HOUSING
DEVELOPMENT
CORPORATION

In-Building Wiring Guideline

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Approved by:

Managing Director

Record of revisions

#	Revision Approval Date	Version	Revisions made	Page number	Approved by	Decision Number
1	26th November 2020	1.0	Initial Document	-	Chief Commercial Officer, Commercial Division	-
2	8th September 2021	2.1	Template Revision	-	Chief Commercial Officer, Commercial Division	-
3	27th March 2024	3.0	Revisions to Clause 4.3: Different architectures used in fiber deployment	10-15	Managing Director	242/DAF/2024

Table of Content

1. Purpose

The following guideline is a set of guidelines which dictates best practices to be followed for the deployment of fiber (PON) for communication services, and other general telecommunications distribution systems within buildings. This guideline is of general nature and may be modified by HDC to accommodate special design or functional requirements as wiring standards are dynamic and constantly changing due to continually evolving networking standards. Therefore, it is advisable to consult engineers during the planning stage.

2. Scope

This guideline applies to any party involved in the design and deployment of fiber (PON) within buildings for communication services and general telecommunication distribution systems. It pertains specifically to areas falling under the jurisdiction of HDC.

3. Terms & Definitions

Key Terms	Definitions
PON	Passive Optical Network
OTF	Optical termination frame
ODF	Optical distribution frame
ATB	Small wall terminal
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector

4 Guideline Details

4.1 General Standard Equipment and Procedures

4.1.1 Internal Cabling Recommendation

4.1.1.1 Indoor cables may be installed in ducts, on raceways or attached directly to the walls. Before surface mounted trucking or raceways are used, approval must be obtained from the Engineer.

4.1.1.2 Where possible, ducts and other installations into which cable can be conveniently installed shall be chosen.

4.1.1.3 Cables in vertical shafts shall be secured according to the manufacturer's recommendations and at not more than 200 cm intervals.

4.1.1.4 All necessary precautions must be observed when pulling cables through conduits to avoid damages to the cables and conduit.

4.1.1.5 Where practical, cables which are surface mounted shall be run in straight lines vertically and/or horizontally and placed as inconspicuously as possible.

4.1.1.6 Where external cables enter a building for transition to indoor cable, the maximum indoor length of the polyethylene sheathed cable shall be 20 m if not protected by a flame retarding material i.e., sleeve or duct. Suitably aesthetically pleasing channeling or ducting shall be used to protect and mask the indoor installations.

4.1.1.7 Where the running of large numbers of indoor cables occurs, care shall be taken to ensure that a neat workmanlike and logical cabling system is the result.

4.1.1.8 As required by site conditions, fire protective sealing shall also be applied to horizontal cable access holes, as indicated by the Engineer (e.g. generator

rooms).

4.1.2 Bend Radius

4.1.2.1 Do not exceed the cable bend radius. Fiber optic cable can be broken when kinked or bent too tightly, especially during pulling.

4.1.2.2 If no specific recommendations are available from the cable manufacturer, the cable should not be pulled over a bend radius smaller than twenty (20) times thecable diameter.

4.1.2.3 After completion of the pull, the cable should not have any bend radius smaller than ten (10) times the cable diameter.

4.1.3 Splicing / Splicing Errors

4.1.3.1 All errors in the splicing of cable pairs, determined by the commissioning tests,shall be corrected.

4.1.3.2 Splice enclosures shall only be utilized with the cable type for which they are designed.

4.1.4 Optical Distribution Frame

4.1.4.1 The ITU-T L.50 standard is recommended.

4.1.4.2 An optical passive node, which resides in a central office environment, is generallycontained in a rack or frame. This is commonly referred to as an optical distribution frame (ODF) or optical termination frame (OTF).

4.1.4.3 A fiber distribution unit is used to provide a standard termination node for the fibernetwork to which transmission equipment can be readily connected. Sometimes the fiber distribution unit is mounted in the same rack of cabinet as the transmission equipment. The connectors in a termination application

are sometimes replaced by fiber splices, reducing the number of connectors in the link.

4.1.4.4 An ODF should be re-accessible without interruptions to the live circuits, other thanthe ones that are subject to reconfiguration.

4.1.5 Design Consideration

4.1.5.1 It is recommended that the bend radius of a fiber should not be smaller than 30 mm to ensure the residual strain of the fiber will not exceed 0.2%. However, for some fiber designs, a larger bend radius may be necessary to prevent an increasein optical loss at long wavelengths.

4.1.5.2 Splices of fibers in service should not be disrupted by installation of new fibers or maintenance of other installed fibers. There are many types of fiber splices. It canbe expected that there will be new ones in the future. Fiber distribution units shouldbe chosen to accommodate all the types of splices that are anticipated to be used, and to adapt easily to new ones.

