Key Considerations

for In-Building Fibre Installations

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While fibre-to-the-home is still in its relative infancy, momentum is building and now is the right time to consider installing fibre inside the building or to provision sufficiently large empty conduits for later fibre installation.

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Consumer demand for fast and reliable data has never been greater. High-quality streaming for movies and music, coupled with the growth of remote working, is making download and upload speeds much more significant. The performance of in-building networks is now of paramount importance.

The increased prevalence of automation within buildings, such as demand-based control of ventilation, heating and cooling to optimise energy consumption, is pushing the network even further. Commercial and industrial buildings will see a convergence towards one united IP network, driven by a fibre-deep architecture that can support next-gen WiFi and current, as well as forthcoming, 5G cellular services.

Twisted pair CATx cables are commonly used in buildings today and are capable of transporting 10Gbit/s over a distance of up to 100m. However, this capacity can reach its limits in a riser building installation – particularly in large properties with many residential units. This requires more cables provisioned in parallel, which takes up more space in supply riser shafts.

With all these services requiring higher bandwidth, and the potential need for 100Gbit connections in future, fibre optic connections represent a future-ready solution and have an almost unlimited capacity (from a technical point of view).

In-building construction product regulation compliance

Since 2018, the Construction Product Regulation (CPR) has been mandatory inside the European Union. The regulation affects approaches to power, control and communication cables, which are considered a permanent part of a building's construction.

Corning's research centre in Berlin-Adlershof, Germany, has developed a full suite of CPR-compliant products to ensure installers have cables that meet high standards for safety – especially for buildings with high fire risks such as hospitals; schools; hotels; high-rise buildings/multidwelling units; government or public buildings and data centres.

CPR ensures reliable and sustainable information on construction products in relation to their performance. Through certification by Notified Bodies (external laboratories) appointed by European authorities, products complying with the requirements must be marked with a CE label that indicates the cable is both rated according to the standard EN13501-6 and conforms to the fire safety characteristics.

CPR is primarily concerned with safety and lays essential performance criteria for building under seven headings: mechanical resistance and stability; safety in case of fire; hygiene, health and environment; safety and accessibility in use; protection against noise; energy economy (including heat retention) and sustainable use of natural resources.

The level of performance is graded from F up to B2ca (with B2ca being the most stringent), with a number of variations across classes. For Dca, Cca and B2ca, additional parameters are measured (smoke, droplets and acidity). Alternatively, for classes Cca and B2ca, annual product and manufacturing recertification has been incorporated into standard requirements to ensure that quality and sustainability are retained.

The regulation applies to all construction products that are produced for, or incorporated within, building and civil

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engineering construction works. It harmonises all construction products subject to regulatory controls for CE marking purposes.

The planning phase

Cables that are laid in shafts or under plaster are difficult to replace later. To be future-ready, fibre optic cabling should be considered throughout the entire building process – whether renovation work or a new building project.

But how is fibre installed inside a building? There are a number of possibilities. In principle, basic conditions must first be considered such as a building's age, its height, compliance with which regulations; how much space is available and the availability of trained labour who can quickly manage installation and testing.

Another essential element to consider is cost – the type of building; number of floors; number of apartments per floor; cable lengths; connection (take) rate and, of course, material and labour costs are all important factors. Different types of cabling and approaches to installation are, of course, required depending upon the type of building. For example, the "Direct Drop" method is used for small buildings (e.g. with fewer than twelve residential units), "Multi Fibre Riser" (bundling several fibres within one riser cable) for medium-sized buildings (e.g. fewer than 48 residential units) and "Multi Riser" (several riser cables) for larger buildings (e.g. 48 or more residential units).

We offer a cost modelling tool for customers to help calculate costs and compare different variants, taking into account the modelling, optimisation and comparison of the costs of different plans and solutions. For example, splice costs, the necessary level of training of installers and installation difficulty are all taken into account, depending upon the installation variant.

