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**Fibre-optic communication subsystem test procedures –
Part 4-5: Installed cabling plant – Attenuation measurement of MPO terminated
fibre optic cabling plant using test equipment with MPO interfaces**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –**Part 4-5: Installed cabling plant –
Attenuation measurement of MPO terminated fibre
optic cabling plant using test equipment with MPO interfaces**

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International Standard IEC 61280-4-5 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
86C/1669/FDIS	86C/1679/RVD

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

A list of all the parts in the IEC 61280 series, under the general title *Fibre-optic communication subsystem test procedures*, can be found on the IEC website.

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

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FIBRE-OPTIC COMMUNICATION SUBSYSTEM TEST PROCEDURES –

Part 4-5: Installed cabling plant – Attenuation measurement of MPO terminated fibre optic cabling plant using test equipment with MPO interfaces

1 Scope

This part of IEC 61280 is applicable to the measurement of attenuation and determination of polarity and length of installed multimode and single-mode optical fibre cabling plant, terminated with MPO connectors, using test equipment having an MPO interface. This cabling plant can include multimode or single-mode optical fibres, connectors, adapters, splices, and other passive devices. The cabling can be installed in a variety of environments including residential, commercial, industrial, and data centre premises, as well as outside plant environments.

In this document, the optical fibres that are addressed include sub-categories A1-OM_x, where $x = 2, 3, 4$ and 5 (50/125 μm) multimode optical fibres, as specified in IEC 60793-2-10, and category B-652 and B-657 (9/125 μm) single-mode optical fibres, as specified in IEC 60793-2-50. The attenuation measurements of the other multimode and single-mode categories can also be made using a light source and power meter (LSPM) or optical time domain reflectometer (OTDR) utilising an internal or external optical switch having one MPO interface. Multimode measurements are made with an 850 nm source because transceivers used for parallel optics applications having an MPO interface only operate at 850 nm; 1 300 nm measurements are optional. Single-mode measurements are made with a 1 310 nm and/or 1 550 nm source because transceivers used for parallel optics applications having an MPO interface operate at these wavelengths. This document does not include descriptions of cabling that is not exclusively MPO to MPO.

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 60825 (all parts), *Safety of laser products*

IEC 61280-1-3, *Fibre optic communication subsystem test procedures – Part 1-3: General communication subsystems – Central wavelength and spectral width measurement*

IEC 61280-4-1:2019, *Fibre-optic communication subsystem test procedures – Part 4-1: Installed cabling plant – Multimode attenuation measurement*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Visual inspection of fibre optic connectors and fibre-stub transceivers*

IEC 61315, *Calibration of fibre-optic power meters*

IEC 61746-1, *Calibration of optical time-domain reflectometers (OTDR) – Part 1: OTDR for single mode fibres*

IEC 61746-2, *Calibration of optical time-domain reflectometers (OTDR) – Part 2: OTDR for multimode fibres*

3 Terms, definitions, graphical symbols and abbreviated terms

For the purposes of this document, the following terms, definitions, graphical symbols and abbreviated terms 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 Terms and definitions

3.1.1

adapter

female-part of a connector in which one or two plugs are inserted and aligned

[SOURCE: IEC TR 61931:1998, 2.6.4]

3.1.2

alternative test method

ATM

test method for measuring a given characteristic in a manner consistent with the definition of this characteristic, and giving results which are reproducible and relatable to the reference test method and to practical use

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[SOURCE: IEC TR 61931:1998, 2.8.2, modified – The alternative term "practical test method (for optical fibres)" has been removed.]

3.1.3

attenuation

A

reduction of optical power induced by transmission through a medium such as cabling, given as *A*:

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

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.

3.1.4

bi-directional measurement

two measurements of the same optical fibre made by launching light into opposite ends of that fibre

3.1.5

channel

end-to-end transmission path connecting any two pieces of application-specific equipment

[SOURCE: ISO/IEC 11801-1:2017, 3.1.26]

3.1.6 configuration

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

3.1.7 connector

component normally attached to an optical cable or piece of apparatus for the purpose of providing frequent optical interconnection/disconnection of optical fibres or cables

[SOURCE: IEC TR 61931:1998, 2.6.1, modified – The words in brackets "optical" and "fibre" have been omitted from the term.]

3.1.8 encircled flux EF

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

[SOURCE: IEC TR 62614-2:2015, 3.3, modified – The words "radial-weighted" have been deleted from the definition.]

3.1.9 light source power meter LSPM

test system consisting of a light source (LS) and power meter (PM) used to measure the attenuation of installed cabling plant

3.1.10 low attenuation grade

connector and plug whose attenuation of a connection formed by mating two such assemblies is lower and more repeatable than a "standard grade" termination (grade B in this document)

Note 1 to entry: An adapter required to assure the reduced attenuation can be considered to be part of the low attenuation grade where required by the test configuration.

3.1.11 measurement bias

estimate of a systematic measurement error

Note 1 to entry: A systematic error is a component of measurement error that in repeated measurements remains constant or varies in a predictable manner.

[SOURCE: ISO/IEC Guide 99:2007, 2.18, modified – Note 1 to entry has been added.]

3.1.12 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

Note 1 to entry: See IEC 61754-7 (all parts) for description.

3.1.13 optical switch

passive component processing one or more ports which selectively transmits, redirects or blocks optical power in an optical fibre transmission line

[SOURCE: IEC 60876-1:2014, 3.2.1]

3.1.14
optical time domain reflectometer
OTDR

test system consisting of an optical time-domain reflectometer used to characterize and measure the attenuation of installed cabling plant and specific elements within that cabling plant

3.1.15
plug
male-type part of a connector

[SOURCE: IEC TR 61931:1998, 2.6.2]

3.1.16
polarity
means of positioning optical fibres between MPO plugs to ensure a specific connectivity or mapping of the cabling

3.1.17
reference plane
theoretical plane without thickness or tolerances

Note 1 to entry: The reference plane is used to define spaces in mechanical structures.