4.1.5.3 A suitable slack should be foreseen so that the cable fiber stored in the fiber organizer should not experience bends below the above-referred value. In addition, the fibers in service should not experience such bends, e.g., when other fibers are being brought into service or when fiber splices are replaced. This includes bends in the fiber outside the organizer due to motion of the fiberorganizer in storing or gaining access to it.

4.1.6 Optical Fiber Splices

4.1.6.1 The ITU-T L.12 and ITU-T G.671 standards are recommended.

4.1.6.2 A suitable procedure for splicing should be carefully followed to obtain reliable splices between optical fibers.

4.1.6.3 Splices are critical points in the optical fiber network, as they strongly affect not only the quality of the links, but also their lifetime. In fact, the splice shall ensure high quality and stability of performance with time. High quality in splicing is usually defined as low splice loss and tensile strength near that of the fiber proof test level. Splices shall be stable over the design life of the system under its expected environmental conditions.

4.1.7 Connection Point

4.1.7.1 The outlet shall be equipped with:

- 1 SC/APC pigtail
- 1 SC/APC optical adapter

4.1.7.2 The type of the optical connector is SC/APC connector.

4.1.7.3 Characteristics Requirement Max. attenuation of splices 0.2 dB Return loss > 60dB.

4.1.8 Optical Fibers

4.1.8.1 The optical fiber shall conform to ITU-T recommendations ITU-T. G652D

4.2 General Description and Components of In-Building Fiber Installation

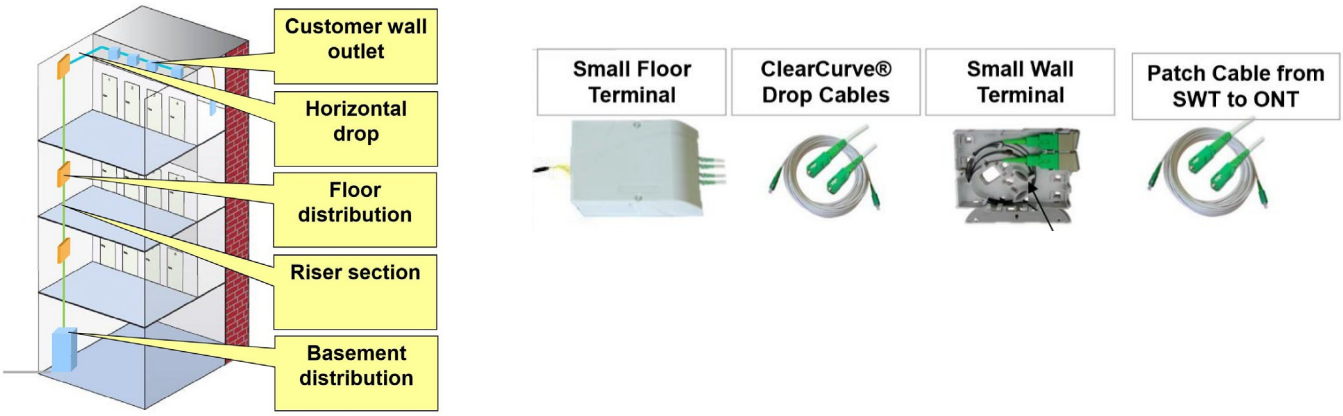


Figure 2.1 Components of In-building Fiber Installation

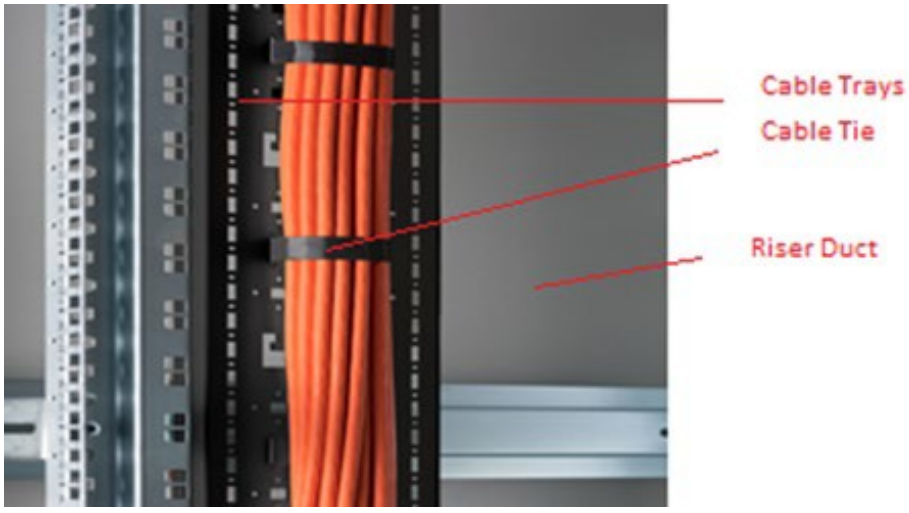
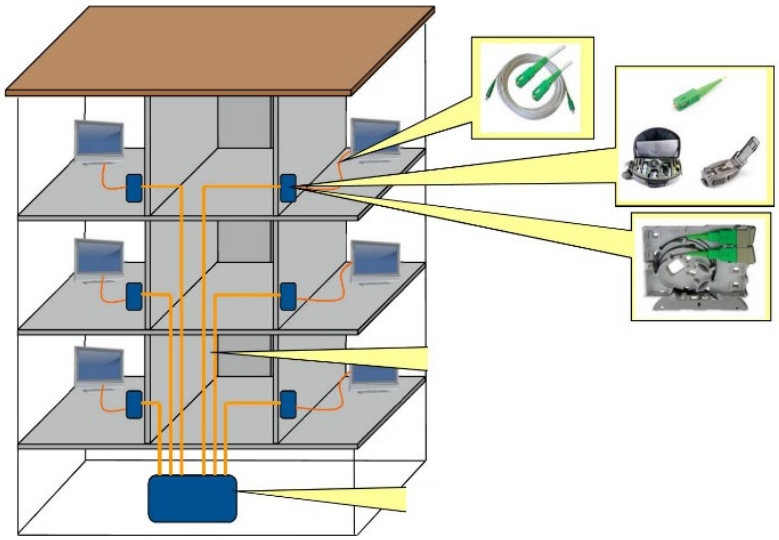


Figure 2.2 Cables Riser duct and cable tray (Riser Cable -The backbone riser system(vertical)

4.3 Three Different Architectures used in Indoor Fiber Deployment

