IEC 63267-1

Edition 1.0 2023-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Dispositifs d'interconnexion et composants passifs fibroniques – Interfaces optiques de connecteurs fibroniques – Partie 1: Fibres multimodales de diamètre de cœur de 50 µm à performances améliorées en matière de pertes par macrocourbures – Généralités et recommandations



IEC 63267-1:2023-05(en-fr)



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.180.10

ISBN 978-2-8322-6016-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

FOREWORD

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

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

Draft	Report on voting
86B/4657/FDIS	86B/4676/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/standardsdev/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

0.1 Overview

A connector optical interface standard is a multi-part collection of the geometric, dimensional and material requirements necessary in order to comply with the optical functionality specifications for a defined interface between two optical fibres. It consists of those essential features that are functionally critical to the optical attenuation and return loss performance of an optical interface in the mated condition.

The IEC 63267 series is composed of optical interface standards for multimode connectivity which provide general information on optical connector interfaces for IEC 60793-2-10, subcategory A1-OM2b to A1-OM5b multimode fibre, at 850 nm band only.

The IEC 63267 series defines the location of the fibre core in relation to the datum target and the following key parameters: lateral and angular misalignment, core diameter, numerical aperture, end face separation, end face high index layer condition. It also defines standardized test methods where appropriate.

The subsequent parts of the multimode series contain those optical interfaces that have been standardized for international use. Each interface contains the essential information to ensure that products conforming to the standard will work together repeatedly to a known level of optical performance without the need for compatibility testing or cross checking.

It is important to emphasize that standard optical interfaces are intended to be used with IEC standards of various categories, which already include

– mechanical connector interface standards,

– test and measurement methods,

– performance standards, and

– reliability technical reports.

Interface standards, according to the IEC 61754 series, provide all the essential information about a given product type or family necessary to ensure that all products compliant with the interface standard will mate/de-mate.

Test and measurement methods, according to the IEC 61300-2 series and the IEC 61300-3 series, give a prescribed approach to the way in which key parameters that need to be assessed are evaluated.

Performance standards, according to the IEC 61753 series, use these test and measurement methods to define a set of conditions indicative to a known system location against which a product can be evaluated on a "once off" basis to prove that its design and manufacture are capable of satisfying the necessary criteria.

Reliability technical reports are intended to provide the user and manufacturer with a set of guidelines for assessing the ability of the product to continue to meet the required criteria over time.

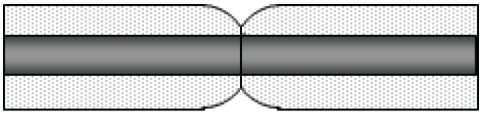
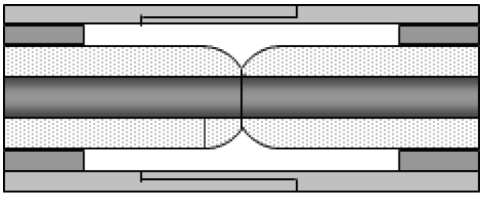
The two basic optical transmission performance parameters that characterize the optical interface are attenuation and return loss. Each parameter places different physical constraints on the optical interface. Environmental conditions also affect the performance of the optical interface and it may require definition of physical and mechanical requirements to ensure that the performance specified is maintained over the environmental extremes defined in a particular performance standard.

Manufacturing materials and processes also affect the optical interface and, therefore, this document has been designed to allow manufacturers to demonstrate compliance with this document while still permitting the maximum of manufacturing differentiation. The relationship between, and suitability of, materials specified in the IEC 63267-3 series standards for different performance categories as specified in IEC 61753-1 will be defined, for example zirconia ferrule material can be applied in all environmental categories, while the thermoset polymer material specified for some rectangular ferrules may only be applicable for category C.

Optical interface standards define sets of prescribed conditions, which should be maintained in order to satisfy the requirements for the attenuation and return loss performance in a randomly mated pair of fibres of the same type.

0.2 Hierarchical relationship

The hierarchical relationship between optical interface standards and interface standards is shown in Figure 1.

	Optical interface: IEC 62367-1 – General and guidance
 IEC	Optical interface: IEC 62367-2 – Fibre to fibre, optical connection performance requirements, e.g. lateral and angular misalignment, mode field diameter mismatch excluding fibre support mechanisms
 IEC	Optical interface: IEC 62367-3 – Fibre support mechanisms, optical connector end face and material deformation properties e.g. in the case of ferrules, effects of dome offset, fibre undercut and fibre position necessary to meet the performance requirements of IEC 62367-2
 IEC	Connector mechanical interface – IEC 61754 (all parts) Connector mating dimensions, e.g. effects of spring force, etc.

