

INTERNATIONAL STANDARD



Optical fibre cables –
Part 1-1: Generic specification – General

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

IEC 60794-1-1:2015

<https://standards.iteh.ai/catalog/standards/iec/ess313d8-2f7c-42b5-833a-27c7258785a4/iec-60794-1-1-2015>

Withhold



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 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.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.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 more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 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: csc@iec.ch.

IEC 60794-1-1:2015

<https://standards.iteh.ai/standards/iec/ess313d8-2f7c-42b5-833a-27c7258785a4/iec-60794-1-1-2015>

INTERNATIONAL STANDARD



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

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

IEC 60794-1-1:2015

<https://standards.iteh.ai/standards/iec/ess313d8-2f7c-42b5-833a-27c7258785a4/iec-60794-1-1-2015>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.10

ISBN 978-2-8322-3002-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Graphical symbols and abbreviations.....	12
5 Optical fibre cables	13
6 Materials	13
6.1 Optical fibre	13
6.1.1 General	13
6.1.2 Attenuation coefficient	13
6.1.3 Attenuation uniformity – Attenuation discontinuities	13
6.1.4 Cable cut-off wavelength	14
6.1.5 Fibre colouring.....	14
6.1.6 Polarization mode dispersion (PMD)	14
6.2 Electrical conductors.....	14
6.3 Other materials	14
6.4 Environmental requirements	14
7 Cable construction.....	14
7.1 General.....	14
7.2 Colour coding	15
7.2.1 Overview	15
7.2.2 Unit colour coding	15
7.2.3 Sheath colour coding.....	15
8 Measuring methods	15
8.1 General.....	15
8.2 Measuring methods for dimensions	15
8.3 Measuring methods for mechanical characteristics	16
8.4 Measuring methods for electrical characteristics	16
8.5 Measuring methods for transmission and optical characteristics.....	16
8.6 Measuring methods for environmental characteristics	17
8.7 Measuring methods for cable element characterisation	17
9 Related Technical Reports.....	17
Annex A (informative) Guidelines for specific defined applications and cabled fibre performance	18
A.1 General.....	18
A.2 Cabled fibre attenuation requirements.....	18
A.3 Cabled fibre bandwidth requirements	19
A.4 Type testing at 1 625 nm.....	20
Annex B (informative) Guidelines for qualification sampling	21
B.1 General.....	21
B.2 Fibre selection for cable testing	21
B.3 Pass/fail criteria	21
Bibliography.....	23
Table 1 – Measuring methods for dimensions	16

Table 2 – Measuring methods for electrical characteristics	16
Table 3 – Measuring methods for transmission and optical characteristics of cabled optical fibres	17
Table A.1 – Maximum cabled fibre attenuation coefficient (dB/km), as given by ITU-T	18
Table A.2 – Category A1 multimode fibre maximum cable attenuation coefficient (dB/km).....	19
Table A.3 – Single-mode maximum cable attenuation coefficient (dB/km)	19
Table A.4 – Category A1 multimode cabled fibre bandwidth (MHz·km).....	20
Table A.5 – Guidance values for 1 625 nm type test acceptance criteria	20

Withheld

iTech Standards
(<https://standards.itih.ai>)
Document Preview

<https://standards.itih.ai/standards/iec/60794-1-1-2015>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 1-1: Generic specification – General

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 60794-1-1 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This fourth edition cancels and replaces the third edition, published in 2011. This edition constitutes a technical revision.

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

- a) the expansion of the definitions, graphical symbols, terminology and abbreviations content, with the aim of making this standard the default and reference for all others in the IEC 60794-x series;
- b) the inclusion of updated and expanded optical fibre, attenuation and bandwidth sections, with the aim of making this standard the default and reference for all others in the IEC 60794-x series.

The text of this standard is based on the following documents:

CDV	Report on voting
86A/1651/CDV	86A/1667/RVC

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

A list of all parts in the IEC 60794 series, published under the general title *Optical fibre cables*, can be found on the IEC website.

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

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

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

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

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.

OPTICAL FIBRE CABLES –

Part 1-1: Generic specification – General

1 Scope

This part of IEC 60794 applies to optical fibre cables for use with communication equipment and devices employing similar techniques and to cables having a combination of both optical fibres and electrical conductors.

