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SERIES L: CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Optical fibre cables: Special needs for access network

ITU-T Recommendation L.58

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Optical fibre cables: Special needs for access network

Summary

This Recommendation describes characteristics and the construction of optical fibre cables for access networks. Such cables are required to have some additional performance characteristics (e.g., high fibre count, mid-span access) compared with cables for trunk systems. Characteristics, relevant to the appropriate performance of an optical access network cable, are described. Required conditions may differ according to the installation environment and, therefore, detailed conditions of experiments and tests need to be agreed between a user and a supplier on the basis of the environment where a cable is to be used.

Source

ITU-T Recommendation L.58 was approved on 8 March 2004 by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Optical fibre cables: special needs for access network

1 Scope

This Recommendation:

– refers to multimode graded index and single-mode optical fibre cables to be used for telecommunication access networks;

– deals with special characteristics of the optical fibre cables for access networks. The basic characteristics and structure of optical fibre cables are described in ITU-T Recs L.10, L.26 and L.43 respectively, based on environmental categories;

– deals with fundamental considerations related to optical fibre cables for access networks.

2 References

The following ITU 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 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.

[1] ITU-T Recommendation L.10 (2002), *Optical fibre cables for duct and tunnel application*.

[2] ITU-T Recommendation L.26 (2002), *Optical fibre cables for aerial application*.

[3] ITU-T Recommendation L.43 (2002), *Optical fibre cables for buried application*.

3 Definitions

For the purpose of this Recommendation, the definitions given in ITU-T Recs G.650.1, G.650.2, G.651, G.652, G.653 and G.655 apply.

4 Abbreviations

This Recommendation uses the following abbreviations:

FTTH Fibre to the home

SZ Reverse oscillating stranding

WB Water Blocking

5 Conventions

None

6 Particular functions and data management for optical fibre cables in an access network

6.1 Basic structure and characteristics

Basic structure and required characteristics for optical fibre cables are described in ITU-T Recs L.10, L.26 and L.43. Those Recommendations are categorized based on the environment where

optical fibre cables are installed. ITU-T Rec. L.10 is for cables in duct, ITU-T Rec. L.26 is for aerial cables and ITU-T Rec. L.43 is for direct buried cables. Those recommendations are suitable for both trunk and access cables. However, for access cables, some special functions and/or maintenance may be required. In the following clauses, special requirements for access network optical fibre cables are described.

6.2 High count cables

Usually, in access cable networks, user and carrier are connected with a dedicated fibre or fibres. Therefore, near a carrier's office, many fibres are concentrated. If there is enough infrastructure (e.g. ducts), many low count cables can be used. However, the number of empty ducts is usually limited because such infrastructure is/was designed for and contains high count copper cables. Therefore, if there is rapid FTTH growth and increase in subscriber numbers, high count optical fibre cables will be required in such area.

There are typically two ways to construct such high count cables. One is to use mini-tubes (e.g. loose tube, micro-sheath) which contain coated fibres. Mini-tubes are stranded around a central member. By increasing the number of mini-tubes, the fibre count in a cable may be increased.

The other way is to use optical fibre ribbons. Optical fibre ribbons consist of a binding material and coated fibres which are aligned in a row. Specific descriptions of optical fibre ribbons are referred to in ITU-T Recs L.10, L.26 or L.43. Optical fibre ribbon is suitable for high density cables because it already includes fibres with high density.

6.3 Connectorized cables (a cable with connectors pre-equipped)

As described in 6.1, very high count cables may be used near a telecommunication carrier's office in access networks. When such cables are used, the time it takes to splice or connect fibres is very long. In order to make that time shorter, one possible solution is to use mass splicing techniques. The other way is to use pre-connectorized cables. A pre-connectorized cable has connectors which are fitted in the factory prior to delivery.

When using pre-connectorized cables, it is required to safeguard excess length of fibres and connectors which are pre-mounted on fibres with a suitable protector. If connectorized fibres are located at the pulling end, a pulling force is applied to the protector. In addition, the protector has to pass through ducts and over mandrels which are used for installation. The protector has to be designed to have sufficient strength against assumed pressure and/or bending during installation.

When connectorized fibres are not located at the pulling end, the protector may be designed less ruggedly. However, it must be designed for the agreed conditions for delivery.

6.4 Mid-span access (branching)

In an access cable network, the locations of potential customers are often uncertain when cables are initially installed.

Usually, cables are installed in a route where potential demand is likely to be high. When demand occurs, an optical fibre cable should be installed between a customer and a nearby cable. If there is a cable connection point nearby, a new cable will be installed between a connection point and a customer. If not, optical fibres must be accessed from the mid-span of a cable. The first step is to choose an appropriate point at which to branch. The next is to remove the outer sheath, access the desired fibres and splice according to the desired route. Finally, a new enclosure to protect spliced fibre should be assembled. In this procedure, it is important to be able to take access fibres easily from within a cable. One solution is to use SZ stranding where the stranding direction of fibres (or ribbon or mini-tube) is periodically reversed with a defined pitch length. Therefore, if a cable sheath is removed over a pitch in length, fibres may be accessed from the cable easily and safely.

When mid-span access is undertaken, it is important to avoid interference to other fibres within the cable (which may be carrying live traffic).

Slack (excess length of cables) may be useful in order to undertake mid-span access more easily.

6.5 Record of cable types and access points

Once cables have been installed in a trunk network, significant route changes do not occur frequently. However, the access network continually evolves with changing customer locations and services. It may take over 20 years before a single network is completed and cable design may change over such a long period. Therefore, it is important to accurately record access network equipment and plant because, if completely different types of cables are used, they may be difficult to interconnect.

Records of the three items described below (6.5.1, 6.5.2 and 6.5.3) are the minimum requirements for maintenance of optical fibre cables in an access network.

6.5.1 Fibre type

The type, or types, of fibre (e.g., G.651, G.652, G.654 and G.655) within a cable will determine whether fibres may be interconnected. For example, multimode fibre cannot be connected to single-mode fibre. Therefore, the fibre type should be recorded.

6.5.2 Fibre package type

An important issue is fibre package type. There are two major types, coated fibre (0.25 mm in diameter) and fibre ribbon. In order to connect between the types of package, ribbon fibres should be divided into individual fibre or coated fibre should be unified into a ribbon-like structure by use of a binding material. Both methods are possible technically. However, extra time is needed to use either technique during cable connection works. Therefore, the fibre package type should be recorded.

6.5.3 Splicing method

There are different splicing methods (e.g., fusion splice, connector and mechanical splice). For connectors, several types of connectors are currently used. Therefore, the type of splice method or connector used for each splicing point should be recorded.

6.5.4 Protection against water ingress

There are three major techniques used to protect a cable core from water penetration; gas-pressurization, (jelly) filling and water blocking. Where a gas-pressurized system is used, connection to other cable types is prohibited without the use of complex termination techniques because the gas flow resistance of the other cable types is high. Filled cables and WB cables may be connected together as protection against water ingress is achieved *within* each type and there is no requirement for a continuous gas path.

Note that because of the improvements to optical fibre coatings, particularly with respect to performance and lifetime in moist environments, access network cables do not, of necessity, require protection against water ingress.

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