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oSIST prEN IEC 61755-2-1:2022
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Optični spojni elementi in pasivne komponente - Vmesniki optičnih konektorjev za enorodovna vlakna - 2-1. del: Parametri konektorjev za disperzijsko premaknjena, nepoševno fizično staknjena optična vlakna

Fibre optic interconnecting devices and passive components - Connector optical interfaces for single-mode fibres - Part 2-1: Connection parameters of non-dispersion unshifted physically contacting fibres - non-angled

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86B/4537/CDV

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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.
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TITLE:

Fibre optic interconnecting devices and passive components - Connector optical interfaces for single-mode fibres - Part 2-1: Connection parameters of non-dispersion unshifted physically contacting fibres - non-angled

PROPOSED STABILITY DATE: 2032

NOTE FROM TC/SC OFFICERS:

CONTENTS

1		
2		
3	FOREWORD.....	3
4	1 Scope.....	5
5	2 Normative references	5
6	3 Terms and definitions	6
7	4 Attenuation and return loss grades	6
8	5 Criteria for a fit within attenuation and return loss grades	7
9	5.1 General.....	7
10	5.2 Attenuation grades and criteria	7
11	5.3 Visual requirements for return loss grades	8
12	Annex A (informative) Effect of damaged surface layer on non-angled connections	10
13	Bibliography.....	12
14		
15	Figure 1 – Lateral offset and angular offset versus attenuation, η_{combined} , for single-	
16	mode fibre with 8,9 μm MFD at 1 310 nm.....	8
17	Figure A.1 – Model of the connection of convex polished end faces under compressive	
18	load 10	
19	Figure A.2 – High index layer refractive index and thickness versus return loss for a	
20	typical dispersion unshifted single-mode fibre.....	11
21		
22	Table 1 – Single-mode random mate attenuation grades.....	6
23	Table 2 – Single-mode return loss grades	6
24	Table 3 – MFD and fibre core nominal index of refraction	7
25	Table 4 – Visual requirements for single-mode PC polished fibres with RL grade 2.....	8
26	Table 5 – Visual requirements for single-mode PC polished fibres with RL grade 3.....	9
27	Table 6 – Visual requirements for single-mode PC polished fibres with RL grade 4.....	9
28		
29		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –
CONNECTOR OPTICAL INTERFACES FOR SINGLE-MODE FIBRES –**

**Part 2-1: Connection parameters of dispersion unshifted physically
contacting fibres – non-angled**

FOREWORD

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International Standard IEC 61755-2-1 has been prepared by subcommittee 86B. Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

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,

- add normative references and visual requirement tables
- reconsider the whole parts of the text to avoid misuse of the standard

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

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

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

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

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

- 85 • reconfirmed,
- 86 • withdrawn,
- 87 • replaced by a revised edition, or
- 88 • amended.

89

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91 **FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –**
92 **CONNECTOR OPTICAL INTERFACES FOR SINGLE-MODE FIBRES –**
93

94 **Part 2-1: Connection parameters of dispersion unshifted physically contacting**
95 **fibres – non-angled**

96
97

98 **1 Scope**

99 This part of IEC 61755 defines a set of prescribed conditions for a single-mode fibre optic
100 connection that is maintained in order to satisfy the requirements of attenuation and return loss
101 (RL) performance in a randomly mated pair of non-angled polished physically contacting (PC)
102 fibres. The model uses a Gaussian distribution of light intensity over the specified mode field
103 diameter (MFD) for determination of attenuation performance grades, based on MFD mismatch
104 and the amount of lateral and angular fibre core offsets. Attenuation and RL performance grades
105 are defined in IEC 61755-1.

