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CHANGE, E-WASTE, ENERGY EFFICIENCY;
CONSTRUCTION, INSTALLATION AND PROTECTION
OF CABLES AND OTHER ELEMENTS OF OUTSIDE
PLANT

Optical fibre cables – Cable structure and characteristics

Optical fibre cable elements for microduct blowing-installation application

Recommendation ITU-T L.108

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ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

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Recommendation ITU-T L.108

Optical fibre cable elements for microduct blowing-installation application

Summary

Recommendation ITU-T L.108 (ex. L.79) describes the characteristics, construction and test methods for microduct fibre units and microduct cables that are used with the blowing installation technique. The cable characteristics required for a cable to perform appropriately are described. Also, a method is described for determining whether or not the cable has the required characteristics. The required conditions may differ according to the installation environment; detailed test conditions must be agreed upon between a user and a manufacturer for the environment in which a cable is to be used.

History

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Blowing installation, fibre unit, microcable, microduct, optical fibre cable.

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Introduction

Air blowing installation methods are based on viscous drag acting upon a cable within a duct by forcing a continuous high-speed airflow through the duct. The velocity of the moving air propels the cable and makes it advance at a typical speed supported by the blowing equipment. When using blowing techniques, there is generally no pulling force at the front end of the cable; the airflow exerts a distributed force along the entire cable. In addition, connection to a pulling cord is not needed.

Generally, the blowing force is an order of magnitude lower than the typical force involved in other installation methods, for example pulling techniques, thus reducing installation hazards. Additionally, with this technique, bends in a duct run are of less concern than with pulling techniques, so, generally, the installation speed increases and longer lengths of cable can be installed. Cables are installed with low stress levels, leaving the cable or other elements effectively relaxed in the duct once the installation has been completed.

Therefore, cables can be designed with lower tensile capabilities than cables to be pulled. And, elements without additional strength members, such as fibre units and single fibres, can also be considered.

New generation cabling techniques, based on microduct cables, microduct fibre units and microduct systems, offer the possibility of branching without the need for splices. These techniques are extremely flexible and make them possible to grow in accordance with demand. This gives rise to the concept of "fibre on demand", which involves the pre-installation of a multi-microduct system and then the subsequent, incremental installation of fibres based on individual customer demand.

To support this "fibre on demand" approach, a fibre cable product must allow the installation of only a few fibres at a time. These types of cable products should take up the smallest possible amount of the service provider's right-of-way (i.e., fit the smallest microduct) so that there is plenty of space to add fibres for future customers. Therefore, usually only a small number of the fibres that are installed are used immediately. Also, the latest fibre technology can be adopted when required.

Recommendation ITU-T L.108

Optical fibre cable elements for microduct blowing-installation application

1 Scope

This Recommendation:

- refers to microduct fibre units and microduct cables to be used for telecommunication networks with blowing installation techniques;
- deals with mechanical and environmental characteristics of microduct fibre units and microduct cables. The optical fibre dimensional and performance parameters, together with their test methods, should comply with [IEC 60793-5-10] or [IEC 60794-5-20] which deal with microduct cable and microduct fibre units, respectively. The optical fibre dimensional and transmission characteristics, together with their test methods, should comply with [IEC 60793-2-10] and with [ITU-T G.651.1], [ITU-T G.652], [ITU-T G.653], [ITU-T G.654], [ITU-T G.655], [ITU-T G.656] and [ITU-T G.657] which deal with multi-mode graded index optical fibres and single-mode optical fibres, respectively;
- acknowledges that some optical fibre cables may contain metallic elements, for which reference should be made to [b-ITU-T Technical Report] and other L-series Recommendations.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.650.1] Recommendation ITU-T G.650.1 (2018), *Definitions and test methods for linear, deterministic attributes of single-mode fibre and cable*.
- [ITU-T G.651.1] Recommendation ITU-T G.651.1 (2007), *Characteristics of a 50/125 μm multimode graded index optical fibre cable for the optical access network*.
- [ITU-T G.652] Recommendation ITU-T G.652 (2016), *Characteristics of a single-mode optical fibre and cable*.
- [ITU-T G.653] Recommendation ITU-T G.653 (2010), *Characteristics of a dispersion-shifted single-mode optical fibre and cable*.
- [ITU-T G.654] Recommendation ITU-T G.654 (2016), *Characteristics of a cut-off shifted single-mode optical fibre and cable*.
- [ITU-T G.655] Recommendation ITU-T G.655 (2009), *Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable*.
- [ITU-T G.656] Recommendation ITU-T G.656 (2010), *Characteristics of a fibre and cable with non-zero dispersion for wideband optical transport*.
- [ITU-T G.657] Recommendation ITU-T G.657 (2016), *Characteristics of a bending loss insensitive single mode optical fibre and cable*.

