BS EN 61300-3-25:2016

BSI Standards Publication

Fibre optic interconnecting devices and passive components — Basic test and measurement procedures

Part 3-25: Examinations and measurements — Concentricity of non-angled ferrules and non-angled ferrules with fibre installed

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National foreword

This British Standard is the UK implementation of EN 61300-3-25:2016. It is identical to IEC 61300-3-25:2016. It supersedes BS EN 61300-3-25:2013 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/2, Fibre optic interconnecting devices and passive components.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Dispositifs d'interconnexion et composants passifs fibroniques - Procédures fondamentales d'essais et de mesures - Partie 3-25: Examens et mesures - Concentricité des férules sans angle et des férules sans angle avec fibre montée
(IEC 61300-3-25:2016)

Lichtwellenleiter-Verbindungselemente und passive Bauteile - Grundlegende Prüf- und Messverfahren - Teil 3-25: Untersuchungen und Messungen - Konzentrizität der nicht schräggeschliffenen Ferrulen und der nicht schräggeschliffenen Ferrulen mit eingebauter Faser
(IEC 61300-3-25:2016)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 86B/3900/CDV, future edition 3 of IEC 61300-3-25, prepared by SC 86B “Fibre optic interconnecting devices and passive components” of IEC/TC 86 “Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61300-3-25:2016.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-07-04
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-10-04

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In the official version, for Bibliography, the following note has to be added for the standard indicated :

ISO 2538	NOTE	Harmonized as EN ISO 2538 [1)].

[1)] The latest edition is superseded by EN ISO 2538-1:2014 and EN ISO 2538-2:2014.

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International Standard IEC 61300-3-25 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2013 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) deletion of method C due to potential damage of ferrule end face by the spindle. Method C is the ferrule bore reference method for bare ferrules according to IEC 61300-3-25:2013;
b) separation of original method A into method A-1 and method A-2 relating to the two different types of ferrule (with/without fibre fitted);
c) integration of the content of Annexes A and B into the test procedure.

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

CDV	Report on voting
86B/3900/CDV	86B/3956A/RVC

Full information on the voting for the approval of this document 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.

A list of all parts in the IEC 61300 series, published under the general title, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures,* 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 "http://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.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 3-25: Examinations and measurements – Concentricity of non-angled ferrules and non-angled ferrules with fibre installed

1 Scope

This part of IEC 61300 describes the procedure to determine the concentricity of the axis of the bore in a non-angled ferrule with the axis of the ferrule, and in the case of non-angled ferrules with fibre installed, to determine the concentricity of the axis of the fibre core with the axis of the ferrule.

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.

There are no normative references in this document.

3 General description

3.1 General

This procedure describes the measurement of concentricity of ferrules and ferrules with assembled fibres. Concentricity is defined as twice the distance between the axis of the ferrule and the axis of the inner diameter of the ferrule (ferrule bore), or in the case of ferrules with fibre installed, twice the distance between the axis of the ferrule and the axis of the core of the installed fibre (see Figure 1). When concentricity measurements are made on a ferrule with fibre installed the results will be affected by the geometry of the fibre, and by the fit of the fibre in the ferrule inner diameter. Imperfections of the cylindricity and circularity of the outside diameter of the ferrule will influence the measurement results.

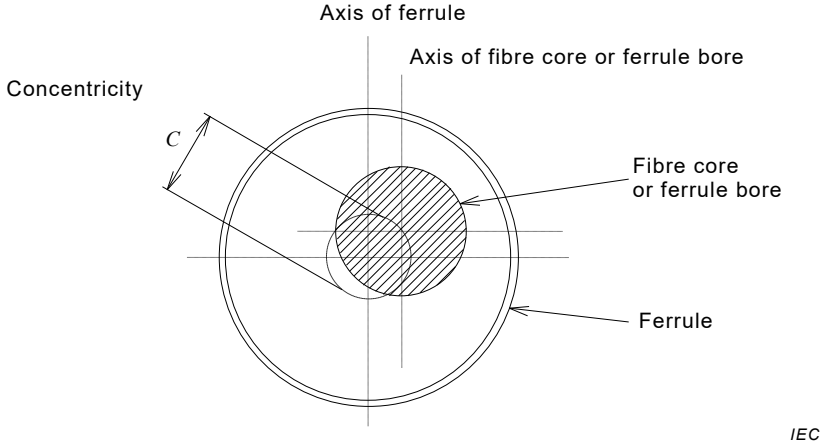


Figure 1 – Definition of concentricity

Two methods of concentricity measurement are described in 3.2 and 3.3.

