

INTERNATIONAL STANDARD

CONSOLIDATED VERSION

**Fibre optic interconnecting - Devices and passive components - Basic test and measurement procedures -
Part 1: General and guidance**

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions	8
3.2 Abbreviated terms	11
4 Requirements for IEC 61300-2 (all parts) and IEC 61300-3 (all parts)	11
4.1 Requirements for IEC 61300-2 (all parts) (tests)	11
4.2 Requirements for IEC 61300-3 (all parts) (examinations and measurement procedures)	11
4.2.1 General requirements	11
4.2.2 Requirements for attenuation variation	12
4.2.3 Requirements for test sample configuration in environmental test chamber	12
5 Standard atmospheric conditions	12
6 Significance of the numerical value of a quantity	12
6.1 General	12
6.2 Quantity expressed as nominal value with tolerance	12
6.3 Quantity expressed as a range of values	13
7 Graphical symbols and terminology	14
8 Safety	14
9 Calibration	14
9.1 General	14
9.2 Round robin calibration procedure	14
10 Launch conditions	14
10.1 General	14
10.2 Multimode launch conditions for A1 fibres	15
10.3 Multimode launch conditions for A3e fibre	16
10.4 Multimode launch conditions for the other multimode fibres	16
10.5 Single-mode launch conditions	16
10.6 Multimode planar waveguide launch conditions	16
Annex A (normative) Multimode launch condition requirement for measuring attenuation of components terminated on IEC 60793-2-10 type A1 fibres	18
A.1 General	18
A.2 Technical background	18
A.3 EF template	18
A.3.1 Applicable types of optical fibres	18
A.3.2 Encircled flux	18
A.3.3 EF template example	18
A.4 Target launch and upper and lower tolerance bands for attenuation measurements of A1-OM2 to A1-OM5 and A1-OM1 optical fibre connections	19
A.4.1 General	19
A.4.2 Limits on EF	19
Annex B (normative) Multimode launch condition requirement for measuring attenuation of components terminated on IEC 60793-2-30 type A3e fibres	21

B.1	EAF template	21
B.1.1	Applicable types of optical fibres	21
B.1.2	Encircled angular flux	21
B.1.3	EAF template example.....	21
B.2	Target launch and upper and lower tolerance bands for attenuation measurements of A3e optical fibre connections	21
B.2.1	General	21
B.2.2	Limits on EAF	22
Annex C (normative)	Test sample configuration in environmental test chamber	23
C.1	General.....	23
C.2	Pigtail test sample	24
C.3	Hardened connector pigtail test sample	24
C.4	Patchcord test sample	25
C.5	Non-connectorized passive component test sample	26
C.6	Connectorized passive component test sample	28
C.7	Plug-receptacle style passive component test sample	28
C.8	Fibre management system test sample	29
C.9	Protective housing test sample without looped cable.....	30
C.10	Protective housing test sample with looped cable	30
C.11	Combined protective housing test sample with looped cable	32
C.12	Mechanical splice or fusion splice test sample	33
Bibliography	35
Figure A.1	– Encircled flux template example.....	19
Figure B.1	– Encircled angular flux template example	21
Figure C.1	– Example configuration of a pigtail test sample	24
Figure C.2	– Example configuration of a hardened connector pigtail test sample	25
Figure C.3	– Example configuration of a patchcord test sample	26
Figure C.4	– Example configuration of a non-connectorized passive component test sample.....	27
Figure C.5	– Example configuration of a connectorized passive component test sample.....	28
Figure C.6	– Example configuration of a plug-receptacle style passive component test sample.....	29
Figure C.7	– Example configuration of a fibre management system test sample.....	29
Figure C.8	– Example configuration of a protective housing test sample without looped cable	30
Figure C.9	– Example configuration I of a protective housing test sample with looped cable	31
Figure C.10	– Example configuration II of a protective housing test sample with looped cable	32
Figure C.11	– Example configuration of a combined distribution and track or spur protective housing test sample with looped cable.....	33
Figure C.12	– Example configuration of a mechanical splice or fusion splice test sample.....	34
Table 1	– Standard atmospheric conditions.....	12

Table 2 – Expected variation of attenuation due to mode variation of single connections for A1-OM2, A1-OM3, A1-OM4 and A1-OM5 fibres 15

Table 3 – Expected variation of attenuation due to mode variation of single connections for A3e fibre 16

Table A.1 – EF requirements for 50 µm core fibre at 850 nm 19

Table A.2 – EF requirements for 50 µm core fibre at 1 300 nm..... 20

Table A.3 – EF requirements for 62,5 µm fibre at 850 nm 20

Table A.4 – EF requirements for 62,5 µm fibre at 1 300 nm 20

Table B.1 – EAF requirements for NA of 0,37 and 200 µm core fibre at 850 nm 22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Fibre optic interconnecting - Devices and passive components - Basic test and measurement procedures - Part 1: General and guidance

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 61300-1 edition 5.2 contains the fifth edition (2022-04) [documents 86B/4582/FDIS and 86B/4602/RVD], its amendment 1 (2024-04) [documents 86B/4865/FDIS and 86B/4900/RVD] and its amendment 2 (2025-12) [documents 86B/5026/CDV and 86B/5110/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

IEC 61300-1 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics. It is an International Standard.

