



SLOVENSKI STANDARD
oSIST prEN IEC 60974-1-111:2023
01-marec-2023

Optični kabli - 1-111. del: Splošna specifikacija - Osnovni preskusni postopki za optične kable - Mehanske preskusne metode - Upogib, metoda E11

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

iTeh Standards
(<https://standards.iteh.ai>)

Ta slovenski standard je istoveten z: prEN IEC 60794-1-111:2023

[SIST EN IEC 60794-1-111:2023](https://standards.iteh.ai/catalog/standards/sist/45de1c07-533c-461f-80bb-d3b85bc86da1/sist-en-iec-60794-1-111-2023)

<https://standards.iteh.ai/catalog/standards/sist/45de1c07-533c-461f-80bb-d3b85bc86da1/sist-en-iec-60794-1-111-2023>

ICS:

33.180.10 (Optična) vlakna in kabli Fibres and cables

oSIST prEN IEC 60974-1-111:2023 en



86A/2269/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 60794-1-111 ED1	
DATE OF CIRCULATION: 2023-01-20	CLOSING DATE FOR VOTING: 2023-04-14
SUPERSEDES DOCUMENTS: 86A/2223/CD, 86A/2261/CC	

IEC SC 86A : FIBRES AND CABLES	
SECRETARIAT: France	SECRETARY: Mr Laurent Gasca
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING Attention IEC-CENELEC parallel voting The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING

SIST EN IEC 60794-1-111:2023

<https://standards.iteh.ai/> This document is still under study and subject to change. It should not be used for reference purposes. [iec-60794-1-111-2023](https://standards.iteh.ai/iec-60794-1-111-2023)

Recipients of this document are invited to submit, with their comments, notification of

- any relevant patent rights of which they are aware and to provide supporting documentation,
- any relevant "in some countries" clauses to be included should this proposal proceed. Recipients are reminded that the enquiry stage is the final stage for submitting "in some countries" clauses. See AC/22/2007.

TITLE:

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

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

Copyright © 2022 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41

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	6
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.....	7
5.3 Two-helix configuration	7
5.4 Procedure	9
6 Method E11B – U bend.....	9
7 Requirements	10
8 Details to be specified	10
9 Details to be reported	11
Annex A (informative) Example of a special mandrel for two-helix configuration.....	12
Annex B (informative) Rationale for the options of an equal or larger turnaround loop diameter for the two-helix configuration of method E11A	13
Bibliography.....	18
Figure 1 – Bend test set-up for method E11A: single-helix configuration	7
Figure 2 – Bend test set-up for method E11A: two-helix configuration.....	8
Figure 3 – Bend test set-up for method E11B.....	10
Figure A.1 – Example of a special mandrel	12
Figure B.1 – Options for turnaround loop size for two-helix configuration of method E11A	13
Figure B.2 – Difference of change in attenuation for single-mode cable	16
Figure B.3 – Difference of change in attenuation for multimode cable	16
Figure B.4 – Worst case difference of change in attenuation.....	17
Table A.1 – Used change in attenuation values.....	13
Table A.2 – Calculated changes in attenuation of single-mode cable	14
Table A.3 – Calculated changes in attenuation of multimode cable	15

SIST EN IEC 60794-1-111:2023

<http://standards.iteh.ai/catalog/standards/sist/en-iec/60794-1-111-2023>

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) 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.

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 first edition cancels and replaces Method E11 of the first edition of IEC 60794-1-21:2015, which will be withdrawn. It includes an editorial revision, based on the new structure and numbering system for optical fibre test methods. Additionally, there are a few technical changes.

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 the figure for the single-helix configuration were corrected to match the number of turns shown in the figure for the two-helix configuration;

- 97 c) Requirements on the turnaround loop were added for method E11A, two-helix configuration;
 98 d) The turnaround loop with the same diameter as the mandrel was taken into account for
 99 calculation of the number of turns of each helix for method E11A, two-helix configuration;
 100 e) Added a formula for calculation of the number of revolutions in each helix for method E11A,
 101 two-helix configuration;
 102 f) Added a description for the procedure when the turnaround loop diameter is larger than the
 103 mandrel diameter for method E11A, two-helix configuration;
 104 g) All the figures were updated and the different components labelled;
 105 h) Added the attenuation monitoring equipment in the clause for the apparatus and the
 106 description to measure the change in attenuation in the test methods E11A and E11B;
 107 i) Added a clause for details to be reported;
 108 j) Added Annex A showing an example of a special mandrel to perform the bend test according
 109 to method E11A, two-helix configuration;
 110 k) Added Annex B providing the rationale for the options of method E11A, two-helix
 111 configuration.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

113
 114 Full information on the voting for its approval can be found in the report on voting indicated in
 115 the above table.

