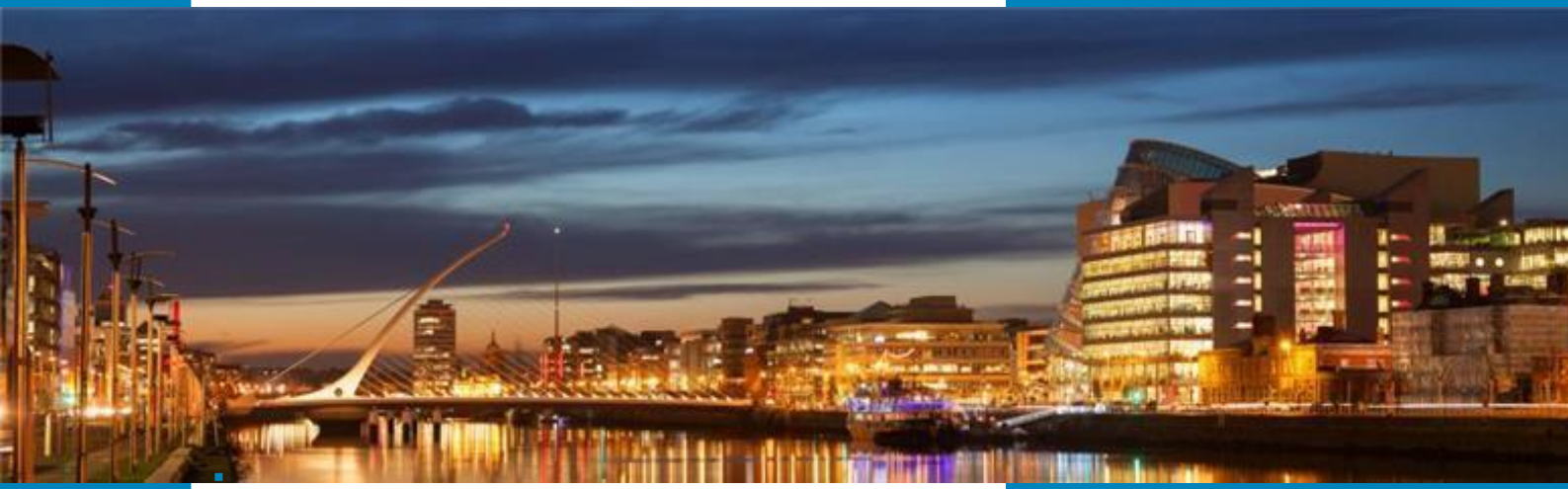


Guide to the Installation of Telecoms Infrastructure in Residential and Mixed-Use Developments

April 2024 Version 13

Dublin City Council – Telecoms Unit

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

Contents

1. Background

Dublin City Council (DCC) recognises that digital connectivity infrastructure plays a critical and increasingly important role in Dublin's social, cultural, and economic development. COVID-19 has reinforced the importance of connectivity in our cities and towns. Having the right type of connectivity is also essential for Dublin's future competitiveness. We are entering a new era of super connectivity and with the emergence of fifth generation (5G) mobile networks, and access to gigabit network connectivity, we need the right structures in the local authority to support these network rollouts.

Dublin City Council Telecoms Unit

The Telecoms Unit was established to collaborate with the industry in an open, proactive, and transparent way, and to help realise Dublin's connectivity potential by removing barriers to deployment. Put simply, it is a "one-stop-shop" for all telecoms-related requests within the council. For this reason, DCC is taking an active role in the promotion of enhanced connectivity in the city. One element of this is to ensure best in class connectivity to DCC and privately owned social housing estates, Multi-Dwelling Units, and private developments. DCC is working with industry to enable network Service Providers to increase the footprint of their FTTH networks to areas not currently served. This is achieved by mandating the installation of open access fibre networks in new developments which are open to all network Service Providers on the same basis. This allows network Service Providers to increase their achievable markets and presents the consumer with greater freedom of choice.

EU Electronic Communications Code

The EU's electronic communications policy improves competition, drives innovation, and boosts consumer rights within the European single market.

To advance these objectives and meet Europe's growing connectivity needs, the EU Electronic Communications Code, which was adopted in 2018, updates and merges EU telecommunications rules under one regulatory framework designed to boost connectivity and better protect users throughout Europe.

These rules are crucial for achieving Europe's connectivity targets and providing everyone in the EU the best possible internet connection, so they can participate fully in the digital economy.

The Code improves connection speeds and coverage by:

- making it more attractive for all companies to invest in new top-quality infrastructures, everywhere in the EU, both locally and across national borders
- making rules for co-investment more predictable and promoting risk sharing in the deployment of very high capacity networks, including 5G networks
- promoting sustainable competition for the benefit of consumers

Access to basic communication services is crucial to participate in today's economy and society. European electronic communications rules seek to make broadband internet access and voice communications affordable and available throughout Europe through effective competition and choice. Where the needs of consumers are not met by the market, universal service obligations ensure that affordable adequate services are available regardless of personal circumstances like location, income or disability. Broadband internet must have sufficient bandwidth for using important services such as eGovernment, internet banking, and standard quality video calls.

Broadband Cost Reduction Directive

S.I. No. 391/2016 - European Union (Reduction of Cost of Deploying High-Speed Public Communications Networks) Regulations 2016 was transposed in Irish Law on 26th July 2016 and aims to facilitate and incentivise the roll-out of high-speed electronic communications networks by lowering the costs of deployment with a set of harmonised measures.

Gigabit Infrastructure Act Proposal

On 23 February 2023, the Commission presented a set of actions aimed to make Gigabit connectivity available to all citizens and businesses across the EU by 2030. A political agreement was reached in February 2024 and the Gigabit Infrastructure act (GIA) will soon become law. The initiatives keep in line with the objectives of Europe's Digital Decade, and to enable the transformation of the connectivity sector in the EU. They consist of:

- An adopted proposal for a ‘Gigabit Infrastructure Act', a regulation that will put forward new rules to enable faster, cheaper, and more effective rollout of Gigabit networks across the EU.
- A draft Gigabit Recommendation, which seeks to provide guidance to National Regulatory Authorities on the conditions of access to telecom networks of Service Providers with significant market power, to incentivise faster switch-off of legacy technologies and accelerated Gigabit networks deployment.

Fibre to the X (FTTX)

Fibre to the X is a collective term that is used to describe various types of broadband network architectures, depending on wherever they terminate. The ‘X’ in ‘FTTX’ represents a particular object. It could be a home, a cabinet, or any end-user premise. Resultantly, FTTx could be Fibre to the Home (FTTH), Fibre to the Building (FTTB), Fibre to the Premises (FTTP) and Fibre to the Kerb (FTTK).