This fifth edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of the information of measurement uncertainties in 4.2.1;
- b) change of the requirements for attenuation variation in 4.2.2;
- c) addition of the multimode launch conditions of other fibres than A1-OM2, A1-OM3, A1-OM4, A1-OM5 and A3e in 10.4;
- d) addition of the multimode launch conditions of the planar waveguide in 10.6;
- e) splitting Annex A for EF and Annex B for EAF;
- f) correction of errors in the definitions of encircled flux and encircled angular flux.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61300 series, published under the general title, *Fibre optic interconnecting and passive components – Basic test and measurement procedures*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The publications in IEC 61300 series [1]¹ contain information on mechanical and environmental testing procedures and measurement procedures relating to fibre optic interconnecting devices and passive components. They are intended to be used to achieve uniformity and reproducibility in environmental testing procedures and measurement procedures.

The term "test procedure" refers to procedures commonly known as mechanical and environmental tests. The expressions "environmental conditioning" and "environmental testing" refer to the environments to which components or equipment may be exposed so that an assessment may be made of their performance under the conditions of use, transport and storage.

The term "measurement procedure" refers to those measurements which are necessary to assess the physical and optical characteristics of a component and may also be used before, during or after a test procedure to measure the effects of environmental conditioning or testing. The return loss and attenuation tests are examples of measurement procedures.

The requirements for the performance of components or equipment subjected to the test and measurement procedures described in this document are not included. The relevant specification for the device under test defines the allowed performance limits.

When drafting a specification or purchase contract, only those tests which are necessary for the relevant components or equipment taking into account the technical and economic aspects should be specified.

The mechanical and environmental test procedures are contained in IEC 61300-2 (all parts) and the measurement procedures in IEC 61300-3 (all parts). Each test or measurement procedure is published as a stand-alone publication so that it may be modified, expanded or cancelled without having an effect on any other test or measurement procedure. However, it should be noted that, where practical, reference is made to other standards as opposed to repeating all or part of already existing standards. As an example, the cold test for fibre optic apparatus refers to IEC 60068-2-1 [2], but it also provides other needed information such as purpose, recommended severities and a list of items to be specified.

Multiple methods may be contained in a test or measurement procedure. As an example, several methods of measuring attenuation are contained in the attenuation measurement procedure.

If more than one method is contained in a test or measurement procedure, the reference method may be identified.

The tests in this document permit the performance of components or equipment to be compared. To assess the overall quality of a production lot, the test procedures should be applied in accordance with a suitable sampling plan and may be supplemented by appropriate additional tests, if necessary.

To provide tests appropriate to the different intensities of an environmental condition, some of the test procedures have a number of degrees of severity. These different degrees of severity are obtained by varying the time, temperature or some other determining factor separately or in combination.

¹ Numbers in square bracket refer to the Bibliography.

1 Scope

This part of IEC 61300 provides general information and guidance for the basic test and measurement procedures defined in IEC 61300-2 (all parts) and IEC 61300-3 (all parts) for interconnecting devices, passive components, mechanical splices, fusion splice protectors, fibre management systems and protective housings.

This document is used in combination with the relevant specification which defines the tests to be used, the required degree of severity for each of them, their sequence, if relevant, and the permissible performance limits. In the event of conflict between this document and the relevant specification, the latter takes precedence.

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 60050-731, *International Electrotechnical Vocabulary – Part 731: Optical fibre communication* (available at www.electropedia.org)

IEC 60617, *Graphical symbols for diagrams* (available at <http://std.iec.ch/iec60617>)

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60793-2-30, *Optical fibres – Part 2-30: Product specifications – Sectional specification for category A3 multimode fibres*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCSS)*

IEC 61280-1-4, *Fibre optic communication subsystem test procedures – Part 1-4: General communication subsystems – Light source encircled flux measurement method*

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

IEC 61300-2 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2: Tests*

IEC 61300-3 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3: Examinations and measurements*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

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*

Bibliography

- [1] IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components*
- [2] IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*
- [3] ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*
- [4] IEC TR 61282-14, *Fibre optic communication system design guidelines – Part 14: Determination of the uncertainties of attenuation measurements in fibre plants*
- [5] IEC 61300-3-53, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-53: Examinations and measurements – Encircled angular flux (EAF) measurement method based on two-dimensional far field data from multimode waveguide (including fibre)*
- [6] IEC TR 62614-2:2015, *Fibre optics – Multimode launch conditions – Part 2: Determination of launch condition requirements for measuring multimode attenuation*
- [7] ISO 1, *Geometrical product specifications (GPS) – Standard reference temperature for the specification of geometrical and dimensional properties*
- [8] IEC 61315, *Calibration of fibre-optic power meters*
- [9] IEC 62614-1, *Fibre optics – Multimode launch conditions – Part 1: Launch condition requirements for measuring multimode attenuation*
- [10] IEC 63267 (all parts), *Fibre optic interconnecting devices and passive components – Connector optical interfaces for enhanced macro bend loss multimode fibres*³
- [11] IEC 60793-2-40, *Optical fibres – Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres*
- [12] IEC 60050-112, *International Electrotechnical Vocabulary (IEV) – Part 112: Quantities and units* (available at www.electropedia.org)
- [13] IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components – Performance standard*
- [14] IEC 61753-111 (all parts), *Fibre optic interconnecting devices and passive components – Performance standard – Part 111: Sealed closures*
- [15] IEC 62005 (all parts), *Reliability of fibre optic interconnecting devices and passive components*

³ Under preparation.