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

Sheath closures for terrestrial copper telecommunication cables

ITU-T Recommendation L.18

(Previously CCITT Recommendation)

ITU-T L-SERIES RECOMMENDATIONS

CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

For further details, please refer to ITU-T List of Recommendations.

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The 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 Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation L.18 was prepared by ITU-T Study Group 6 (1993-1996) and was approved by the WTSC (Geneva, 9-18 October 1996).

NOTES

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

2. The status of annexes and appendices attached to the Series L Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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Recommendation L.18

SHEATH CLOSURES FOR TERRESTRIAL COPPER TELECOMMUNICATION CABLES

(Geneva, 1996)

Introduction

A copper cable telecommunication network will require, at certain locations, cable interconnections (cable joints) because:

a) cables are not necessarily continuous from one terminal point to the other; or

b) cables may have been damaged.

A cable joint consists of spliced conductors and a closure. The methods for splicing conductors are covered in a separate Recommendation L.9: *Methods of terminating metallic cable conductors* and further information is also found in the ITU-T Handbook, *Outside plant technologies for public networks* (Part II, Chapter 3 – Symmetrical and coaxial pairs jointing techniques).

Basically a closure is a structure, which is attached at the outer surface of the ends of the sheaths of the cables to be jointed, covering the spliced conductors and thereby restoring the integrity of the cable sheaths at the cable joint. The closure should:

– Protect the spliced conductors from the environment in the type of plant where it is installed – directly buried, in ducts and tunnels, in surface troughing and as an aerial installation (wall, pole and pole line).

– Provide mechanical strength across the sheath opening between the cable ends.

– Provide electrical bonding and grounding of the metal parts of the sheath where required. The method of achieving this will vary with the type of cable sheath. Further information is given in Recommendations K.11 and K.25 and the ITU-T manual: *Protection of telecommunication lines against lightning discharges*.

1 Scope

This Recommendation:

– Deals with the design of cable sheath closures for copper cables used in telecommunication networks, in duct, tunnel, buried surface troughing and aerial installations.

– Deals with mechanical and environmental characteristics of sheath closures for copper cable.

2 Characteristics of closures for copper cable

2.1 Design of the closure

Closure designs employ cold or hot installation processes based upon the sealing method used.

Cold installed closures make use of mastics, tapes, grommets, o-rings, rubber shapes, pastes, gels, potting compounds, adhesives, etc. which do not require heat. Cold installed closures include mechanical closures which can be reused.

Thermoshrinkable materials[1)], lead plumbing and polyethylene injection welding involve hot processes. The heat source may be a gas flame, a hot air generator or electrical resistance heating.

Considerations for closures are as follows:

1) Closures for underground networks (for example, ducted, direct buried) should be water immersion resistant.
2) For aerial networks two types of closure exist, depending on the network:
   a) For a sealed network the closure should also be totally sealed.
   b) For free-breathing networks, openings may be present in the closure to allow the exchange of air with the environment. However, also in this case the closure design should prevent water penetration from, for example rain or rainwater running along the cable.
3) Closures for use in pressurized plant should be able to withstand the operating pressure without leaking during their expected lifetime. Air valves are required to reduce the pressure for safe re-entry or as a feeding point to increase the pressure and may be required on the closure for measurement purposes.
4) The materials of the closure should be compatible with the materials of the cable sheath. Further, to prevent corrosion or other electro/chemical damage, the materials should be compatible with other materials normally used in outside plant. Special provisions may be required in order to cope with cables having various sheath combinations.
5) The closure should not affect the specified electrical characteristics of the cable or the spliced conductors.
6) The closure should be mechanically suitable with respect to its application and the environment in which it is to be placed.
7) The closure should be able to cope with the required cable sizes and cable configurations entering the closure.
8) Designs may allow for installation around a continuous cable without having to cut the conductors, for example, the connecting of a customer drop cable within a cable length.
9) It is necessary that closures can be re-opened without interruptions to the working circuits.
10) Designs may allow for the addition of cables.
11) The type of network for which the closure is designed (pressurized, underground, etc.), as well as any limitation in its application domain (for example, compatibility with branch configurations) should be clearly indicated to the user. Clear and correct installation instructions should be made available, indicating – which tools are required, the necessary safety regulations and precautions to be taken and how to select the correct closure size.
12) The closure may be designed to provide an external earthing terminal.