[SOURCE: IEC 60050-581:2008, 581-25-30]

3.1.18
reference test method
RTM

test method for measuring a given characteristic strictly according to the definition of this characteristic, and giving results which are accurate, reproducible and relatable to practical use

[SOURCE: IEC TR 61931:1998, 2.8.1, modified – The words in brackets "for optical fibres" have been omitted from the term.]

3.1.19
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 five types of test cords:

- launch cord: used to connect the light source to the cabling;
- receive cord: used to connect the cabling to the power meter (LSPM only);
- tail cord: attached to the far end of the cabling when an OTDR is used at the near end; this provides a means of evaluating attenuation of the whole of the cabling including the far end connection;
- adapter cord: used to transition between incompatible connectors in a required test configuration;
- substitution cord: a test cord used within a reference measurement which is replaced during the measurement of the attenuation of the cabling under test.

3.2 Graphical symbols

Graphical symbols for different connection options, which have been adapted from IEC TR 61282-15 and IEC 61280-4-1, and illustrate plug variability, are shown in Figure 1 a) to h). Refer to IEC TR 61930 for other graphical symbols used within this document.

NOTE Low attenuation MPO plugs are terminated on test cords but not marked or shaded differently in the graphical symbols or in testing examples within this document.

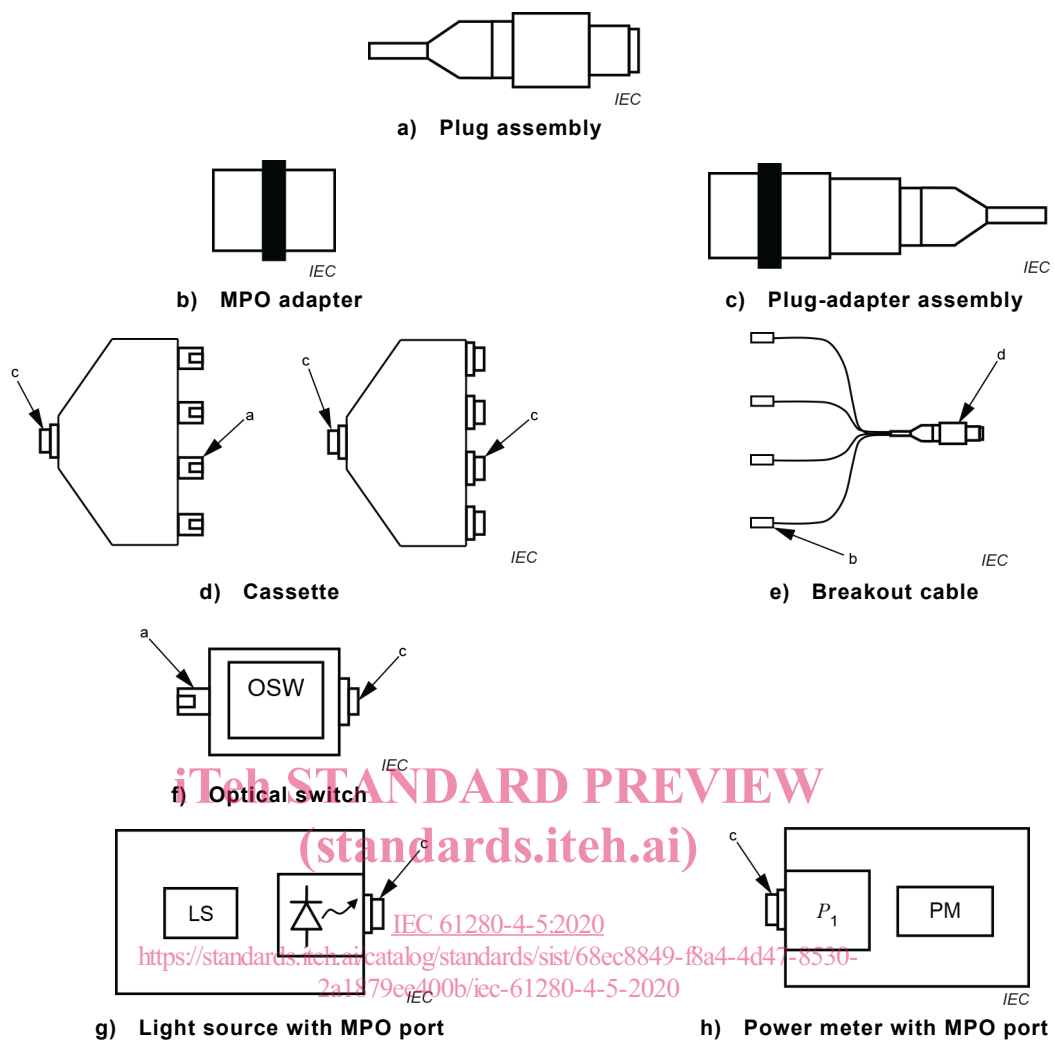


Figure 1 – Connector and apparatus symbols

In the figures that illustrate the measurement configurations in Annexes A through C, the cabling under test is illustrated by a loop and connectors as shown in Figure 2. It can contain additional splices and connectors. For purposes of measuring the attenuation of this cabling, the attenuation associated with the near and far end connectors are considered separately from the cabling itself.

In Figure 2, the cabling is shown with adapters pre-attached.