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

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

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

- 124 • reconfirmed,
- 125 • withdrawn,
- 126 • replaced by a revised edition, or
- 127 • amended.

128

129

INTRODUCTION

130 This document cancels and replaces method E11 of IEC 60794-1-21:2015, which will be
131 withdrawn. It includes an editorial revision, based on the new structure and numbering system
132 for optical fibre cable test methods. Additionally, technical changes were implemented. The
133 mechanical tests contained in IEC 60794-1-21:2015 will be individually numbered in the IEC
134 60794-1-1xx series. Each test method is now considered to be an individual document rather
135 than part of a multi-test method compendium. Full cross-reference details are given in IEC
136 60794-1-2.

137 The descriptions and the figures of the test methods E11A and E11B in this document have
138 been remarkably changed to improve the procedures, avoid different interpretations and add
139 useful information such as examples and rationale. However, the intention and procedures of
140 the test methods were not changed.

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

[SIST EN IEC 60794-1-111:2023](https://standards.iteh.ai/catalog/standards/sist/45de1c07-533c-461f-80bb-d3b85bc86da1/sist-en-iec-60794-1-111-2023)

<https://standards.iteh.ai/catalog/standards/sist/45de1c07-533c-461f-80bb-d3b85bc86da1/sist-en-iec-60794-1-111-2023>

OPTICAL FIBRE CABLES

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

141
142
143
144
145
146
147

1 Scope

148
149 This part of IEC 60794 defines the test procedure to determine the ability of an optical fibre
150 cable to withstand bending around a test mandrel. The primary purpose of this procedure is to
151 measure the change in attenuation when the cable is bent around a test mandrel. A secondary
152 purpose is to assess whether the cable has been physically damaged by bending.

153 NOTE 1 This test may be utilized at any specified temperature, including the low or high temperature limits for the
154 cable.

155 NOTE 2 The bend test procedure for cable elements is specified in IEC 60794-1-301, method G1.

2 Normative references

156
157 The following documents are referred to in the text in such a way that some or all of their content
158 constitutes requirements of this document. For dated references, only the edition cited applies.
159 For undated references, the latest edition of the referenced document (including any
160 amendments) applies.

161 IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

162 IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test*
163 *procedures – General guidance*

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

3 Terms and definitions SIST EN IEC 60794-1-111:2023

166
167 For the purposes of this document, the terms and definitions given in IEC 60794-1-1 apply.

168 ISO and IEC maintain terminological databases for use in standardization at the following
169 addresses:

- 170
- IEC Electropedia: available at <http://www.electropedia.org/>
 - ISO Online browsing platform: available at <http://www.iso.org/obp>
- 171

4 General

4.1 Sample

172
173
174 The nominal sample length shall be 10 m and shall be terminated at each end in a manner such
175 that the fibres, buffer, sheath(s) and any strain members are clamped, glued or otherwise fixed
176 together in a representative manner, unless otherwise specified in the relevant specification.
177 The actual sample length should be longer than the nominal sample length to allow for
178 connection to the optical monitoring equipment. The section in the middle of the nominal sample
179 length shall be bent.

4.2 Apparatus

180
181 A single mandrel shall enable the sample to be wrapped tangentially in a close helix around a
182 mandrel (see Figure 1, Figure 2 and Figure 3).

183 If optical monitoring is required, an optical monitoring equipment according to IEC 60793-1-46
184 shall be used.

185 **4.3 Test methods**

186 As indicated in the relevant specification, one of the methods described in clauses 5 or 6 shall
187 be used.

188 **4.4 Test conditions**

189 The tests shall be carried out at the specified temperature. If no temperature is specified, the
190 ambient temperature shall be within the standard atmospheric conditions as specified in IEC
191 60794-1-2.

192 **5 Method E11A – Bend as helix**

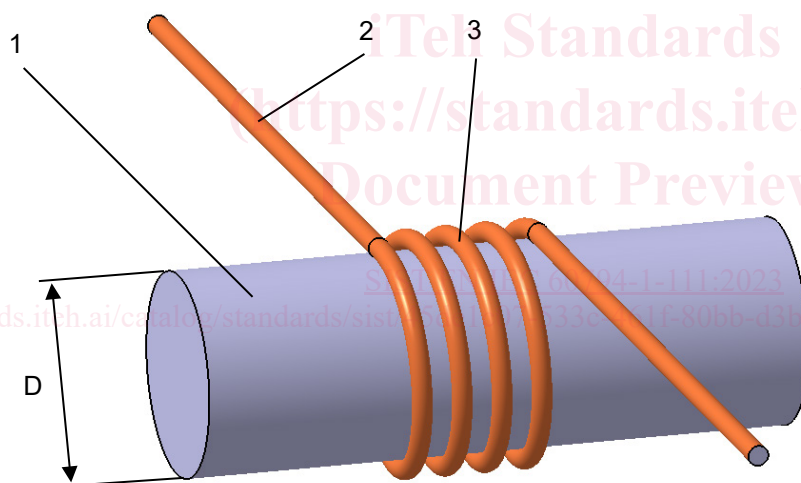
193 **5.1 General**

194 The intent of method E11A is to specify the test with the total number of turns on a mandrel of
195 a specified diameter.

