

---

**Optični spojni elementi in pasivne komponente - Vmesniki optičnih konektorjev - 3  
-1. del: Parametri konektorjev za disperzijsko nespremenjena optična vlakna z  
nekotnim fizičnim stikom 2,5 mm in cirkonijevimi cilindričnimi tulkami premera  
1,25 mm**

Fibre optic interconnecting devices and passive components - Connector optical  
interfaces - Part 3-1: Connector parameters of dispersion unshifted single-mode  
physically contacting fibres - non-angled 2,5 mm and 1,25 mm diameter cylindrical full  
zirconia ferrules

[oSIST prEN IEC 61755-3-1:2023](https://standards.iteh.ai/catalog/standards/sist/263b0279-4bc8-4164-a179-44dc79a69d79/osist-pren-iec-61755-3-1-2023)

<https://standards.iteh.ai/catalog/standards/sist/263b0279-4bc8-4164-a179-44dc79a69d79/osist-pren-iec-61755-3-1-2023>

**Ta slovenski standard je istoveten z: prEN IEC 61755-3-1:2023**

---

**ICS:**

33.180.20	Povezovalne naprave za optična vlakna	Fibre optic interconnecting devices
-----------	---------------------------------------	-------------------------------------

**oSIST prEN IEC 61755-3-1:2023 en**





# 86B/4769/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:

**IEC 61755-3-1 ED2**

DATE OF CIRCULATION:

**2023-07-14**

CLOSING DATE FOR VOTING:

**2023-09-08**

SUPERSEDES DOCUMENTS:

**86B/4707/CD, 86B/4732A/CC**

IEC SC 86B : FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS	
SECRETARIAT: Japan	SECRETARY: Mr Shigeru Tomita
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 <b>Attention IEC-CENELEC parallel voting</b> 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

This document is still under study and subject to change. It should not be used for reference purposes.

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.

Recipients of this document are invited to submit, with their comments, notification of any relevant "In Some Countries" clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE:

**Fibre optic interconnecting devices and passive components – Connector optical interfaces – Part 3-1: Connector parameters of dispersion unshifted single-mode physically contacting fibres – non-angled 2,5 mm and 1,25 mm diameter cylindrical full zirconia ferrules**

PROPOSED STABILITY DATE: 2031

NOTE FROM TC/SC OFFICERS:

**Copyright © 2023 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	FOREWORD .....	3
5	1. Scope .....	5
6	2. Normative references .....	5
7	3. Terms and definitions .....	5
8	4. Description .....	6
9	5. Interface parameters .....	6
10	Annex A (informative) Maximum allowed spherical fibre undercut .....	11
11	Annex B (informative) Expected attenuation when mated to reference connector plugs .....	13
12	Annex C (informative) Guidance related to simulation of optical interface attenuation .....	14
13	Annex D (informative) Estimation of average fibre core eccentricity limits as a function	
14	of batch size .....	19
15	Bibliography .....	21
16		
17	Figure 1 – Connector plug endface dimensions .....	7
18	Figure 2 – Geometric requirements for fibre core location after termination .....	7
19	Figure 3 – Ferrule dimensions .....	10
20	Figure A.1 – Allowable undercut as a function of endface radius and apex offset – 4,9	
21	N minimum contact force .....	11
22	Figure A.2 – Allowable undercut as a function of endface radius and apex offset – 2,9	
23	N minimum contact force .....	12
24	Figure C.1 – MFD distribution used in the design curve calculation .....	15
25	Figure C.2 – Resultant fibre core to ferrule eccentricity distribution for Grade B	
26	attenuation .....	16
27	Figure C.3 – Resultant fibre angle distribution for Grade B attenuation .....	16
28	Figure C.4 – Scatterplot of fibre core eccentricities for Grade B attenuation .....	17
29	Figure C.5 – Histogram indicating attenuation distribution of a Grade B optical	
30	interface, Variant 1 to Variant 2 .....	18
31	Figure D.1 – Example histogram showing fibre core eccentricity mean distribution for	
32	Grade B Variant 1 interfaces with a batch size of 25 .....	19
33	Figure D.2 – Illustrative run chart of fibre core eccentricity for different batch sizes	
34	which all conform to the mean and maximum limits .....	20
35		
36	Table 1 – Optical interface parameter values for 2,5 mm diameter ferrule .....	8
37	Table 2 – Optical interface parameter values for 1,25 mm diameter ferrule .....	9
38	Table 3 – Optical interface parameter values for PC ferrules .....	10
39	Table B.1 – Descriptive statistics when performance grades are mated against a	
40	reference interface .....	13
41	Table C.1 – MFD and fibre core nominal index of refraction .....	15
42	Table D.1 – Maximum allowable average fibre core eccentricity limit for different batch	
43	sizes .....	20
44		

