



TECHNICAL REPORT

**Access, Terminals, Transmission and Multiplexing (ATTM);
Deployment of indoor cabling system based on
invisible optical cables**

Reference

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

Modal verbs terminology

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1 Scope

The present document describes the structure of indoor cabling systems based on invisible optical cables, main components and attachments and their characteristics, deployment method and installation details.

The present document is mainly applicable to indoor cabling system based on invisible optical cables. It can also be used as a reference for other indoor cabling systems with optical fibre connections.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

- [i.1] IEC 60794-1-21: "Optical fibre cables - Part 1-21: Generic specification - Basic optical cable test procedures - Mechanical tests methods".
- [i.2] IEC 61754-4:2022: "Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 4: Type SC connector family".
- [i.3] IEC 60793-2-50:2025: "Optical fibres - Part 2-50: Product specifications - Sectional specification for class B single-mode fibres".
- [i.4] IEC 61753-031-2:2014: "Fibre optic interconnecting devices and passive components - Performance standard - Part 031-2: Non-connectorized single-mode $1 \times N$ and $2 \times N$ non-wavelength-selective branching devices for Category C - Controlled environment".
- [i.5] IEC 60794-1-101:2024: "Optical fibre cables - Part 1-101: Generic specification - Basic optical cable test procedures - Mechanical tests methods - Tensile, method E1".
- [i.6] IEC 60794-1-104:2024: "Optical fibre cables - Part 1-104: Generic specification - Basic optical cable test procedures - Mechanical tests methods - Impact, method E4".
- [i.7] IEC 60794-1-201:2024: "Optical fibre cables - Part 1-201: Generic specification - Basic optical cable test procedures - Environmental test methods - Temperature cycling, method F1".
- [i.8] ISO 29862:2024: "Self adhesive tapes — Determination of peel adhesion properties".
- [i.9] ISO 4892-2:2013: "Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps".
- [i.10] IEC 60068-2-78:2025: "Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state".
- [i.11] IEC 60332-1-2:2025: "Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame".

- [i.12] ISO/CIE 11664-4:2019: "Colorimetry — Part 4: CIE 1976 L*a*b* colour space".
- [i.13] IEC 60754-2:2011: "Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity".
- [i.14] ISO 13468-1:2019: "Plastics — Determination of the total luminous transmittance of transparent materials — Part 1: Single-beam instrument".
- [i.15] IEC 60793-1-40:2024: "Optical fibres - Part 1-40: Attenuation measurement methods".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

indoor cabling system: system of cables, connectors and cords that supports the indoor connection of information technology equipment and transmission of optical signal

invisible optical cables: simplex or multiplex cable for indoor cabling, deployed in the corridor or in the rooms, with the minimum visibility

self-adhesive invisible optical cables: simplex or multiplex optical cable that has adhesive on the cable surface

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BEP	Building Entry Point
ETFE	Ethylene Tetra-Fluoro-Ethylene
EVA	Ethylene Vinyl Acetate
FB	Floor Box
FEP	Fluorinated Ethylene Propylene
LSZH	Low Smoke Zero Halogen
ODN	Optical Distribution Network
OLT	Optical Line Terminal
ONT	Optical Network Terminal
PA	Polyamide
PEI	Polyetherimide
PON	Passive Optical Network
PVC	Polyvinyl Chloride
SEBS	Styrene Ethylene Butadiene Styrene
SIS	Styrene Isoprene Styrene
TPA	Thermoplastic Polyamide Elastomer
TPU	Thermoplastic Polyurethane

4 Structure of indoor cabling system based on invisible optical cables

4.1 General

As download speed of the internet will be more than 1 000 Mbps in the future, a Passive Optical Network (PON) that goes directly to the customer is needed. To this end, it should be driven strongly through the laying of fibre-optic cables right into the customer's home.

In the passive optical network communication system, the end-to-end PON network is composed of "Optical Line Terminal (OLT) - Optical Distribution Network (ODN) - Optical Network Terminal (ONT)". For fibre-to-the-home, the ODN network structure can be divided into three parts: feeder section, distribution section, and drop section, as Figure 4.1 shows.

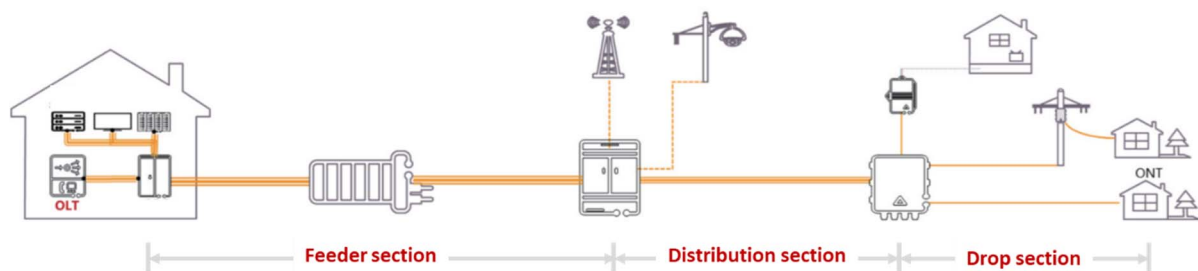


Figure 4.1: Typical ODN network structure

Generally, the feeder section and distribution section are relatively well constructed at present, but for the drop section many old buildings have no pipelines or enough space to deploy cables, so the overall project volume is large. This is the main difficulty for indoor cabling. Besides, it would be unsightly or even destroy the original decoration of the building to directly fix the cables on the wall.

Therefore, deployment of indoor cabling system based on invisible optical cables with minimum visibility is what customers need, and at present the typical scenarios include in-corridor cabling and in-room cabling.

4.2 In-corridor cabling

For the in-corridor cabling, it includes the fibre routing from the building entry point to the ONT, and Figure 4.2 shows the typical structure. In the indoor scenario of high-rise buildings, the Building Entry Points (BEP) are generally placed in the basement to lead different links to different floors or floor groups. However, in some old buildings of multi-dwelling unit without pipelines or enough space for deploying traditional cable, connecting the BEP or the Floor Box (FB) to the ONT through the invisible cables by open-line deployment is needed. And for the fibre to the home in the building, invisible optical cables are usually deployed vertically along stairs and horizontally along in-corridor ceilings.

