SLOVENSKI STANDARD
oSIST prEN IEC 63267-2-1:2023

01-april-2023

Optični spojni elementi in pasivne komponente - Vmesniki optičnih konektorjev za izboljšana mnogorodovna optična vlakna zaradi upogibanja - 2-1. del: Parametri konektorjev s fizičnim stikom za vlakna s premerom jedra 50 µm - Nepoševno

Fibre optic interconnecting devices and passive components - Connector optical interfaces for enhanced macro bend multimode fibres - Part 2-1: Connection parameters of physically contacting 50 µm core diameter fibres - non-angled

Ta slovenski standard je istoveten z: **prEN IEC 63267-2-1:2023**

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86B/4710/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 63267-2-1 ED1**	
DATE OF CIRCULATION: **2023-02-03**	CLOSING DATE FOR VOTING: **2023-04-28**
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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: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
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TITLE:

Fibre optic interconnecting devices and passive components – Connector optical interfaces for enhanced macro bend multimode fibres – Part 2-1: Connection parameters of physically contacting 50 µm core diameter fibres– non-angled

PROPOSED STABILITY DATE: 2032

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTOR OPTICAL INTERFACES FOR ENHANCED MACRO BEND MULTIMODE FIBRES –

Part 2-1: Connection parameters of physically contacting 50 µm core diameter fibres– non-angled

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International Standard IEC 63267-2-1 has been prepared by sub-committee 86B. Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

The text of this standard is based on the following documents:

FDIS	Report on voting
86B/XX/FDIS	86B/XX/RVD

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

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

A list of all parts of the IEC 63267 series, under the general title *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

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.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTOR OPTICAL INTERFACES FOR ENHANCED MACRO BEND MULTIMODE FIBRES –

Part 2-1: Connection parameters of physically contacting 50 µm core diameter fibres– non-angled

1 Scope

This part of IEC 63267 defines a set of prescribed conditions for an enhanced macro bend 50/125 µm, graded index multimode fibre optic connection that is maintained in order to satisfy the requirements of attenuation and return loss performance in a randomly mated pair of polished physically contacting (PC) fibres. An encircled flux (EF) compliant launch condition in accordance with IEC 61300-1, at an operational wavelength of 850 nm, is used for determination of performance grades, based on lateral fibre core offset, numerical aperture (NA) mismatch, and fibre core diameter (CD) variation. Attenuation and return loss performance grades are defined in IEC 63267-1[1].

2 Normative references

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.

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

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

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

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

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

IEC 63267-1, *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces – Part 1: Enhanced macro bend loss multimode 50 µm core diameter fibres – General and guidance*[1]

IEC 63267-2-2, *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces for enhanced macro bend multimode fibres – Part 2-2: Connection parameters of physically contacting 50 µm core diameter fibres – Non-angled for reference connection applications*[1]

[1] To be published.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 63267-1 apply.

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

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

4 Attenuation and return loss grades

Proposed attenuation and return loss grades for PC polished connections are given in Tables 1 and 2.

Table 1 – Multimode random mate attenuation grades at 850 nm

Attenuation grade	Attenuation Mean dB	Attenuation[a] ≥ 97 %[b] dB	Notes
Am			Reserved for future application
Bm	≤ 0,30	≤ 0,60	
Cm	≤ 0,50	≤ 1,00	
Dm			Not specified at this time

[a] Attenuation shall be measured by IEC 61300-3-34 for single-fibre connectors and IEC 61300-3-45 for multi-fibre connectors.

[b] The probability of a random mated connection set to meet the specified attenuation requirement will be ≥ 97 %. This performance is reached considering a statistical distribution of the connection's parameters (optical fibre core diameter, numerical aperture, and lateral offset) and using an encircled flux (EF) compliant launch at the source operating at a nominal value for wavelength of 850 nm.

Table 2 – Multimode return loss grades at 850 nm

Return loss grade	Return loss (mated) [a] dB	Notes
1		Grade 1 is defined as ≥ 45 dB (mated) and reserved for use with angled, physically contacting fibres
2	≥ 20	

[a] The test shall be carried out according to IEC 61300-3-6.