45

46

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

47

48

49

**FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS  
– CONNECTOR OPTICAL INTERFACES –**

50

51

52

**Part 3-1: Connector parameters of dispersion unshifted single-mode  
physically contacting fibres - non-angled 2,5 mm and 1,25 mm diameter  
cylindrical full zirconia ferrules**

53

54

55

56

## FOREWORD

57

58

59

60

61

62

63

64

65

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.

66

67

68

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.

69

70

71

72

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.

73

74

75

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.

76

77

78

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.

79

80

81

82

83

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.

84

85

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.

86

87

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.

88

89

International Standard IEC 61755-3-1 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre Optics.

90

91

This second edition cancels and replaces the first edition published in 2006. It constitutes a technical revision. The changes with respect to the previous edition are:

92

a) to incorporate a previous corrigendum;

93

b) to add normative references;

94

95

c) to introduce an additional optical interface with a different fibre core eccentricity profile. The previous revision of optical interface standard is named "Variant 1: with fibre core

- 96 axis oriented towards the connector guide key". The additional optical interface is named  
97 "Variant 2: with fibre core axis not oriented towards the connector guide key";
- 98 d) to provide statements related to interoperability, where both variants remain  
99 intermateable within a given performance grade and backwards-compatible to IEC  
100 61755-3-1:2006;
- 101 e) to add Grade B and Grade C interface requirements for both variants;
- 102 f) to add a descriptive statistic for the mean fibre core eccentricity (mean value) to further  
103 describe the distribution of fibre core eccentricity to ensure interoperability;
- 104 g) the addition of informative Annex B to give guidance on the expected attenuation when  
105 mated to a reference connector plug;
- 106 h) the addition of informative Annex C to give guidance related to the simulation of optical  
107 interface attenuation;
- 108 i) the addition of informative Annex D to give guidance related to estimation of mean fibre  
109 eccentricity limits for finite production batch sizes.

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

CDV	Report on voting
XXX	86B/4732/CC

111

112 Full information on the voting for the approval of this International Standard can be found in the  
113 report on voting indicated in the above table.

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

115 A list of all parts of the IEC 61755 series, published under the general title *Fibre optic*  
116 *interconnecting devices and passive components – Fibre optic connector optical interfaces*, can  
117 be found on the IEC website.

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

- 121 • reconfirmed,
- 122 • withdrawn,
- 123 • replaced by a revised edition, or
- 124 • amended.

125

126 The National Committees are requested to note that for this document the stability date  
127 is XXXX.

128 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED  
129 AT THE PUBLICATION STAGE.

130

131 **FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE**  
132 **COMPONENTS – FIBRE OPTIC CONNECTOR OPTICAL INTERFACES –**

133  
134 **Part 3-1: Connector parameters of dispersion unshifted single-mode**  
135 **physically contacting fibres - non-angled 2,5 mm and 1,25 mm diameter**  
136 **cylindrical full zirconia ferrules**  
137  
138  
139

140 **1. Scope**

141 This part of IEC 61755 defines the dimensional limits of the optical interface that are necessary  
142 for single-mode fibre optic connectors with 2,5 mm or 1,25 mm diameter cylindrical zirconia  
143 (ZrO<sub>2</sub>) ferrules to meet the specific requirements for fibre-to-fibre interconnection as defined in  
144 IEC 61755-2-1.

145 Ferrules made from the material specified in this document are suitable for use in all the  
146 operating service environments defined in IEC 61753-1.

147 Ferrule dimensions and features are contained in the IEC 61754 series of fibre optic connector  
148 interface standards.

