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

Optical infrastructures – Infrastructure including node
elements (except cables)

Performance requirements for passive optical nodes: Sealed Closures for Outdoor Environments

Recommendation ITU-T L.201

ITU-T L-SERIES RECOMMENDATIONS

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

Recommendation ITU-T L.201

Performance requirements for passive optical nodes: Sealed closures for outdoor environments

Summary

Recommendation ITU-T L.201 refers to passive optical nodes in outdoor environments. It deals with the design of the closure housing as well as the fibre organizer or fibre management system, taking into account mechanical and environmental characteristics as well as the characteristics of the optical fibre organizer.

The following new elements have been added in this revision:

- A new clause 6.3 on closure materials with detailed test requirements for UV-light exposure and the fungal resistance of polymer materials and a material test requirement for the ageing of polymer materials by humidity;
- A new clause 6.5 on cable attachment and termination with recommendations for the electrical grounding of the metallic elements of the cables;
- A test programme for the performance evaluation of sealed optical closures in the outdoor ground level (OG) environment.

The following changes were made to harmonize the performance tests with [IEC 61753-1]:

- Sealing tests are done with 20 kPa overpressure for OG and outdoor above ground (OA) closures.
- Pass-fail criteria of pressure loss during test have been added to mechanical sealing tests for OG and OA closures.
- Reduced loads for the cable axial tension test for small diameter cables and microduct tubes.
- Reduced loads for the cable axial compression test for small diameter cables.
- The duration of the cycles in cable torsion and cable bending test have been added.
- The location for impact test has been added for rectangular shaped closures.
- The free fall test has been removed (it has been replaced by a more reproduceable shock test).
- In the assembly and disassembly test the duration is reduced to 5 cycles.
- Resistance to solvents and contaminating fluids: immersion in diesel with duration of 1 h and 24 h drying time and added immersion in petroleum jelly for 5 days has been added. Kerosene immersion has been removed.
- The duration of the change of temperature has been reduced to 12 cycles.
- Water immersion test at 1 m for 7 days for OG closures has been added.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.13	1992-07-31		11.1002/1000/1417
2.0	ITU-T L.201/L.13	2003-04-11	6	11.1002/1000/6135
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Keywords

Fibre management system, organizer, outside plant, passive optical nodes, sealed closures.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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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.

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Introduction

A node occurs at each opening or end of a cable sheath. When an optical node resides in an outdoor environment, it is generally contained in a sealed enclosure. This is commonly referred to as an optical closure, optical cable joint or optical sheath joint. In this Recommendation the term "optical closure" will be used.

An optical closure comprises a mechanical structure (closure housing) that is attached to the ends of the sheaths joined and a means (organizer) for containing and protecting the fibres and passive optical devices. The optical closure will:

- Restore the integrity of the sheath, including mechanical continuity of strength members when required
- Protect the fibres, fibre joints and optical devices from the environment in all types of outdoor plant (aerial, direct buried, in ducts and underwater).
- Provide for the organization of the fibre joints, passive devices and the storage of fibre overlength.
- Provide electrical bonding and grounding of the metal parts of the sheath and strength members where required. The method of achieving electrical continuity will vary with the type of cable sheath and the type and location of the strength members. Further information is given in [ITU-T K.11], [ITU-T K.47], [IEC 62368-1] and the ITU-T Manual "Protection of telecommunication lines and equipment against lightning discharges" [b-ITU-T Manual].

This Recommendation provides the means for characterizing and evaluating the performance of optical closures according to the principles of [ITU-T L.200]. This includes both the mechanical integrity and the optical stability of the product, simulating the effect of environmental factors, as well as interventions related to network maintenance. It contains a basic test programme for optical closures which is globally applicable. Additional requirements can be agreed between customer and supplier to reflect local or special conditions. All functions and features that a product may contain should be reflected in the mix of test samples that are subjected to the test programme.

Recommendation ITU-T L.201

Performance requirements for passive optical nodes: Sealed closures for outdoor environments

1 Scope

This Recommendation:

- Refers to passive optical nodes in outdoor environments;
- Deals with the design of the closure housing as well as the fibre organizer;
- Deals with the mechanical and environmental characteristics of the optical closure;
- Deals with the characteristics of the optical fibre organizers;
- Provides a test programme for the performance evaluation of sealed optical closures in three basic environments: outdoor subterranean or underground (OS), outdoor ground level (OG) and outdoor above ground (OA);
- Provides a simulation of the effect of interventions related to network maintenance;
- Contains a checklist for a systematic product characterization according to [ITU-T L.200];
- Contains a list of additional requirements to reflect special environments (e.g., tunnels) and local conditions.

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.652] Recommendation ITU-T G.652 (2016), *Characteristics of a Single-Mode Optical Fibre and Cable*.
- [ITU-T G.657] Recommendation ITU-T G.657 (2016), *Characteristics of a Bending-Loss Insensitive Single-Mode Optical Fibre and Cable*.
- [ITU-T K.11] Recommendation ITU-T K.11 (2009), *Principles of Protection Against Overvoltages and Overcurrents*.
- [ITU-T K.47] Recommendation ITU-T K.47 (2012), *Protection of Telecommunication Lines Against Direct Lightning Flashes*.
- [ITU-T L.200] Recommendation ITU-T L.200/L.51 (2003), *Passive Node Elements for Fibre Optic Networks – General Principles and Definitions for Characterization and Performance Evaluation*.
- [IEC 60068-2-10] IEC 60068-2-10 (2005), *Environmental testing – Part 2: Tests - Test J and guidance: Mould growth*.
- [IEC 60529] IEC 60529 (2013), *Degrees of protection provided by enclosures (IP Code)*.
- [IEC 61300-2-1] IEC 61300-2-1 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*.

