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

Dispositifs d'interconnexion et composants passifs fibroniques – Interfaces optiques de connecteurs pour fibre multimodale à performances améliorées par macrocourbures – Partie 2-2: Paramètres de connexion de fibres de diamètre de cœur de 50 µm en contact physique – Fibres inclinées et non inclinées pour les applications de connecteurs de référence



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INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONALE

ICS 33.180.20

ISBN 978-2-8322-8416-2

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CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	5
4 Performance grades	6
5 Description	6
6 Criteria for a fit within the performance grade	7
7 Attenuation measurement uncertainty contribution.....	7
8 Visual inspection	7
Annex A (informative) Multimode attenuation measurement uncertainty contribution.....	9
A.1 General.....	9
A.2 Sources of variability.....	9
A.2.1 Measurement condition and setup	9
A.2.2 Geometry mismatch.....	9
A.3 Overall uncertainty.....	10
Annex B (informative) Test limits for performance grade R_m connectors against grade R_m reference connectors	12
B.1 General.....	12
B.2 Test limits	12
Bibliography.....	13
Figure 1 – Geometrical requirements for fibre core location after termination	7
Figure A.1 – Attenuation measurement uncertainty contribution for Grade R_{m1} reference connections resulting from lateral offset, NA and CD mismatch	9
Table 1 – Attenuation grades for multimode reference connections at 850 nm	6
Table 2 – Lateral offset values for grade R_m reference connections	7
Table 3 – Visual requirements for multimode PC and APC polished connection	8
Table A.1 – Evaluation of the uncertainty contribution due measurement conditions	11
Table B.1 – Performance grade test limits at 850 nm	12

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTOR OPTICAL INTERFACES FOR ENHANCED MACRO BEND MULTIMODE FIBRES –**Part 2-2: Connection parameters of physically contacting 50 µm core diameter fibres – Non-angled and angled for reference connector applications**

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

Draft	Report on voting
86B/4857/FDIS	86B/4878/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/publications.

A list of all parts in the IEC 63267 series, published under the general title *Fibre optic interconnecting devices and passive components – Connector optical interfaces for enhanced macro bend multimode fibre*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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

Part 2-2: Connection parameters of physically contacting 50 µm core diameter fibres – Non-angled and angled for reference connector applications

1 Scope

This part of IEC 63267 defines the dimensional limits of an optical interface for reference connections necessary to meet specific requirements for fibre-to-fibre interconnection of non-angled and angled polished multimode reference connectors intended to be used for attenuation measurements in the field or factory.

Several grades of reference connections are defined in this document. The multimode reference connections are terminated to restricted IEC 60793-2-10 A1-OM2b to A1-OM5b fibre at the 850 nm band only. The geometrical dimensions and tolerances of the specified reference connections have been developed primarily to limit the variation in measured attenuation between multiple sets of two reference connectors, and therefore to limit the variation in measured attenuation between randomly chosen reference connectors when mated with connectors in the field or factory.

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 61300-3-35, *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*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 Performance grades

This document currently specifies several performance grades.

The performance grade for physical contact non-angled (PC) and angled (APC) polished fibre-to-fibre reference connections detailed in this document is shown in Table 1.

The attenuation is measured in accordance with IEC 61300-3-4 (insertion method B).

The attenuation test limit of reference grade connectors mated with standard grade B_m connectors is provided in Annex B.

Table 1 – Attenuation grades for multimode reference connections at 850 nm

Reference grade	Attenuation [dB]
R _{m1}	≤ 0,1
R _{m12}	≤ 0,15
R _{m16}	≤ 0,15
R _{m16A}	≤ 0,15
R _{m24}	≤ 0,15
R _{m32}	≤ 0,15
<p>NOTE 1 Grade R_{m1} reference connection applies to 1,25 mm and 2,5 mm single fibre cylindrical ferrules while all other reference grades apply to multifibre rectangular ferrules.</p> <p>NOTE 2 The number in the designation of the reference grade indicates the number of fibres in the reference connector. The letter "A" indicates an angled physical contact interface.</p> <p>NOTE 3 As described in Annex A, the contribution to measurement uncertainty in attenuation measurement between any connector according to the IEC optical interface standards in the 63267 series and a population of IEC reference connectors is for all performance grades ± 0,071 dB.</p>	

5 Description

Optical reference connections are connections manufactured with restricted tolerances on dimensions that contribute to lateral and angular offset of mating fibre cores. These connections are mainly used for attenuation measurement purposes in field and factory and shall be considered as part of the measurement setup. The goal is to strongly reduce the measurement uncertainty. The attenuation uncertainties due to the reference connections are defined in this document and are discussed in Annex A.

The performance of a multimode optical interface is not only determined by the alignment accuracy of the optical datum targets of two mating fibres, but largely by any fibre parameter mismatches. Parameters influencing the fibre-to-fibre intrinsic attenuation include:

- core diameter (CD) mismatch,
- numerical aperture (NA) mismatch.

6 Criteria for a fit within the performance grade

Figure 1 and Table 2 give the criteria for meeting the performance grades as listed in Table 1. The parameters that are selected for the criteria definition are based on their degree of significance in affecting the performance.