A FTTH network is a system of interconnected elements in which end-users are connected to a central point using only optical fibre cabling. End users of FTTH networks are primarily located in their residences. However, a plethora of other end user locations are also possible, including offices and wireless antenna sites.

Fibre offers the highest available bandwidth today and can transport huge volumes of data with the lowest latency. After installation, the performance of fibre can be improved by changing the electronics while continuing to use the existing cable infrastructure.

The move to FTTH supports the copper switch-off programmes which are prevalent throughout Europe. Fibre cable can also improve CAPEX/OPEX for telecoms Service Providers thanks to its relatively low cost, durability, and the fact it offers scope for adding services in future. In short, fibreoptic cable is key to accommodating today’s increasingly bandwidth-hungry applications, future technologies and leading to increased energy savings and efficiencies.

Numerous studies indicate that fibre broadband brings a wide range of benefits, from increasing GDP and employment to supporting job retention and new business creation. In fact, fibre networks - the ‘fourth utility’ - are vital to our long-term economic and social future.

2. Guide Objectives

Regulations under development at local and European level will require the installation of a very high-speed fibre optic electronic communications network in all new constructions and in some renovations.

This guide aims to prepare the connection of any new construction, residential or mixed buildings (including premises for professional use) to an open access shared fibre optic network, referred to as FttH (Fibre to the Home) and to consider the requirement for mobile connectivity.

It sets out the best practices that preside over the construction of an internal optical network in a new building and a Fibre-to-the-Home network within a housing estate. For MDUs, it also sets out the requirement for the developer to include a provision for mobile connectivity at the development. This guide has been designed to help professionals by stating the good practices that apply to the construction of a quality optical network in the building or housing estate and its connection to the shared optical network.

Compliance with the rules therein allows:

- to create favourable conditions for connecting the internal wiring of the dwelling to this network.
- to deploy an optical network in the building or housing estate from the Primary Distribution Point to the connection point of the Housing Unit, in a multi-fibre solution.
- the first occupants to access the services as soon as they enter the premises.
- to serve the homes or premises of future occupants at very high-speed using FttH technology, without intervention for additional construction work.
- the deployment of multiple micro ducts from the basement to the rooftop, in an MDU, to support backhaul for mobile infrastructure.
- access to MDU rooftops for mobile operators to include mobile connectivity requirements via antenna placement within allowed deployment levels.

3. Definitions

- **Access Box**

  An access box (sometimes called a small access chamber) is a plastic or concrete structure set below ground with a lid flush to the surrounding surface to facilitate the installation and maintenance of the telecoms duct and fibre cable.

- **Bandwidth**

  Bandwidth is the amount of data that can be transferred from one point to another in a given period. The higher the bandwidth, the more data will be transferred in the allotted time. Bandwidth is measured by how many gigabits per second (Gbps) your data can be transferred through the fibre optic cables, e.g., a network with a bandwidth of 100Gbps can transfer 100 gigabits of data per second.

- **Building Entry Point – BEP**

  The building entry point allows a connection between the outdoor cable (i.e., the Service Provider's feeder cable) and the premises cabling. This access chamber will be required for MDUs and housing estates.

- **Chamber**

  An underground vault or chamber in which telecom cables are collected and distributed through a duct infrastructure.

- **Customer Premises Equipment - CPE**

  Located in the subscriber's home, CPE devices are used to provide customers with a connection to the internet, as well as access to online services.

- **Draw Wire**

  A rope, usually 6 mm nylon (polypropylene), inserted in a duct for the purpose of pulling a cable through the duct during service installation or maintenance.

- **Fibre**

  A network cable that contains strands of glass fibres inside an insulated casing. They are designed for long-distance, high-performance data networking, and telecommunications.

- **FTTH (Fibre-to-the-Home)**

  Fibre broadband service which is delivered into the premises via a fibre optic cable.

- **FTTX**

  Fibre to the X is a collective term that is used to describe various types of broadband network architectures, depending on wherever they terminate.

- **Gigabit infrastructure**

  Very high-capacity networks (VHCN) with cost-efficient measures on infrastructural access, civil works, permit granting, and in-building infrastructure.

- **Latency**

  Latency is the time delay between the initiation of an event and its reception. In telecommunications and networking, latency is often also called lag.

- **MDU – Multi dwelling unit**

  A residential, commercial, or mixed-use building with multiple apartments and/or offices.

- **ONT – Optical Network Terminal**

  Upon entering the customer premises, fibre is terminated at an optical network terminal (ONT). The ONT connects to customer premise equipment (CPE). The ONT and CPE can be separate or integrated.

- **Open Access Model**

  An open access network is one where several service providers sell retail services over the same access network infrastructure simultaneously, allowing the subscribers to decide from which service provider they will purchase their services.

- **PDP - Primary Distribution Point**

  The point at which the Service Provider's feeder cables are cross connected to the fibres from the Housing Units. This is typically a wall mounted or free-standing optical distribution frame. The Service Provider's feeder cables, and the Housing Unit's fibre cables are terminated here in readiness for connection.

- **Pigtail**

  A fibre optic pigtail is a fibre optic cable terminated with a factory-installed connector on one end, leaving the other end ready for splicing.

- **Single mode Fibre**

  A single strand of glass fibre with a diameter of 8.5-10 microns.

- **Slow Bend**

  A preformed, graduated 90-degree bend used to connect two lengths of duct at a bend and reduces the stress on the cable when it is being pulled into the duct.

4. Physical Infrastructure / Design Criteria

FTTH (Fibre to the Home) promotes the performance and reliability of passive infrastructure. In buildings and housing estates to be constructed, it is up to the developer or owner to install this optical network. This installation constitutes the end user part of the FTTH network. It is shared between all Service Providers and serves each of the housing units and other potential fibre users in the development.

It is the intention of Dublin City Council to make it mandatory to install a fibre optic network in buildings to serve all dwellings or premises for professional use, as well as in mixed-use buildings.

The development will make the internal network available by agreement to a Service Provider to serve their customer base with broadband services on a commercial basis. The fees must be fair and reasonable and respect the principles of efficiency, relevance, objectivity, and non-discrimination.

This specification requires that fibre optic lines connect each dwelling, with at least two fibres per dwelling, to a connection point in the building.

FTTH networks need to provide customers with a number of basic services:

- Best-in-Class latency
- Reliable bandwidth
- Secure connections
- Options to upgrade services
- Scalability and flexibility

The MDU network will consist of the following elements (see Fig 1):

- Service Provider Feeder Cable.
- Building Entry Point, i.e., external chamber.
- Primary Distribution Point, i.e., basement patch panel.
- Riser Cable.

- Secondary Distribution Point (if required, i.e., depends on the number of Housing Units).
- Drop Cable, i.e., final connection to the Housing Unit.
- Equipment internal to the Housing Unit, i.e., the wall outlets, CPE, ONT.

