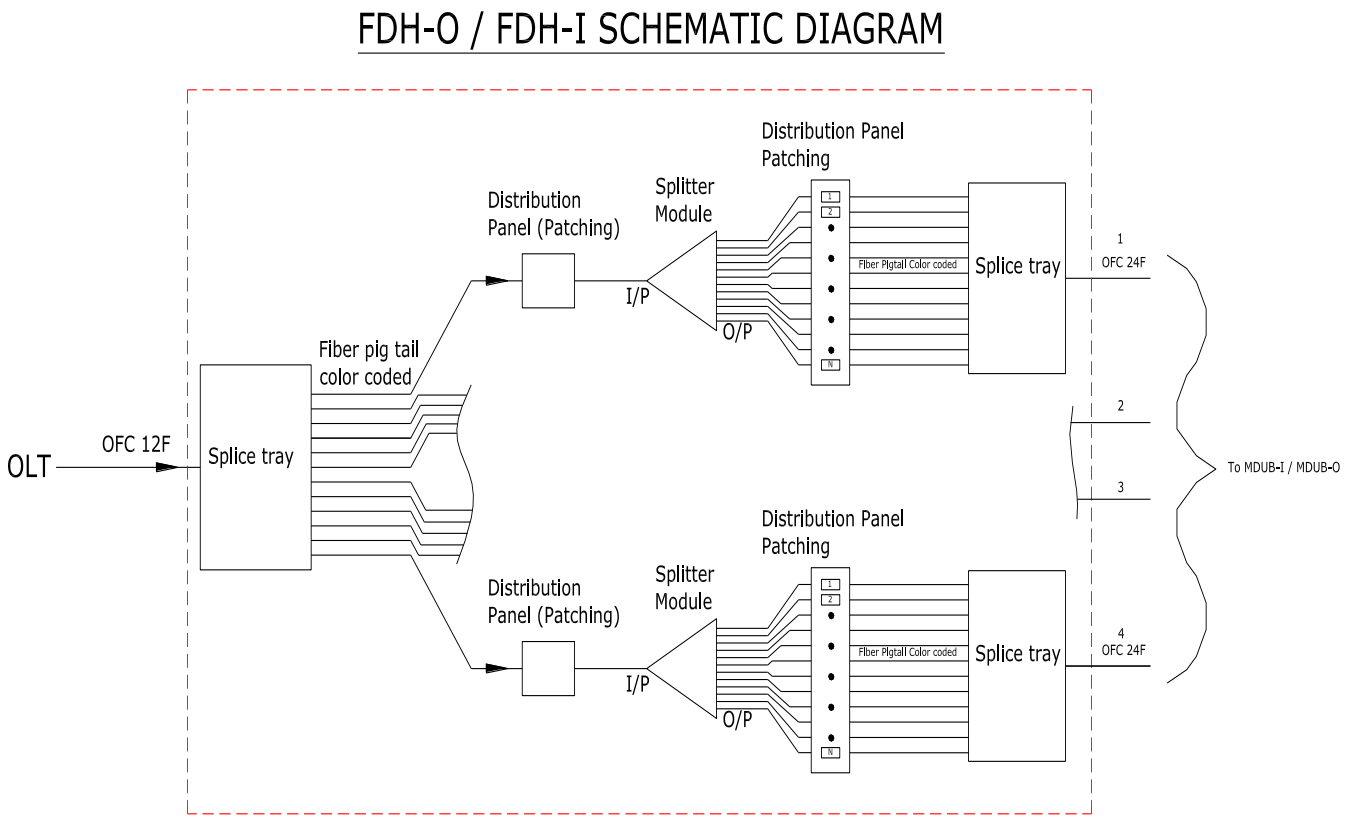

Fig. 3 : Schematic Diagram of Fibre Distribution Hub (FDH)

2.3 FTDB shall provide the facilities of proper and well engineered bend controls and routing such that the fibres shall not experience any stress or bending below the minimum bend radius of 35mm at any point in the box. The fibre management (fibre routing, storage, coiling, identification, placement of splices) shall also ensure that in the event of reconfiguration etc. of any fibre, only fibres placed on the same organizer tray, may experience disturbance. However, fibres placed on other organizer trays shall not experience any disturbance and such fibres shall not be affected in any manner. It should also not inflict any damage to pig tails, patch cord and optical fibre and optical fibre cables and the fibre splices, during normal cable and element handling. It shall provide well-engineered bend radius control throughout.

