IEC 61300-3-30

Edition 3.0 2026-07

INTERNATIONAL STANDARD

REDLINE VERSION

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures -
Part 3-30: Examinations and measurements - Endface geometry of rectangular ferrule

ICS 33.180.20

ISBN 978-2-8327-1420-1

IEC 61300-3-30:2026-07 RLV(en)

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

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

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-30: Examinations and measurements - Endface geometry of rectangular ferrule

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61300-3-30:2020. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61300-3-30 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.

This third edition cancels and replaces the second edition published in 2020. This edition constitutes a technical revision.

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

a) clarification of region diameter symbols;
b) introduction of x116 and x132 region of interest (ROI) to support MT-16 and MT-32 ferrule types;
c) preparation of geometry limit (GL) parameter tables for 16-, 24- and 32-fibre ferrules;
d) clarification of the neighbouring fibres definition when computing adjacent height;
e) improvement of figures in Annexes.

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

Draft	Report on voting
86B/5224/FDIS	86B/5250/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.

A list of all parts in the IEC 61300 series, published under the general title *Fibre optic interconnecting devices and passive components*, can be found on the IEC website.

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.

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, or
– revised.

1 Scope

This part of IEC 61300 describes a method for measuring the endface geometry of rectangular multifibre ferrules having an IEC defined optical interface. The primary attributes are fibre position relative to the endface, ~~either withdrawal or protrusion,~~ endface angle relative to the guide ~~pin bores~~ holes, fibre tip radii and core dip for multimode fibres.

2 Normative references

There are no normative references in this document.

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 General description

Guide pin based multifibre connector plugs in IEC 61754-5 and all parts of IEC 61754-7 typically have a rectangular endface with a long axis and a short axis. Ideally a flat polish is desired on the endface with the fibres protruding slightly and all in the same plane to assure physical contact of the fibre cores when two connectors are intermated. In practice, the endface typically has two different curvatures across the surface along the long and short axis. Since mated ferrules are aligned by pins in the guide holes, the endface of the ferrule shall be properly oriented (SX and SY angles) with respect to the guide holes to achieve positive contact. The endface angle SX in the long axis (X-axis) and the endface angle SY in the short axis (Y-axis) (as defined in Annex B) are measured by finding the best fit plane (P_J), based on a percentage of the highest points in a specified region of interest. The highest points typically show the greatest modulation from an interferometric standpoint. This allows for more robust measurements and greater repeatability between different interferometers.

The angle of the best fit plane P_J is calculated by comparing it to the reference plane P which is perpendicular to the averaged axis of ~~each~~ the guide holes. The height H (positive is a protrusion) of the fibres is a planar height defined as the distance between the fibre endface and the best fit plane. Core dip is only relevant to multimode fibres because the large core is softer than the cladding of the fibre and tends to polish away faster. Core dip is calculated using the paraboloid method described in Annex E.

One method is described for measuring the polish angle and fibre position for a single ferrule multifibre connector by analysing the endface with a three-dimensional interferometry type surface analyser.

5 Measurement regions

The following regions shall be defined on the ferrule endface.