All R_m multimode reference connections shall be terminated on selected multimode (MM) A1-OM2b to A1-OM5b fibre, as specified in IEC 60793-2-10, with a core diameter of $50 \mu\text{m} \pm 0,5 \mu\text{m}$ and a numerical aperture of $0,200 \pm 0,002$. The selection is required to restrict the variability of attenuation measurements using reference connectors.

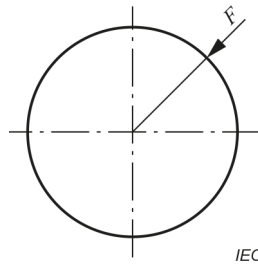


Figure 1 – Geometrical requirements for fibre core location after termination

Table 2 – Lateral offset values for grade R_m reference connections

Reference grade	F [μm] ^a	
	Minimum	Maximum
R_{m1}	0	1,0
R_{m12}		
R_{m16}		
R_{m16A}		
R_{m24}		
R_{m32}		
<p>^a Parameter F defines the core location of a reference connector in relation to the optical datum target (Figure 1). In addition, parameter F describes also the maximum lateral offset between the fibre cores of two mated reference connectors.</p> <p>NOTE Lateral offset of R_m grades for rectangle ferrules consists of both the fibre true position on the ferrule and the relative ferrule position from guide pin and bore fitting.</p>		

7 Attenuation measurement uncertainty contribution

Using the specified fibre geometry and the dimensional tolerances mentioned in Clause 6, it is possible to achieve measurements using the specified reference connections that have an uncertainty of $\pm 0,071$ dB, with random varied reference connections and with the target EF launch as specified in IEC 61300-1 satisfied (see Annex A).

8 Visual inspection

The fibre end faces of all reference grade variants shall be inspected to IEC 61300-3-35 and shall meet the requirements as detailed in Table 3. The zone size for multimode fibres has been set at $65 \mu\text{m}$. This has been done to simplify the grading process.

Table 3 – Visual requirements for multimode PC and APC polished connection

Zone (diameter)	Defects (diameter)	Scratches (width)
A: core zone 65 µm	< 2 µm: no limit ≥ 2 µm and ≤ 5 µm: maximum 4 > 5 µm: none	< 3 µm: no limit ≥ 3 µm and ≤ 4 µm: maximum 4 > 4 µm: none
B: cladding zone 65 µm to 110 µm	≤ 25 µm: no limit > 25 µm: none	No limit

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Annex A (informative)

Multimode attenuation measurement uncertainty contribution

A.1 General

The attenuation of a multimode connectorised component (or connector) based on a cylindrical ferrule is measured against an R_{m1} reference connector in a reference adapter and when based on rectangular ferrules against the relevant pinned/unpinned R_{m12} to R_{m32} reference connector. Since reference connection parts vary within the tolerances allowed in this document, the variability has to be considered as a contribution to the attenuation measurement uncertainty of the setup.

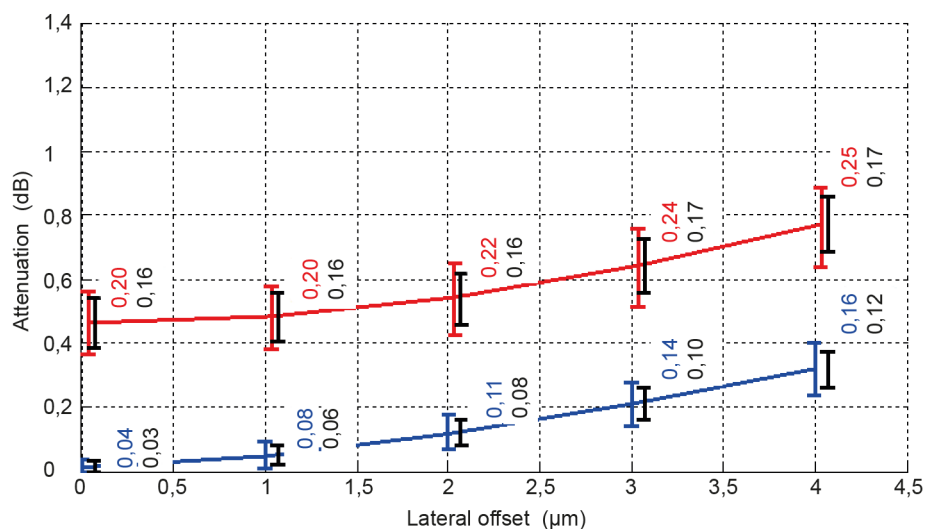
A.2 Sources of variability

A.2.1 Measurement condition and setup

Measurement condition and setup variability are caused by factors such as power meter calibration, finite display resolution, linearity, connector/detector coupling repeatability, source stability and launch conditions. IEC TR 62627-04 gives a more detailed explanation of how to determine this uncertainty for single mode fibres and it can be adapted for use with MM connections.

A.2.2 Geometry mismatch

Another factor causing variability is the mismatch between the fibre geometry parameters of the reference connector and the DUT connector, such as core diameter (CD), numerical aperture (NA) and lateral offset. For the calculation, worst case mismatch is used assuming that the DUT fibre has a CD of 47,5 μm and a NA of 0,185. The calculated uncertainty also depends on the offset between the fibre cores of reference and DUT plugs. See Figure A. 1.



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Figure A.1 – Attenuation measurement uncertainty contribution for Grade R_{m1} reference connections resulting from lateral offset, NA and CD mismatch