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**Fibre optic interconnecting devices and passive components – Connector optical interfaces for multi-core fibre –
Part 3-30: Connector parameters of standard outer diameter 4-core physically contacting fibres – Non-angled 2,5 mm and 1,25 mm diameter cylindrical full zirconia ferrules**

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS
– CONNECTOR OPTICAL INTERFACES FOR MULTI-CORE FIBRE –****Part 3-30: Connector parameters of standard outer diameter 4-core
physically contacting fibres – Non-angled 2,5 mm and 1,25 mm diameter
cylindrical full zirconia ferrules**

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International Standard IEC PAS 63503-3-30 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

The text of this Publicly Available Specification is based on the following document:

Draft	Report on voting
86B/4763/DPAS	86B/4784/RVDPAS

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

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

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

- reconfirmed,
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- replaced by a revised edition, or
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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTOR OPTICAL INTERFACES FOR MULTI-CORE FIBRE –

Part 3-30: Connector parameters of standard outer diameter 4-core physically contacting fibres – Non-angled 2,5 mm and 1,25 mm diameter cylindrical full zirconia ferrules

1 Scope

This Publicly Available Specification defines the dimensional limits of the optical interface for 125 µm outer diameter 4-core physically contacting fibre optic connectors with 2,5 mm or 1,25 mm diameter cylindrical zirconia (ZrO₂) ferrules to ensure reliable interconnection and intermateability.

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

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

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 61755-1, *Fibre optic interconnecting devices and passive components – Connector optical interfaces for single-mode fibres – Part 1: Optical interfaces for dispersion unshifted fibres – General and guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61755-1 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 Description

The reliability of a physical contact (PC) cylindrical ferrule optical interface is determined by parameters influencing the connector endface deformation required to maintain physical contact of the ferrules within a mated connection. These parameters include the following:

- endface spherical radius;
- endface spherical radius apex offset;
- fibre undercut;

- axial force on ferrule endface;
- ferrule and fibre material physical constants;
- alignment sleeve frictional force.

5 Interface parameters

The endface dimensions of terminated connector plugs are provided in Figure 1.

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

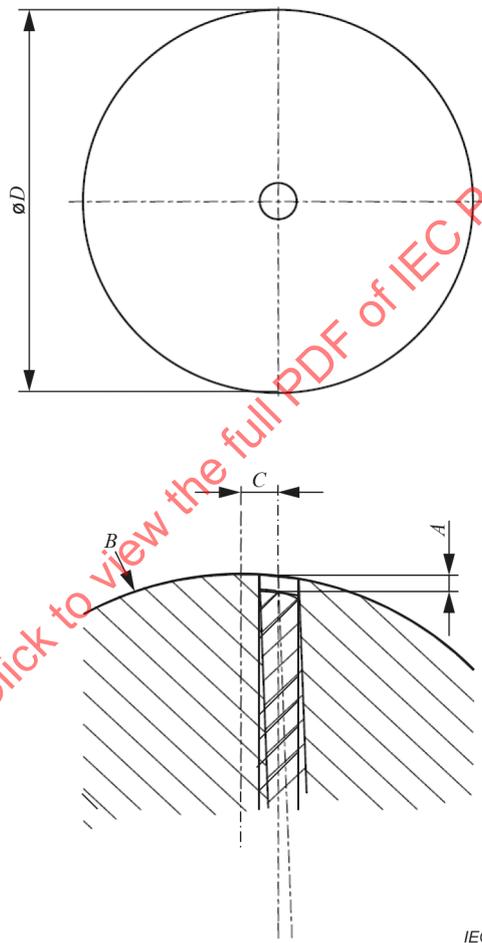


Figure 1 – Connector plug endface dimensions

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

Ref.	Parameter values		Units	Remarks
	Minimum	Maximum		
A^b	-100	^a	nm	Fibre undercut or protrusion
B	5	30	mm	Spherical radius
C	0	50	μm	Apex offset
D	2,498 5	2,499 5	μm	Ferrule outside diameter

NOTE Refer to IEC 61300-3-47 [1] for end face geometry measurement of PC spherically polished ferrules using interferometry.

^a Contact force 4,9 N nominal. Ferrule material: 3 mol % yttria stabilized zirconia, ZrO_2 . Nominal material physical constant values: Young's Modulus, 200 GPa \pm 20 GPa, Poisson's Ratio, 0,30 to 0,31. See Annex A for details

$$A_{\text{maximum}} = 1988 \cdot B^{(-0,795)} - B \cdot 10^6 + \left[\sqrt{B^2 \cdot 10^6 - (C + 6)^2} \right] \cdot 10^3 - 60$$

^b A as a negative value indicates fibre protrusion.