Fig 1. Example of a typical MDU fibre deployment.

The housing estate network will consist of the elements identified in Fig 2. As with the MDU overview, the operator access duct will extend from the BEP external chamber to a nominated Comms cabinet, or Comms room, within the estate.

- BEP
- Comms Cabinet – this cabinet is where the fibre from the operator cables is terminated and becomes available to interface with any of the fibre cables connected to each housing unit.
- Distribution network – network connecting the Comms Cabinet to the housing unit.
- Boundary box – this is typically located at the customer boundary/kerb and can be connected to the existing network upon infrastructure installation, allowing quick and easy customer connections.
- Customer entry – the point at which the fibre network enters the housing unit.

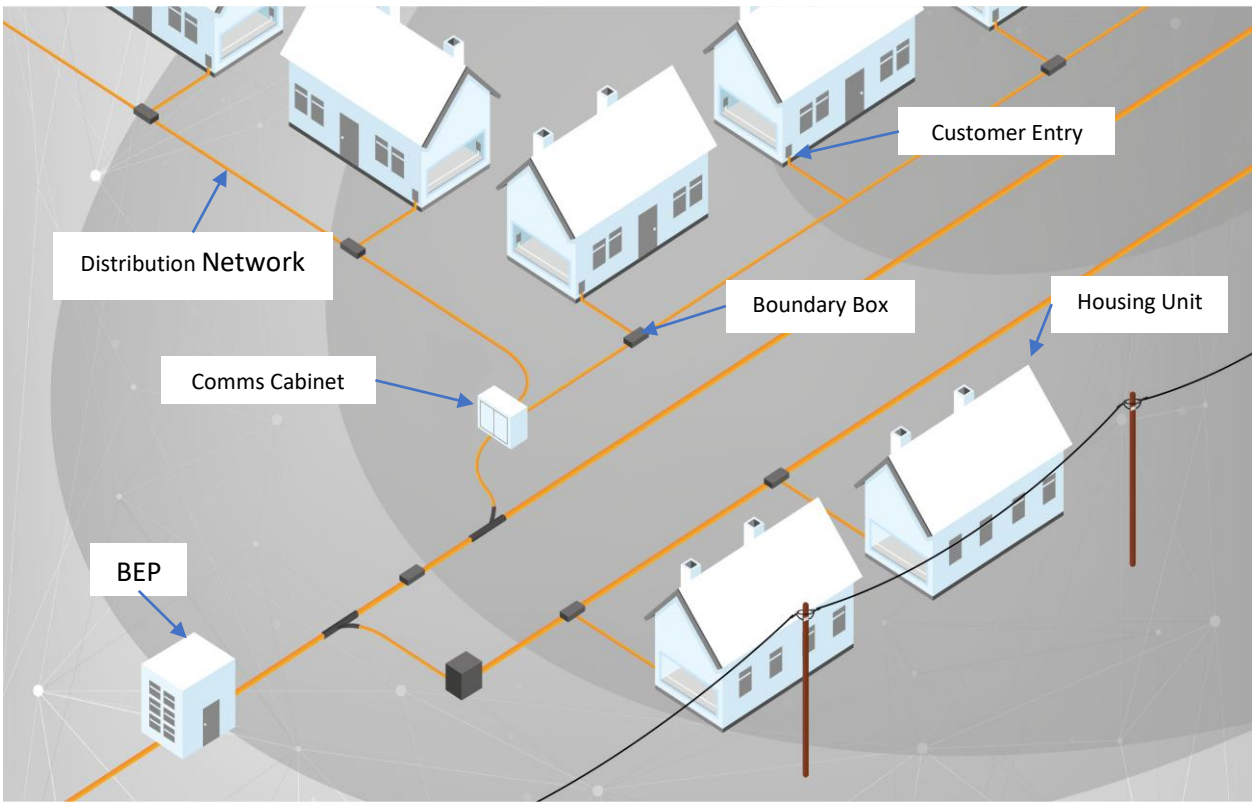


Fig 2. Example of a typical housing estate duct deployment.

4.1 Overview

The Service Providers will connect their duct infrastructure to a nominated building entry point which is a chamber external to the MDU or housing estate but on the grounds of the MDU or housing estate, see Fig 1 and Fig 2. This chamber should be located to facilitate easy access by the Service Providers to the development. This chamber will be connected by duct to a 'comms room' cabinet, i.e. can be a cabinet located in a basement or outdoors, in which the fibre optic cabling from the Housing Units will terminate, i.e., the Primary Distribution Point patch panel.

The duct connecting the Building Entry Point Chamber to the Primary Distribution Point Patch Panel must be used exclusively for telecommunications infrastructure (cables) and must always be installed by a competent, qualified person or contractor. The duct must be installed in a location and manner which minimizes the possibility of accidental damage, irrespective of cause. The duct should always have a Draw Wire inserted.

The principal network elements required to deliver the service to the Housing Units in the MDU/housing estate and as described in this document include:

- Service Provider Feeder Cable.
- Duct
- Building Entry Point, i.e., external chamber.
- Primary Distribution Point, i.e., basement patch panel.
- Distribution Network (housing estate).
- Boundary Box (housing estate).
- Riser Cable.
- Secondary Distribution Point (if required, i.e., depends on the number of Housing Units).
- Drop Cable, i.e., final connection to the Housing Unit.
- Customer Entry Point.
- Housing Unit.

There are two methods for distributing fibre connections within Multi-Dwelling Units. The optimum method for any building is dependent on the number of floors and apartments. The methods are:

i. **Direct drops from a terminal box installed in the basement / Primary Distribution Point (PDP)**

   This topology is mostly used in low-rise buildings with 12/16 or fewer apartments, and usually no more than three floors. If there are more apartments or floors, the use of direct drops can very easily result in cable congestion in the risers and ducts inside the building.

ii. **Structured cabling using Riser Cables and Secondary Distribution Points**

   Where there are more than a few floors, secondary distribution points are placed either on each floor, or every two or three floors in some networks, to facilitate connection between the Customer Drops and the Riser cable. The PDP and the secondary distribution points are typically separate.

Within the housing estate the fibre connections will be distributed via the duct Distribution Network to each housing unit.

4.2 Service Provider Feeder Cable

Feeder cables are fibre optic cables that run from the Service Provider's access node to the Primary Distribution Point patch panel. These cables are the property of the telecom Service Provider. The number of fibres within the cable will depend on the Service Provider's network design architecture and the number of units within the MDU development to be served.

It will be the responsibility of the development owner to facilitate the Service Provider to route their feeder cables to the Primary Distribution Point patch panel via the building entry point external chamber.

