IEC 61755-3-7

Edition 1.0 2009-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces –
Part 3-7: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical PC composite ferrule using titanium as fibre surrounding material, single mode fibre

Dispositifs d'interconnexion et composants passifs à fibres optiques – Interfaces optiques de connecteurs pour fibres optiques –
Partie 3-7: Interfaces optiques, férules composites cylindriques PC, de diamètre 2,5 mm et 1,25 mm, utilisant le titane comme matériau entourant la fibre, fibres unimodales

IEC 61755-3-7:2009

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International Standard IEC 61755-3-7 has been prepared by subcommittee 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/2768/FDIS	86B/2801/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 61755 series, published under the general title *Fibre optic interconnecting devices and passive components – Fibre optic connector optical interfaces,* can be found on the IEC website.

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

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – FIBRE OPTIC CONNECTOR OPTICAL INTERFACES –

Part 3-7: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical PC composite ferrule using titanium as fibre surrounding material, single mode fibre

1 Scope

This part of IEC 61755 defines dimensional limits and material properties of a 2,5 mm and a 1,25 mm diameter cylindrical composite ferrule optical interface to meet specific requirements for PC fibre-to-fibre interconnection. The composite ferrule uses different materials in the end face contact zone and in ferrule to sleeve contact zone. The specified materials for each zone are zirconia (ZrO_2) for the ferrule to sleeve contact zone and titanium for the end face contact zone. Ferrules made from the material specified in this standard are suitable for use in categories C, U, E and O as defined in IEC 61753-1.

NOTE If mated within the same family (cylindrical PC ferrule), the ferrules specified in this standard are intended to have the same optical attenuation performance grade for connections with all ferrules described in different parts of IEC 61775-3.

2 Description

The performance of a cylindrical ferrule optical interface is determined by the accuracy with which the optical datum targets of two mating ferrules are aligned with each other. There are three conditions affecting the alignment of two optical datum targets, lateral offset, angular offset and longitudinal offset.

Parameters influencing the lateral and angular offset of the optical fibre axes include the following:

- ferrule outside diameter;
- fibre hole concentricity relative to the ferrule outside diameter;
- fibre hole angle relative to outside diameter axis;
- fibre cladding diameter to fibre hole clearance;
- alignment sleeve inside diameter;
- fibre core concentricity relative to the cladding diameter;
- fibre core orientation relative to keying feature.

Parameters influencing the longitudinal offset of the optical fibre axes include the following:

- end face spherical radius;
- end face spherical radius apex offset;
- fibre undercut;
- axial force on ferrule end face;
- ferrule and fibre material physical constants;
- alignment sleeve frictional force.

3 Interface parameters for PC ferrule independent from the ferrule material

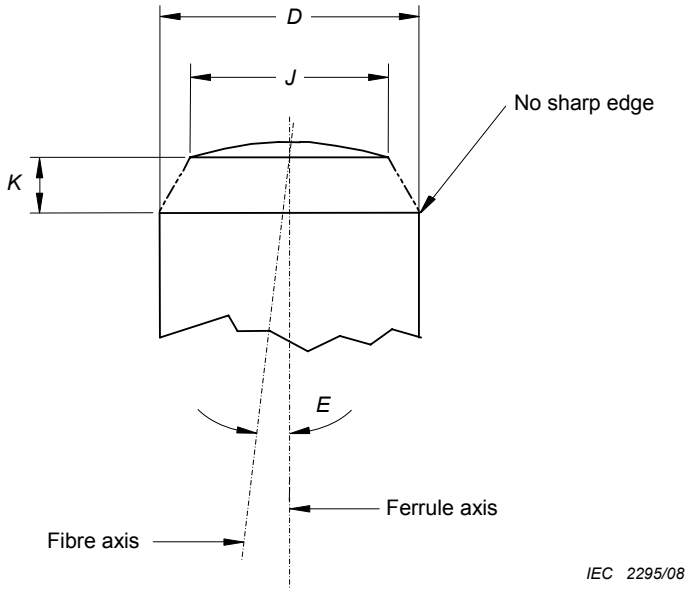

Figure 1 – Interface dimensions for PC ferrule

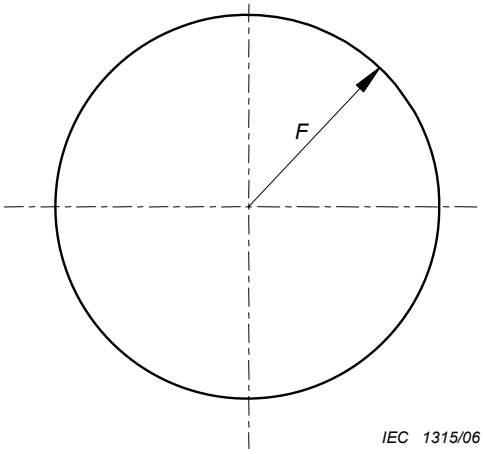

Figure 2 – Fibre core location

F defines the radial coordinate limits of the optical fibre core relative to the optical datum of the ferrule.