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

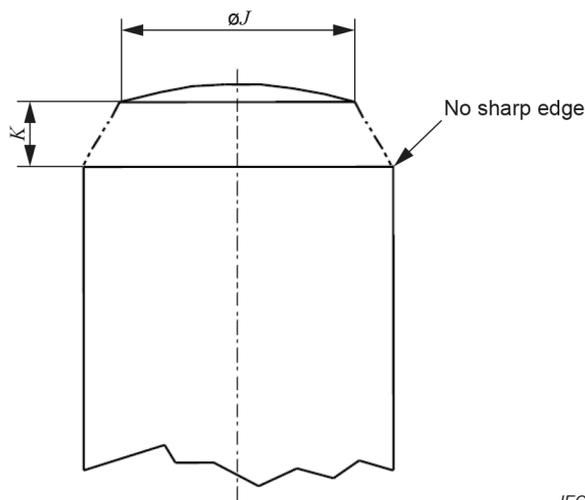
Ref.	Parameter values		Units	Remarks
	Minimum	Maximum		
A^b	-100	^a	nm	Fibre undercut or protrusion
B	5	30	mm	Spherical radius
C	0	50	μm	Apex offset
D	1,248 5	1,249 5	μm	Ferrule outside diameter

NOTE Refer to IEC 61300-3-47 [1] for end face geometry measurement of PC spherically polished ferrules using interferometry.

^a Contact force 2,9 N nominal. Ferrule material: 3 mol % yttria stabilized zirconia, ZrO_2 . Nominal material physical constant values: Young's Modulus, 200 GPa \pm 20 GPa, Poisson's Ratio, 0,30 to 0,31. See Annex A for details

$$A_{\text{maximum}} = 1798 \cdot B^{(-0,795)} - B \cdot 10^6 + \left[\sqrt{B^2 \cdot 10^6 - (C + 6)^2} \right] \cdot 10^3 - 60$$

^b A as a negative value indicates fibre protrusion.



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Figure 2 – Ferrule dimensions

Table 3 - Optical interface parameter values for PC ferrules

Ref.	2,5 mm diameter ferrule parameter values		1,25 mm diameter ferrule parameter values		Remarks
	Min mm	Max mm	Min mm	Max mm	
J	0,8	-	0,6	-	Diameter
K	-	1,8	-	1,0	

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Annex A (informative)

Maximum allowed spherical fibre undercut

The maximum allowed spherical fibre undercut, A_{maximum} (see Figure A.1 and Figure A.2), is determined by the interaction of the parameters influencing the longitudinal offset of the optical fibre axes as defined by Formula (A.1) [2].

$$A_{\text{maximum}} = k_1 \cdot B^{k_2} - B \cdot 10^6 + \left[\sqrt{B^2 \cdot 10^6 - (C + 6)^2} \right] \cdot 10^3 - D_{\text{DTE}} - D_{\text{PFW}} \quad (\text{A.1})$$

Where

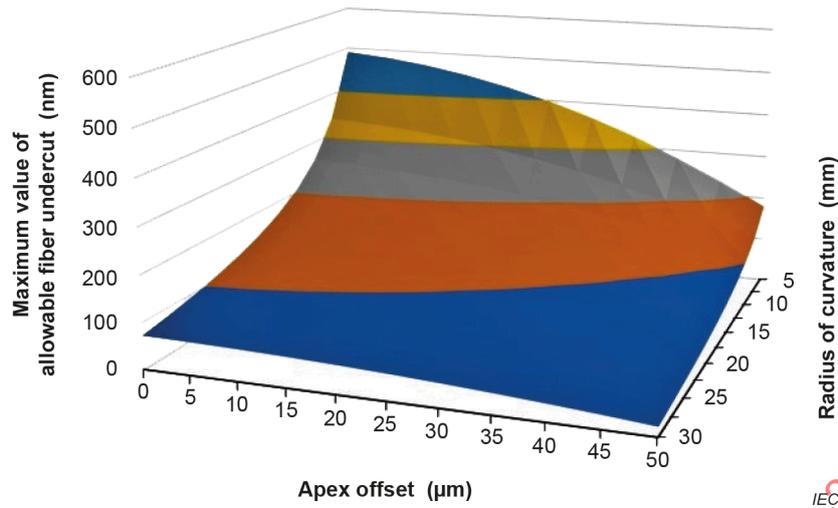
- A_{maximum} is the maximum spherical undercut for physical contact (nm);
- k_1 is the coefficient based on ferrule contact force and material properties;
- k_2 is the exponent based on ferrule contact force and material properties;
- B is the endface spherical radius (mm);
- C is the apex offset from fibre axis (μm);
- D_{DTE} is the differential thermal expansion between the ferrule material and the silica fibre at maximum operating temperature (nm);
- D_{PFW} is the permanent fibre withdrawal that exceeds the transient fibre movement predicted by the first three terms in Formula (A.1) (nm).

Endface deformation term as a function of contact force, endface radius and material properties is shown in Formula (A.2):

$$k_1 \cdot B^{k_2} \quad (\text{A.2})$$

Geometric compensation term for the offset of the ferrule apex from the fibre axis is shown in Formula (A.3):

$$B \cdot 10^6 + \left[\sqrt{B^2 \cdot 10^6 - (C + 6)^2} \right] \cdot 10^3 \quad (\text{A.3})$$



$$A_{\text{maximum}} = 1988 \cdot B^{(-0.795)} - B \cdot 10^6 + \left[\sqrt{B^2 \cdot 10^6 - (C + 6)^2} \right] \cdot 10^3 - 60$$

Figure A.1 – Allowable undercut as a function of endface radius and apex offset – 4,9 N minimum contact force

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