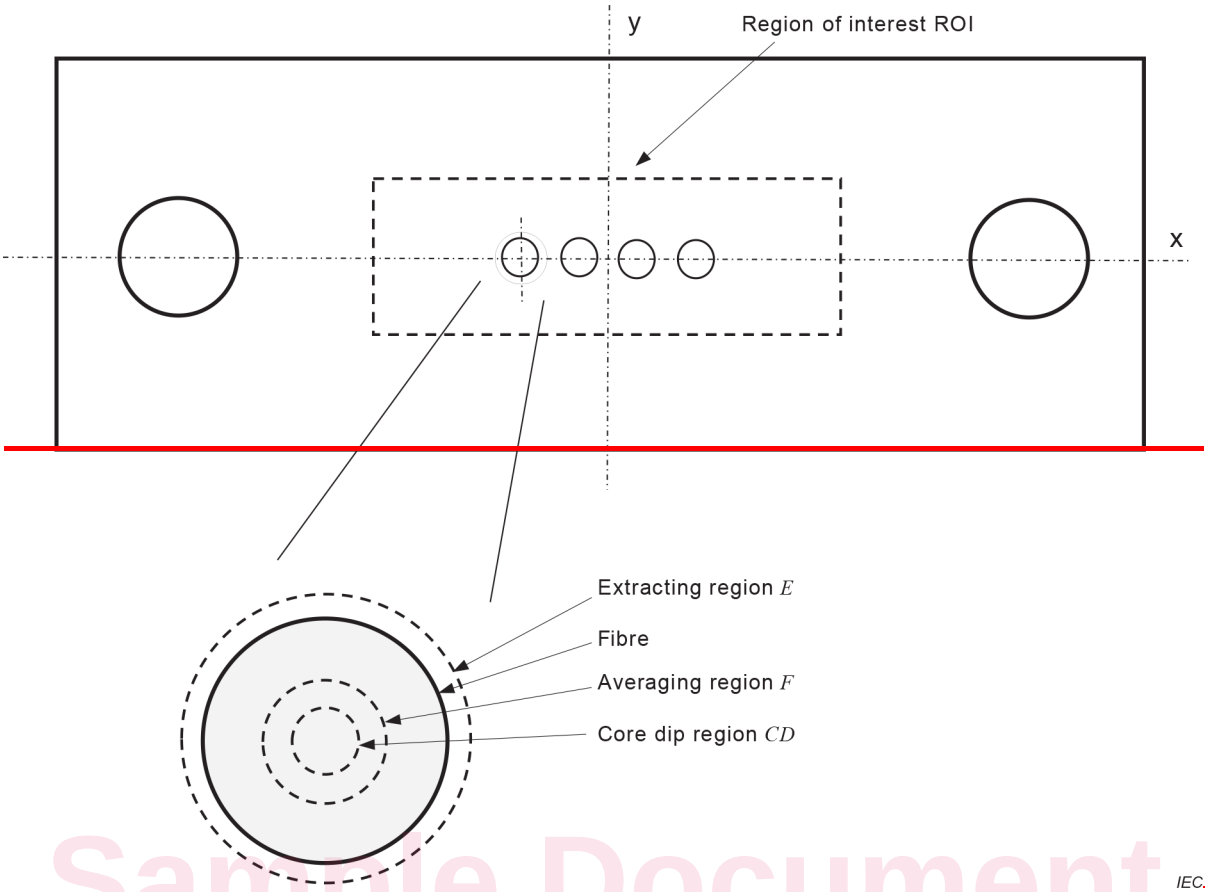
a) Region of interest (ROI): the ROI is set on the ferrule surface and defined by a rectangular region having a long axis (X-axis) ~~of length, L,~~ and a short axis (Y-axis) ~~of height, H~~. The region of interest is chosen to cover the intended contact zone of the ferrule endface when the ferrules are mated. The region of interest shall be centred on the fibre array. See Figure 1. Refer to Table 1 for measurement areas ~~to~~ that shall be used for different connectors.

b) Extracting region: the extracting region, which includes the fibre endface regions and the associated adhesive regions, is defined by circles having a diameter ~~E~~$Ø_E$, centred on each fibre.

c) Averaging region: the averaging region is set on the fibre surfaces used to calculate the fibre height, and is defined by a circle having a diameter ~~F~~$Ø_F$. The averaging region is the same for single-mode (SM) fibres and multimode (MM) fibres.

d) Core dip region: the core dip region is set on the fibre surfaces used to calculate the fibre core dip using the paraboloid method, and is defined by circles having a diameter ~~CD~~$Ø_{CDIP}$, centred on each fibre.

Additionally, core dip adjustment constant: the calculated core dip amplitude following the fit of a paraboloid function to the fibre endface is adjusted by means of constant R_1.