2.4 FTDB shall have sufficient provision for slack management for storing the extra length of Optical fibres, patch cords & pigtails, which shall not experience bending below critical bend radius.

2.5 FTDB shall allow an easy opening and re-closing, without any degradation in the performance of fibres.

2.6 It shall be possible to fix the strength member(s) of the optical fibre cable firmly and hold the optical fibre cables in the optical fibre termination boxes so that the strength member and optical fibre cables shall not shift or move inside the FTDB. This shall not be applicable to the SPB (Type-I)

2.7 Identification mechanism shall be provided for:
a. Incoming and outgoing cables
b. Loose tubes for incoming and outgoing cables.
c. Pigtails and patch cords
d. Fibres
e. Adapters

2.8 The optical fibre termination and distribution boxes shall be suitable for splicing of optical fibre conforming to section-I of GR No. TEC/GR/TX/ORM-01/04/SEP-09.

2.9 A tray wedge shall be provided to enable ease of working on the lower tray.

2.10 The termination box shall be designed as to protect from entry of dust and insects. Fully loaded box shall be tested for IP rating, as given in Table1.

3.0 Structural Requirements:

The optical fibre termination and distribution box shall basically consist of:

i) Main body of termination box

ii) Fibre Management System (Not applicable to SPB Type I)
   a) Fibre Organizer Trays
   b) Transport Tubes
   c) Fibre routing and Bend control
   d) Patch Panel

iii) Cable fixing arrangement (Not applicable to SPB Type I)
   a) Cable clamping system
   b) Strength Member holding mechanism

The details of each component is covered in the following clauses:

3.1 Main body of Termination Box:

3.1.1 Main body shall be made of materials as per Table 1. The box shall enable easy entry for the optical fibre cables on one side (line side) and exit for taking out the pigtails with proper sealing arrangement, to avoid the entry of insects, dust and water / moisture.

3.1.2 The box shall be robust and highly impact resistant.

TABLE 1

	Type -I	Type-II	Type-III	Type IV	Type V
Materials of box	PC* / ABS***/ PC+ABS	PC* / ABS***/ PC+ABS/ CRCA	PC+ABS/ CRCA/ SMC****	CRCA*****	CRCA*****
IP Rating (as per IEC-60529)	N/A	55	65	55	65
Typical Installation Location	Indoor only	Indoor/ Semi Covered	Outdoor	Indoor/ Semi covered	Outdoor
Length (mm) (without entry ports, glands etc). (Tolerance ± 2mm)	80	380	430	800	800
Width (mm), Tolerance ±2mm	80	320	304	600	600
Depth (mm), Tolerance ± 2mm	20	95	170	325	325
Minimum Thickness of body at any point (mm)	1.5	2.5 and 1.2 for CRCA	2.5-PC+ABS 1.5- CRCA 5 - SMC	1.6	2
Incoming Cable	1 X 2F	1 X 24F	1 X 24F	1 X 12	1 X 12
Outgoing Cables	None	Up to 12 cable (Total no. of fibres not exceeding 24)	Up to 12 cable (Total no. of fibres not exceeding 24)	Up to 8 cable (Total number of fibre not exceeding 96)	Up to 8 cable (Total number of fibre not exceeding 96)
Max Splicing Capacity (Fibre to pigtails) (individual fibre)	2F	24F	24F	108F	108F
No. of organizer trays	Provision for 2splice holders	2	2	9	9
Maximum Patching Capacity	2	24	24	96	96
Number of SC/PC or SC/APC adaptors to be provided pre-fixed.	2	24	24	108	108
Number of SC/PC OR SC/APC pigtails (900 micron, 1.5m(each)) to be provided pre-fixed.	4	24	24	108	108
Colour	White/Off-white	White/Off-white	White/Off-white	White/Off-white	White/Off-white
Cable Entry Ports (Cable diameter-6mm to14mm)	1	2	5	10	10
Output Adapter	2	None	None	None	None

Note:

* Polycarbonate
** Polypropylene
*** Acrylonitrile Butadiene Styrene
**** Sheet Molding Compound
***** Cold Rolled Close Annealed

3.1.3 The cable entry ports and the exit port for patch cords shall be on the bottom side of box.

3.1.4 The entry and exit holes shall be provided with rubber grommets.

3.1.5 The front cover shall be provided with gasket for sealing and should have lock & unique key arrangement except for Type I

3.1.6 Type of connector (mounted on suitable strip): SC/PC or SC/APC or as per requirement

Note: The pigtails, Patch cords & SC/PC or SC/APC type of optical connectors and Adapters shall meet the requirement of TEC GR No. TEC/GR/TX/OFJ-01/05/NOV-09 and the subsequent amendment issued, if any. The manufacturer shall indicate the diameter of the pigtails supplied.