149 **2. Normative references**

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

154 IEC 61300-3-47, *Fibre optic interconnecting devices and passive components - Basic test and*  
155 *measurement procedures – Part 3-47: Examinations and measurements – End face geometry*  
156 *of PC/APC spherically polished ferrules using interferometry*

157 IEC 61755-1, *Fibre optic interconnecting devices and passive components – Fibre optic*  
158 *connector optical interfaces – Part 1: Optical interfaces for single-mode non-dispersion shifted*  
159 *fibres – General and guidance*

160 IEC 61755-2-1, *Fibre optic interconnecting devices and passive components – Fibre optic*  
161 *connector optical interfaces – Part 2-1: Connection of dispersion unshifted single mode non-*  
162 *angled physically contacting fibres*

163 IEC 61755-2-4, *Fibre optic interconnecting devices and passive components – Fibre optic*  
164 *connector optical interfaces – Part 2-4: Connection of non-dispersion shifted single-mode non-*  
165 *angled polished physically contacting fibres for reference connector applications*

166 **3. Terms and definitions**

167 For the purposes of this document, the terms and definitions given in IEC 61755-1 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/>  
171 • ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 172 4. Description

173 The performance of a physical contact (PC) cylindrical ferrule optical interface is determined by  
174 the alignment of the optical datum targets of two mating ferrules. There are three conditions  
175 affecting the alignment of two optical datum targets: lateral offset, angular offset and  
176 longitudinal offset.

177 Parameters influencing the lateral and angular offset of the optical fibre axes include the  
178 following:

- 179 – ferrule outside diameter;
- 180 – ferrule bore concentricity relative to the ferrule outside diameter;
- 181 – ferrule bore angle relative to ferrule outside diameter axis;
- 182 – fibre cladding diameter relative to ferrule bore diameter;
- 183 – fibre core concentricity relative to the fibre cladding diameter;
- 184 – fibre core orientation relative to connector guide key;
- 185 – alignment sleeve inside diameter.

186 Parameters influencing the connector plug endface deformation requirements needed to  
187 maintain the physical contact of the ferrules within a mated connection are as follows:

- 188 – endface spherical radius;
- 189 – endface spherical radius apex offset;
- 190 – fibre undercut;
- 191 – axial force on ferrule endface;
- 192 – ferrule and fibre material physical constants;
- 193 – alignment sleeve frictional force.

#### 194 5. Interface parameters

195 The endface dimensions of terminated connector plugs provided in Figure 1 and Figure 2 show  
196 the geometrical position of the fibre core for two alternative variants. These core location  
197 variants ensure full intermateability between Variant 1 and Variant 2 as defined in IEC 61755-  
198 1. In addition, both variants produced per this document are fully backwards compatible with  
199 Grade B in IEC 61755-3-1:2006.