3.2 Method A: ferrule surface reference method (reference test method)

In Method A, the ferrule is placed in a V-groove or outer diameter (OD) reference mechanism, and rotated. The displacement of the ferrule inner diameter or fibre core is observed and the concentricity determined.

3.3 Method B: core centre reference method on a ferrule with fibre installed

Method B uses a roundness measuring instrument to measure concentricity. In this method, the core axis is fixed at the axis of the measuring instrument, and the concentricity is determined by measuring, usually with a probe, the displacement of the outer diameter of the ferrule as the ferrule is rotated.

4 Apparatus

4.1 Method A

The apparatus for method A consists of the following elements:

- V-groove or OD reference mechanism mounted on a micro-manipulator. According to ISO 2538, the preferred angle for a V-groove is 108°;
- microscope with video camera;
- display;
- light source; a white light is suitable for this procedure;
- signal processor.

4.2 Method B

The apparatus for method B consists of the following elements:

- roundness measuring instrument with microscope including a recorder, X-Y table, chuck and pickup;
- light source; a white light is suitable for this procedure.

5 Procedure

5.1 Method A-1

The procedure for a ferrule with fibre installed is as follows.

a) Clean the outer surface of the ferrule.

b) Place the ferrule in the V-groove or OD reference mechanism as shown in Figure 2.

c) Illuminate the fibre core from the other end of the fibre.

d) Acquire an image of the illuminated fibre core.

e) Calculate the centre of gravity (COG) with the coordinates x and y of the core-pixels using the following formula:

$$\begin{pmatrix} COGx = \sum_{I(x,y)\geq thresh} \dfrac{x \times I(x,y)}{total} \\ COGy = \sum_{I(x,y)\geq thresh} \dfrac{y \times I(x,y)}{total} \end{pmatrix} \quad (1)$$

where

(x,y) is the current pixel location;

$I(x,y)$ is the pixel intensity at this location;

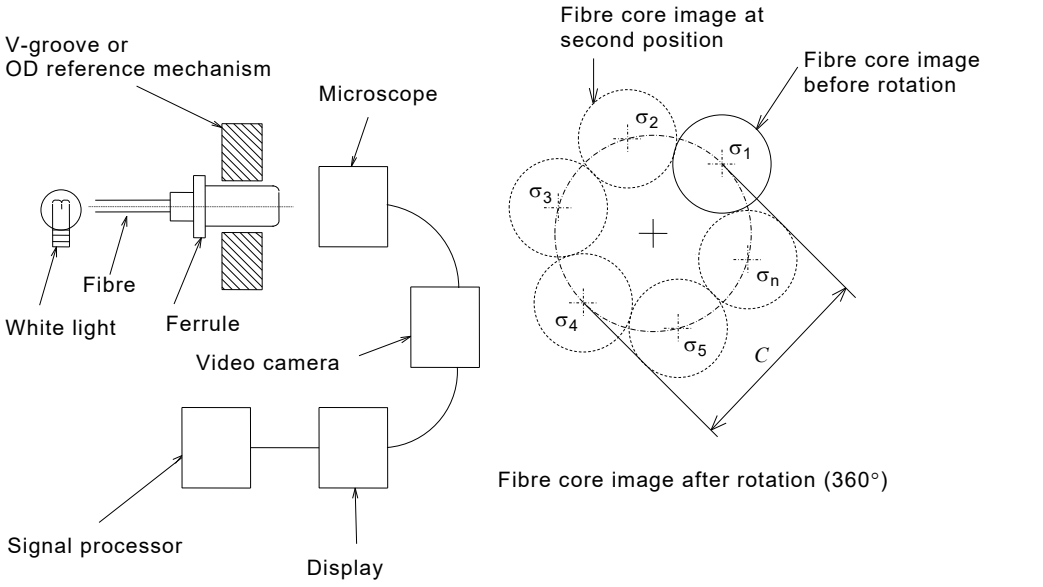
$thresh$ is the threshold (in grey scale value) of the pixel intensity;