3.2 Fibre Management System:

3.2.1 Fibre Organiser Tray:

3.2.1.1 A system of cassettes or trays shall be provided on which the splices and the extra length of fibres, after splicing, shall be placed (fibre organization). Fibre organizer trays facilitate proper storage of fibre and fibre splices. The tray design shall be such that fibre is stored securely and without stresses so that it does not fall out of the tray when the tray is moved about its hinge.

3.2.1.2 The Fibre organiser (cassettes) system shall be built in such a way so as to offer the facilities of its movement about a hinge, similar to turning a page in a book. It shall offer easy access to each tray such that the working with fibres and splices, in any one of the tray, shall not disturb the traffic in the fibres on the other trays. This shall ensure splicing of all fibres of the cables in predetermined order.

3.2.1.3 The minimum-bending diameter allowed for the fibre coils inside the splice trays shall be at least 70 mm.

3.2.1.4 Splice trays shall allow for storing of at least 900mm length of each fibre with primary (0.250 mm) and secondary (0.9 mm) coating.

3.2.1.5 Arrangement to hold up to twelve splice protection sleeves in the splice tray shall be provided. Splice protection sleeves (heat-shrink type, up to 45±1 mm in length and up to 3mm in diameter) used for the protection of the splice shall meet the requirement as per TEC GR No. GR/PTS-01/02.APR 2006.

3.2.1.6 Slots of the splice tray shall be able to fasten the splice protection sleeves in such a way that they will not shift or move inside the splice tray or come into conflict with the fibre coils, once fixed in a slot of the tray. There shall not be extra pressure on the protection sleeve or on fibre.

3.2.1.7 The fastening arrangement (if any) for entry of the fibres into the splice tray shall be suited to secondary coated fibres and primary coated fibres in tubes without there being any risk of bending loss or damage to the fibres. The fastening arrangement shall allow unhindered moving of trays without inflicting any transient losses on the fibres on the trays being moved. It shall be similarly possible to hold the buffer tubes/pig tails and pigtails at the entry and exit point of the splice trays. No PVC or adhesive tape is permitted to hold fibre and loose tube.

3.2.1.8 It shall be possible to take any individual fibre out of the splice tray for repair during normal operation without damaging the remaining fibres.

3.2.1.9 Splice trays shall be fixed inside the box in such a way that it shall be impossible for them to be loosen once fixed or to shift or move in any way.

3.2.1.10 Splice trays shall be non-metallic made of ABS material (as per Annexure-II) and so designed that they shall not harm the fibres from sharp edges etc.

3.2.1.11 The number of splice trays to be supplied in the box shall be as per Table 1.

3.2.1.12 The splice holder shall be able to hold heat - shrinkable splice protectors. The manufacturer shall give the details of the protection sleeves to be used for the protection of the splice. The heat-shrinkable splice protection sleeves shall be as per the TEC GR no. GR/PTS-01/02.APR 2006.

3.2.1.13 It shall be possible to arrange a splice for the ribbon type of cable having four fibre per ribbon. It shall be procured separately, if required, The details of the fibre ribbon management and the splicing of such ribbons, along with the accessories and spares, shall also be submitted.

3.2.2 Transport Tubes:

3.2.2.1 Transport tubes (if required) shall be provided to guide the fibres from termination points of the cable to storage basket of the closure and or to the entry port of the cassette. The transport tube shall be made of polyolefin/silicon and shall be non-kinking type. The material of the transport tube shall not affect the primary coated fibres.

3.2.2.2 Diameter of transport tube shall match the dimension of the funnel and shall be able to accommodate two fibres.

3.2.2.3 Suitable arrangement shall be made to convert the OF cable, having Central tube design, into loose tubes for transporting into different cassette assemblies.

Note: Suitable arrangement for the fibres of different cable construction designs shall be provided for transporting it to cassette assemblies.

