

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Fibre optic interconnecting devices and passive components – Performance standard –
Part 1: General and guidance**

**Dispositifs d'interconnexion et composants passifs fibroniques – Norme de performance –
Partie 1: Généralités et recommandations**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Fibre optic interconnecting devices and passive components – Performance standard –

Part 1: General and guidance

Dispositifs d'interconnexion et composants passifs fibroniques – Norme de performance –

Partie 1: Généralités et recommandations

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.20

ISBN 978-2-8322-5923-8

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions	10
4 Abbreviations	14
5 Preparation of a performance standard	14
5.1 Performance standard title	14
5.2 Tests	14
5.3 Details	14
5.4 Requirements.....	14
5.5 Sample size	14
5.6 Sample definition	14
5.7 Groupings/sequences.....	15
5.8 Pass/fail criteria	15
5.9 Reference product definition.....	15
5.10 Performance standard test report	15
6 Environmental aspects.....	15
Annex A (normative) Tests, severities and criteria for performance standards	16
A.1 General.....	16
A.2 How to find the performance tests for the desired category?.....	20
A.3 Performance criteria	45
Annex B (normative) Performance standard numbering.....	58
Bibliography	60
Figure 1 – Relationship between various protective housing types	13
Figure A.1 – Flow chart to identify the relevant category for the operating service environment.....	21
Table A.1 – Operating service environments and performance categories	18
Table A.2 – Operating service environments and performance categories for components in locations with additional heat dissipation by active electronics.....	20
Table A.3 – Connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category C – Indoor controlled environment.....	22
Table A.4 – Connectors, field mountable connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category C ^{HD} – Indoor controlled environment with additional heat dissipation	24
Table A.5 – Connectors, field mountable connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category OP – Outdoor protected environment	25
Table A.6 – Connectors, field mountable connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category OP ^{HD} – Outdoor protected environment with additional heat dissipation	27

Table A.7 – Connectors, field mountable connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category OP+ – Extended outdoor protected environment	28
Table A.8 – Connectors, field mountable connectors, passive components, mechanical splices, fusion splice protectors and fibre management systems – Category OP+ ^{HD} – Extended outdoor protected environment with additional heat dissipation	28
Table A.9 – Connectors, passive optical components – Category I – Industrial environment	29
Table A.10 – Connectors, passive optical components – Category I ^{HD} – Industrial environment with additional heat dissipation	31
Table A.11 – Connectors and passive optical components – Category E – Extreme environment	32
Table A.12 – Wall outlets, boxes, optical distribution frame modules and closures – Category C – Indoor controlled environment	34
Table A.13 – Hardened optical connectors, street cabinets, boxes and closures Category A – Outdoor aerial environment	36
Table A.14 – Hardened optical connectors and closures – Category G – Outdoor ground environment	39
Table A.15 – Hardened optical connectors and closures – Category S – Outdoor subterranean environment	42
Table A.16 – Single mode connectors	45
Table A.17 – Single mode field mountable connectors	46
Table A.18 – Multi mode connectors	47
Table A.19 – Single mode mechanical splices	48
Table A.20 – Multi mode mechanical splices	49
Table A.21 – Single mode fusion splice protectors	49
Table A.22 – Passive optical components	50
Table A.23 – Fibre management systems	51
Table A.24 – Category C – Wall outlets and boxes	52
Table A.25 – Category C – Optical distribution frame modules (OFDM)	53
Table A.26 – Category A, single mode boxes, street cabinets and free breathing closures	54
Table A.27 – Category A, G and S single mode sealed closures	55
Table A.28 – Category A, G and S single mode hardened fibre optic connectors	56

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND
PASSIVE COMPONENTS – PERFORMANCE STANDARD –****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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61753-1 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2007. It constitutes a technical revision.

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

- a) definitions updated with new products: wall outlets, wall or pole mounted boxes, splices, ODF modules, street cabinets, hardened connectors and field mountable connectors;
- b) categories U and O are replaced by categories OP and OP+. No mandatory sequence in category OP+. Category OP+ contains the tests from category OP with the addition of only 4 other tests;
- c) addition of Category I (Industrial);