$total$ is the number of pixels where pixel intensity ($I(x,y)$) is equal to or higher than the threshold.

$$total = \sum_{I(x,y) \geq thresh} I(x,y)$$

f) Rotate the ferrule in steps of 60° or less, and repeat steps d) and e), until a complete rotation is made.

g) Calculate, with the measured positions (σ1 to σn), a circle using the best fit method. The diameter of the circle equals the maximum displacement C.



Key

σn centre of the fibre core at each position

C maximum displacement of the fibre core image

Figure 2 – Set-up example for concentricity measurement (method A-1) of ferrules with fibre installed

5.2 Method A-2

The procedure for bare ferrules is as follows.

a) Clean the ferrule bore thoroughly to assure it is free of dirt, burrs or other obstructions.

b) Place the ferrule in the V-groove or OD reference mechanism as shown in Figure 3.

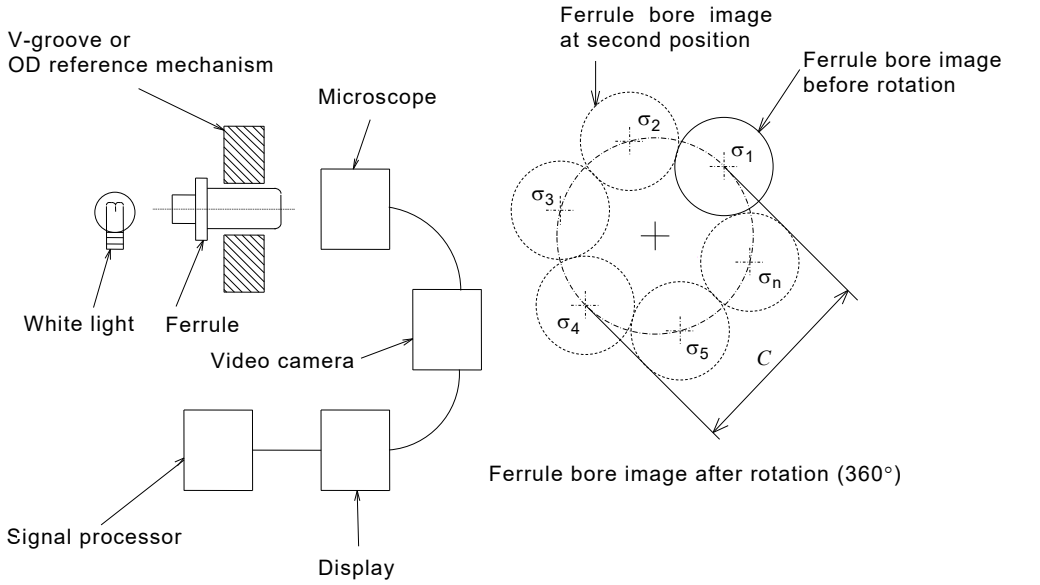
c) Illuminate the bore of the ferrule.

d) Acquire an image of the illuminated ferrule bore.

e) Using high-pass filtering, identify the pixels lying on the edge of the ferrule bore. Find the centre-coordinates of the bore by calculating the least-square fit of a circle to the edge pixels. An iterative process shall be used in order to remove all pixels which do not lie perfectly on the circle.

f) Rotate the ferrule in steps of 60° or less, and repeat steps d) and e), until a complete rotation is made.

g) Calculate, with the measured positions (σ1 to σn), a circle using the best fit method. The diameter of the circle equals the maximum displacement C.



