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TECHNICAL REPORT

colour inside

Optical fibre cables – Shrinkage effects on cable and cable element end termination – Guidance

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FOREWORD

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IEC TR 62959, which is a Technical Report, has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86A/2032/DTR	86A/2058/RVDTR

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

Cable shrinkage is sometimes used as a part of the performance criteria for optical fibre cables, including standard glass optical fibres for telecommunication application. However, there is only a partial correlation between shrinkage and other important cable parameters such as temperature performance and optical transmission characteristics, particularly during mechanical and environmental stress, since shrinkage strongly depends on the cable materials, the cable construction and the manufacturing processes.

The environmental performance of optical fibre cables is mainly determined using a suitable temperature cycling test while continuously measuring the change in attenuation during and after the test. Low shrinkage performance is not guaranteed by such a test method, so any cable shrinkage observed during and/or after the temperature cycle test can be used as an additional indicator for the characterisation of cables.

Cable shrinkage should be understood to include shrinkage of the entire cable, shrinkage of cable sub-assemblies such as units, and shrinkage of cable elements. It should also be understood that shrinkage of portions of the cable might be expressed as "growth" of other elements, such as fibres, strength members. Specific issues of cable shrinkage – buffer shrinkage, strength member growth, sheath shrinkage, etc. – should be carefully addressed when applying the principles of this document.

A combination of the passive component design (connectors, passive components, protective housings or cable management components) and cable shrinkage influences the cable/component performance. Excessive shrinkage at the cable/device interface can cause extra process steps and/or extra precautions to be taken at the interface and can cause degradation of the interface in service, for example the failure of strain relief effectiveness at a connector as the sheath shrinks back in use compromising the continuously optimal optical transmission parameters. Component manufacturers use a number of compensations for cable shrinkage in the design or assembly process of their components and will often select cables used in finished components for their low shrinkage performance. On the other hand, shrinkage can be compensated by installation technique.

To cover all relevant aspects of cables to be terminated, the recommended tests for performance evaluation of cables for different termination cases in addition to the optional tests for evaluation of shrinkage effects are included in this document.

This study into cable shrinkage was triggered by a CENELEC/TC86 BXA liaison letter sent to IEC/SC 86A in April 2016. The letter pointed out observed inconsistencies in indoor cable standards from a user point of view and asked for their concerns and recommendations to be addressed. The main subject was that jacket shrinkage should be a specified parameter for all indoor cables that are normally terminated by connectors, passive components or closures/enclosures.

A correspondence group in IEC/SC 86A/WG 3 was formed in 2016 to address issues about cable shrinkage. After discussion about relevant issues, cable shrinkage tests were performed, and the test results were collected and recorded. Annex A shows these test results and Clause 7 gives the conclusions of the cable shrinkage study. Generally, optical fibre cable types with a small outer diameter were involved in shrinkage testing. The results of different cable types from only a few cable manufactures were included, hence the number of cable types was limited and does not represent all cable types in the worldwide market. Subsequent work was done on recommendations for performance evaluation of cables to be terminated with connectors.

OPTICAL FIBRE CABLES – SHRINKAGE EFFECTS ON CABLE AND CABLE ELEMENT END TERMINATION – GUIDANCE

1 Scope

This document, which is a Technical Report, provides information on cable shrinkage characterisation of optical fibre cables that consist of standard glass optical fibres for telecommunication application. The characterisation is directed to the effects of cable shrinkage or cable element shrinkage on the termination of cables. Shrinkage can or cannot be a concern depending on the method of termination. Examples of different cable termination cases are included and described. Tests for the evaluation of cable shrinkage are recommended that can be used as indicators, and shrinkage classification by several grades are given.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
shrinkage
irreversible contraction after extrusion of plastic materials caused by heating or over time at ambient temperature

Note 1 to entry: The irreversible contraction in the direction of the cable axis is usually called "cable shrinkage".

Note 2 to entry: This behaviour is also called "shrinkback".

3.2
thermal contraction
decrease in length of an element or assembly when subjected to a temperature increase or decrease

3.3
thermal expansion
increase in length of an element or assembly when subjected to a temperature increase or decrease