5 Criteria for a fit within attenuation and return loss grades

5.1 General

The criteria for meeting the attenuation and return loss grades listed in Tables 1 and 2 are given in Figures 1 to 3 and Tables 3 and 4. The parameters chosen for the criteria definition are based on the degree of significance in affecting the performance under test. The criteria selected are based on the theoretical model in 5.2, as well as experimental results.

Many of the key technical aspects related to simulation and measurement of attenuation was formulated in a Multimode Launch Coordinating Group (MMLCG) reporting to IEC TC86, which included representatives in subcommittees 86A, 86B, and 86C as well as ISO/IEC JTC1 SC25. IEC TR 62614-2, which is a Technical Report, provides further background on EF in conjunction with attenuation and return loss of graded index multimode fibre products.

5.2 Attenuation grades and criteria

When launched into multimode optical fibre, light emitting diode (LED) and laser sources may exhibit varying modal power distributions. These differing modal power distributions, combined with the differential mode attenuation (DMA) inherent in most multimode components, commonly cause variations when measuring attenuation. EF is used to provide quantitative requirements based on near-field intensity, measured in accordance with IEC 61300-1 so that the maximum expected variation in attenuation is known. An EF flux template is constructed from a set of three EF curves, defined at critical values of radius, using the lower and upper limits to establish an envelope, and a target condition. Requirements are tabulated for a particular combination of optical fibre size and wavelength in IEC 61300-1.

The theory leading to the EF limits is based on assumptions that include optical fibre core refractive index dimension and shape, spectral width, and Hermite-Gauss or Laguerre–Gauss models for mode fields. A mode group power coupling matrix associated with lateral offset of a connection can be generated by overlap integrals of the different mode fields, having the input fields displaced relative to the receiving fibre mode fields. This allows the attenuation of a connection to be computed for a given encircled flux launch condition based on lateral misalignment, optical fibre core diameter, and numerical aperture, which are the most significant parameters influencing performance under test. Lookup tables of attenuation for various launch conditions have been retained and stored on the IEC collaboration platform for reference and further development of Part 3 Optical Interface documents.

Characterization of the requisite EF launch condition is described at the end of an equipment launch cord, generally with reference grade fibre and interface geometry. When a random cord is concatenated to the launch cord, the first interface is referred to as connection zero (C0). This connection tends to alter the launch condition through mode coupling and differential mode attenuation. However, the second connection, defined as connection one (C1), is used for estimation of a given attenuation performance grade. Therefore, the estimated loss at C1 is dependent on the connection at C0 with respect to how much the power intensity distribution is modified and must be considered in the determination of a performance grade. A schematic of the test setup illustrates the connections in Figure 1.

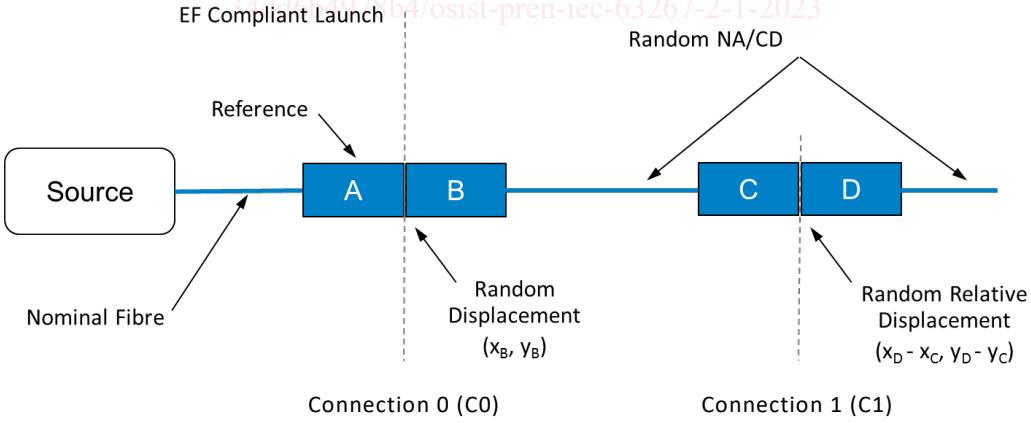

Figure 1 – Schematic illustration showing connection zero and connection one

The attenuation grades are based on a statistical approach defining parameter values of connection populations to reach the given random attenuation (or below) in 97% of the connections. This performance assumes a nominal wavelength of 850 nm with multimode optical fibre defined in IEC 60793-2-10 category A1-OMx (x = 2, 3, 4, or 5) as highlighted by the properties listed in Table 3.