200 The ferrule dimensions are defined in Figure 3. The parameter requirements are detailed in  
201 Tables 1, 2 and 3.



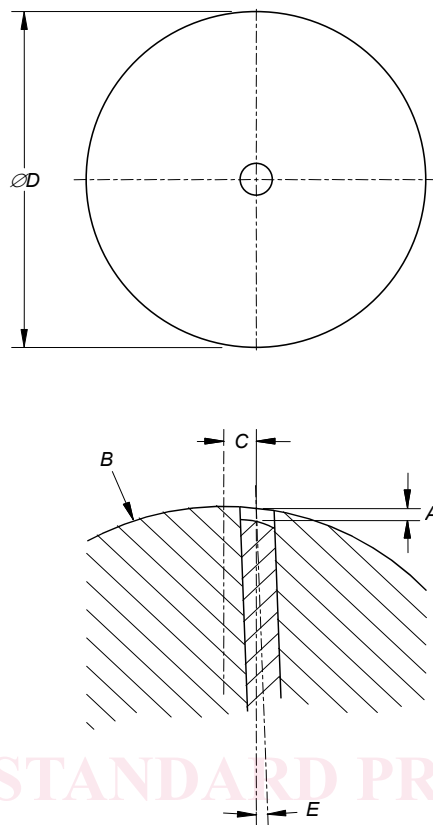
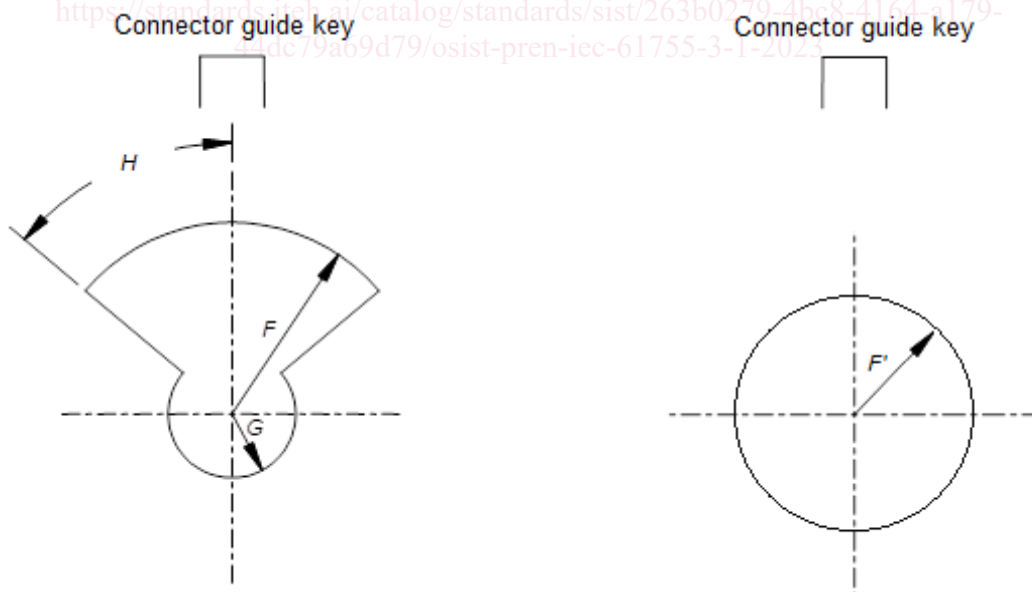


Figure 1 – Connector plug endface dimensions



a) Variant 1

b) Variant 2

NOTE  $F$ ,  $F'$ ,  $G$  and  $H$  define the radial and angular coordinate limits of the optical fibre core axis relative to the optical datum target of the ferrule.

Figure 2 – Geometric requirements for fibre core location after termination

210

**Table 1 – Optical interface parameter values for 2,5 mm diameter ferrule**

Ref.	Parameter values								Units	Remarks
	Grade A		Grade B		Grade C		Grade D			
	Min	Max	Min	Max	Min	Max	Min	Max		
A <sup>b</sup>			-100	a	-100	a	-100	a	nm	Fibre undercut or protrusion
B			5	30	5	30	5	30	mm	Spherical radius
C			0	50	0	50	0	50	µm	Apex offset
D			2,498 5	2,499 5	2,498 5	2,499 5	2,498 5	2,499 5	mm	Ferrule outside diameter
E			0	0,2	0	0,3	0	0,6	°	Angle of fibre axis
F			0	1,2 <sup>c</sup>	0	1,5 <sup>d</sup>	Not Applicable		µm	Radius, See Figure 2 a)
F'			0	0,7 <sup>e</sup>	0	1,2 <sup>f</sup>	0	1,6 <sup>g</sup>	µm	Radius, See Figure 2 b)
G			0	0,3	0	0,3	Not Applicable		µm	Radius, See Figure 2 a)
H			0	50	0	50	Not Applicable		°	See Figure 2 a)

NOTE 1 The core location (*F*, *F'*, *G*, *H*) and tilt angle (*E*) values specified in this document have been calculated to ensure that the attenuation values specified in IEC 61755-2-1 are met under all circumstances (See Annex C). Guidance on expected attenuation values when mated to a reference connector plug can be found in Annex B.

NOTE 2 Core eccentricity Variant 1 [Figure 2 a)] and Variant 2 [Figure 2 b)] are intended to be fully intermateable for a given performance grade as defined in IEC 61755-1.

NOTE 3 Grade A is reserved for future application.

NOTE 4 Attenuation performance grades are defined in IEC 61755-1.

NOTE 5 See Annex D for information on estimation of average fibre core eccentricity limits as a function of batch size.