4.3 Duct

4.3.1 Installation Guidelines

- For an MDU, the open access duct will extend from the BEP external chamber at the development boundary to the basement, or Comms room, in the building. For a housing estate, the duct will extend from the BEP external chamber to a nominated Comms cabinet, or Comms room, within the estate.
- A Draw Wire must be inserted that is continuous from end to end. A minimum of 1 metre of slack rope should be safely secured at each end.
- The duct will be shared by the telecom Service Providers/broadband providers serving the development.
- Sharing of the telecommunications duct with other services is not permitted.
- The duct should be laid flat and in a straight line with as few curves (either sideways or up and down) as possible. If a sharp change of direction (90 degree or so) is necessary, then a suitable Access Box must be installed at the point where the direction changes to facilitate ease of cable installation. The recommended spacing for standard 100mm duct, if required, is 250mm.
- It is recommended that a 100mm duct populated with sub-duct be used to allow for multiple service providers which provides physical security for each.
- If a 100 mm duct is used and a bend is required, a ‘slow bend’ can be used if an access box cannot be installed at this point.
- Another draw wire must be installed with the telecoms cable at the time of cable installation. This will ensure that there is a draw wire present in the duct always should it be required in the future.

4.1.2 Duct Specifications

- It is always preferable to lay duct in a continuous length but for long distances where more than one length of duct is necessary, “access boxes” must be installed between

each section of duct. An access box should be installed at any location where there is a sharp bend. Such boxes should typically be 300 mm by 300 mm and 450 mm deep. Minimum depth of cover above the duct should be 450 mm. The maximum bending radius should be 450 mm.

- The duct should enter the box to the side thereby allowing maximum space in the box to manage and support the cable radius within the chamber.
- If the duct is being joined without the provision of an access box at that location, a proper duct coupler (designed for use with the duct to form a water blocking seal) must be used. Care must be taken to avoid leaving any sharp edges which could snag the cable during installation.
- The duct must be laid in a trench minimum 450 mm below ground level. If for any reason the duct cannot be laid at the required depth it must be laid in a location where it will not be crushed, and adequate measures must be deployed to prevent crushing. In some instances, the chamber will need to be deeper than 450 mm to, for example, accommodate 450 mm depth of cover over a 100 mm duct. Knowing the depth of cover and line of the trench also helps to locate the infrastructure at a future date as may be required.
- Ducting should be covered with sand or pea-gravel (or equivalent substrate) to a depth of 100 mm before back filling the trench to avoid damage by sharp stones or back fill aggregate material.
- A record should be kept of the duct route and marker wire, outside the pipe, used to enable tracing. A cable/duct marker warning tape should be placed along the length of the duct at half depth before completing the back fill to help avoid future damage in the event of further excavation in the vicinity of the duct.
- Shallow duct should be protected by plates and or cable marker/duct marker warning tape at half depth before back fill.
- Where the duct must be laid under a driveway it is important that the duct is either laid deep enough to include >600 mm depth of cover or suitably protected to ensure it does not suffer crushing damage over time due to the weight of the vehicles traversing over it.

4.4 Building Entry Point - External Chamber

This chamber is located at the boundary of the development and is connected by duct to a basement or 'comms room'. This allows the network Service Providers to route their cable from their own networks, through the external chamber and to the Primary Distribution Point patch panel where their fibre cables will be terminated.

The chambers must be large enough to allow for duct cable installation operations, i.e., storage of slack cable loops for jointing and maintenance, placing cable hangers and bearers.

The chambers used must adhere to the relevant standards for load bearing and build quality depending on where they are in the development, i.e., in the footway or carriageway. Fig 3 is an example of a typical specification for a footway chamber and Fig 4 is an example of a typical specification for a carriageway chamber.

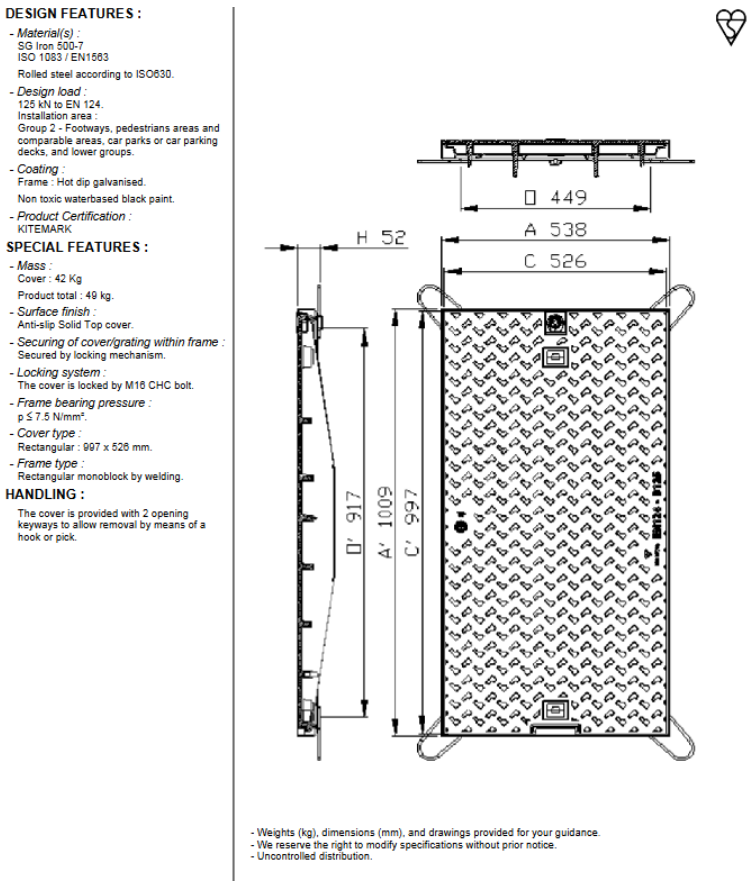


Fig 3. JB4 footway chamber

DESIGN FEATURES :

- *Material(s) :*
  SG Iron 500-7
  ISO 1083 / EN1563
- *Design load :*
  400 kN to EN 124. Group 4 installation area : carriageway of roads (including pedestrian streets), hard shoulders and parking areas, for all types of roads vehicles (and lower groups).
- *Coating :*
  Non toxic waterbased black paint.
- *Product Certification :*
  KM

SPECIAL FEATURES :