- [IEC 61300-2-4] IEC 61300-2-4 (2019), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention.*
- [IEC 61300-2-5] IEC 61300-2-5 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion.*
- [IEC 61300-2-9] IEC 61300-2-9 (2017), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock.*
- [IEC 61300-2-10] IEC 61300-2-10 (2021), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-10: Tests – Crush resistance.*
- [IEC 61300-2-11] IEC 61300-2-11 (2012), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-11: Tests – Axial compression.*
- [IEC 61300-2-12] IEC 61300-2-12 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact.*
- [IEC 61300-2-19] IEC 61300-2-19 (2012), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state).*
- [IEC 61300-2-22] IEC 61300-2-22 (2007), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature.*
- [IEC 61300-2-23] IEC 61300-2-23 (2010), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-23: Tests – Sealing for non-pressurized closures of fibre optic devices.*
- [IEC 61300-2-26] IEC 61300-2-26 (2007), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-26: Tests – Salt mist.*
- [IEC 61300-2-33] IEC 61300-2-33 (2012), *Fibre optic interconnecting devices and passive components – Basic test – and measurement procedures – Part 2-33: Tests – Assembly and disassembly of fibre optic mechanical splices, fibre management systems and closures.*
- [IEC 61300-2-34] IEC 61300-2-34 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-34: Tests – Resistance to solvents and contaminating fluids of interconnecting components and closures.*
- [IEC 61300-2-37] IEC 61300-2-37 (2016), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-37: Tests – Cable bending for closures.*
- [IEC 61300-2-38] IEC 61300-2-38 (2006), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-38: Tests – Sealing for pressurized fibre optic closures.*

- [IEC 61300-3-1] IEC 61300-3-1 (2005), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination.*
- [IEC 61300-3-3] IEC 61300-3-3 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss (multiple paths).*
- [IEC 61300-3-28] IEC 61300-3-28 (2012), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss.*
- [IEC 61753-1] IEC 61753-1 (2018), *Fibre optic interconnecting devices and passive components - Performance standard - Part 1: General and guidance.*
- [IEC 61756-1] IEC 61756-1 (2019), *Fibre optic interconnecting devices and passive components – Interface standard for fibre management systems – Part 1: General and guidance.*
- [IEC 62368-1] IEC 62368-1 (2018), *Audio/video, information and communication technology equipment – Part 1: Safety requirements.*

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 closure housing: Closure housing refers only to the sealed container or box and does not include the organizer system. Its main functions are: providing sealing to the cables, mechanical attachment of the cable and protecting its content.

3.2.2 optical closure: The term "optical closure" refers to a sealed sheath joint, including the optical fibre organizer or fibre management system.

3.2.3 optical fibre organizer (fibre management system): In a node, the optical fibres are to be properly managed and guided from where a cable or pigtail enters the node until it leaves again. The organizer system comprises all the means and features that are intended to guide and store fibres and passive devices inside a node, at any location where they are not protected by the cable sheath.

4 Abbreviations and acronyms

For the definitions of terms used in this Recommendation, see [ITU-T L.200].

ME	Multiple Element (mass storage)
OA	Outdoor Above Ground
OG	Outdoor Ground level
OPGW	Optical Power Ground Wire
OS	Outdoor Subterranean or underground
SC	Single Circuit
SE	Single Element

SF	Single Fibre
SR	Single Ribbon

5 Conventions

None.

6 Design characteristics of optical closures

6.1 General requirements

Each optical closure must comply to the general requirements as listed in clause 8 of [ITU-T L.200].

6.2 Design of the closure housing

Closure housing designs employ either cold or hot systems depending on the sealing methods used. Cold processes do not require heat, whereas hot processes do. Mastic, tapes, grommets, o-rings, cured rubber shapes, pastes, potting compounds, rubber gels and (cold) adhesives are cold processes. Thermoshrinkable materials, hotmelts and polyethylene injection welding are the primary hot processes. The heat source may be electrical resistance heating, infrared heating, hot air or a gas flame. Regardless of which of these processes is used, the following should be considered:

- The materials used for making the cable joint should be compatible with each other, with the materials of the sheath and with other materials and solvents normally used in the outside plant.
- A design may allow for jointing together two or more cable ends. The cables entering the closure may be of differing sizes and/or types.
- A design should allow for jointing together at least one pair of cables which are not at the end of a cable, i.e., without cutting all the fibres between both cable ends (this application is also known as "external node", "midspan closure" or "balloon splice").
- It is desirable that closures can be re-opened when necessary and remade without interruptions to working circuits.
- A single design, which may be used for all of the above applications and in all outdoor environments.
- If a design is limited to certain applications and environments in the network, any limitations should be clearly indicated to the user; the detailed characterization of features and compatibility of a closure can be done using the checklist in Appendix I.
- If joint sealing encapsulant is used, information is required for adjustments in setting time due to variations in ambient temperature and humidity; the use of encapsulant is not recommended for re-enterable closures.
- If a heat source is required to seal the closure and/or closure to the sheath, a suitable heat source (gas flame or electrical power) needs to be available at the jointing points. Consideration should be given to the control of the heat source to protect personnel and prevent damage to the closure or cable.

6.3 Closure materials

All materials that are likely to come in contact with personnel should meet appropriate local health and safety regulations. Closure materials should be compatible with each other and with the materials of the cables and/or microducts. All components of the closure should be resistant to solvents and degreasing agents that are typically used to clean and degrease fibres and cables.