Key

σn centre of the ferrule bore at each position

C maximum displacement of the ferrule bore image

Figure 3 – Set-up example for concentricity measurement (method A-2) of bare ferrules

5.3 Method B

The procedure for method B is as follows.

a) Clean the outer surface of ferrule.

b) Mount the ferrule on the roundness measuring instrument as shown in Figure 4.

c) Using an X-Y table on the roundness measuring instrument, position the ferrule so that the centre of the fibre core is set exactly at the centre of the rotation axis. The centre of the core is estimated by illuminating the core from the other end of the fibre.

d) Position the pick-up of the roundness measuring instrument onto the outer surface of the ferrule so as to measure the displacement of the outer surface of the ferrule as the ferrule is rotated.

e) Rotate the ferrule a minimum of 360° and record the maximum reading from the roundness gauge as C_1 and the minimum reading as C_2. Concentricity of the part is the difference between the maximum and minimum values ($C = C_1 - C_2$; see Figure 4).

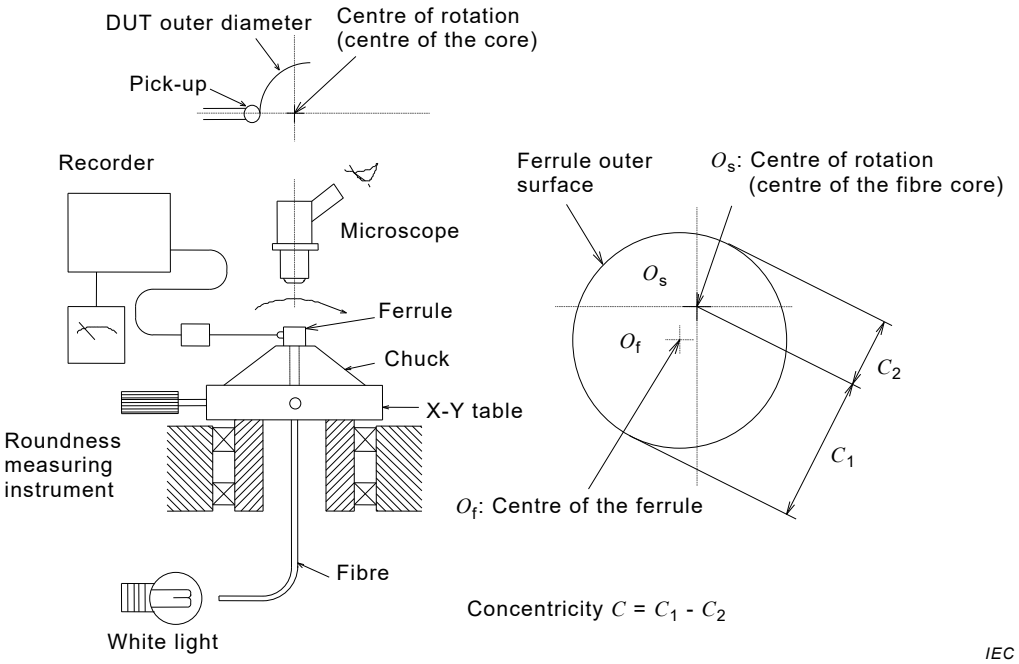


Figure 4 – Set-up example for concentricity measurement (method B) of ferrules with fibre installed

6 Details to be specified

6.1 Method A

The following details, as applicable, shall be specified in the relevant specification:

- allowable concentricity;
- magnification of the microscope;
- deviation from the test procedure;
- measurement uncertainty;
- V-groove or OD reference mechanism;
- resolution of the optical signal processor.

6.2 Method B

The following details, as applicable, shall be specified in the relevant specification:

- allowable concentricity;
- accuracy of roundness measuring instrument;
- deviation from the test procedure;
- measurement uncertainty.

Bibliography

ISO 2538, *Geometrical product specifications (GPS) – Series of angles and slopes on prisms*

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