4.3.1 Small Buildings



Small Buildings can be served by a direct drop cable (four core) from central location, ground floor distribution ODF to each customer.

4.3.1.1 Typically, number of floors is less than 6.

4.3.1.2 Separate floor distribution not required.

4.3.1.3 4 core drop cable is preferred, from ground floor distribution to customer end.

4.3.1.4 Riser duct size preferred to be 200 x 400mm (inner dimensions) with proper cable trays installed.

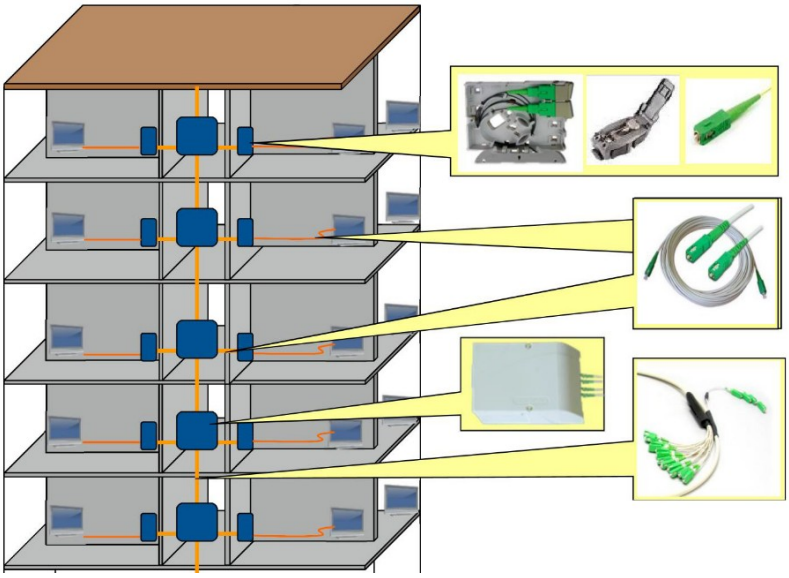
4.3.1.5 Horizontal conduit minimum 20mm to the apartment from distribution point. Allbending points shall be minimum 10 times the diameter of the conduit pipe.

4.3.1.6 In each apartment it is recommended to install wall recess enclosure for CPE device, fiber termination can be done within the same enclosure, (Height 12, width 15, depth 4 inches) with 1 x AC (230V) power socket.

4.3.1.7 ODF to be located at the central location (Ground floor /First floor) all fiber cables, ports properly terminated and labelled.

4.3.1.8 Horizontal duct to the telecommunication room, main cable (any service provider / operator) entry shall be 1 x 75 mm pipes, connected to nearest Handhole on the road side.

4.3.2 Medium Buildings



Medium-sized buildings are often served by central riser and various floor terminals.

4.3.2.1 Single fiber connectivity and field-installed connectors.

4.3.2.2 Buildings with 6 to 10 floors fall within this category

4.3.2.3 Separate floor distribution box required.

4.3.2.4 Central riser solution preferred.

4.3.2.5 Horizontal cable from Floor distribution to each customer end is preferred to be 4 cores drop cable.

4.3.2.6 Riser duct size preferred to be 250 x 500mm (inner dimensions) with proper cable trays installed.

4.3.2.7 Horizontal conduit minimum 20mm to the apartment from floor distribution point, all bending points shall be minimum 10 times the diameter of the conduit pipe.