The building installation

Building access point

Building installation usually starts in the basement, where the respective network operator installs the fibre optic termination point. The Building Access Terminal (BAT) is also located in the same housing. From the BAT, a connection to the wall outlet (Gf-TA) in the apartment must be established.

Finally, the network provider connects a fibre-optic modem (ONT) to the wall outlet. The modem has the commonly used RJ45 network connectors to plug in a router and supply the other network-compatible devices in the household. The installation between the fibre optic termination point and the fibre optic modem is part of the building network.

Building network architecture choices

The right fibre optic cabling depends upon the architecture of the building. A small building with less than twelve apartments can be accessed with a direct customer connection (direct drop method). In this case, one cable each runs from the house connection (Gf-GV) in the basement to the subscriber connection (Gf-TA) in the apartments.

This method is out of the question for larger buildings because the space required in the supply shafts would be too large for all the connections. For buildings of up to 48 apartments, a floor terminal is usually installed on each floor and only one multi-fibre cable leads up from the basement. From each floor, terminal fibres go to the apartments on this floor – this solution is called "Multi-Fibre Riser" (Fig. 1).

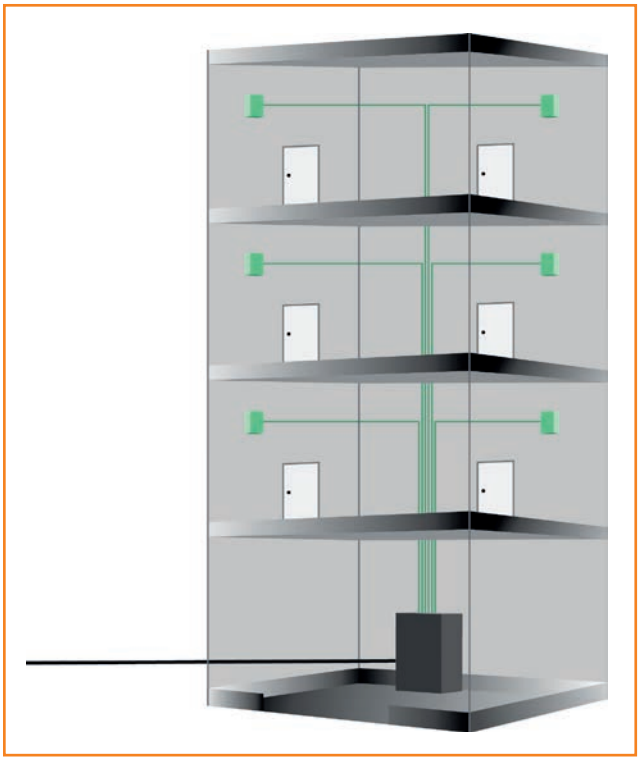

Figure 1: Multi-fibre riser

For very large buildings (more than 48 apartments), the multi-fibre riser method also reaches its limits, and so a multi-riser method is generally used. In this scenario, several risers run upwards in the building to floor terminals, each supplying a certain number of floors. This is sometimes also referred to as satellite architecture (Fig. 2 opposite).