- [ITU-T L.100] Recommendation ITU-T L.100/L.10 (2015), *Optical fibre cables for duct and tunnel application.*
- [ITU-T L.101] Recommendation ITU-T L.101/L.43 (2015), *Optical fibre cables for buried application.*
- [ITU-T L.102] Recommendation ITU-T L.102/L.26 (2015), *Optical fibre cables for aerial application.*
- [ITU-T L.103] Recommendation ITU-T L.103/L.59 (2016), *Optical fibre cables for indoor applications.*
- [ITU-T L.162] Recommendation ITU-T L.162 (2016), *Microduct technology and its applications.*
- [ITU-T L.400] Recommendation ITU-T L.400/L.12 (2008), *Optical fibre splices.*
- [IEC 60189-1] IEC 60189-1 (2007), *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods.*
- [IEC 60793-1-1] IEC 60793-1-1 (2017), *Optical fibres – Part 1-1: Measurement methods and test procedures – General and guidance.*
- [IEC 60793-1-20] IEC 60793-1-20 (2016), *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry.*
- [IEC 60793-1-21] IEC 60793-1-21 (2001), *Optical fibres – Part 1-21: Measurement methods and test procedures – Coating geometry.*
- [IEC 60793-1-32] IEC 60793-1-32 (2010), *Optical fibres – Part 1-32: Measurement methods and test procedures – Coating strippability.*
- [IEC 60793-1-53] IEC 60793-1-53 (2014), *Optical fibres – Part 1-53: Measurement methods and test procedures – Water immersion tests.*
- [IEC 60793-2-10] IEC 60793-2-10 (2017), *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres.*
- [IEC 60794-1-1] IEC 60794-1-1 (2015), *Optical fibre cables – Part 1-1: Generic specification – General.*
- [IEC 60794-1-2] IEC 60794-1-2 (2017), *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures – General guidance.*
- [IEC 60794-1-21] IEC 60794-1-21 (2015), *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods.*
- [IEC 60794-1-22] IEC 60794-1-22 (2012), *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods.*
- [IEC 60794-1-23] IEC 60794-1-23 (2012), *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods.*
- [IEC 60794-5] IEC 60794-5 (2014), *Optical fibre cables – Part 5: Sectional specification – Microduct cabling for installation by blowing.*
- [IEC 60794-5-10] IEC 60794-5-10 (2014), *Optical fibre cables – Part 5-10: Family specification - Outdoor microduct optical fibre cables, microducts and protected microducts for installation by blowing.*
- [IEC 60794-5-20] IEC 60794-5-20 (2014), *Optical fibre cables – Part 5-20: Family specification – Outdoor microduct fibre units, microducts and protected microducts for installation by blowing.*

3 Definitions

3.1 Terms defined elsewhere

For the purpose of this Recommendation, the definitions given in [ITU-T G.650.1] and [ITU-T G.651.1] apply.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 blowing duct: There are three kinds of blowing ducts: outer protective duct, protected microduct and composite protected microduct/cable.

3.2.2 blown-in element: A blown-in element consists of optical fibre(s), sheath and other materials and can be inserted into the microduct by continuous high-speed airflow force. Some of the characteristics of this element are described in clause 7.2.

