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TECHNICAL REPORT

Fibre optic communication system design guides – Part 15: Cable plant and link – Testing multi-fibre optic cable plant terminated with MPO connectors

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC COMMUNICATION SYSTEM DESIGN GUIDES –

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FOREWORD

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 61282-15, which is a Technical Report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
86C/1427/DTR	86C/1443/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.

A list of all parts in the IEC 61282 series, published under the general title *Fibre optic communication system design guides*, can be found on the IEC website.

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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Cabling testing standards such as IEC 61280-4-1 for multimode attenuation measurements and IEC 61280-4-2 for single-mode attenuation and optical return loss measurement describe testing simplex or duplex fibre cabling terminated with single-fibre ferrule connectors (e.g. LC). This document has been written to describe measurement methods for attenuation and polarity and can be used in the absence of any multi-fibre testing standard.

This document addresses the testing of installed multimode and single-mode cabling terminated with multi-fibre connectors of IEC 61754-7 (all parts) related to multi-fibre push on (MPO) and describes the challenges when testing array connectivity, which parameters are important to measure, and why the test methods of IEC 61280-4-2 and IEC 61280-4-1 cannot be used.

Installed optical fibre cabling terminated with MPO interfaces can be tested in different ways, for example, with equipment having an MPO connector test port. Testing using other types of equipment is possible, for example using an optical time domain reflectometer (OTDR).

This document focuses on MPO connectors containing 12 fibres in a single row; however, many of the principles can also be applied to testing of cabling terminated with different types of MPO connectors with appropriate changes to test cords and/or test equipment interfaces.

FIBRE OPTIC COMMUNICATION SYSTEM DESIGN GUIDES –

Part 15: Cable plant and link – Testing multi-fibre optic cable plant terminated with MPO connectors

1 Scope

This part of IEC 61282 provides guidance for the testing of multi-fibre cable, multimode or single-mode, terminated with plugs described in IEC 61754-7 (all parts) (multiple-fibre push on – MPO). Guidance is provided on the measurement of attenuation, polarity, length and optical return loss. The cabling can be installed in a variety of environments, including residential, commercial, industrial, and data centre premises, and possibly in outside plant environments.

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 61280-4-1, *Fibre-optic communication subsystem test procedures – Part 4-1: Installed cable plant – Multimode attenuation measurement*

IEC 61280-4-2, *Fibre-optic communication subsystem test procedures – Part 4-2: Installed cable plant – Single-mode attenuation and optical return loss measurement*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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

3.1.1
adapter
part of a connector in which one or two plugs are inserted and aligned

3.1.2
attenuation
reduction of optical power induced by transmission through a medium such as cabling, given as

$$L = 10 \log_{10}(P_{in}/P_{out})$$

where P_{in} and P_{out} are the power, typically measured in mW, into and out of the cabling

Note 1 to entry: Attenuation is expressed in dB.

3.1.3
configuration
form or arrangements of parts or elements such as terminations, connections and splices

3.1.4
connector
component consisting of two plugs mated together in an adapter, for the purpose of providing frequent optical interconnection/disconnection of optical fibres or cables, between two cables, or a cable to an apparatus

3.1.5
encircled flux
fraction of cumulative near-field power to total output power as a function of radial distance from the optical centre of the core

3.1.6
launch cord
test cord used to connect the light source to the cabling under test

3.1.7
light source power meter
test system consisting of a light source (LS), power meter (PM) and associated test cords used to measure the attenuation of installed cable plant

3.1.8
MPO connector
multi-fibre component consisting of pinned or unpinned plug and mating adapter, normally attached to an optical fibre cable, for the purpose of providing high density termination capability, and frequent interconnection or disconnection

3.1.9
plug
free part of a connector

3.1.10
test cord
terminated optical fibre cord used to connect the optical source or detector to the cabling, or to provide suitable interfaces to the cabling under test

Note 1 to entry There are two types of test cords:

– launch cord;
– receive cord.