2.2 Mechanical characteristics

The mechanical characteristics should be considered according to the conditions of the installation. Where appropriate, test methods according to IEC 1073-1 should be used for mechanical tests.

2.2.1 Bending

After installation, the closure may be subjected to bending stresses due to dynamic conditions encountered by the cables and shifts in the earth in directly buried applications. The closures should maintain a seal to the cable sheaths and should not permit cable movement which could transfer strain to the conductors.

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1) Today thermoshrinkable materials are also made from fibre reinforced laminated materials for both pressurized and non-pressurized applications.

2.2.2 Axial tension

Dynamic conditions, especially in aerial and duct plant and shifts in the soil in directly buried applications may cause cyclic and static tensile loads in the cable. These tensile loads should be supported by the closure without affecting the seal to the sheaths and transferring strain to the conductors.

2.2.3 Crush and impact

The closure may be subjected to crush and impact both just after installation and during operational life at different temperatures. The closure should protect the spliced conductors under normal crush and/or impact loading experienced during the life of the cable system. In certain circumstances, for directly buried closures, additional protection may be provided, for instance, by placing the closure within a suitable housing.

2.2.4 Torsion

Under dynamic conditions during operation, the cable may be subjected to torsion. The closure should be able to transmit the torque across the joint without cable slippage while maintaining the seal to the cable sheaths.

2.2.5 Vibration

Cable joints may be located on messenger strands, underground in manholes, on bridges and other structures or directly buried. As a result of their location they may be subjected to vibrations from wind, traffic, railways, etc. The closure should be able to withstand these vibrations without loss of function.

2.3 Environmental characteristics

The environmental characteristics should be considered according to the conditions of the location of the closure. Wherever appropriate, test methods according to IEC 1073-1 should be used for environmental tests.

2.3.1 Temperature variations

During their operational life cable joints may experience severe temperature variations. The closure should be able to withstand the temperature variations without loss of function.

2.3.2 Water penetration

The closure should prevent the entry of water.

2.3.3 Moisture permeation

During their operational life cable joints may be immersed in water or exposed to high humidity. High humidity levels in the joint are not desirable because of corrosion and possible condensation with changes in temperature. Therefore it is important to take the humidity of the environment into account when selecting the type of closure and the materials used in the joint.

A desiccant may be installed in the closure to reduce the humidity in the closure during its lifetime. Based upon the moisture characteristics of the closure, the quantity of desiccant can be defined in order not to exceed a given level of relative humidity. Various materials, such as a metal screen will reduce the moisture permeation rate.

2.3.4 Electrical continuity of metal sheaths

The metal sheath (if present) of the cables terminating into a cable joint will usually have to be electrically interconnected with one another at the joint. This can be done for measurement purposes, for safety considerations or for minimizing the possible effects of lightning.

When the cable may be subjected to induced voltage from electrified railways total insulation of the metallic sheath at the joint is sometimes prescribed.

2.3.5 Earthing

Provisions for earthing may be required at the closure (for example, for areas of high keraunic levels or in the vicinity of power lines).

2.3.6 UV (solar) radiation

Cable joints will be subjected to UV radiation from sunlight when installed in aerial plant or other sun exposed locations. When subjected to UV radiation the material of the closure should be resistant to degradation.

2.3.7 Snow and ice

In some aerial and duct applications, the closure will be exposed to and be coated with snow and/or ice. The performance of the closure should not be degraded by snow or ice.

2.3.8 Fluid resistance

The closure should resist the fluids that it might normally be exposed to during its lifetime.

2.3.9 Fire resistance

In tunnels and other internal installations, closures may be required to be manufactured from material having defined flammability and smoke emission properties.

3 References

- The ITU-T Handbook (1992), *Outside plant technologies for public networks* describes in detail various closure systems in use in the telecommunications network (see Part II, Chapter 4 – Methods of jointing cable sheaths).
- IEC 1073-1:1994, *Splices for optical fibres and cables – Part 1: Generic specification – Hardware and accessories.*

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