NOTE 6 Refer to IEC 61300-3-47 for end face geometry measurement of PC spherically polished ferrules using interferometry.

NOTE 7 To account for uncertainty in fibre core eccentricity measurements, the limits and mean values are to be rounded to one significant digit.

<sup>a</sup> Contact force 4,9 N nominal. Ferrule material: 3 mol % yttria stabilized zirconia, ZrO<sub>2</sub>. Nominal material physical constant values: Young's Modulus, 200 GPa ± 20 GPa, Poisson's Ratio, 0,30 to 0,31. See Annex A for details.

$$A_{\text{maximum}} = 1\,988 \cdot B^{(-0,795)} - B \cdot 10^6 + \left( \sqrt{B^2 \cdot 10^6 - C^2} \right) \cdot 10^3 - 60$$

<sup>b</sup> A as a negative value indicates fibre protrusion.

<sup>c</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,4 µm. See Note 5.

<sup>d</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,6 µm. See Note 5.

<sup>e</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,3 µm. See Note 5.

<sup>f</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,5 µm. See Note 5.

<sup>g</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,6 µm. See Note 5.

211

212

213

**Table 2 – Optical interface parameter values for 1,25 mm diameter ferrule**

Ref.	Parameter values								Units	Remarks
	Grade A		Grade B		Grade C		Grade D			
	Min	Max	Min	Max	Min	Max	Min	Max		
A <sup>b</sup>			–100	a	–100	a	–100	a	nm	Fibre undercut or protrusion
B			5	30	5	30	5	30	mm	Spherical radius
C			0	50	0	50	0	50	µm	Apex offset
D			1,248 5	1,249 5	1,248 5	1,249 5	1,248 5	1,249 5	mm	Outside diameter
E			0	0,2	0	0,3	0	0,6	°	Angle of fibre axis
F			0	1,2 <sup>c</sup>	0	1,5 <sup>d</sup>	Not Applicable		µm	Radius, See Figure 2 a)
F'			0	0,7 <sup>e</sup>	0	1,2 <sup>f</sup>	0	1,6 <sup>g</sup>	µm	Radius, See Figure 2 b)
G			0	0,3	0	0,3	Not Applicable		µm	Radius, See Figure 2 a)
H			0	50	0	50	Not Applicable		°	See Figure 2 a)

NOTE 1 The core location (*F*, *F'*, *G*, *H*) and tilt angle (*E*) values specified in this document have been calculated to ensure that the attenuation values specified in IEC 61755-2-1 are met under all circumstances (See Annex C). Guidance on expected attenuation values when mated to a reference connector plug can be found in Annex B.

NOTE 2 Core eccentricity Variant 1 [Figure 2 a)] and Variant 2 [Figure 2 b)] are intended to be fully intermateable for a given performance grade as defined in IEC 61755-1.

NOTE 3 Grade A is reserved for future application.

NOTE 4 Attenuation performance grades are defined in IEC 61755-1.

NOTE 5 See Annex D for information on estimation of average fibre core eccentricity limits as a function of batch size.

NOTE 6 Refer to IEC 61300-3-47 for end face geometry measurement of PC spherically polished ferrules using interferometry.

NOTE 7 To account for uncertainty in fibre core eccentricity measurements, the limits and mean values are to be rounded to one significant digit.

<sup>a</sup> Contact force 2,9 N nominal. Ferrule material: 3 mol % yttria stabilized zirconia, ZrO<sub>2</sub>. Nominal material physical constant values: Young's Modulus, 200 GPa ± 20 GPa, Poisson's Ratio, 0,30 to 0,31. See Annex A for details.

$$A_{\text{maximum}} = 1\,798 \cdot B^{(-0,795)} - B \cdot 10^6 + \left( \sqrt{B^2 \cdot 10^6 - C^2} \right) \cdot 10^3 - 60$$

<sup>b</sup> A as a negative value indicates fibre protrusion.

<sup>c</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,4 µm. See Note 5.

<sup>d</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,6 µm. See Note 5.

<sup>e</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,3 µm. See Note 5.

<sup>f</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,5 µm. See Note 5.

<sup>g</sup> Fibre core eccentricity distribution shall have a mean less than or equal to 0,6 µm. See Note 5.