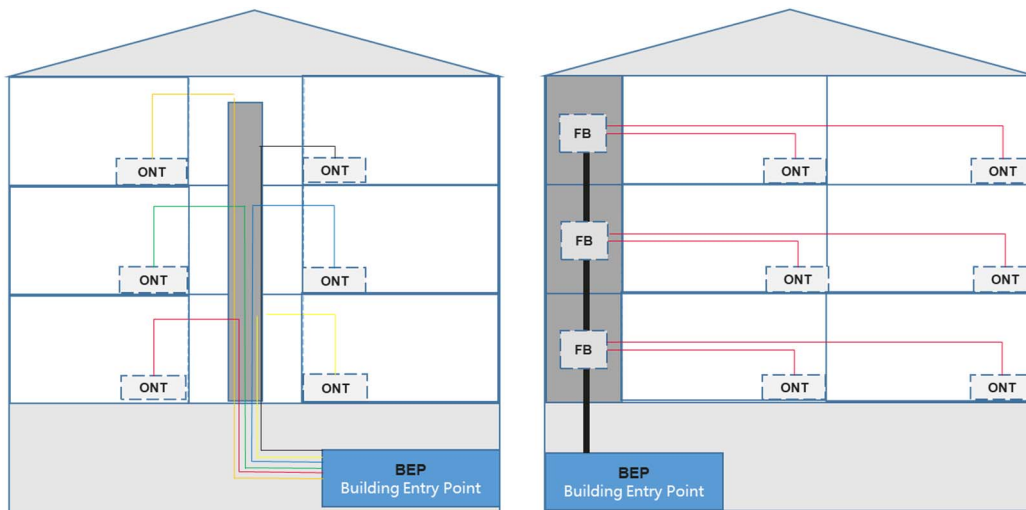


Figure 4.2: Typical in-corridor cabling structure

4.3 In-room cabling

In-room cabling further extends optical fibre to every room at home or in a small or micro enterprise, and Figure 4.3 shows the typical structure, and it can achieve full-house coverage beyond Gigabit. The ONTs can be extended to the areas required by users according to the layout of home and small or micro enterprises, providing network coverage everywhere and achieving high-quality networks. However, not all rooms have pipelines, so invisible optical cables are usually deployed along baseboards, door frames or ceilings.

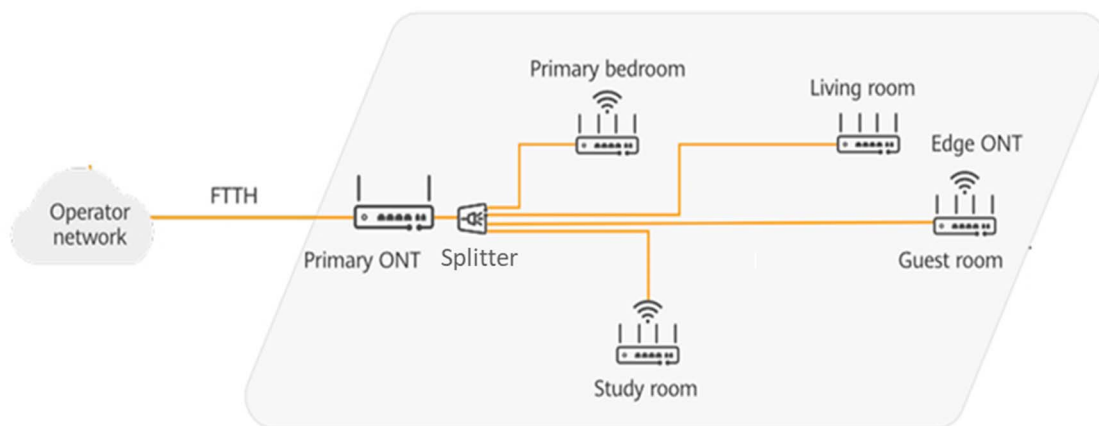


Figure 4.3: Typical in-room cabling structure

5 Main components and attachments

5.1 General

The demand for home communication bandwidth continues to increase and signal stability requirements increase, fibre optical cable cabling technology in buildings and indoors has developed rapidly. Users have also put forward higher requirements for rapid deployment, aesthetics, reliability, and fire safety of cabling in buildings and indoors.

For indoor cabling system based on invisible optical cables, the key components mainly include invisible optical cables and single-mode connectors.

5.2 Invisible optical cable

5.2.1 Structure

5.2.1.0 Typical invisible optical cables

The invisible optical cable consists of optical fibre, strength member (when applicable), outer sheath and outer adhesives (when applicable). To meet the requirements for invisibility and aesthetics of indoor optical cables, transparent materials, or materials with similar colour as the wall are used for cable design. The performance of invisible optical cables should meet the requirements in corridors or in-home scenarios.

Typical invisible optical cables include the round-type and bow-type. Sectional views of typical structures are shown in Figures 5.1 to 5.3. The dimension of bow-type invisible optical cables should be no more than 3×2 mm, and the typical diameter of round-type invisible optical cables is 1,2 mm. Self-adhesive invisible cable are the cable with adhesive on the cable surface. It does not need extra attachments or glue to stick it on the wall. A self-adhesive invisible cable is recommended for construction convenience and aesthetics purpose.