The object of this standard is to establish uniform generic requirements for the geometrical, transmission, material, mechanical, ageing (environmental exposure), climatic and electrical properties of optical fibre cables and cable elements, where appropriate.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60189-1, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60304, *Standard colours for insulation for low-frequency cables and wires*

IEC 60793-1-21, *Optical Fibres Part 1-21: Measurement methods and test procedures – Coating geometry*

IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*

IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

IEC 60793-1-46, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

IEC 60793-1-48, *Optical fibres – Part 1-48: Measurement methods and test procedures – Polarization mode dispersion*

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*

IEC 60794-1-22, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods*

IEC 60811-201, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 201: General tests – Measurement of insulation thickness*

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

IEC TR 61931, *Fibre optic – Terminology*

ISO 14001, *Environmental management systems – Requirements with guidance for use*

ISO 14064-1, *Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*

3 Terms and definitions

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

3.1

no change in attenuation

acceptance criterion for attenuation measurement that includes an allowance for measurement uncertainty arising from measurement errors or calibration errors due to a lack of suitable reference standards

Note 1 to entry: For a practical interpretation, the following values shall be used:

a) no change in attenuation, single-mode (Class B): the total uncertainty of measurement shall be $\leq \pm 0,05$ dB for attenuation or $\leq \pm 0,05$ dB/km for attenuation coefficient. Any measured value within this range shall be considered as “no change in attenuation”

The requirement for these parameters is indicated as “No change ($\leq \pm 0,05$ dB or $\leq \pm 0,05$ dB/km)”. <https://standards.iteh.ai/>

By agreement between customer and supplier, minor deviation from this limit may be accepted at some low frequency, e.g. less than 10%. However for mechanical tests no deviation in excess of 0,15 dB shall be accepted. For environmental tests no deviation in excess of 0,10 dB/km shall be accepted.

b) no change in attenuation, multimode (Category A1): the total uncertainty of measurement shall be $\leq \pm 0,2$ dB for attenuation or $\leq \pm 0,2$ dB/km for attenuation coefficient

Any measured value within this range shall be considered as “no change in attenuation”.

The requirement for these parameters is indicated as “No change ($\leq \pm 0,2$ dB or $\leq \pm 0,2$ dB/km)”.

By agreement between customer and supplier, minor deviation from this limit may be accepted at some low frequency, e.g. less than 10%. However for mechanical tests no deviation in excess of 0,5 dB shall be accepted. For environmental tests no deviation in excess of 0,5 dB/km shall be accepted.

c) no change in attenuation, plastic optical fibre (Category A4): the total uncertainty of measurement for this standard shall be ≤ 2 % of maximum specified attenuation in IEC 60793-2-40 Annex A to G

Any measured value within this range shall be considered as “no change in attenuation”.

3.2

allowable change in attenuation

<during mechanical and environmental tests> change in attenuation that may be a value larger than the no change limits, depending on fibre category, single-mode or multimode, cable design and application

3.3 link design attenuation LDA

statistical average attenuation value for a link of concatenated cables

3.4 no change in fibre strain

acceptance criterion for fibre strain measurement that includes an allowance for measurement uncertainty arising from measurement errors or calibration errors due to a lack of suitable reference standards

Note 1 to entry: For a practical interpretation, the total uncertainty of measurement shall be $\pm 0,05$ % strain. Any measured value within this range shall be considered as “no change in strain”.

3.5 allowable change in fibre strain

<during mechanical and environmental tests> level of strain that will not compromise fibre mechanical reliability for some of the parameters specified

Note 1 to entry: For 1 % proof-tested fibres, the fibre strain under long term tensile load (T_L) shall not exceed 20 % of this fibre proof strain (equal to absolute 0,2 % strain) and there shall be no change in attenuation during the test

Under short term tensile load (T_S) the fibre strain shall not exceed 60 % of the fibre proof strain and the attenuation change during test shall be measured and recorded.

Other criteria may be agreed between the customer and the supplier.

For fibres proof tested at higher levels the safe long-term load will not scale linearly with proof strain, so a lower percentage of the proof strain is applicable. For greater than 1 % up to 2 % proof-tested fibres, the strain at T_L shall be limited to 17 % of the proof-test strain (equal to absolute 0,34 % strain for 2 % proof tested fibres).

3.6 cable load definitions (non-aerial applications)

3.6.1 long term load

T_L
acceptable amount of long term load which the cable may experience during operation (i.e. after installation is completed)

Note 1 to entry: Long term load may be due to residual loading from the installation process and/or environmental effect. This is the rated maximum load for which a cable is subject to in long term tests.

3.6.2 short term load

T_S
 T_M
acceptable amount of short-term load that can be applied to a cable without permanent degradation of the characteristics of the fibres, cable elements or sheath

Note 1 to entry: Short term load is often called rated installation load.

3.7 cable load definitions and tensile testing terminology (self-supporting aerial applications)