



BSI Standards Publication

Optical fibre cables

Part 1-111: Generic specification — Basic optical cable test procedures — Mechanical tests methods — Bend, method E11

National foreword

This British Standard is the UK implementation of EN IEC 60794-1-111:2023. It is identical to IEC 60794-1-111:2023. It partially supersedes BS EN 60794-1-21:2015+A1:2020.

The UK participation in its preparation was entrusted to Technical Committee GEL/86/1, Optical fibres and cables.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 23217 2

ICS 33.180.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2023.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

Optical fibre cables - Part 1-111: Generic specification - Basic
optical cable test procedures - Mechanical tests methods - Bend,
method E11
(IEC 60794-1-111:2023)

Câbles à fibres optiques - Partie 1-111: Spécification
générique - Procédures fondamentales d'essais des câbles
optiques - Méthodes d'essai mécanique - Courbures,
méthode E11
(IEC 60794-1-111:2023)

Glasfaserkabel - Teil 1-111: Fachgrundspezifikation -
Grundlegende Testverfahren für optische Kabel -
Mechanische Prüfverfahren - Biegung, Verfahren E11
(IEC 60794-1-111:2023)

This European Standard was approved by CENELEC on 2023-10-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 86A/2367/FDIS, future edition 1 of IEC 60794-1-111, prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60794-1-111:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-07-24
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-10-24

This document partially supersedes EN 60794-1-21:2015 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60794-1-111:2023 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60793-2-10:2019 NOTE Approved as EN IEC 60793-2-10:2019 (not modified)

IEC 60793-2-50:2018 NOTE Approved as EN IEC 60793-2-50:2019 (not modified)

IEC 60794-1-21:2015 NOTE Approved as EN 60794-1-21:2015 (not modified)

IEC 60794-1-301 NOTE Approved as EN IEC 60794-1-301

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60793-1-46	-	Optical fibres - Part 1-46: Measurement methods and test procedures - Monitoring of changes in optical transmittance	EN 60793-1-46	-
IEC 60794-1-1	-	Optical fibre cables - Part 1-1: Generic specification - General	EN IEC 60794-1-1	-
IEC 60794-1-2	-	Optical fibre cables - Part 1-2: Generic specification - Basic optical cable test procedures - General guidance	EN IEC 60794-1-2	-

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 General	6
4.1 Sample	6
4.2 Apparatus	7
4.3 Test methods	7
4.4 Test conditions	7
5 Method E11A – Bend as helix.....	7
5.1 General.....	7
5.2 Single-helix configuration.....	8
5.3 Two-helix configuration	9
5.4 Procedure	10
6 Method E11B – U bend.....	10
7 Requirements	11
8 Details to be specified	11
9 Details to be reported	12
Annex A (informative) Example of a special mandrel for two-helix configuration.....	13
Annex B (informative) Rationale for the options of an equal or larger turnaround loop diameter for the two-helix configuration of method E11A.....	14
Bibliography.....	19
Figure 1 – Bend test set-up for method E11A: single-helix configuration	8
Figure 2 – Bend test set-up for method E11A: two-helix configuration	9
Figure 3 – Bend test set-up for method E11B.....	11
Figure A.1 – Example of a special mandrel	13
Figure B.1 – Options for turnaround loop size for two-helix configuration of method E11A.....	14
Figure B.2 – Difference of change in attenuation for single-mode cable	17
Figure B.3 – Difference of change in attenuation for multimode cable	17
Figure B.4 – Worst case difference of change in attenuation	18
Table B.1 – Used change in attenuation values.....	15
Table B.2 – Calculated changes in attenuation of single-mode cable	15
Table B.3 – Calculated changes in attenuation of multimode cable	16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

**Part 1-111: Generic specification –
Basic optical cable test procedures –
Mechanical test methods – Bend, method E11**

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.

IEC 60794-1-111 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This document partially cancels and replaces IEC 60794-1-21:2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 60794-1-21:2015:

- a) the nominal sample length was newly specified as 10 m between the cable element fixing points at both ends, unless otherwise specified;
- b) the number of turns on the mandrel in Figure 1 for the single-helix configuration were corrected to match the number of turns shown in the figure for the two-helix configuration,

- c) requirements on the turnaround loop were added for method E11A, two-helix configuration;
- d) the turnaround loop with the same diameter as the mandrel was taken into account for calculation of the number of turns of each helix for method E11A, two-helix configuration;
- e) added a formula for calculation of the number of revolutions in each helix for method E11A, two-helix configuration;
- f) added a description for the procedure when the turnaround loop diameter is larger than the mandrel diameter for method E11A, two-helix configuration;
- g) all the figures were updated and the different components labelled;
- h) added the attenuation monitoring equipment in 4.2 for the apparatus and the description to measure the change in attenuation in the test methods E11A and E11B;
- i) added Clause 9 for details to be reported;
- j) added Annex A showing an example of a special mandrel to perform the bend test according to method E11A, two-helix configuration;
- k) added Annex B providing the rationale for the options of method E11A, two-helix configuration.

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

Draft	Report on voting
86A/2367/FDIS	86A/2373/RVD

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

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 60794 series, published under the general title *Optical fibre cables*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.