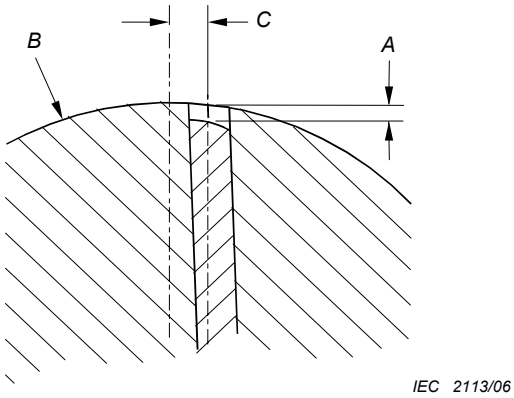

Figure 3 – Interface dimension of the end-face contact zone

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

Ref.	Parameter values								Remarks
	Grade A		Grade B		Grade C		Grade D		
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
A			−200 [a]		−200 [a]		−200 [a]		[b], nm
B			7	20	7	20	7	20	Radius, mm
C			0	70	0	70	0	70	µm
D			2,4985	2,4995	2,4985	2,4995	2,4985	2,4995	Diameter, mm
E			0	0,6	0	0,8	0	0,6	Degrees
F			0	0,00015	0	0,0003	0	0,0016	Radius, mm
J			0,8	-	0,8	-	0,8	-	Diameter, mm
K			-	1,8	-	1,8	-	1,8	mm

[a] Contact force 4,9 N minimum. Ferrule material: titanium. Nominal material physical constant values: Young's Modulus, E = 105 GPa, Poisson's Ratio, v = 0,34.

$$A_{\text{Maximum}} = 2115 \times B^{(-0,765)} - B \times 10^{6} + \left(\sqrt{B^{2} \times 10^{6} - C^{2}} \right) \times 10^{3} - 80$$

[b] A negative value indicates fibre protrusion.

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

Ref.	Parameter Values								Remarks
	Grade A		Grade B		Grade C		Grade D		
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
A			-200	[a]	-200	[a]	-200	[a]	[b], nm
B			7	20	7	20	7	20	Radius, mm
C			0	70	0	70	0	70	µm
D			1,2485	1,2495	1,2485	1,2495	1,2485	1,2495	Diameter, mm
E			0	0,6	0	0,8	0	0,6	Degrees
F			0	0,00015	0	0,0003	0	0,0016	Radius, mm
J			0,6	-	0,6	-	0,6	-	Diameter, mm
K			-	1,0	-	1,0	-	1,0	mm

[a] Contact force 2,9 N minimum. Ferrule material: titanium. Nominal material physical constant values:

Young's Modulus, E = 105 GPa, Poisson's Ratio, v = 0,34.

$$A_{\text{Maximum}} = 1880 \times B^{(-0,765)} - B \times 10^{6} + \left(\sqrt{B^{2} \times 10^{6} - C^{2}} \right) \times 10^{3} - 80$$

[b] A negative value indicates fibre protrusion.

Annex A
(informative)

Maximum allowed spherical fibre undercut

The maximum allowed spherical fibre undercut $A_{Maximum}$ is determined by the interaction of the parameters influencing the longitudinal offset of the optical fibre axes as defined by [A.1].

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

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 end face 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_{DTE} between the Ti-composite ferrule material and the silica fibre at maximum operating temperature is 50 nm;

D_{PFW} is the permanent fibre withdrawal that exceeds the transient fibre movement predicted by the first three terms in [A.1] (nm). D_{PFW} for the Ti-composite ferrule is 30 nm.

End face deformation term as a function of contact force, end face radius and material properties.

$$k_1 \times B^{k_2} \quad [A.2]$$

Geometric compensation term for the offset of the ferrule apex from the fibre axis.

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