106 **2 Normative references**

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

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

113 IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and*
114 *measurement procedures – Part 3-6: Examinations and measurements – Return loss*

115 IEC 61300-3-34, *Fibre optic interconnecting devices and passive components – Basic test and*
116 *measurement procedures – Part 3-34: Examinations and measurements – Attenuation of*
117 *random mated connectors*

118 IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and*
119 *measurement procedures – Part 3-35: Examinations and measurements – Visual inspection of*
120 *fibre optic connectors and fibre-stub transceivers*

121 IEC 61300-3-45, *Fibre optic interconnecting devices and passive components – Basic test and*
122 *measurement procedures – Part 3-45: Examinations and measurements – Attenuation of*
123 *random mated multi-fibre connectors*

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

127 IEC 61755-2-2, *Fibre optic interconnecting devices and passive components – Connector*
128 *optical interfaces – Part 2-2: Connection of dispersion unshifted single-mode angled physically*
129 *contacting (APC) fibres*

130 3 Terms and definitions

131 For the purposes of this document, the terms and definitions given in IEC 61755-1 and the
132 following apply.

133 ISO and IEC maintain terminological databases for use in standardization at the following
134 addresses:

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

137 3.1

138 Defect size

139 diameter of the smallest circle that can encompass the entire defect

140 4 Attenuation and return loss grades

141 As defined in IEC 61755-1, attenuation and return loss grades for PC polished connections are
142 given in Tables 1 and 2. The return loss grades are for non-angled contacting fibres only. The
143 grade for angled PC (APC) connections is given separately in IEC 61755-2-2.

144 **Table 1 – Single-mode random mate attenuation grades**

Attenuation grade	Mean [dB]	Attenuation [dB] ^a ≥ 97 % ^b	Notes
A			Reserved for future application
B	≤ 0,12	≤ 0,25	
C	≤ 0,25	≤ 0,50	
D	≤ 0,50	≤ 1,0	
<p>^a Attenuation shall be measured by IEC 61300-3-34 for single-fibre connectors and IEC 61300-3-45 for multi-fibre connectors.</p> <p>^b The probability of a randomly mated connection set meeting the specified attenuation requirement will be ≥ 97 %. This performance is reached by means of a statistical distribution of connection parameters (MFD mismatch, lateral offset and angular offset) using a nominal value for wavelength of 1 310 nm.</p>			

145

146 **Table 2 – Single-mode return loss grades**

Return loss grade	Return loss (mated) ^a [dB]	Notes
1	-	Grade 1 is defined as ≥ 60 dB and reserved for use with angled, physically contacting fibres as defined in IEC 61755-2-2.
2	≥ 45	
3	≥ 35	
4	≥ 26	
<p>^a The test shall be carried out according to IEC 61300-3-6.</p>		

147

148 Single-mode attenuation and return loss grades are applicable for the wavelengths from 1 310
149 nm to 1 625 nm.

150 5 Criteria for a fit within attenuation and return loss grades

151 5.1 General

152 The following figures and tables give the criteria for meeting the attenuation and return loss
 153 grades listed in Table 1 and Table 2. The parameters chosen for the criteria definition are based
 154 on the degree of significance by which they affect the performance under test. The criteria
 155 selected are based on the theoretical model in 5.2 and 5.3 as well as experimental results.

156 5.2 Attenuation grades and criteria

157 Using a Gaussian distribution for the incident light, the attenuation of the joint between two
 158 dispersion unshifted single-mode optical fibres defined by IEC 60793-2-50 category B is given
 159 by Formula (1). Attenuation is also referred to as insertion loss, or coupling efficiency of the
 160 fibres.

161 The range of the nominal MFD and index of refraction (n_0) of the fibre cores are given in Table
 162 3.

163 **Table 3 – MFD and fibre core nominal index of refraction**

Fibre Sub-Category	Nominal wavelength [nm]	Nominal MFD [μm]	n_0 (core)
IEC 60793-2-50 fibres	1 310	8,6 to 9,2	1,452 0

164
 165 These attenuation grades are based on a statistical approach defining parameter values of
 166 connection populations to be less than or equal to the given value in 97 % of the connections.
 167 This performance is assumed at the nominal wavelength with fibre MFD in the range defined in
 168 IEC 60793-2-50 family specification for single-mode dispersion unshifted fibres category B.

169 Populations of lateral and angular offset of the randomly mated connections are assumed to be
 170 statistically distributed within the specific ranges of parameter values d and θ in Formula (1).