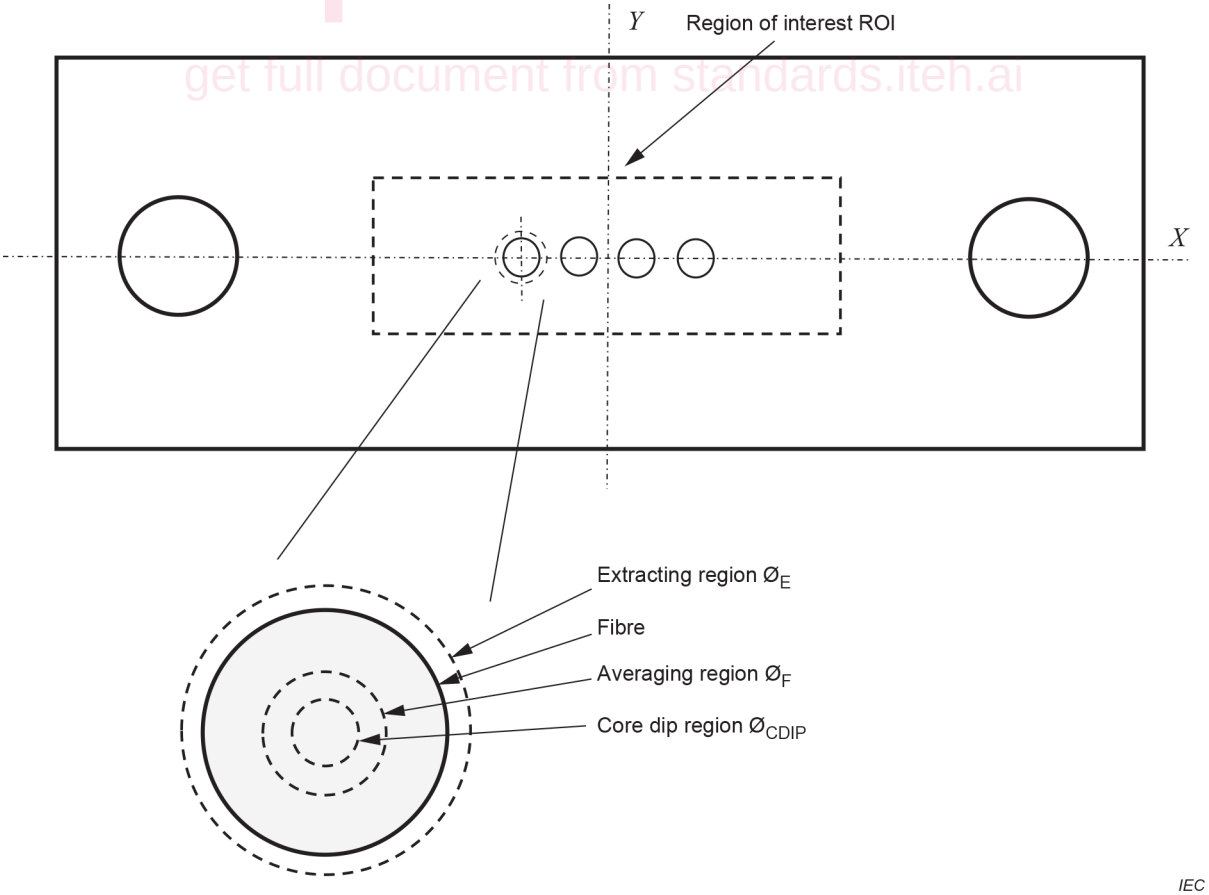


Figure 1 – Measurement regions on ferrule and fibre

Table 1 – Ferrule measurement areas and parameters

Ferrule type (variant number) [a]	Descrip-tion	Region of interest *ROI* ~~(*L* × *H*~~ (*X* × *Y*) ~~mm²~~mm × mm	% top pixels excluded	Next % top pixels used	Extracting region (diameter ~~*E*~~$Ø_E$) mm	Averaging region-SM+MM (diameter ~~*F*~~$Ø_F$) mm	Core dip fitting region (diameter ~~*CD*~~$Ø_{CDIP}$) mm	Core dip adjustment constant R_1 (see Annex E)
~~x104~~ 1104_Y	MT-04	2,900 × 0,675	3	20	0,140	0,05	0,03	0,03
~~x108~~ 1108_Y	MT-08	2,900 × 0,675	3	20	0,140	0,05	0,03	0,03
~~x112~~ 1112_Y	MT-12	2,900 × 0,675	3	20	0,140	0,05	0,03	0,03
~~x124~~ 1116_Y	MT-~~24~~ 16	~~2,900 × 1,160~~ 3,900 × 0,675	3	20	0,140	0,05	0,03	0,03
1124_Y	MT-24	2,900 × 1,160	3	20	0,140	0,05	0,03	0,03
1132_Y	MT-32	3,900 × 1,160	3	20	0,140	0,05	0,03	0,03
~~1002~~ 1002_Y	MiniMT	0,900 × 0,675	3	20	0,140	0,05	0,03	0,03