IEC 2531/05

Figure 1 – Relationship between optical interface standards and interface standards

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 Scope

This part of IEC 63267 covers enhanced macrobend loss 50 µm core diameter multimode fibre optic connection interfaces. It includes references, document structure details, definitions, and standardised optical connection grades. The grades are based on random mated connections between two optical connector populations according to prescribed characteristics including the core diameter and numerical aperture mismatches.

This document describes the rules under which an optical interface is created. It also defines standardised test methods where appropriate.

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 61280-1-4, *Fibre optic communication subsystem test procedures – Part 1-4: General communication subsystems – Light source encircled flux measurement method*

IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

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

IEC 63267 (all parts), *Fibre optic interconnecting devices and passive components – Fibre optic connector multimode optical interfaces*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1
encircled flux
EF
fraction of cumulative near-field power to the total output power as a function of radial distance from the optical centre of the core, defined by Formula (1):

$$EF(r) = \frac{\int_0^r xI(x)\,dx}{\int_0^R xI(x)\,dx} \quad (1)$$

where

$I(x)$ is the near-field intensity profile as a function of radial position x;

R is the maximum range of integration

Note 1 to entry: The encircled flux shall be measured according to IEC 61280-1-4.

[SOURCE: IEC 61300-1:2022, 3.1.10]

3.2
connection zero
C_0
first interface of a random cord when it is concatenated to the launch cord

Note 1 to entry: The connection zero tends to alter the launch condition through mode coupling and differential mode attenuation.

3.3
connection one
C_1
second connection in a link, between two random interfaces, which is used for determination of a given attenuation performance grade

Note 1 to entry: The estimated loss at C_1 is dependent on the connection at C_0 with respect to how much the power intensity distribution is modified.

3.4
launch conditions
<connection one> populations of resulting launches at connection zero

Note 1 to entry: The launches at connection zero are generated during Monte Carlo simulation. The launch condition at mating zero is an EF compliant launch at target.

3.5
fibre core diameter
physical size of the core measured in micrometer

3.6
fibre numerical aperture
NA
range of angles over which the fibre can accept or emit light

Note 1 to entry: The numerical aperture is a dimensionless number.

3.7
fibre core eccentricity
radial and angular polar position of the fibre axis in cylindrical co-ordinate system of the connector relative to the assumed datum target

3.8
fibre core tilt angle position
tilt angle position of the fibre axis in the cylindrical co-ordinate system of the connector relative to the assumed horizontal fibre axis in the z direction

3.9
contact area
total surface area of the optical interface which is intended to be in contact when two identical optical interfaces are brought together under a set of prescribed conditions

3.10
defect
non-linear surface feature on the end face or ferrule including, pits, chips, edge chipping, and nonremovable contamination

Note 1 to entry: Scratches are excluded from this definition.

3.11
scratch
permanent surface feature where the fibre end face has been damaged, and where the width of the damaged area is small compared to its length, with a length to width of equal or larger than 5:1

3.12
high index layer
compacted region at the fibre end face where the refractive index is often higher than that of an unpolished cleaved fibre

[SOURCE: IEC 61755-1:2005, 3.9]

3.13
end face boundary conditions
surface conditions that exist at the optical interface after all termination processes have been completed

3.14
end face separation losses
attenuation losses associated with an axial separation of the two fibres from the point of alignment where lowest attenuation occurs

3.15
lateral offset losses
attenuation losses associated with a lateral displacement of the two fibres from the point of alignment where lowest attenuation occurs

3.16
optical datum target
theoretical datum point on a connector interface where the optical fibre core centre or centre of the optical waveguide should be positioned

3.17
optical interface standard
set of prescribed, measurable conditions to be met in order to satisfy the requirements for attenuation and return loss performance and environmental stability in a mated pair of fibres

4 Document structure

An optical fibre connection interface standard is a multipart collection of the geometrical and material requirements necessary in order to comply with the optical functionality specifications for a defined interface between two multimode optical fibres. It consists of those essential features that are functional criteria to the optical attenuation and return loss performance of an optical connection. This document provides general information on optical interfaces for multimode fibre according to IEC 60793-2-10, subcategory A1-OM2b to A1-OM5b.

The IEC 63267 series consists of different standards as shown in Table 1.