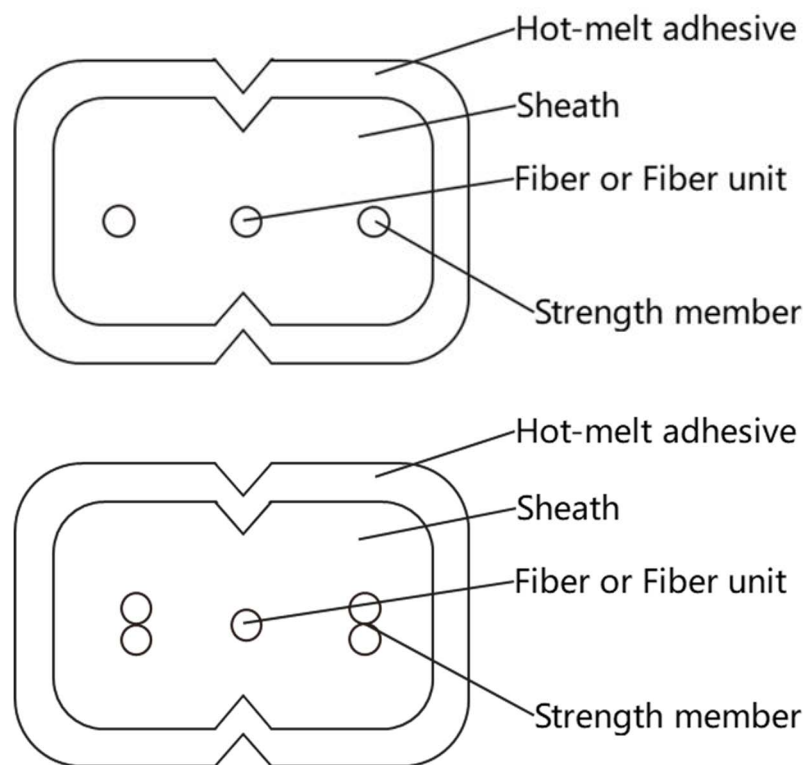


Figure 5.1: Bow-type self-adhesive invisible optical cable with hot-melt adhesive

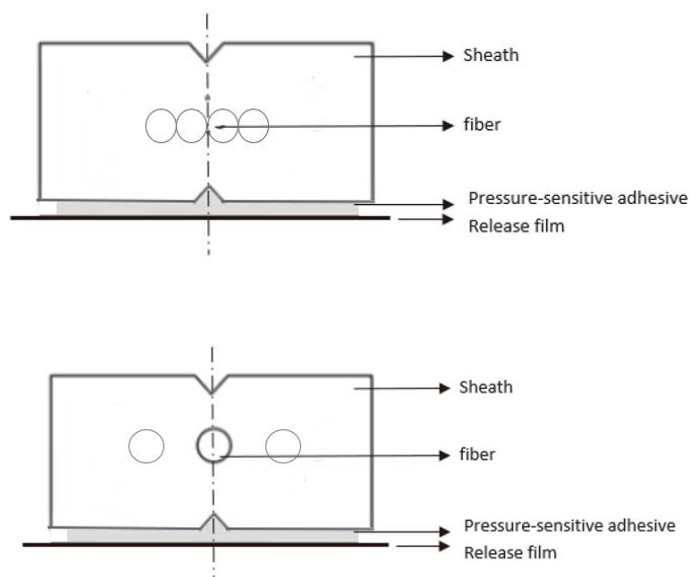


Figure 5.2: Bow-type self-adhesive invisible optical cable with pressure-sensitive adhesive

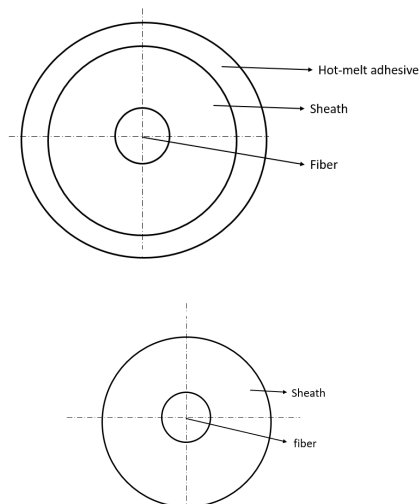


Figure 5.3: Round-type invisible optical cable

5.2.1.1 Optical fibre

At present, single-mode optical fibre B-657.A2 or B-657.B3 which comply with IEC 60793-2-50 [i.3] are mainly used for communication in invisible optical cables.

5.2.1.2 Strength member

It is advisable to take optical fibre or other invisible material as strength members, placed in a suitable position according to the structure of the invisible optical cable.

5.2.1.3 Sheath

The sheath material of the invisible optical cables could be Ethylene-Tetra-Fluoro-Ethylene (ETFE), Fluorinated Ethylene Propylene (FEP), Thermoplastic Polyurethane (TPU), Thermoplastic Polyamide Elastomer (TPA), Low Smoke Zero Halogen (LSZH) material, Polyvinyl Chloride (PVC), Polyamide (PA), or Polyetherimide Elastomer (PEI), and light-coloured or transparent materials are preferred according to the application.

5.2.1.4 Adhesive

Thermoplastic Polyurethane (TPU), Ethylene Vinyl Acetate (EVA), Styrene Ethylene Butadiene Styrene (SEBS), Styrene Isoprene Styrene (SIS), acrylic acid, polyacrylate or other suitable materials can be used.

5.2.2 Optical transmission performance

Optical transmission performance for cabled optical fibre elements should conform to Table 5.1.

Table 5.1: Optical transmission performance for cabled optical fibre elements

Parameter	Test procedure	Requirements/Remarks
Attenuation coefficient	IEC 60793-1-40 [i.15]	≤ 0,2 dB/km (1 310 nm)
		≤ 0,2 dB/km (1 550 nm)
		≤ 0,2 dB/km (1 625 nm)

Optical transmission performance for optical splitter should conform to the IEC 61753-031-2 [i.4] standards.

5.2.3 Mechanical performance

The mechanical tests will affect all the elements of the optical cable to some degree. The optical cable needs to be tested as a whole, rather than as discrete elements.

Tests on single mode fibre cables need to be carried out at 1 550 nm. Measurement at other wavelengths or wavelength range may be agreed upon between the customer and supplier.

Mechanical performance tests need to conform to Table 5.2.

