

REDLINE VERSION



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.10

ISBN 978-2-8322-3018-3

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	14
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	15
7.1 General	15
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	16
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	17
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) Guide to Guidelines for specific defined applications and cabled fibre performance	19
A.1 General	19
A.2 Cabled fibre attenuation requirements	19
A.3 Cabled fibre bandwidth requirements	20
A.4 Type testing at 1 625 nm	21
Annex B (informative) Guide to Guidelines for qualification sampling	22
B.1 Introduction General	22
B.2 Fibre selection for cable testing	22
B.3 Pass/fail criteria	23
Bibliography	24
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	19
Table A.2 – Category A1 multimode fibre maximum cable attenuation coefficient (dB/km).....	20
Table A.3 – Single-mode maximum cable attenuation coefficient (dB/km)	20
Table A.4 – Category A1 multimode cabled fibre bandwidth (MHz·km).....	21
Table A.5 – Guidance values for 1 625 nm type test acceptance criteria	21

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.

DISCLAIMER

This Redline version is not an official IEC Standard and is intended only to provide the user with an indication of what changes have been made to the previous version. Only the current version of the standard is to be considered the official document.

This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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 60793-1-1, *Optical fibres – Part 1-1: Measurement methods and test procedures – General and guidance*~~

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 60793-1-22, *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*~~
~~IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*~~

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 60794-1-2, Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures~~

~~IEC 60794-1-2:2003, Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures¹~~

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 60794-4-20:2, Optical fibre cables – Part 4-20: Aerial optical cables along electrical power lines – Family specification for ADSS (All Dielectric Self-Supported) Optical cables~~

IEC 60811-201, Electric and optical fibre cables – Test methods for non-metallic materials – Part 201: General tests – Measurement of insulation thickness³

IEC 60811-202, Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath⁴

IEC 60811-203, Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions⁵

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

¹~~—To be replaced by future IEC 60794-1-22.~~

²~~—To be published.~~

³~~—To be published.~~

⁴~~—To be published.~~

⁵~~—To be published.~~

INTERNATIONAL STANDARD



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

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

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*