3.2.3 Fibre routing and Bend control:

3.2.3.1 Plastic bend controls and guides shall be positioned appropriately in the box so that the bare fibres, pigtails, patch cords, and loose tubes are not exposed to accidental damage, strain, or kinking, These elements shall be easily identifiable throughout their route.

3.2.4 Patch Panel:

3.2.4.1 The patch panel shall be conveniently fixed so that all adaptors are easily accessible. Enough space should be provided to allow two fingers of an adult hand to screw and unscrew any connector position on both sides (Pigtail side and Patch Cord side).

3.2.4.2 The patch panel shall be a mechanical assembly, which shall provide the facility and function of pigtails/patch cords patching and making connections. The patch panel shall have the required capacity, suitable for the box type. These shall be pre-mounted and installed.

3.2.4.3 For Type-I, the adapters shall be mounted on the bottom plate of the box with a suitable transparent dust cover or outside the box with dust protection caps and for Type-II, Type-III, Type-IV & Type-V, the patch panel shall be provided inside the box .

3.3 Cable Fixing Arrangement:

3.3.1 A complete arrangement to hold and terminate the cables and strength member (s) shall be as below:

a) Cable clamping system: The clamps shall be made of galvanized mild steel, or suitable engineering polymer. The metal clamps shall be provided with rubber or plastic inserts such that the cables are protected from damage and no clamping stress passes on to the fibres or loose tubes.

b) Strength Member holding mechanism: This shall be suitable for all popular types of strength members, viz. Single FRP rod, Multiple FRP Rods, Aramid Yarn. The strength member holding mechanism shall be galvanized mild steel, brass, or suitable engineering polymer.

3.3.2 Velcro tape shall be provided to secure the pigtails and cassette assembly.

4.0 Performance Tests:

The sample preparation shall include fixing of cable, all adaptors and pigtails (fully loaded). Two Samples shall be prepared for each cable type (Loose Tube and Central Uni-tube). One sample shall use the smallest size of cable that can be accommodated and the other sample shall use the largest size of cable.

The optical fibre termination and distribution box shall meet the following test requirements:

4.1 Visual Examination:

The termination box shall be examined physically for the workmanship, design and technology employed. It shall be checked for any flaws, defects, and cracks visible to naked eye.

4.2 Variation in attenuation (Residual Loss):

Objective:
To check the effect of the use of fibre organiser and other arrangement on the transmission characteristics of optical fibres in assembled condition.

Test Parameters:
Wavelength of operation: 1310nm /1550 nm
Change in attenuation: $\pm$ 0.10 dB

Requirement:
The fibre attenuation shall be measured, leaving the fibre un-looped, after the arrangement on the tray and stabilization time of one hour.

4.3 Axial Tension (Sheath Retention):

Objective:
To check the cable holding mechanism and the axial tension of the assembled Box. An axial load when individually applied to each cable shall not cause any damage to the cable or the clamping hardware.

Test Parameters:
Tension applied longitudinally on cables: 70 Newtons
Test Time: 10 minutes

Requirement:
Variation in attenuation (Residual Loss, Fibre Organisation) shall be checked after the completion of the test and the variation in attenuation shall be $\pm$0.10 dB. There shall be no visible flaws or defects after the test.

4.4 Pig tail/ Patch cord retention test:

Objective:
It is required to check the holding mechanism and the effect of the accidental pull on the pigtails/patch cords. An axial load shall be applied longitudinally on pigtail/patch cords, which shall not cause any damage.

Test Parameters:
Tension applied longitudinally: 25 Newton
Test Time: 10 minutes

Requirement:
Variation in attenuation (Residual Loss, Fibre Organisation) shall be checked after the completion of the test and the variation in attenuation shall be $\pm$ 0.10 dB. There shall be no visible flaws or defects after the test.

4.5 Vibration Test:

Objective:
To check the effect of vibration on optical fibre termination and distribution box and its Accessories.

Test Parameters:

Planes: 3 (X- axis, Y-axis, Z-axis)
Sweep: (10-300) Hz ± 2% at 1 octave ± 10% per minute
a) Sine sweep (10-28) ± 1 Hz 0.1" (2.5 mm) double amplitude
b) Sine sweep (28-300) Hz ± 2% max. 4 g acceleration
Time: 2 hours each axis

Requirement:
Variation in attenuation (Residual Loss, Fibre Organisation) shall be checked after the completion of the test and the variation in attenuation shall be $\pm$ 0.10 dB.