Table 5.2: Mechanical performance for invisible cable

No.	item	Severity	Requirements
1	Tensile strength IEC 60794-1-101 [i.5]	Length under test: ≥ 50 m. For buffered fibre cables: Test loads: short term load, TS = 5 N, long term load, TL = 30 % of TS. For invisible cables: Test loads: short term load, TS = 10 N, long term load, TL = 30 % of TS.	Attenuation changes at 1 550 nm: ≤ 0,05 dB during and after the test. The strain of optical fibre at short term tensile force should be ≤ 0,6 %. No fibre and cable breakage.
2	Crush IEC 60794-1-21 [i.1], E3	Force: 500 N/10 cm Duration: 1 min Length between test locations: 500 mm Number of tests: 3	Attenuation change after the test should not exceed 0,1 dB.
3	Impact IEC 60794-1-104 [i.6]	Radius of striking surface: 12,5 mm Impact energy: 1 J Number of impacts: at least 3, each separated at least 500 mm Height: 1 m	Attenuation changes during and after the test should not exceed 0,1 dB.
4	Repeated bending IEC 60794-1-21 [i.1], Method E6	Bending radius: 10 D Number of cycles: 50 Load: 10 N Duration of cycle: Approximately 2 s	Attenuation change after the test should not exceed 0,05 dB.
5	Bending IEC 60794-1-21 [i.1], E11A	Number of turns in the helix: 6. Mandrel diameter: 10 D + 10 %. Test temperature: -10 °C.	Attenuation changes at 1 550 nm: ≤ 0,20 dB during the test, ≤ 0,05 dB after the test. No fibre and cable breakage.
6	Torsion IEC 60794-1-21 [i.1], Method E7	Number of cycles: 20 Distance between fixed and rotation clamp: 500 mm Tension load: 20 N Torsion angle: ±180°	Attenuation change after the test should not exceed 0,05 dB.

5.2.4 Environmental performance

Environmental performance tests need to conform to Table 5.3.

Table 5.3: Environmental performance for invisible cable

No.	item	Severity	Requirements
1	Temperature cycling IEC 60794-1-201 [i.7]	Temperature: -10 °C ~ 60 °C Temperature change rate: ≤ 1 °C/min Sample length: 1 000 m Number of cycles: 2 The sample coil is preconditioned a spool and at room temperature for 24 hours. hold time at every temperature plateau should be 12 h.	1) attenuation change at 1 550 nm: ≤ 0,4 dB/km during the test; ≤ 0,05 dB/km after the test; 2) there should be no damage to the cable elements under visual inspection, visual inspection shows no obvious deformation or detachment of the release film; 3) wrinkles and separation during the test are not judged.
2	Adhesive force (For self-adhesive invisible optical cable) ISO 29862 [i.8], Method 1, Annex B	Deploy the optical fibre cable at 23 °C ± 3 °C, 50 % RH ~ 65 % RH, on a standard stainless-steel plate with 2 kg heavy roller press back and forth 3 times. Keep it for 24 hours after construction at 23 °C ± 3 °C, 50 % RH ~ 65 % RH. Test conditions: peel angle 90°, peel speed 300 mm/min, take the average force value of the stable section, peel length at least 5 cm.	The adhesive force: ≥ 0,4 N/mm
3	UV resistance ISO 4892-2 [i.9], Method B	Cycle: 5 Exposure time: 500 h	Attenuation change: ≤ 0,2 dB at 1 550 nm after the test. Change of colour: chromatic aberration before and after UV resistance should be less than 6, test method according to ISO 11664-4 [i.12]. Adhesive force test after returning to 23 °C ± 3 °C, 50 % RH ~ 65 % RH for 24 hours. The adhesive force after test: ≥ 0,3 N/mm.
4	Damp heat IEC 60068-2-78 [i.10]	Pre-processing of optical cables and interfaces for 2 hours before installation, deploy the optical cables onto a standard stainless plate at 23 °C ± 3 °C, 50 % RH ~ 65 % RH. Then, put the installed cables at normal atmospheric temperature condition for 24 hours before putting it into the temperature chamber. Temperature change speed: 1°C/min Temperature: 65 °C Relative humidity: 95 % Duration of test: 500 h	Change of colour: chromatic aberration before and after UV resistance should be less than 6, test method according to ISO 11664-4 [i.12]. Repeat adhesive force test after returning to 23 °C ± 3 °C, 50 % RH ~ 65 % RH for 24 hours. The adhesive force after test: ≥ 0,3 N/mm, test method according to ISO 29862 [i.8], Method 1, Annex B.

No.	item	Severity	Requirements
5	Fire safety IEC 60332-1-2 [i.11]	Sample length: 600 ± 25 mm Position of sample: The distance between the bottom of the upper support and the top of the lower support is (550 ± 5) mm. Release film should be removed from sample before the test. Sample adhesive side should face the flame during the test. Positioning of flame: At (475 ± 5) mm from the lower edge of the upper horizontal support. Duration: 60 ± 2 s If the fibre Track auxiliary is used to deploy invisible cable, the test sample should be contained with fibre and Track auxiliary.	Upper onset of charring ≥ 50 mm Lower onset of charring ≤ 540 mm Charring H ≤ 425 mm





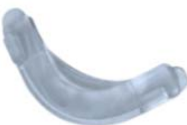
5.3 Connectors

The connector in IFDN Cabling System is a miniaturized plug-in connector that consists of a single-core plug and an adapter. At present, single mode connectors are mainly used in IFDN Cabling System and type SC connectors which comply with IEC 61754-4 [i.2] are the most widely used.

5.4 Auxiliary parts

In order to ensure wiring reliability and optical performance, auxiliary parts are used in construction to reinforce and protect optical cables in complex scenarios such as cable corners and wall penetration. The options are as follows:

Table 5.4

Invisible optical cable attachments				
Self-adhesive buckle	External corner protector	Through-wall protector	Cable clip	Plane corner protector
				

The self-adhesive buckle is used to reinforce the deployment in straight-line section near the external corner, and the external corner protector is mainly used to reduce the optical loss generated in the external angle. The through-wall protector is mainly used to protect optical cables when routing through the wall. Cable clips are mainly used when the wall is not easy to adhere to. The plane corner protector is mainly used to ensure the bending radius and strengthen the adhesive force when bending an optical cable on the same plane.