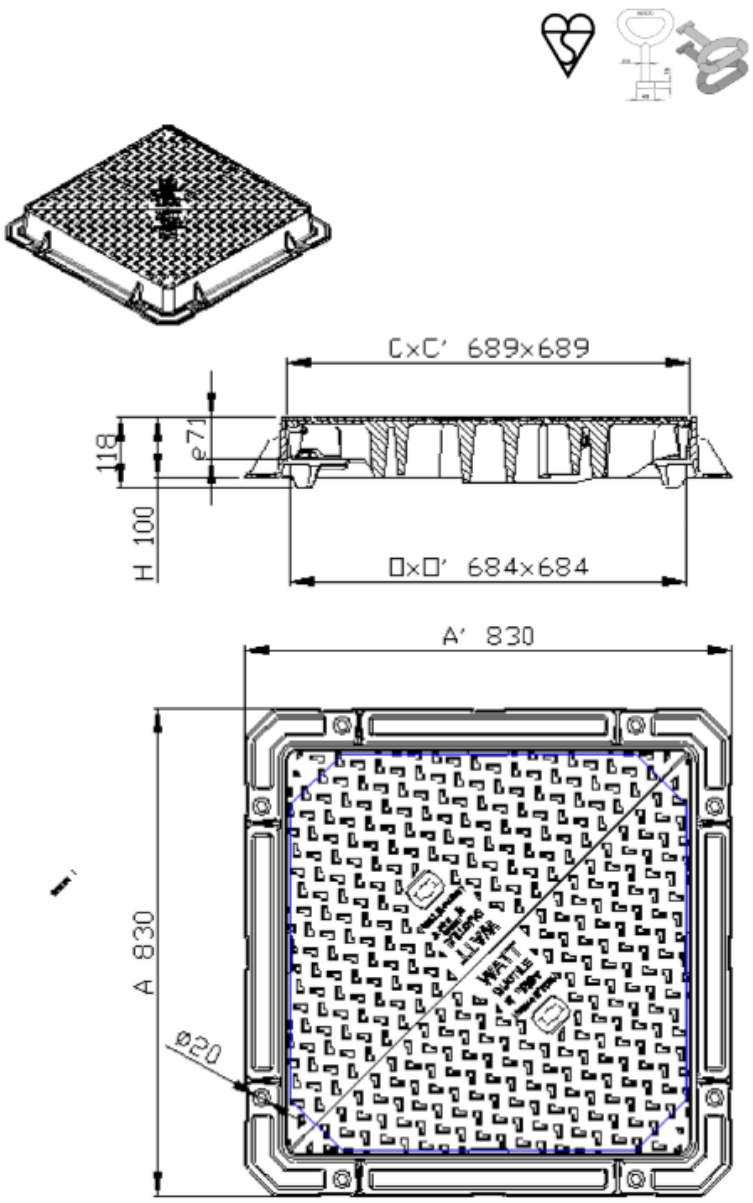
- *Mass :*
  Each triangular cover : 31.8 kg
  Product total : 92.388 kg.
- *Seatings ensure non-rock stability and silence :*
  Non-rocking by means of three-point suspension.
- *Frame bearing pressure :*
  $p \leq 7.5$ N/mm².
- *Surface finish :*
  Cover: Anti-slip surface with 4L patented design.
- *Securing of cover/grating within frame :*
  With sufficient mass per unit area.
- *Frame type :*
  square monoblock frame as cast.
  Depth : 100 mm
  Frame provided with ⌀ 20 mm holes to dowel if necessary.
- *Cover type :*
  Depth of insertion : e= 71 mm.
  Double triangular design assures stability.
  The cover assembly can be rotated by 180° on a horizontal plan.
  Non-rigid coupling of the covers by bolt.
  (HM16x90 head).

OPTION(S) :

Badging available please enquire

HANDLING :

Closed BS keyway.
Handle with BA1 heavy duty lifting key. (item code : 511793)
Key or hook is supplied separately, to order



- Weights (kg), dimensions (mm), and drawings provided for your guidance.
- We reserve the right to modify specifications without prior notice.
- Uncontrolled distribution.

Fig 4. CW1 carriageway chamber

The chambers may be constructed on site or provided as prefabricated units to minimise construction costs and site disruption. Modular chamber units are also available. Where existing legacy access chambers are unsuitable due to size or overpopulation of cables/closures, an ‘off-track or spur’ chamber should be considered.

4.5 Primary Distribution Point Patch Panel

The Primary Distribution Point (PDP) patch panel can be wall mounted or free standing and is typically located in a Comms room or basement of a building. This panel will serve as the network demarcation point (NDP), i.e., this is the interface between the Service Provider's network (public) and the fibre inside the building (private) and is generally located where the cable/duct enters the building.

The panel is multi-Service Provider which means that any of the Service Providers who wish to access the building will terminate their feeder cables in this panel. The panel should have sufficient capacity to accommodate multiple Service Providers. An example of a typical 'Multi-Service Provider' patch panel can be seen in Fig 5. The service provider feeder cables and the fibre from the housing units is terminated in dedicated shelves. The cross connections from the service provider to the housing units is contained within the right-hand side of the panel.

Fig 5. Typical example of a multi-Service Provider PDP patch panel.

The design requirements for this multi-Service Provider fibre distribution panel include:

- It is necessary that the cabinet allows for easy cross-connection and management of fibre cables. The cabinet should have sufficient space for housing the fibre termination points, splitters, and other necessary equipment. It should also provide proper cable management to ensure neat and organized fibre routing.
- Fibre Patch Panels: Fibre patch panels should be within the cabinet to enable cross-connection between different Service Provider fibres. Patch panels allow for flexible interconnection and easy troubleshooting of fibre connections.
- Labelling and Documentation: Label each fibre connection and document the cross-connections in a structured manner. This helps in quick identification and maintenance of fibre connections.
- Secure Access: Ensure that the cabinet is securely locked and accessible only to authorized personnel. This prevents unauthorized tampering and ensures the integrity of the fibre connections.
- Collaboration and Coordination: Encourage collaboration and coordination among Service Providers to ensure smooth cross-connection within the cabinet. Establish clear communication channels and protocols for managing fibre distribution.
- Future Scalability: Design the cabinet and fibre distribution infrastructure with future scalability in mind. Consider the potential growth in the number of Service Providers and the increasing demand for fibre services within the MDU.
- Typically, an in-building installation would require an IP30 rating.
- It is important that the PDP cabinet is positioned close to the vertical cabling path, to allow for optimal routing of the cables.

The size of the PDP cabinet depends on the size of the building, such as the number of apartments or floors, the overall complexity of the installation, and the network structure.
All cabling must be labelled in the PDP to show its destination. An industry recommendation would be that individual cable lengths should not exceed 100m from a distribution point, although advances in cabling and laser technology are leading to constant improvements in this area.

Fig 6 illustrates the network configuration for a multi building development.