4.6 Shower test:

Objective:
To check the integrity of the seal of the box. The test shall be conducted on a fully assembled box with cables and maximum no. of patch cords, as per the rated capacity.

Test Parameters:

Spray Medium:	Tap Water
Spray position:	The water jet shall hit the sample at an angle of 45º (Front and Top)
Flow rate:	40 L/min/head
Number of heads:	4

Head to sample: 400 ± 100 mm
Sample position: Box mounted in vertical position.
Duration: One hour

Requirement: No water ingress

4.7 Environmental cycle:

Objective:
To determine the working capability of fibre termination and distribution box for climatic conditions.

Test Parameters:
Lowest temperature: -15^{o} C
Highest temperature: 60^{o} C
Dwell Time: 4 hrs
Transition time: 2 hrs
Cycle duration: 10 and 1/2 hrs.
Number of cycles: 10

Requirement:
The Variation in attenuation (Residual Loss, Fibre Organisation) shall be checked after the completion of the test and it shall be limited to $\pm$ 0.1 dB. There shall be no visible flaws or defects after the test.

PART- II GENERAL REQUIREMENTS:

5.0 Engineering Requirements:

5.1 The Fibre Termination and Distribution Boxes shall be manufactured as per the latest state of art technology.

5.2 The boxes shall be of compact design and its construction shall be inherently robust and rigid for all conditions of operation, adjustment, replacement, storage and transport. It should be made of fire retarding material for indoor application and heat resistance material for out door applications..

5.3 All connectors shall be reliable and of the standard type to ensure for over 10,000 failure-free operations under the environmental conditions specified. All connectors used shall be of low-loss type, and suitably shielded.

5.4 The mechanical design and construction of each unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport and conforming to Para 12 of BSNL QA document no. QM 333 (1990)—Specification for environmental testing of electronic equipments for transmission and switching use.

5.5 The Box shall be able to work in saline atmosphere in coastal areas and should be protected against corrosion.

5.6 The Box shall be accessible for operation, installation, testing and easy handling from the front side.

5.7 The box shall be wall mountable /floor mountable/pole mountable (as applicable), using anchor bolts.

5.8 The powder coating painting (50–70 micrometer thickness) shall be provided (wherever applicable). The painting shall be of good quality. (Please refer QM 605).

5.9 It shall be possible to install the optical fibre termination & distribution box with tools as per GR No. GR/OFT-01/03. APR 2006. Special tool, if any, required for the installation & operation of the box shall be provided along with the optical fibre termination and distribution box.

5.10 The boxes shall be supplied with the adaptors and pigtails pre-fixed in their positions. The adaptors positions shall be clearly and permanently marked. The pigtails shall be colour coded for easy identification. A common identification system shall be followed, which is as below:

a) Trays shall be numbered bottom to top (tray no 1 is lower most).
b) Pigtails will follow tray numbering.
c) Pigtails shall be colour coded similar to the fibre colour coding.
d) Adaptors will be numbered Bottom to Top or Left to Right in ascending order.

5.11 All adaptors shall be provided with dust protection caps.

5.12 Important Do's and Don'ts about the operation of the equipment shall be clearly indicated at a convenient place on the equipment.

6.0 Quality Requirements:

6.1 The Fibre termination and distribution box shall be manufactured in accordance with international quality standards ISO 9001-2000 for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system, being followed by the manufacturer, should be submitted.

And

The equipment shall meet the latest BSNL QA Guidelines indicated in Quality Manuals QM 118—Quality and Reliability in Product Design, and QM 301—Transmission Equipment General Documentation. The supplier shall furnish a certification from the manufacturer to this effect, which shall be verified at the time of technical specifications evaluation.

6.2 The Fibre termination and distribution box shall be designed & manufactured to have a life guarantee of at least 25 years, without maintenance.

7.0 Marking on body of the Optical fibre termination & distribution box:

7.1 The following information shall be provided by marking on optical fibre termination and distribution box:

a. Manufacturer's name & date / year of production.
b. Model no.
c. Type of system (i.e. Type I - Type V)
d. Number of splice (organiser) cassettes
e. Capacity i.e. nos. of cables & fibres
f. GR No. and TAC/TSEC No. with its validity.