4.3.2.8 Horizontal cabling provisioning (walkway, corridors, open areas) is required to cater other telecom services, including wireless communication network.

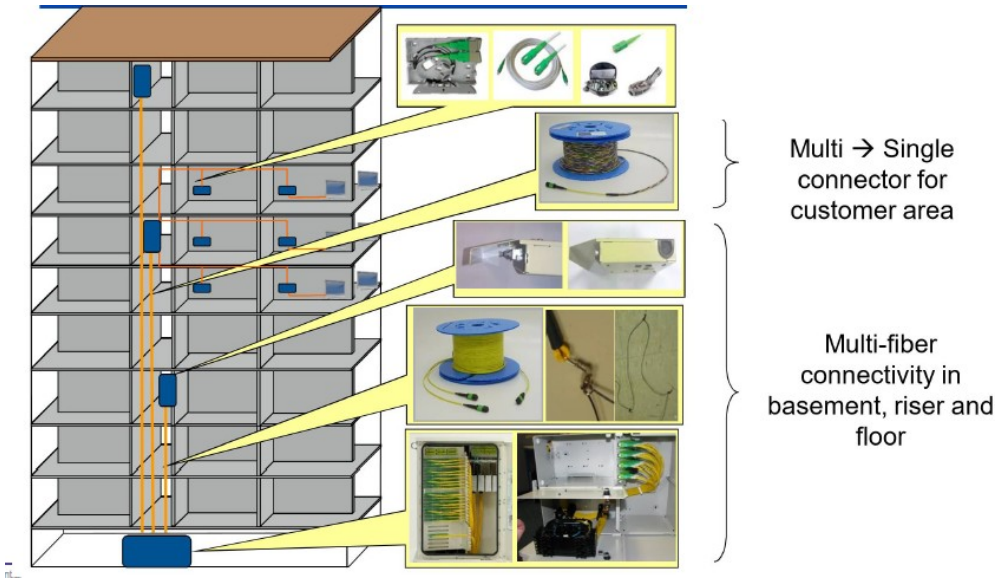
4.3.2.9 In each apartment it is recommended to install wall recess enclosure for CPE device, fiber termination can be done within the same enclosure, (Height 12, width 15, depth 4 inches) with 1 x AC (AC230V) power socket.

4.3.2.10 ODF to be located at the central location (Basement/Ground floor/First floor) and all fibers cables, ports properly terminated and labelled.

4.3.2.11 Central location is preferred space for splitter installation, typically 12U standardrack space.

4.3.2.12 Horizontal duct to telecommunication room, for main cable entry shall be 2 x 75mm pipes, connected to nearest Handhole on the roadside.

4.3.3 Large Buildings



High buildings are well served by using multi-fiber connectivity.

4.3.3.1 Typically, higher number of floors; more than 10 floors.

4.3.3.2 Separate dedicated riser cable required.

4.3.3.3 Separate floor distribution or collector element required.

4.3.3.4 Favors multi fiber connectivity.

4.3.3.5 Horizontal cable from Floor distribution to each customer end is preferred to be4 cores drop cable.

4.3.3.6 Riser duct size, preferred to be not less than 300 x 600mm with proper cabletrays installed.

4.3.3.7 Horizontal conduit minimum 20mm to the apartment from floor distributionpoint, all bending points shall be minimum 10 times the diameter of the conduit pipe.

4.3.3.8 Horizontal cabling provisioning (walkway, corridors, open areas) is required to cater other telecom services, including wireless communication network.

4.3.3.9 In each apartment it is recommended to install wall recess enclosure for CPE device, fiber termination can be done within the same enclosure, (Height 12, width 15, depth 4 inches) with 1 x AC (AC230V) power socket.

4.3.3.10 ODF to be located at the central location (Basement/Ground floor/First floor) and all fibers cable, ports properly terminated and labelled.

4.3.3.11 Central location is preferred space for splitter installation, typically 40U standardrack space.

4.3.3.12 Horizontal duct to telecommunication room, for main cable entry shall be 2 x 110mm HDPE pipes, connected to nearest Handhole on the roadside.

5 Roles & Responsibilities

5.1 HDC will be responsible for reviewing and updating this guideline to ensure the latest best practices are applied for fiber optical network deployments.

5.2 HDC holds the right to reject designs which do not adhere to the standards specified in this design.

5.3 All developers shall follow this guideline as the best recommendation provided when designing and deploying in-building networks.

6 Review

This guideline will be reviewed yearly to ensure the latest best practices for fiber deployment are recommended.