6 Installation and deployment

6.1 Deployment methods

Nowadays indoor cabling system based on invisible optical cables could be deployed in following ways:

- 1) Hot-melt self-adhesive: the invisible optical cables used are hot-melt self-adhesive and with small dimensions, and could be bow-type or round-type. During deployment, tools are used to heat the glue, then the melted glue can be attached to the wall. The deployment in the straight-line section is completed at one time and efficient, and the deployment in the external corner needs to be reinforced by external corner protector and self-adhesive buckle. The tensile force can be enhanced by strength member, and the optical cables can be pre-connected to an assembly (SC/LC type) before delivery.



Figure 6.1: Deployment with hot-melt self-adhesive

- 2) Pressure-sensitive self-adhesive: the invisible optical cables used are bow-type, with pressure-sensitive adhesive and small dimensions. During deployment, release film is removed and pressure-sensitive adhesive is pressed, then the invisible optical cables are attached to the wall. The deployment in the straight-line section is completed at one time and efficient, and the deployment in the external corner needs to be reinforced by external corner protector and self-adhesive buckle. The tensile force of invisible optical cables can be enhanced by strength member, and the invisible optical cables can be pre-connected before delivery to an assembly (SC/LC type).

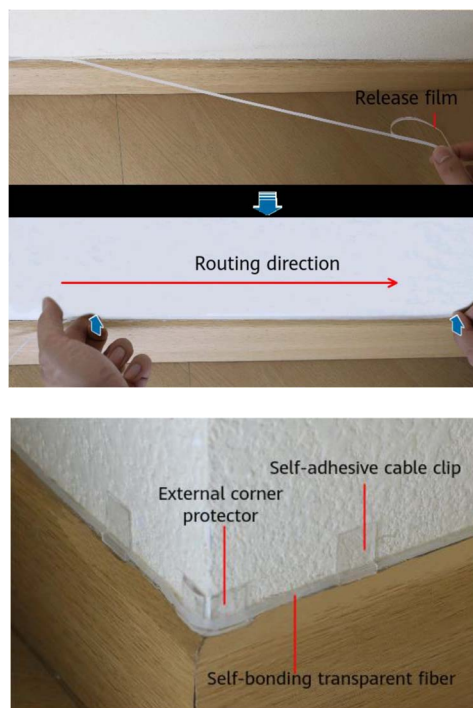


Figure 6.2: Deployment with pressure-sensitive self-adhesive

- 3) Glue dispensing in the field: the invisible optical cables used are usually buffered fibre without any adhesive. During deployment in the field, dispense glue in a distributed manner or glue the whole cabling route, then the invisible optical cables are attached to the wall. Generally, the invisible optical cables are not terminated, and onsite splicing or termination is required.



Figure 6.3: Deployment with glue dispensing in the field

- 4) Track auxiliary deployment: the track with pressure-sensitive adhesive is usually transparent, and the invisible optical cables used are usually 0,9 mm buffered fibre. During deployment, release film is removed and the track is pressed onto the wall, then the invisible optical cables are laid by tools along the track, finally the track can be covered by the strip cover to prevent ash falling. Generally, the invisible optical cables are not terminated, and onsite splicing or termination is required.

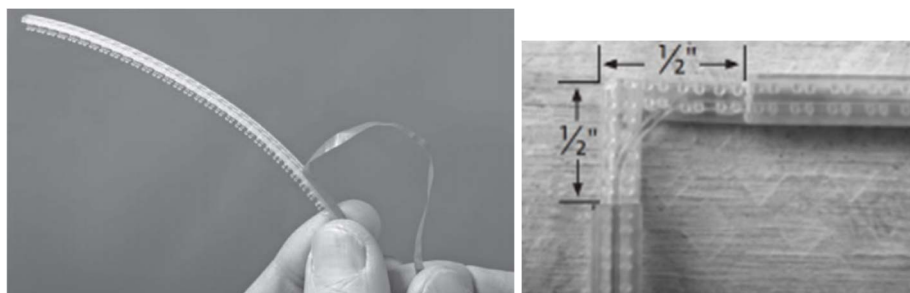


Figure 6.4: Deployment with track auxiliary

6.2 Details to be noted

The typical corner diagram of indoor cabling system is shown in Figures 6.5, 6.6 and 6.7, which mainly includes external corner, internal corner, and plane corner. The indoor cabling generally has many corners and the route is complex. Therefore, the deployment should be performed according to the construction guidelines provided by the manufacturer.



Figure 6.5: External corner diagram



Figure 6.6: Internal corner diagram



Figure 6.7: Plane corner diagram

The bending radius of the optical fibre and the warping stress of the optical cable should be taken into account at the corner, and the construction specifications usually require that necessary installation accessories be used at the corner (see Figure 6.2, such as self-adhesive buckle, external corner protector, plane corner protector, through-wall or through-hole protector, cable clip, etc).

Details to be noted are as following:

- 1) Preparations before construction:
 - a) Route planning. Generally, determine the installation position of the fibre terminal box first, and then plan the optical fibre deployment route. The route should be away from direct sunlight, heat sources of electrical equipment, narrow space, and wet walls. Cable assemblies with appropriate length should be selected.
 - b) The wall surface cleaning. Use a dry cloth or vacuum cleaner to wipe the dust and dirt on the wall surface to avoid the influence of dust, dirt, and water vapor on the adhesive force.
 - c) The adhesive force verification. It should be determined whether the glue can adapt to the wall and whether the expected adhesive force can be achieved by means of trial bonding and weight hanging on the wall.

- d) It is recommended that the deployment temperature be between 10 °C and 40 °C to ensure that the glue is used at the optimal temperature.
- 2) If required by the construction guidelines, install protective accessories such as external corner protector, plane corner protector, through-wall or through-hole protector at corresponding positions to ensure the bending radius of optical fibres in the cabling route.
- 3) Route cables according to the deployment method and speed required by the construction guidelines, and the heating temperature (hot melt adhesive), pressure stress (pressure sensitive adhesive), and residence time should be noted in order to achieve the expected bonding effect.
- 4) It is recommended to use glue dispensing or buckles to reinforce the beginning and end points of the route and both sides of the corner to avoid falling off from local weak bonding positions.
- 5) After the deployment, to ensure that there is no risk of fibre clamping, it is advised to check moving parts (e.g. Door) by open and close actions.
- 6) Check the whole route if the invisible optical cable is securely fixed.
- 7) If some optical fibres fall off, the optical cables should be repaired and reinforced by dispensing glue or buckles and optical fibre communication should be not affected.