8.0 Documentation:

8.1 Technical literature in English or Hindi, along with detailed drawings of all the assemblies and parts, shall be provided. All aspects of installation, operation and maintenance shall be covered in the manuals. The soft copy as well as hard copy of the manuals shall also be provided. The manuals shall include the following details

a) Safety measures to be observed in handling the optical fibre termination box.
b) Precautions for operation and maintenance
c) Illustration of internal and external parts.
d) List of the parts including their source and ordering information for all the replaceable parts.

8.2 Each optical fibre termination & distribution box shall be supplied along with small booklet giving the installation method etc. by illustration to help the installer.

8.3 Each optical fibre termination & distribution box shall be supplied along with a test report giving IL and RL values of each pigtail and IL value of each adaptor installed in the box. The values shall be given for 1310 and 1550nm.

9.0 Environmental Requirements:

The system shall conform to the environmental requirements as per BSNL QA document QM-333 (latest issue)—Specification for environmental testing of electronic equipments for transmission and switching use—for operation, transportation and storage, including vibration and corrosion (salt mist) tests. The applicable test shall be for environmental category applicable to the type of equipment (refer clause 4.7)

10.0 Safety Requirements:

The materials used for manufacturing the system and other component parts shall not cause any health hazards to the operating personal in its lifetime.

Note: Certificate of recognized laboratory from the manufacturer may be accepted.

11.0 Spares and accessories:

The supplier shall provide one complete set of all the necessary accessories required for satisfactory and convenient operation/installation of the equipment (as per Annexure – 1).

Note: TAC/TSEC approval may be taken for:

i) Type I Box
ii) Type II & III Boxes together
iii) Type IV & V Boxes together
iv) All types of boxes together

Note: Telecommunication Engineering Center reserve the right to add any new test to check the performance of the system at a later date.

Annexure -1

The manufacturer shall supply sufficient quantity of spares for each optical fibre termination and distribution box.

Sr. No.	Item	Qty.
1.	Protection Sleeves GR No. G/PTS-01/02 APR.2006 (For example, for 12-fibre cable, 18 nos. of Protection sleeves shall be supplied)	As per fibre count in the cable +50 % Extra quantity
2.	Cable Tie	12 Nos. of required length
3.	Tissue / Lens paper 3"x 4"	100 nos.
4.	Isopropyl (Lab Grade)	100 ml.
5.	PVC adhesive tape (5m length of 10mm width)	1 No.
6.	Velcro tape (to hold the cassettes assembly, if required)	As per the requirement
7.	Identification rings for Cable/fibres/pig tails (As per the cable and the fibre counts)	As per the requirement
8.	Transport Tube	As per the requirement
9.	Fibre guiding pin	one
10.	Any other item required for the installation and assembly	As per the requirement

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ANNEXURE - II

Material for Fibre Organiser

The optical fibre organiser shall be made of ABS material having following characteristics:

a)	Specific gravity	1.01-1.21 gm/cc	ASTM-D-792
b)	Tensile strength	≥ 0.002 kg/sq mm	ASTM-D-638
c)	Elongation	< 50%	ASTM-D-638
d)	Water absorption	≤ 0.4%	ASTM-D-57-59
e)	Rock well hardness	R81-R111	ASTM-D-785A

(The hardness may also be checked by Ball indentation method BS EN ISO 2039-1: 1996, the test load shall be 961 N $\pm$ 1% and the diameter of the ball shall be 5.0 $\pm$ 0.05 mm with initial load of 9.8 N).

Note : A certificate from recognized laboratory is acceptable, if the manufacturer do not have the test facility.

LIST OF ABBREVIATIONS

ABS	-	Acrylonitrile Butadiene Styrene
APC	-	Angled Physical Contact
ASTM	-	American Society for Testing Materials
BIS	-	Bureau of Indian Standards
BSNL	-	Bharat Sanchar Nigam limited
dB	-	Decibel
FTTX	-	Fibre to the x
HDPE	-	High Density Polyethylene
IEC	-	International Electro -Technical Commission
IL	-	Insertion Loss
ISO	-	International Standard Organisations
ITU-T	-	International Telecommunication Union Transmission
OF	-	Optical Fibre
QA	-	Quality Assurance
QM	-	Quality Manual
RH	-	Relative Humidity
RL	-	Return Loss
UV	-	Ultra violet