[a] The ~~x~~ first digit defines 1 for ~~polyphenylene sulfide (~~PPS~~) resin~~ ferrule materials ~~and 2 for thermoset materials~~; the second digit represents 2,45 mm × 4,4 mm with 0 and 2,45 mm × 6,4 mm with 1; the last two digits designates the number of fibres (see Table 1 of IEC 61755-3-31:2015, Table 1 of ~~IEC 61755-3-32:2015~~ IEC PAS 63267-3-30:2021 and Table 1 of IEC PAS 63267-3-31:2020); and the subscript Y defines S for single-mode fibres and M for multimode fibres.

6 Apparatus

6.1 General

The apparatus shown in Figure 2 consists of a positioning stage, a ferrule holder, an interferometric video microscope, a PC-based fringe interpretation unit and a monitor to view the ferrule endface interferogram and display the analysis results.

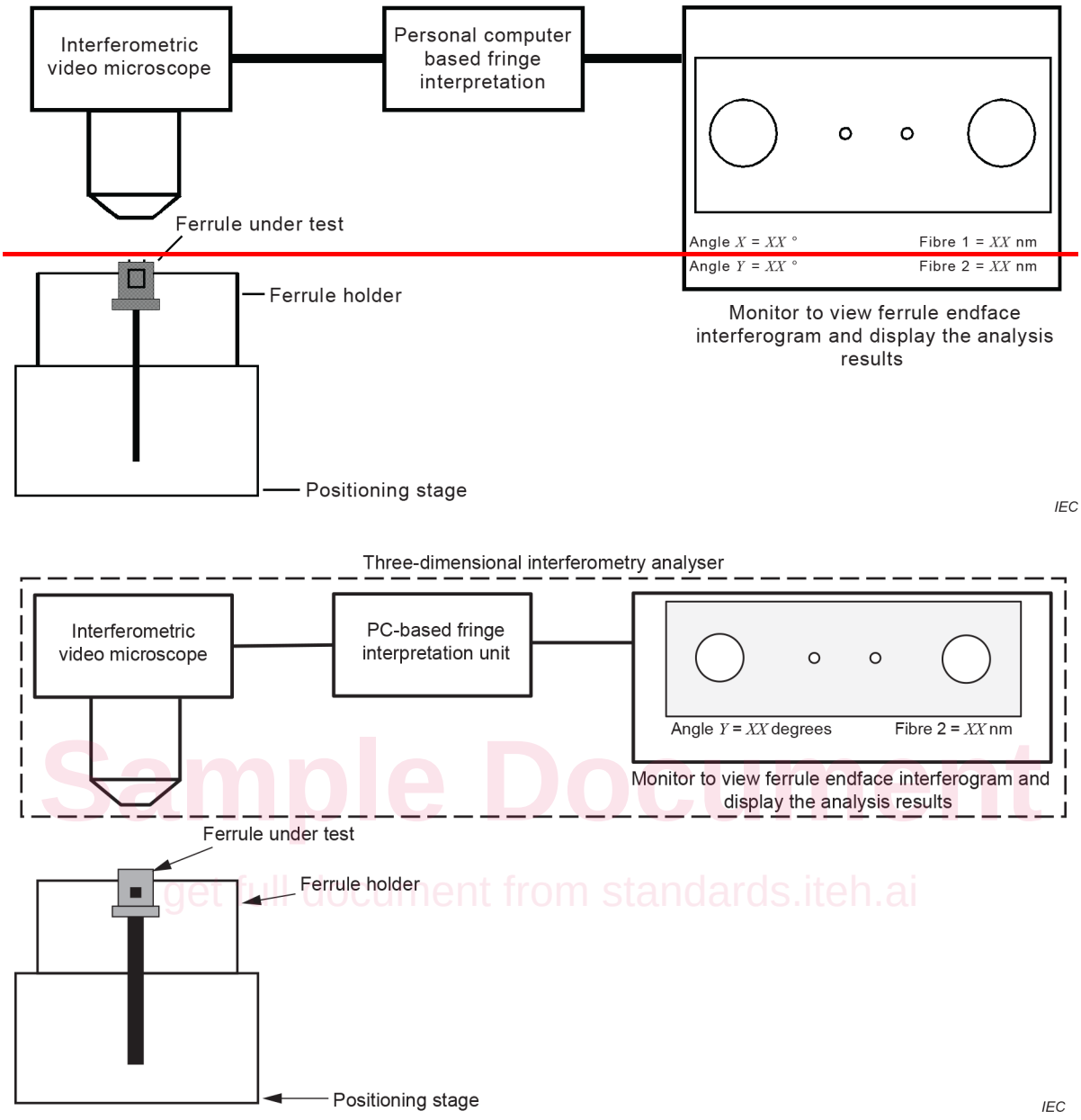


Figure 2 – Measurement setup

6.2 Ferrule holder

The ferrule holder is a suitable device to hold the ferrule in a fixed position, either vertical or horizontal, or in a tilted position in the case of an angled ferrule type. Methods such as mechanical alignment or interferometric measurement shall be used to determine the axis of each guide hole and the average plane perpendicular to the guide hole axes. This plane shall be considered as the reference plane P for reference to subsequent ~~measurements~~ calculations.

6.3 Positioning stage

The ferrule holder is fixed to the positioning stage, which shall enable the ferrule holder to be moved to the appropriate position. The stage shall have sufficient rigidity to allow measurement of the ferrule endface parameters within the required uncertainties detailed in 6.4.

6.4 Three-dimensional interferometry analyser

The three-dimensional interferometry analyser shall have the ability to measure the fibre heights on the ferrule endface with an uncertainty ~~better than~~ within ±50 nm and the core dips with an uncertainty ~~better than~~ within ±20 nm. The analyser shall consist of an interferometric video microscope unit, a PC-based fringe interpretation (surface data processing) unit and a monitor.