6.3 Acceptance requirements

After the indoor cabling system based on invisible optical cables is deployed, it is recommended that construction personnel complete on-site acceptance of optical parameters and fixing conditions of invisible optical cables, including:

- a) Check whether the optical parameters of the link meet the requirements. Generally, the insertion loss changes before and after the deployment is no more than 1 dB, and the change value can be determined by the customer and the manufacturer.
- b) Double-Check the route to ensure that the invisible optical cable is securely fixed throughout the entire route. Perform secondary reinforcement by glue dispensing or buckles at the weak position of the corner.

7 Characteristic requirement for invisible cable

The invisible optical fibre cable construction, materials used and installation accessories should make the cable have minimum visibility for harmonization with the in-home environment. After installation, the colour of the cable surface may gradually change over time, compromising its minimal visibility. In such cases, the UV resistance and aging test of the cable should be taken into account.

The 'minimum visibility' characteristic of invisible cables is relatively subjective, and requirements may vary depending on the usage environment and customer expectations. Consequently, invisible cables are classified into three grades based on factors including deployment method, transparency, dimensions, and aging performance. This characteristic recommendation allows customers to select the appropriate grade of product according to their specific requirements.

Table 7.1

Items	Grade C	Grade B	Grade A
Transparency	Not Transparency	Transparency $\geq 50\%$	Transparency $\geq 60\%$
Cable dimensions	$\leq 3,2\text{ mm} \times 1,4\text{ mm}$	$\leq 3,2\text{ mm} \times 1,4\text{ mm}$	$\leq 2\text{ mm} \times 1,6\text{ mm}$
Deployment	Track or other auxiliary components deployment	Self-adhesive cable	Self-adhesive cable
Tensile strength	Short term load: 5 N	Short term load: 10 N	Short term load: 10 N
Adhesive force	/	$\geq 0,4\text{ N/mm}$	$\geq 0,8\text{ N/mm}$
Adhesive force After aging	/	After UV test, Adhesive force $\geq 0,3\text{ N/mm}$ After damp heat test, Adhesive force $\geq 0,3\text{ N/mm}$	After UV test, Adhesive force $\geq 0,6\text{ N/mm}$ After damp heat test, Adhesive force $\geq 0,6\text{ N/mm}$
Colour changes After aging	After Damp heat test, $\Delta E \leq 8$	After Damp heat test, $\Delta E \leq 6$	After Damp heat test, $\Delta E \leq 4$
	After UV test, $\Delta E \leq 8$	After UV test, $\Delta E \leq 6$	After UV test, $\Delta E \leq 4$
Fire safety	CPR-Eca (IEC 60332-1-2 [i.11])	CPR-Eca (IEC 60332-1-2 [i.11])	CPR-Eca (IEC 60332-1-2 [i.11]); Halogen-free (IEC 60754-2 [i.13], $\text{pH} \geq 4,3$, Conductivity $\leq 10\text{ }\mu\text{s/mm}$)

Annex A: Adhesive force test method

A.1 Introduction

This test method is used for test adhesive force in-home cables when attached to the wall surface.

A.2 Reference standard

See ISO 29862 [i.8], Method 1, Annex B. It is test method for determination of peel adhesion properties of self-adhesive tape. This method is also suitable for self-adhesive invisible cable since they share similar structure and application scenarios.

A.3 Apparatus

See ISO 29862 [i.8].

A.4 Procedures

At least 75 mm length of self-adhesive invisible cable is applied to a standard plate which is then fixed vertically in one clamp of a tensile testing machine. A 2 kg roller should be used to press cable back and forth 3 times to ensure that the optical cable is properly attached on stainless steel. Sample should be standing for at least 24 h at $[23 \pm 1]$ °C and $[50 \pm 5]$ % relative humidity condition.

The other clamp of the machine pulls the free end of the adhesive tape at an angle of 90° to the plate. Remove at least 75 mm test piece of the cable to be tested. Operate the tester at $(5,0 \pm 0,2)$ mm/s.

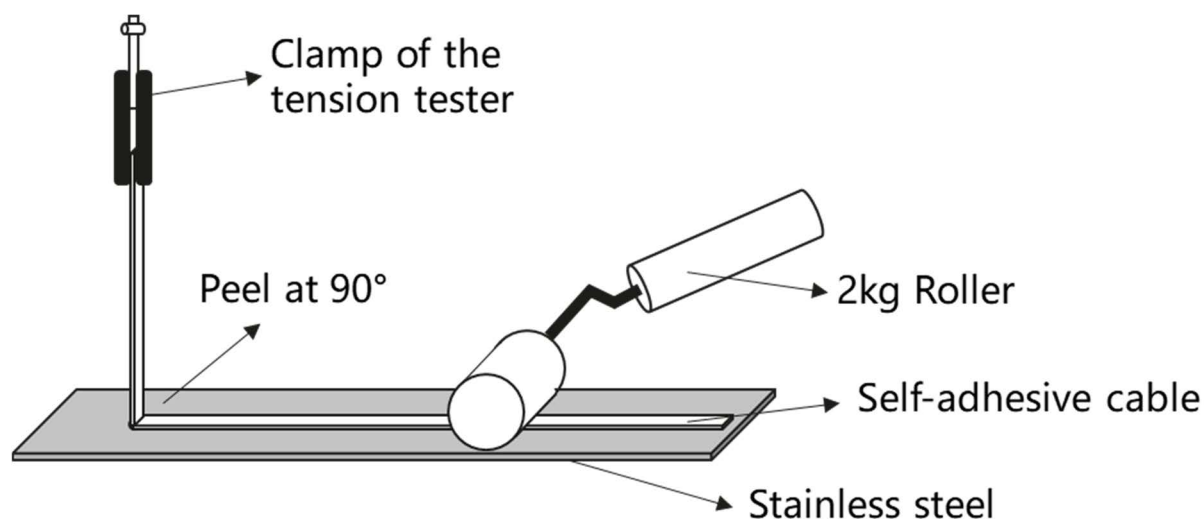


Figure A.1: Adhesive force test set up

A.5 Expression of results

After the movable jaw is started in motion disregard the values obtained while the first 25 mm of cable is mechanically peeled. Use the average force obtained during peeling of the next 50 mm of self-adhesive invisible cable from the panel as the adhesion value.