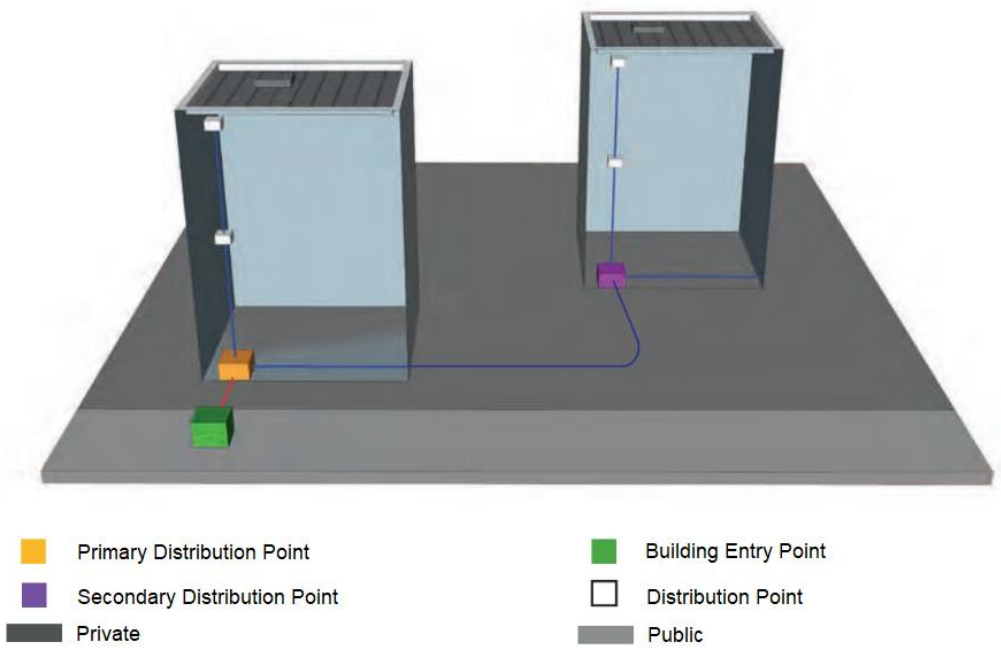


Fig 6. Typical example of a multi-building development.

4.6 Distribution Network (Housing Estate)

This is a duct network which distributes the fibre cables from the housing unit to the Comms Cabinet where they are terminated. At this location they can be patched through to the Operator's network.

4.7 Boundary/Toby Box (Housing Estate)

This is typically located at the customer boundary/kerb. It is an underground storage box for housing microducts and splice enclosures. It can also be used as a maintenance point. Toby Box can also be used for housing an IP65 or IP68 splice enclosure where the drop cable to the home can be spliced. See Fig 7 for an example.

Fig 7. Typical example of a Boundary or Toby Box.

4.8 Riser Cable

Several types of indoor optical cables can be used to connect the Housing Units in the MDUs to the very high-capacity networks. Depending on the place where these cables are to be installed, there may be different cable specifications that can be used.

Riser cables, as their name indicates, are fibre optic vertical cables developed for installation inside technical ducts or conduits passing from one floor to another and serving the entire building. The riser cable connects between the PDP patch panel and the Secondary Distribution Point (SDP).

When fibre cables are being installed in risers/cable trays and fibre patch cords are being routed in patch panels, the fibre optic cables may be subjected to tight bends. This stress on the cable can then result in signal loss and even failure over time. This stress can cause signal loss and even long-term failure. For this reason, it is recommended to use single mode bend insensitive fibre, i.e., specification ITU-T G.657 for example. Cable manufacturers offer single mode bend-insensitive fibres that are tolerant of the bends in the cable which is a big advantage in environments such as MDUs.

It is also recommended that the cables be enclosed in a micro-duct for added protection. A micro-duct is a narrow duct in which the fibre cable is installed. In large MDUs the micro-duct installation may take the form of micro-duct bundles in the risers and single micro-ducts from the Secondary Distribution Point to the Housing Unit.

Cable manufacturers' datasheets specify a value for the maximum force that can be applied to a cable during the installation process. Observing this ensures that any strain imparted to the fibres is within safe working limits. Protection elements such as mechanical fuses protect the cable if the pulling force is exceeded.

4.9 Secondary Distribution Point (SDP)

For larger developments secondary fibre distribution points (SDP) may be required. The SDPs should be installed at equal intervals throughout the building to distribute the fibre to the units on every floor. As every building is unique, the setup for this network can vary. Some larger buildings may require a SDP on every floor, others may only require an SDP on every second floor. This depends on the number of units on each floor. For any building that has less than 12 units to be connected, the secondary fibre distribution point is not typically required. The SDP may hold only splices or may also contain a patch field and pigtails, depending on the network design.

4.10Drop Cable

The link between the SDP and the Housing Unit is called a drop cable or 'horizontal drop'. This drop links the vertical riser cable from the SDP to the subscriber interface with the required number of fibres. It is recommended that a single cable containing multiple fibres is terminated in each unit. The drop cables are fibre cables with small diameters, fire performance and reduced bend radii enabling simple and reliable connections.

The fibre is routed to every Housing Unit directly from the corresponding SDP, or PDP in smaller developments. The fibre is brought to, and coiled in, a wall outlet in the housing unit in preparation for a service request. Once an order has been placed with the service provider, they will terminate the fibre in an ONT. Ideally the fibre from the distribution point to the housing unit should be contained within a micro-duct throughout the building.

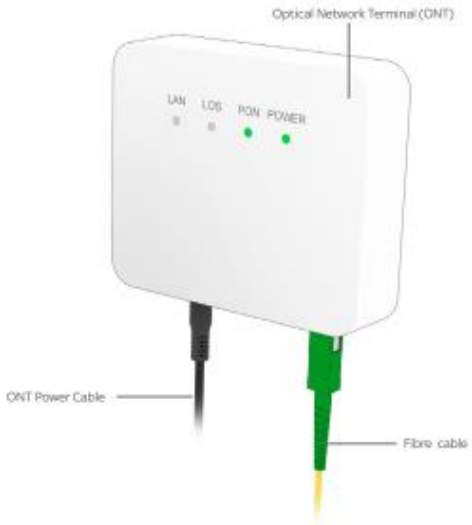


Fig 8. Typical example of an ONT.

As the SDPs are limited with space and may require tight bends and flexibility for connection the bend insensitive fibre cable is an ideal solution.

Cable manufacturers' datasheets specify a value for the maximum force that can be applied to a cable during the installation process. Observing this ensures that any strain imparted to the fibres is within safe working limits. Protection elements such as mechanical fuses protect the cable if the pulling force is exceeded.

4.11Customer Entry Point (Housing Estate)

This is a fibre termination and network demarcation point external to the connected premise in a FTTH network. It also presents a network test point outside of the customer location. See Fig 9 for an example. This is typically mounted on the external wall of the housing unit.

Fig 9. Typical example of a Customer Entry Point.