3.2 Abbreviated terms

APC	angled physical contact (description of plug polish)
LED	light emitting diode
LSPM	light source power meter
MPO	multiple-fibre push on
OTDR	optical time domain reflectometer
PC	physical contact (description of plug polish)
VFL	visual fault locator
OPM	optical power meter
OLTS	optical loss test set

4 MPO connectors

4.1 General

A multi-fibre push on (MPO) connector is a multi-fibre device, used with ribbon cables, that is defined in IEC 61754-7 (all parts). Plugs for multimode have flat end faces, whereas single-mode plugs have angled end faces to minimize back reflection. These plugs are keyed and use a large rectangular plastic ferrule. The plugs can be either pinned or unpinned. The MPO plugs rely on the pins and corresponding holes to align the fibres. An adapter is used for further alignment and to hold two MPO plugs in a fixed position (see Figure 1).

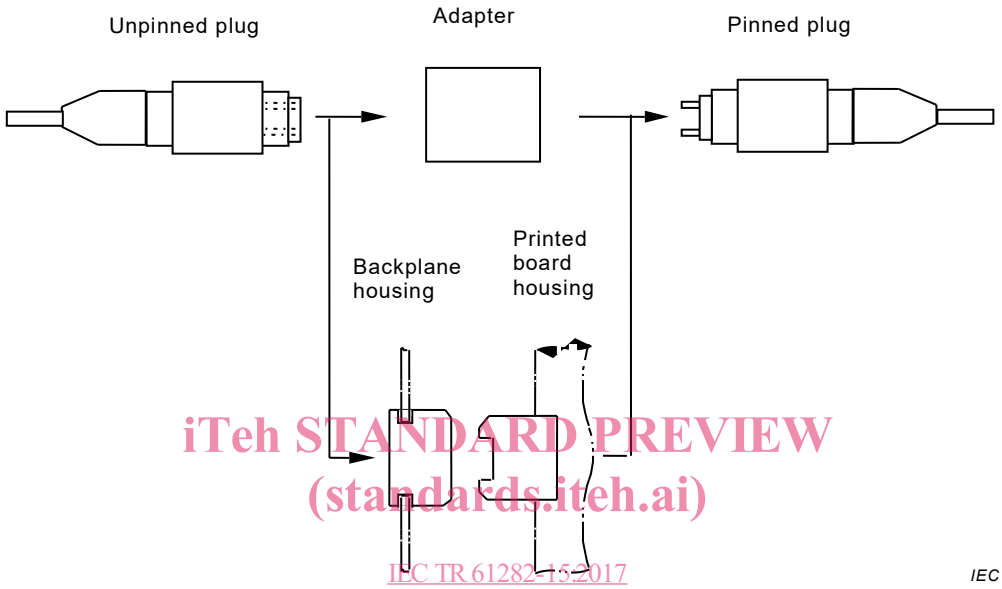

Figure 1 – MPO connector

4.2 Keying and fibre positions

Testing an installed optical fibre plant terminated with MPO plugs requires knowledge of the interface between the test equipment and the cabling under test. Intermateability between 12- and 16-fibre position MPO plugs can complicate testing as can the number of rows. There are two different fibre optic intermateability standards: one for a 12-fibre position MPO plug as defined in IEC 61754-7-1 and IEC 61754-7-2[1], and another for a 16-fibre position MPO plug defined in IEC 61754-7-3[2] and IEC 61754-7-4[3]. The 12- and 16-fibre position MPO plugs are not intermateable due to keying. Although a 12-way connector is mechanically intermateable with a 12-way connector, the number of fibre rows contained in each plug shall match. The same is true for the 16-way connector.

MPO plugs can be one of two types: pinned or unpinned. The plug interfaces are configured as a version without pins and another type with pins. The unpinned plug is intermateable with the pinned plug. Some plugs can be adjusted for either type.

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1 Under preparation. Stage at the time of publication: IEC AFDIS 61754-7-2:2017.

2 Under preparation. Stage at the time of publication: IEC CDM 61754-7-3:2017.

3 Under preparation. Stage at the time of publication: IEC ACD 61754-7-4:2017.