Express the peel adhesion in newtons per mm:

$$\text{Peel adhesion (N/mm)} = \frac{\text{Peeling force (N)}}{\text{Cable width or diameter (mm)}}$$

Annex B: Colorimetry test method

B.1 Introduction

This test method is used for quantization change of colour after UV test.

B.2 Reference standard

See ISO 11664-4 [i.12]. The purpose of this document is to define procedures for calculating the coordinates of the CIE 1976 $L^*a^*b^*$ (CIELAB) colour space and the Euclidean colour difference values based on these coordinates. This method is widely used for quality control on plastic products.

B.3 Apparatus

See ISO 11664-4 [i.12].

B.4 Test specimens

All specimens should be cast or injection, compression transfer or pultrusion moulded to the necessary form (see Figure B.1). After any operation, care it to be taken to remove all dust and any particles form the surface.

The test specimens should include cable sheath sample and adhesive sample. The thickness of the cable sheath sample should be 1mm and 0.5mm for adhesive sample. The adhesive sample should have a PET file cover the bottom surface.

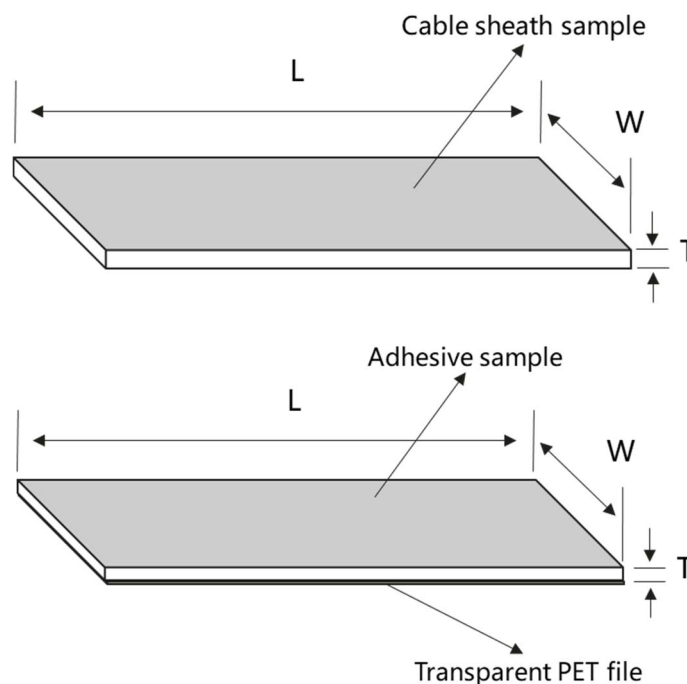


Figure B.1: UV test specimens

Table B.1: UV test specimen dimension

	Cable sheath sample	Adhesive sample
L	150 mm	150 mm
W	80 mm	80 mm
T	1 mm	0,5 mm

B.5 Procedures

Step 1: Place the test specimens on a white plane.

Step 2: Using colorimeter to test the initial value. Take average value of three test point on same sample as the result.

Step 3: Put specimens into the UV chamber for test.

Step 4: After UV test, take out the specimens and let it recover at room temperature for 24 h.

Step 5: Repeat step 2 with same colorimeter.

B.6 Expression of results

The difference of colorimetry (ΔE) before and after UV test should be ≤ 6 .

Annex C: Fire safety test method

C.1 Introduction

This is test for vertical flame propagation for a single insulated cable.

C.2 Reference standard

See IEC 60332-1-2 [i.11].

The purpose of this method is to test the resistance to vertical flame propagation for a single vertical optical fibre cable under fire conditions. The flame resistance property is necessary for in-door cable.

C.3 Apparatus

See IEC 60332-1-2 [i.11].

C.4 Test specimens

The test sample should be a piece of single cable (600 ± 25) mm long. If the Track auxiliary is used to deploy invisible cable, the test sample should be contained with fibre and Track auxiliary.

Before testing, all test pieces should be conditioned at (23 ± 5) °C for not less than 16 h at a relative humidity of (50 ± 20) %.

C.5 Procedures

See IEC 60332-1-2 [i.11].

The test piece should straighten and secure to two horizontal supports by means of a suitable size of copper wire and the adhesive side should face the burner for self-adhesive invisible cable. Release film should be removed from sample before the test.