The interferometric video microscope unit shall consist of an interference microscope, a phase shift actuator, an image detector and an image acquisition and processing setup. The interference microscope equipped with an objective is arranged so as to view the endface of the ferrule.

The following parameters of the interference microscope shall be calibrated:

– optical magnification of the microscope;
– Z travel of the phase shift actuator;
– ferrule holder tilt angle in the case of an angled ferrule type.

The surface data processing unit shall be able to process the surface height information so as to measure the following parameters:

a) ferrule surface x-angle SX (refer to Figure B.1 a) for the sign convention);
b) ferrule surface y-angle SY (refer to Figure B.1 b) for the sign convention);
c) fibre array minus coplanarity CF;
d) fibre plane x-angle GX (or fibre line if parts are single row);
e) fibre plane y-angle GY (if parts have more than one row);
f) fibre tip spherical radii RF (some conditions apply. See Clause 7, m). Refer to Figure C.1 for fibre counting convention);
g) core dip ~~CD~~ C_{DIP} (some conditions apply. See Clause 7, i). Refer to Figure C.1 for fibre counting convention);
h) geometry limit GL (refer to Annex F for the calculation method);
i) ferrule surface x-radius RX (along the Z-axis with main curvature around X-axis);
j) ferrule surface y-radius RY (along the Z-axis with main curvature around Y-axis);
k) fibre height H (refer to Figure C.1 for fibre counting convention);
l) adjacent fibre height differential HA (refer to Figure C.1 for fibre counting convention).

The monitor shall display the measured and calculated surface profiles along each axis.