- d) temperature ranges added (with the HD suffix to the categories C, OP, OP+ and I) in case passive optical components are placed in a housing together with active electronics (HD stands for “heat dissipation”);
- e) the height of category A changed from 3 m to ground level (0 m);
- f) the lower level height of category G environment changed from ground level (0 m) to –1 m below ground level. Upper level remains at 3 m above ground level;
- g) addition of performance tests, test severities and performance criteria for new products: Wall outlet, wall or pole mounted boxes, mechanical splices, fusion splice protectors, ODF modules, street cabinets, field mountable connectors and hardened optical connectors;
- h) test severity of "Mating durability" test for connectors in categories C, OP, OP+ and I is reduced to 200 cycles for connectors with cylindrical ferrules and 50 cycles for connectors with rectangular ferrules;
- i) test severity of "Change of temperature" test for connectors and passive optical components in category I is reduced from 20 cycles to 12 cycles (harmonized with connectors and components from other categories);
- j) test severity of "Flexing of strain relief" test for connectors in categories C, OP and OP+ is reduced to 50 cycles;
- k) test severities of "Assembly and disassembly of fibre optic mechanical splices, fibre management systems and closures" test for all enclosures is reduced to 5 cycles;
- l) test severities of "Change of temperature" test for all protective housings in categories C, A, G and S is reduced from 20 cycles to 12 cycles (harmonized with connectors and components);
- m) test severities of "Resistance to solvents and contaminating fluids" test for closures in categories G and S changed – kerosene is removed, diesel oil exposure reduced to 1 h immersion and 24 h drying at room temperature;
- n) sealing performance criteria of sealed closures for categories G and A are reduced to 20 kPa overpressure.
- o) the change in attenuation criterion for connectors has changed from peak-to-peak into a +/- deviation from the original value of the transmitted power at the start of the test (harmonized with the change in attenuation criterion for components, splices and protective housings).

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

FDIS	Report on voting
86B/4131/FDIS	86B/4137/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.

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

A list of all parts in the IEC 61753 series, published under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The IEC 61753 series is dealing with performance standards for all passive fibre optic products, including connectors, passive optical components, fibre management systems and various protective housings. The standard is published in multiple parts. This part, Part 1, covers general information on performance standards. Subsequent parts are known as performance standards and are numbered according to the classification defined in Annex B. These standards contain the minimum test and measurement severities which are common to all passive fibre optic products, for a particular service environment or performance category, and the test and measurement severities which are considered specific to that particular product in that environment.

Performance Standards define the requirements for standard optical performance under a set of specified conditions. Each standard contains a series or a set of tests and measurements with clearly stated conditions, severities and pass/fail criteria. The series of tests, commonly referred to as an operating service environment or performance category, is intended to be run on a 'one-off' basis to prove the product's ability to satisfy the requirements of a specific application, market sector or user group.

This document define those sets of tests which form each operating service environment or performance category and which have been standardised for international use. A product that has been shown to meet all the requirements of a performance standard can be declared as complying with that performance standard.

Products having the same classification from one manufacturer that satisfy a performance standard, will operate within the boundaries set by the performance standard. Intermateability or interchangeability of products from different suppliers (having the same classification and conforming to the same performance standard) can only be guaranteed when these products also meet the interface standards. Only in this condition will an equivalent level of performance be provided when they are used together (for example, in the case of optical connectors).

Conformance to a performance standard is not a guarantee of lifetime assured performance or reliability. Reliability testing is the subject of a separate test schedule, where the tests and severities selected are truly representative of the requirements of this reliability test programme. Consistency of manufacture will be maintained using a recognised quality assurance programme whilst the reliability of product will be evaluated using the procedures recommended in IEC 62005 (all parts).

Tests and measurements are selected from IEC 61300 (all parts). Where this is not possible, the required test method is attached as an annex to the performance standard.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 1: General and guidance

1 Scope

This part of IEC 61753 provides guidance for the drafting of performance standards for all passive fibre optic products.

This document defines the tests and severities which form the performance categories or general operating service environments and identifies those tests which are considered to be product specific. Test and severity details are given in Annex A.

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 60529, *Degrees of protection provided by enclosures (IP Code)*

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

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-2: Tests – Mating durability*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion*

IEC 61300-2-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-6: Tests – Tensile strength of coupling mechanism*

IEC 61300-2-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-7: Tests – Bending moment*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-10, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-10: Tests – Crush resistance*

IEC 61300-2-11, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-11: Tests – Axial compression*

IEC 61300-2-12, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-21, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-21: Tests – Composite temperature/humidity cyclic test*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-23, *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, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-26: Tests – Salt mist*

IEC 61300-2-27, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-27: Tests – Dust – Laminar flow*

IEC 61300-2-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-28: Tests – Corrosive atmosphere (sulphur dioxide)*

IEC 61300-2-33, *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, *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 61300-2-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-35: Tests – Cable nutation*

IEC 61300-2-37, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-37: Tests – Cable bending for fibre optic closures*

IEC 61300-2-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-38: Tests – Sealing for pressurized fibre optic closures*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for strain relief*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-2-45, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-45: Tests – Durability test by water immersion*

IEC 61300-2-46, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-46: Tests – Damp heat, cyclic*

IEC 61300-2-50, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-50: Tests – Fibre optic connector proof test with static load – Singlemode and multimode*

IEC 61300-3-3, *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*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

IEC 61300-3-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*

IEC 61300-3-29, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-29: Examinations and measurements – Spectral transfer characteristics of DWDM devices*

IEC 61300-3-34, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-34: Examinations and measurements – Attenuation of random mated connectors*

IEC 61300-3-45, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-45: Examinations and measurements – Attenuation of random mated multi-fibre connectors*

IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*

ISO 1998-1:1998, *Petroleum industry – Terminology – Part 1: Raw materials and products*

3 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>

NOTE Terms and definitions for various components can be found in IEC TS 62538 and in the relevant IEC 61753 series performance standards.