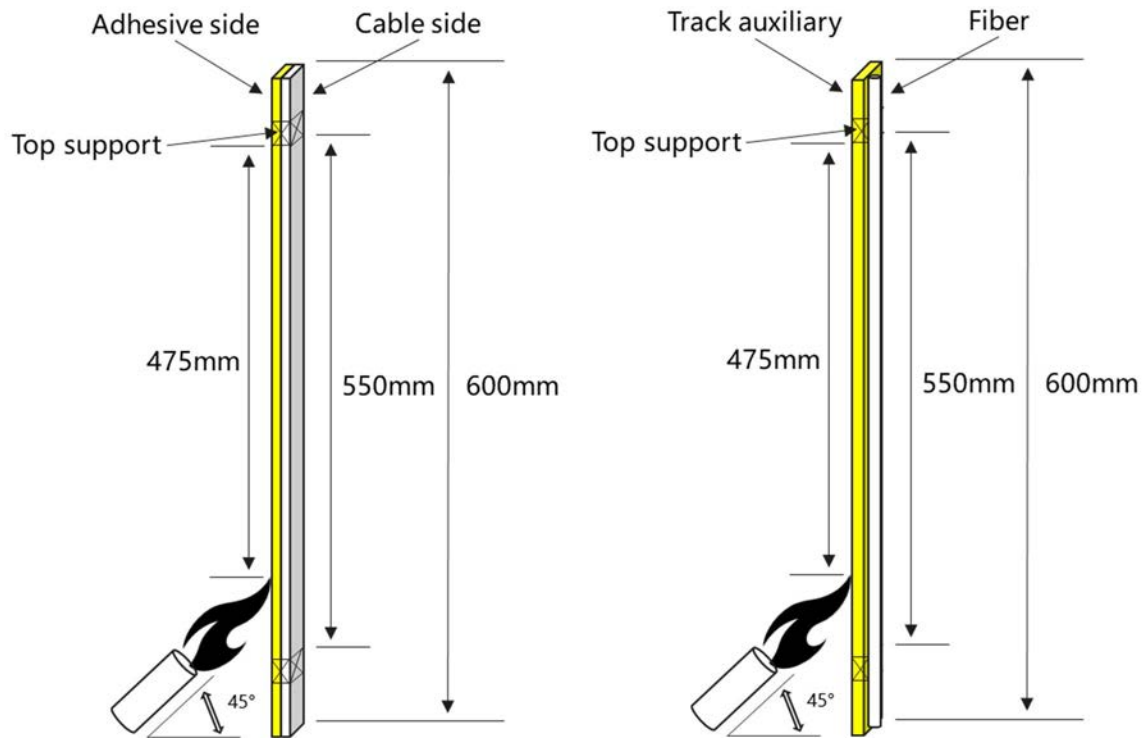


Figure C.1: Fire safety test set up

C.6 Expression of results

Upper onset of charring ≥ 50 mm.

Lower onset of charring ≤ 540 mm.

Charring $H \leq 425$ mm.

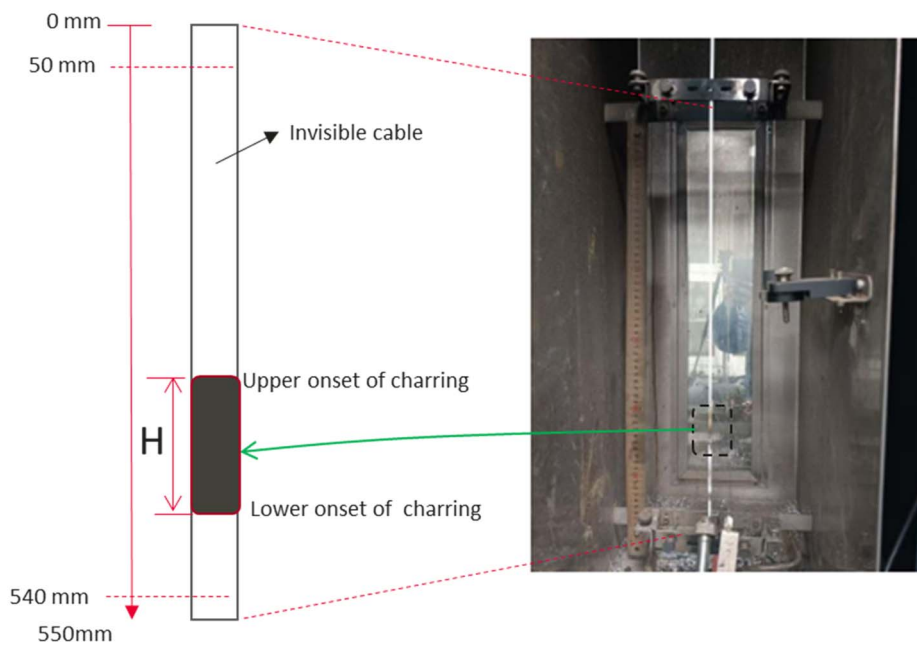


Figure C.2: Fire safety test result measurement

Annex D: Transparency test method

D.1 Introduction

This test method is used for test transparency of the in-home cables for ensuring the "minimum visibility".

D.2 Reference standard

See ISO 13468-1 [i.14].

It is test method for determination of the total luminous transmittance of transparent materials.

D.3 Apparatus

See ISO 13468-1 [i.14].

D.4 Procedures

Step 1 Preparatory measure: Prepare 1,5 mm thick transparent PC sheets (90 mm × 50 mm × 1 mm) as substrate, and prepare several Invisible cables (100 mm) as test sample.

Step 2 Transparency test for substrate: Test the transparency of the substrate according to ISO 13468-1 [i.14] under normal atmospheric and temperature conditions. Record data as T1.

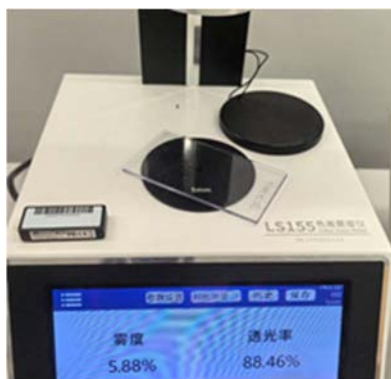


Figure D.1: Test the transparency of the substrate

Step3 Pasting measure: Invisible cables pasting on substrate under normal atmospheric and temperature conditions; sticking length 125 mm.

Step 4 Standby time: 24 hours under normal atmospheric and temperature conditions.

Step 5 Transparency test for pasted cable: Test the overall transparency of the invisible cable and substrate together. Record data as T2.

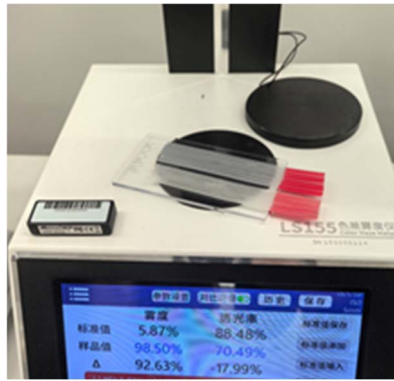


Figure D.2: Test the invisible cable sample

Step 6 Calculate and record data: The transparency of self-bonding cables $T = 1 + T2 - T1$.

NOTE: Because the interface state and transparency of the Polycarbonate (PC) sheets plate is relatively stability, it is recommended that the test results of PC sheets (1 mm) plate be used as a reference.

History

Version	Date	Status
V1.1.1	May 2026	Publication