196 Either test set-up, single-helix and two-helix configuration, may be used for testing per method
197 E11A.

198 **5.2 Single-helix configuration**

199 The test set-up with one helix as shown in Figure 1 may be used.



210 **Key**

- 211 1 mandrel
212 2 sample
213 3 wrapped sample in a single helix
214 D mandrel diameter

215 NOTE This Figure illustrates 4 turns of the sample on the mandrel.

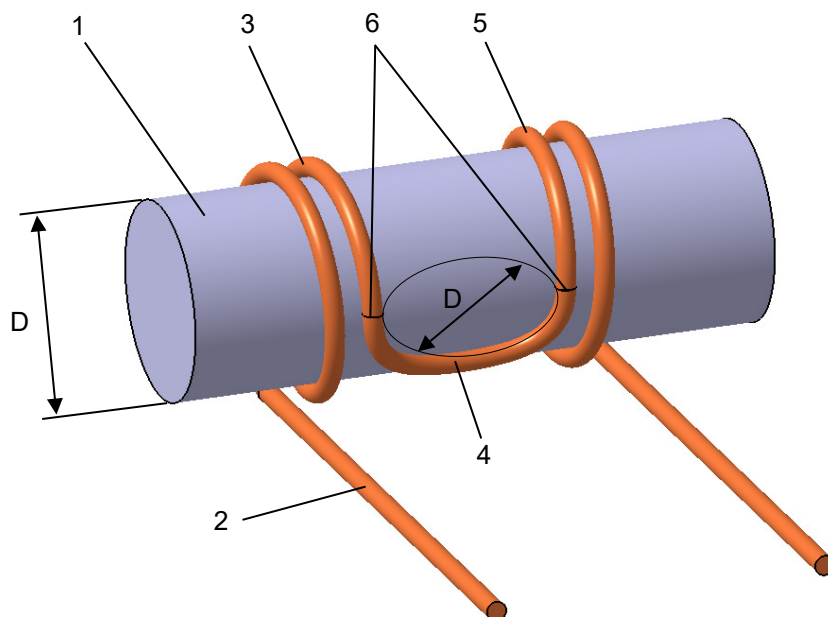
216 **Figure 1 – Bend test set-up for method E11A: single-helix configuration**

217 Torsion should be minimised but cannot be avoided with this configuration. If torsion should be
218 avoided altogether, the two-helix configuration should be used.

219 **5.3 Two-helix configuration**

220 The test set-up with two helixes as shown in Figure 2 may be used.

221
222
223
224
225
226
227
228
229
230
231
232



233
234
235
236
237
238
239
240
241
242
243
244

Key

- 1 mandrel
- 2 sample
- 3 helix with h revolutions on one side of the mandrel
- 4 turnaround loop (180° or 0,5 turns)
- 5 helix with h revolutions on the other side of the mandrel
- 6 transition point between helix and turnaround loop
- D mandrel diameter and same size for turnaround loop diameter

NOTE 1 This Figure illustrates 4 turns of the sample on the mandrel (0,5 turns in the turnaround loop and 1,75 turns in each helix).

NOTE 2 Annex A shows an advanced design of a special mandrel to perform the bend test.

Figure 2 – Bend test set-up for method E11A: two-helix configuration

245 The diameter of the turnaround loop shall be at least the diameter of the mandrel. If the diameter
246 of the turnaround loop is equal to the diameter of the mandrel, the number of revolutions in
247 each helix shall be calculated as given in Formula (1).

$$h = (n - p) / 2 \quad (1)$$

248
249
250
251
252

where

h is the number of revolutions in each helix (without turnaround loop);

n is the specified number of turns;

p is the number of turns in the turnaround loop (0,5 turns).

253 NOTE 1 If, for example, the number of turns (n) is specified with 4 and the number of turns in the turnaround loop
254 with 0,5, the number of revolutions in each helix (h) results in 1,75.

255 NOTE 2 If, for example, the number of turns (n) is specified with 6 and the number of turns in the turnaround loop
256 with 0,5, the number of revolutions in each helix (h) results in 2,75.

257 If the turnaround loop diameter is larger than the mandrel diameter, the turnaround loop shall
258 not be taken into account for the calculation of the number of revolutions in each helix as given
259 in Formula (1). In this case, p shall be entered with the value 0 in Formula (1).