171 Each curve given in Figure 1 represents maximum allowable combinations of lateral offset and
 172 angular offset so as not to exceed the specified attenuation of any single connection, without
 173 the contribution from fibre MFD mismatch. Additional attenuation due to mismatch of the MFD
 174 from the randomly selected fibres is included in Formula (1).

175 Formula (1) is applicable to wavelengths from the range between 1 310 nm and 1 625 nm, using
 176 the parameters for these wavelengths. The curves in Figure 1 are only shown at 1 310 nm
 177 wavelength.

178

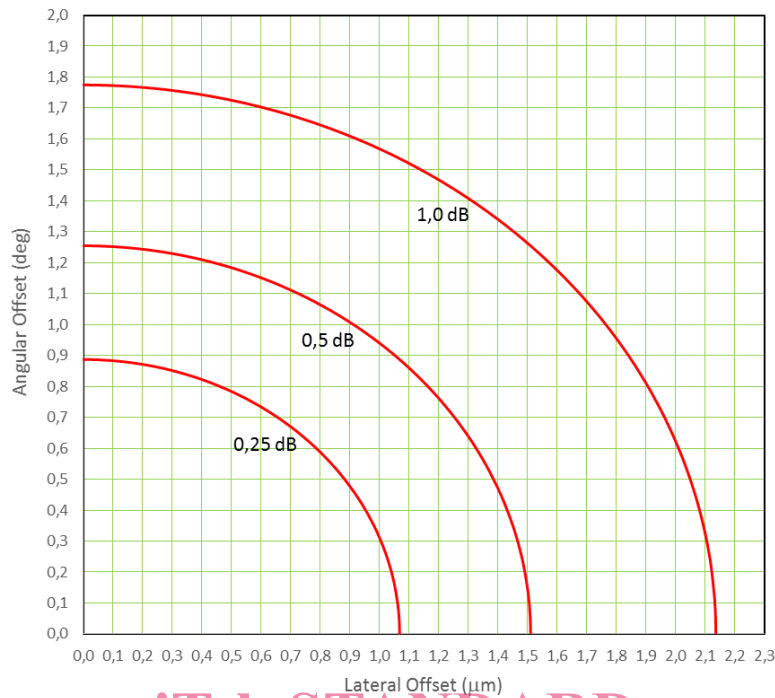


Figure 1 – Lateral offset and angular offset versus attenuation, $\eta_{combined}$, for single-mode fibre with 8,9 µm MFD at 1 310 nm

Attenuation $\eta_{combined}$ is expressed in Formula (1) below:

$$\eta_{combined} = -10 \log_{10} \left[\frac{(2\omega_2\omega_1)^2}{(\omega_2^2 + \omega_1^2)^2} \exp \left[\frac{-2 \cdot d^2}{\omega_2^2 + \omega_1^2} \cdot 2\pi^2 \frac{n_0^2}{\lambda^2} \frac{(\omega_2^2 \omega_1^2)}{(\omega_2^2 + \omega_1^2)} \sin^2(\theta) \right] \right] \quad (1)$$

where

- d is the total lateral offset between two fibres;
- θ is the angular offset between fibre core axes;
- λ is the wavelength of transmitted light in vacuum;
- n_0 is the index of refraction of the fibre core;
- ω_1 is the transmit fibre mode field radius;
- ω_2 is the receive fibre mode field radius.

5.3 Visual requirements for return loss grades

Without considering any contamination or defect on the end face, the intrinsic return loss for physical contacting fibres is governed by the refractive index of the fibre core (see Annex A). The appropriate polishing method shall be applied to obtain the return loss grades in Table 2. The quality of the end face shall be inspected using IEC 61300-3-35. The visual requirements for single-mode PC polished end faces in fibre core zone (Zone A), and fibre cladding zone (Zone B) are shown in Tables 4, 5 and 6.

Table 4 – Visual requirements for single-mode PC polished fibres with RL grade 2 SM (RL ≥ 45dB)

Zone (Diameter)	Defects (diameter)	Scratches (width)