4.12Housing Unit

As per section 4.8, in the construction phase of the development, the fibre is brought to, and coiled in, a wall outlet in the housing unit in preparation for a service request. When a service has been ordered from one of the retail service providers, which will be post construction, the ONT will then be fitted as a termination point. The ONT connects to customer premise equipment (CPE). The ONT and CPE can be separate or integrated. See Fig 10.

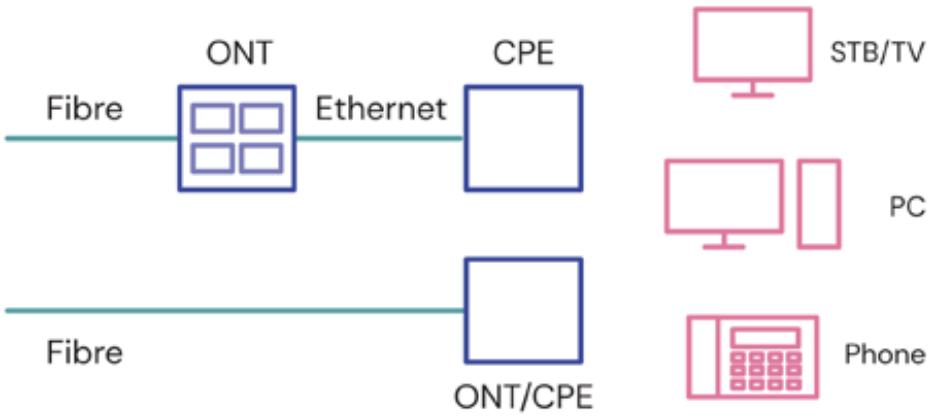


Fig 10. Optical Network Terminal

There are different methods of fibre connection to the wall outlet which are acceptable, such as:

- Spliced pigtails
- Field installed connectors
- Pre-connectorised cables

Bend insensitive fibre, i.e., G.657, is the most commonly used fibre specification. The wall outlet in this instance will accommodate multiple fibres. The wall outlet should allow for the housing of excess fibre for splicing purposes.

When positioning the wall outlet, consideration should be given to the availability of a power socket, space, and adequate ventilation and for the CPE.

4.12.1 Optical Connectors

Angled Physical Contact (APC) connectors are specified at the wall outlet. SC/APC and LC/APC connectors are both acceptable.

The mechanical and climatic requirements typically used are as defined in IEC 61753-021-2 [15] for category C (controlled environment) with a temperature range of -10°C to +60°C.

4.12.2 Customer Premises Equipment (CPE)

The CPE will be network Service Provider specific and will be supplied by them with appropriate cabling to connect to the wall outlet.

Fig 11. Typical example of a CPE.

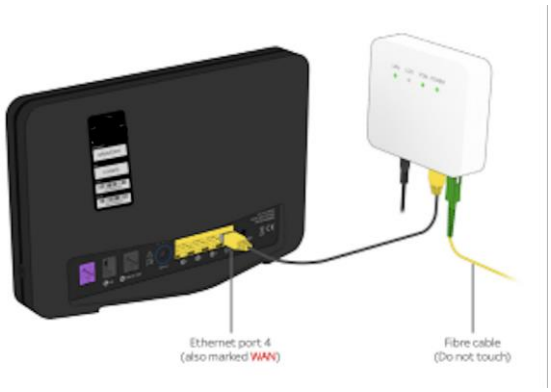


Fig 12. Example of connectivity between the ONT and the CPE.

4.13 Rooftop Infrastructure (i.e. MDUs)

For an MDU, it is recommended that the installation is inclusive of the deployment of multiple micro ducts from the basement to the rooftop to support backhaul for mobile applications. The installation of micro ducts at the construction stage will support a much easier deployment of fibre cables by mobile operators when/if required. As mobile networks continue to grow, fibre backhaul becomes increasingly important. Having micro ducts ready for use takes away issues with drilling through risers and having to fire seal post deployment.

The development design should include access to rooftops for mobile operators for mobile connectivity requirements. This will be achieved by deploying mobile antenna, and associated equipment, on the rooftops in keeping with the development aesthetics and within allowed deployment heights.

4.14Installation Summary

- When installing the fibre, it is important to predetermine the pathway from the PDP to the Housing Unit (ONT).
- It is recommended that the fibre from each Housing Unit will be enclosed in a conduit (micro duct) from the unit to the distribution point.
- Use cable trays and micro-duct and ensure the cable is secured at regular intervals using cable ties, clamps, or brackets.
- It is important to ensure that the cable is not twisted, damaged, or bent prior to rollout.
- Multiple fibre should be terminated in each unit, i.e., it is recommended to install a two fibres.

5. Testing

The purpose of any fibre-optic network is to perform high-speed, error-free data transmission. Adequate testing at each phase of the network construction guarantees that products meet specifications and reduces the risk of service affecting faults when the end users are being connected, which can prove time consuming and costly to locate and fix.

Connectors

Faulty connectors are the number one cause of network failure in an MDU environment. This can be down to poor work practice when the fibre cables are being terminated or down to connector cleanliness. One of the most fundamental processes to be observed when testing FTTH networks is the inspection and cleaning of fibre optic connectors (SC or LC type connectors are the industry norm). It is good practice to always keep the protection caps on the fibre connectors when the fibre is not in service.

The IEC (international Electrotechnical Commission) established recommendation IEC 61300-3-35 to avoid connector failure and provide objective guidelines for connector end-face quality. This standard defines the acceptance criteria based on the number and size of scratches and defects for each of the connector end-face zones and is well understood within the fibre industry in Ireland.

Fibre Testing

For acceptance, there is a comprehensive list of industry standards which are adopted by the telecoms industry in Ireland, see Appendix 1. The test acceptance criteria will be in line with industry standards as agreed between the Mechanical/Electrical contractors and the network Service Providers. Pass/fail criteria will be defined and proof of adherence to this criterion, i.e., as a minimum the acceptance should be a 'Pass' according to ITU 6.671 and TIA 568.3-D, will be provided by the network installer to the network Service Provider prior to service provision.

The network installer will be required to provide as-built information and optical test data to the network Service Providers on completion of the network installation. It will be the Developer's responsibility to have this information available and to provide it to the Management company once they have been appointed.

6. Network Maintenance

- The telecom Service Providers will be responsible for maintaining their network up to the demarcation point, which is the Primary Distribution Point patch panel and from the ONT internal to the Housing Unit.
- The Primary Distribution Point patch panel will be accessed via telecom Service Provider assigned keys.
- Any changes to the connectivity at the cabinet should be recorded locally.
- The telecom Service Providers will be responsible for their own testing and connection verification to the housing unit.
- Any issues outside of this should be directed to the relevant Management Company or the Service Operator nominated by the Management Company.