Table 3 – Multimode optical fibre properties

Fibre type	Nominal wavelength nm	Fibre Core Diameter µm		Numerical Aperture		Effective group index of refraction
		Minimum	Maximum	Minimum	Maximum	
IEC 60793-2-10 category A1-OMx (x = 2, 3, 4, or 5) fibres	850	47,5	52,5	0,185	0,215	1,483 5

Populations of lateral fibre core offset, NA mismatch, and CD of the randomly mated connections are assumed to be statistically distributed for the purpose of simulation. Assuming an optimally centred reference fibre at connection zero, it should be noted that offset distribution at connection, C1, is $\sqrt{2}$ times broader than connection, C0.

The attenuation at C1 is estimated using the lookup table result for a given combination of parameters. The underlying statistical assumptions for these inputs are used to generate the expected loss distribution. A graphical representation, which provides parameter limits and probability density functions for the theoretical analysis is shown in Figure 2.

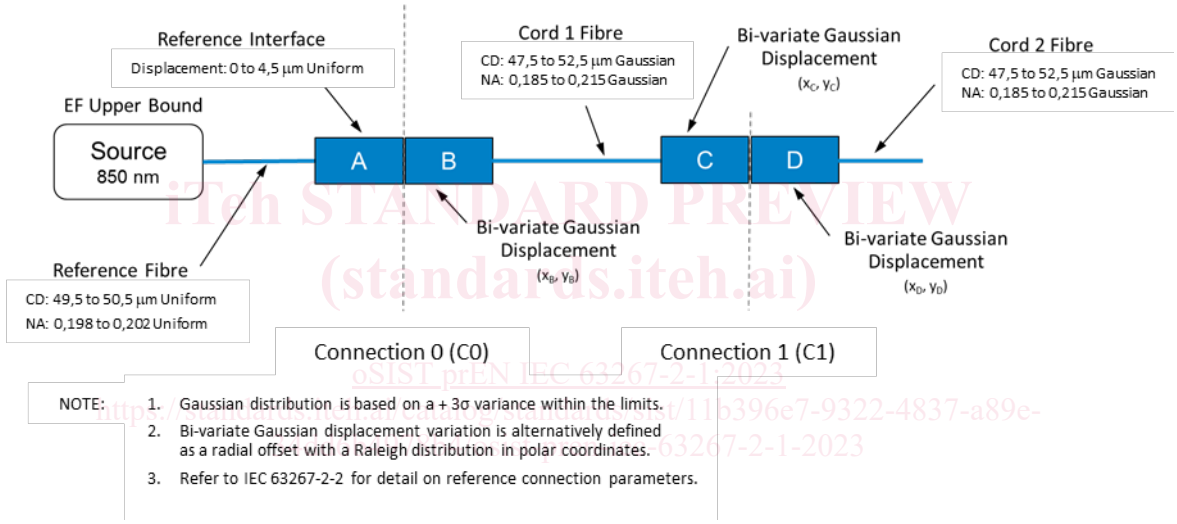

Figure 2 – Graphical representation showing parameter limits and distribution information for the purpose of attenuation modelling

Simulation of the parameters yields characteristic curves for the mean and ≥ 97 % attenuation levels as a function of lateral offset limit for the mating interfaces, as shown in Figure 3. The offset limit is defined by a Raleigh probability distribution, where the tail is truncated at a value of 99.97 %. From the plot, the maximum allowable misalignment between mating fibre cores can be determined for performance Grades Bm and Cm, which are approximately 3 µm and 6 µm, respectively, as illustrated. Alternatively, response surfaces that give the maximum allowable combination of lateral offset, core diameter, and numerical aperture to not exceed attenuations of 0,6 dB and 1,0 dB are shown in Annex A. These provide a qualitative representation of the influence that each factor has on a given performance level.