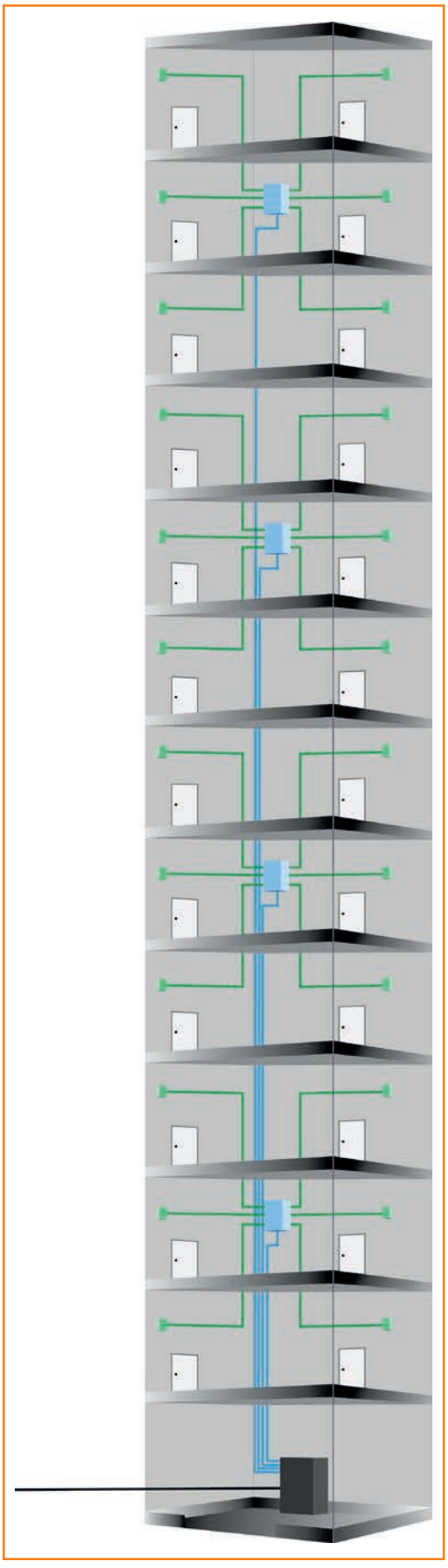

Figure 2: Multi-riser

Inside the BAT, a splitter must be installed. This splitter is usually located in the basement of the building. All fibres of the incoming and outgoing fibre optic cables are stored in the building access terminal and connected to each other.

The installation area inside the BAT consists of the area for incoming cables with the splitter, the patch field and the area for outgoing cables (Fig. 3). If there are more than four apartments in the building, the fibres of the incoming cable are fed into the splitter module and divided (Fig. 4). The outgoing cables are usually already pre-assembled and can be plugged directly into the patch field of the building access terminal. Here LC/APC connectors are used, which ensure a low-damping coupling with their special 8-degree contact surface.

For outgoing cables to the apartments, industrially manufactured plugs with a short fibre optic cable (pigtail) are spliced and connected in the patch field. However, there are also riser cables for which the plugs are already pre-assembled. In the building sector, Deutsche Telekom requires single-mode fibres and a maximum attenuation of 1.5dB in the building