7. Documentation

- All cabling must be labelled in the PDP and SDP to show its destination.
- Each component included in the installation should receive a unique label according to a consistent, user-defined scheme enabling easy reference and identification for the component.
- The resulting documentation will then comprise accurate and complete information for upgrading, troubleshooting, or restoring a network.
- The identification and labelling of fibres, necessary for their subsequent activation by a telecom network Service Provider, is carried out at the Primary Distribution Point patch panel. All cabling must be labelled in the distribution cabinet to show its destination.
- The aims are that the as-built documents are a perfect reflection of network designs to avoid cost variations and unwanted delays. Of course, some changes will occur, and the as-built document process should be thoroughly understood to ensure any changes are documented as this will later help OAM activities and future builds in the area.

7.1 Geographic Information System (GIS)

It is advisable to record the route of the duct should this detail be required in the future. The network as-builts should be added to the DCC GIS Asset Registry platform to enable the city to track current and future fibre infrastructure within the region. The level of information that can be collected, e.g., additional buildings with home count, correct location of existing infrastructure with the available capacity, allows DCC to build a picture of how connectivity is progressing within the City.

For social housing developments this also allows DCC to accurately account for the physical network inventory in their developments, which is a DCC asset.

8. Planning Compliance

Planning compliance will be in accordance with standard Dublin City Council processes.

9. Network Compliance

The developer will provide DCC with a copy of the as-built file for the network once complete.

The Dublin City Council Telecoms Unit will verify compliance with this specification post network completion.

DCC retain the right to perform an on-site QC check to confirm compliance. The QC process may simply consist of a visual inspection of the PDP patch panel and other network locations to verify the installation, fibre routing and labelling.

The Dublin City Council Telecoms Unit will maintain a register of compliance for each development.

10. Contact

Dublin City Council Telecoms Unit

dcctelecoms@dublincity.ie

11. References

- Guidelines for NBI End Users when laying Ducting to facilitate the installation of Fibre Networks on private property; Revision No.: 1.3
- Objective Fibre Practical Guide 2023
- Novegen Standard Chamber Frame and Cover Specifications 1.0
- FTTH Handbook Edition 9
- S.I. No. 391/2016 - European Union (Reduction of Cost of Deploying High-Speed Public Communications Networks) Regulations 2016
- Gigabit Infrastructure Act (February 2024)

Appendix 1 – Relevant Standards

IEC	Fibre optic - Terminology	IEC TR 61931	Int
IEC	Optical Fibres IEC 60793-1-1 - General & Guidance IEC 60793-1-xx - Test Methods IEC 60793-2 - Product Specifications	IEC 60793	Int
IEC	Guidance for combining different single-mode fibre types	IEC TR 62000	Int
IEC	Optical Fibre Cables IEC 60794-1-1 - General IEC 60794-1-2 - Test Methods IEC 60794-1-3 - Ribbon Specs IEC 60794-2 - Indoor Cables IEC 60794-3 - Outdoor Cables IEC 60794-4 - Aerial Cables IEC 60794-5 - Microduct Cables for installation by blowing IEC 60794-6 - Indoor/Outdoor Cables	IEC 60794	Int
IEC	Fire Performance of communication cables installed in buildings	IEC TR 62222	Int
IEC	Reliability of fibre optic interconnecting devices and passive optical components	IEC 62005	Int
IEC	Semiconductor optoelectronic devices for fibre optic system applications	IEC 62007	Int
IEC	Fibre optic interconnecting devices and passive components – Fibre optic WDM devices	IEC 62074	Int
IEC	Fibre optic interconnecting devices and passive components – Fibre optic protective housings. Ed2 Withdrawn, Ed3 at CD stage as of Jan 2021.	IEC 62134	Int
IEC	Fibre optic active components and devices – Package and interface standards	IEC 62148	Int
IEC	Fibre optic active components and devices – Performance standards	IEC 62149	Int

IEC	Fibre optic active components and devices –Test and measurement procedures	IEC 62150	Int
IEC	Fibre optic interconnecting devices and passive components – Part 01: Fibre optic connector cleaning methods	IEC TR 62627-01	Int
ISO/IEC	Information technology – Generic cabling for customer premises Part 1 – General Requirements Part 2 – Office premises Part 3 – Industrial premises Part 4 – Homes Part 5 – Data centres Part 6 – Distributed building services	ISO/IEC 11801	Int
ISO/IEC	Information technology - Implementation and operation of subscriber premises cabling	ISO/IEC 14763	Int
ITU-T	Characteristics and test methods of optical fibres and cables	G.65x series	Int
ITU-T	Transmission characteristics of optical components and subsystems	G.671	Int
ITU-T	Construction, installation and protection of cables and other elements of outside plant	L. xy series	Int
ANSI	Telecommunications pathways and spaces	ANSI/TIA/ EIA 569	Reg
ANSI	Residential telecommunications infrastructure standard	ANSI/TIA/ EIA 570	Reg
ANSI	Administration standard for telecommunications infrastructure	ANSI/TIA/ EIA 606	Reg
ANSI	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises	ANSI/TIA/ EIA 607	Reg
ANSI	Customer-Owned Outside Plant Telecommunications Infrastructure Standard	ANSI/TIA/ EIA 758	Reg
ANSI	Structured cabling infrastructure standard for intelligent building systems	ANSI/TIA/ EIA 862	Reg
CENELEC	Fire classification of construction products and building elements Part 6: Classification using data from reaction to fire tests on electric cables	EN 13501-6	Reg
CENELEC	Information technology – Generic cabling systems	EN 50173	Reg
CENELEC	Information technology – Cabling Installation	EN 50174	Reg
CENELEC	Telecommunications bonding networks for buildings and other structures	EN 50310	Reg

CENELEC	Information technology – Cabling installation – Testing of installed cabling	EN 50346	Reg
CENELEC	Connector sets and interconnect components to be used in optical fibre communication systems - Product specifications	EN 50377	Reg
CENELEC	Common test methods for cables under fire conditions – Heat release and smoke production measurement on cables during flame spread test – Test apparatus, procedures, results	EN 50399	Reg
CENELEC	Fibre organisers and closures to be used in optical fibre communication systems – Product specifications	EN 50411	Reg
CENELEC	Simplex and duplex cables for use in terminated cable assemblies	EN 50551	Reg
CENELEC	Power, control and communication cables – Cables for general applications in construction works subject to reaction to fire requirements	EN 50575	Reg
CENELEC	Optical fibres - Measurement methods and test procedures	EN 60793-1	Reg
CENELEC	Optical fibres - Product specifications	EN 60793-2	Reg
CENELEC	Optical fibre cables	EN 60794	Reg
CENELEC	Generic cabling systems – Specification for the testing of balanced and coaxial information technology cabling	EN 61935	Reg