3.2.3 composite protected microduct/cable: A composite protected microduct/cable is a bundle containing both microducts and optical fibre cable. They are combined and surrounded by a tight or loose protective sheath, perhaps with another optional protective layer such as a moisture barrier.

3.2.4 microduct: A small, flexible tube with enough wall thickness to provide the mechanical protection required by the application, with its outer and inner diameter defined according to the dimension and the condition of the existing duct and the diameter of the microcable.

3.2.5 microduct cable (also called microcable): An optical fibre cable that is suitable for installation into a subducting microduct.

3.2.6 microduct fibre unit: This is a group of fibres (with a count starting at 1) that can be installed in a microduct with the blowing technique.

3.2.7 micromodule: This is a thin walled tubing unit. These flexible modules have bending radii similar to the unbundled fibre and are easy to strip without a tool for easy splice preparation and mid-span access. They have no shape memory and may be used directly in an enclosure up to the splicing tray. Water-blocking material may be contained in the micromodule, if required. See Figure 1.

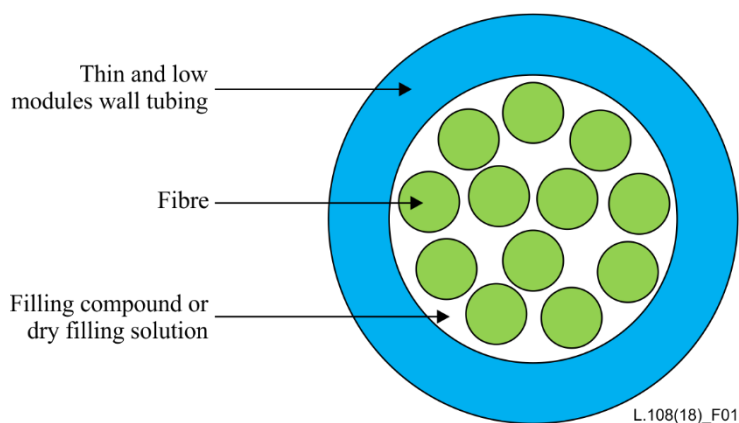


Figure 1 – Example of primary coated fibres protected by micromodule

3.2.8 protected microduct: This kind of duct comprises a number of microducts that are loosely or tightly packed together and jacketed, in much the same way as an optical cable without the fibre.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

FTTH	Fibre To The Home
HDPE	High Density Polyethylene
LSZH	Low Smoke Zero Halogen
OD/ID	Outer Diameter/Inner Diameter
OTDR	Optical Time Domain Reflectometer
PE	Polyethylene
PVC	Polyvinyl Chloride

5 Conventions

None.

6 Environmental conditions

The required characteristics depend strongly on the environmental conditions at the location where the optical cables are installed. Therefore, it is important to know these conditions.

6.1 Underground

6.1.1 Conduits and tunnels

The environmental conditions of conduits and tunnels are described in [ITU-T L.100].

6.1.2 Direct buried

The environmental conditions for buried applications are described in [ITU-T L.101].

6.2 Aerial

The environmental conditions for aerial applications are described in [ITU-T L.102].

6.3 Indoor

The environmental conditions for indoor applications are described in [ITU-T L.103].

7 Construction and characteristics of microduct system and cable elements

7.1 Fibre

7.1.1 Primary coated fibre

Primary coated fibres must comply with the relevant ITU-T G.65x-series Recommendations.

7.1.2 Buffered fibre

When using a tight or semi-tight (loosely applied) buffer, the following characteristics are required:

- A tight buffer should be easily removable over a length of 15 to 25 mm for fibre termination or splicing.
- A semi-tight buffer should be easily removable over a length of 0.3 to 2 m for fibre termination or splicing, and without affecting the fibre coating.
- With a tight buffer, the nominal diameter should be between 300 and 1000 μm , based on an agreement between the user and supplier. The tolerance should be $\pm 50 \mu\text{m}$.