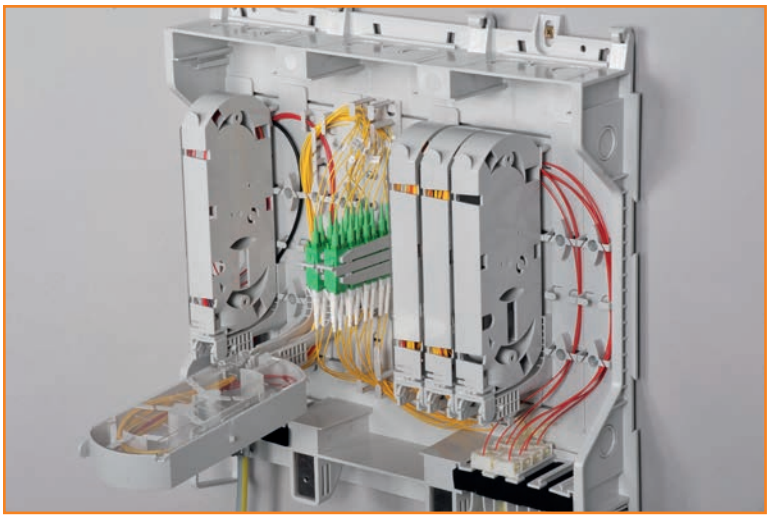

Figure 3: BAT box

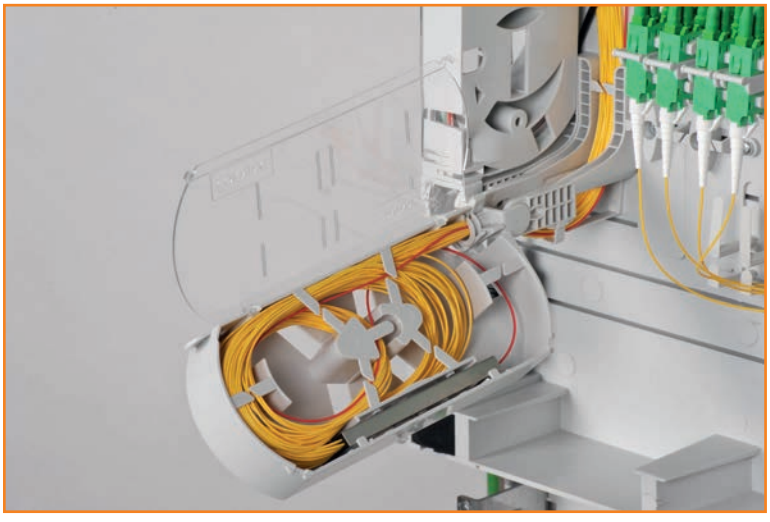

Figure 3: BAT box - divided

cabling. This can be achieved using LC/APC connectors. It should also be noted that some glass fibres attenuate the signal in the event of severe bending, but fibres with almost no attenuation in tight radii are available (such as Corning's ZBL Zero Bend Loss fibre.

Vertical (riser) to horizontal (drop) transition

Building floor terminals are usually installed in larger buildings to ensure proper fibre transition from the vertical riser to the horizontal drop and customers' apartments.

In smaller buildings, the cable is laid directly between the BAT and the customers' wall outlet. This has the advantage that no additional splice points can impair the signal quality. But, generally, the likelihood of errors is low, provided that the fibre optic cables are laid properly.

However, in medium or large buildings the use of building floor terminals is unavoidable. One or more risers lead from the BAT to the floor terminals. These riser cables are also available pre-assembled, so that only plugging is required. For medium-sized buildings, a complete riser cable is available. The connectors are already mounted on these cables at the factory.

An Excel configurator is used to generate the riser cable assembly specific to each building. In this ordering tool, the lengths of the cables between the building distributor and the floors, as well as the number of apartments per floor and the connector type, must be specified. If the information is complete, a purchase order is generated.

The use of pre-assembled riser cables should be taken into account from the start during construction planning. This is because as long as the installation shafts are easily accessible, finished cable harnesses can be easily pulled in. The riser cables are supplied by the manufacturer in the correct dimensions, otherwise the lines to the apartments in the building floor terminals must be spliced. Alternatively, field installable connector systems (Fig. 4) can be used.

Figure 4. OptiRise cable assembly

Finally, a single drop cable (e.g. Corning's 2.4mm 1f ZBL drop) or a compact multifibre drop (e.g. Corning's ClearTrack® Hallway) can be used to achieve the connection to the customer's termination point or wall outlet.

In-living unit

The wall outlet, a small, pre-assembled box in each apartment, is the last point in the building cabling infrastructure. However, there are also variants supplied with pigtails for splicing onto the fibre optic cable to the apartment. In some cases, it is sufficient to terminate a fibre optic cable with an LC/APC connector in a deep flush-mounted housing with dust protection cap. The use of invisible drop cable, such as our ILU ClearTrack® solution, is needed to ensure discrete and aesthetic transitions from the wall outlet to the Optical Network Termination (ONT) unit.

Summary

With the right fibre optic infrastructure inside a building to ensure rapid broadband, requiring little space in the supply shafts and enabling an energy-efficient passive building network, the benefits to consumers and property owners are considerable.

While fibre-to-the-home is still in its relative infancy, momentum is building and now is the right time to consider installing fibre inside the building or to provision sufficiently large empty conduits for later fibre installation.