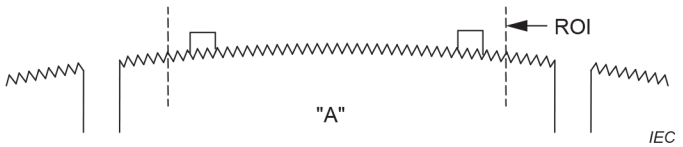
7 Procedure

~~The following procedure shall be used for this measurement.~~

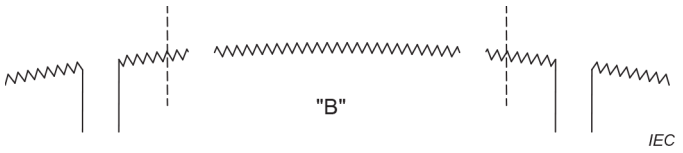
a) Affix the ferrule in the ferrule holder so that the endface is held sufficiently steady with respect to the interferometer.

b) Focus either the microscope or the sample, or both until the fringes are in position to scan the surface.

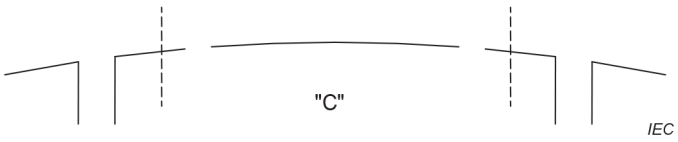
c) Map the surface of the ferrule. To create data set "A", use only the pixels contained within the ROI.



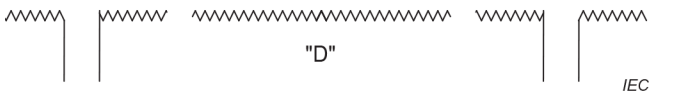
d) Create data set "B" by removing the extracting regions around the fibres.



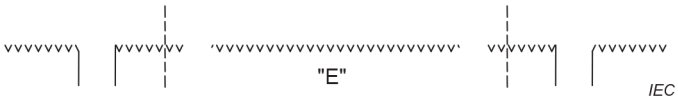
e) Create surface "C" by fitting a bi-parabolic curve to data set "B" ~~(see Annex A for~~. The curve fitting routine~~)~~ shall be performed as specified in Annex A.



f) Create data set "D" by subtracting surface "C" from data set "B"

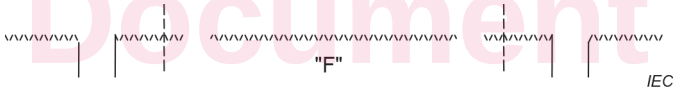


g) Create data set "E" by removing the highest 3 % of all pixels in data set "D". This removes any small points that are extremely high compared to the others. It is assumed these will break off when the connectors contact.



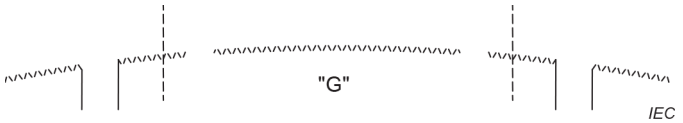
NOTE Points are selected as a percentage of the total area which includes pixels for which heights ~~could not~~ cannot be determined.

h) Create data set "F" by identifying the highest 20 % of all pixels in data set "E".

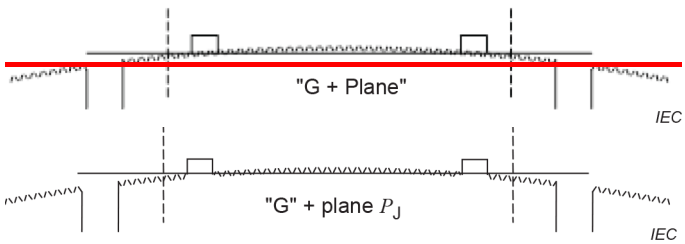


NOTE Points are selected as a percentage of the total area which includes pixels for which heights ~~could not~~ cannot be determined.

i) Create data set "G" by eliminating all pixels from data set "A" except for those identified in data set "F".



j) Fit a least squares plane P_J to data set "G" and use the plane to calculate SX and SY angles using plane P as a reference ~~(see Annex B for end face~~. The endface angle sign conventions~~)~~ shall be in accordance with Annex B. "Add" the extracting regions back in.



Calculate the fibre heights H as the distance normal to plane P_J at the corresponding fibre centre locations ~~(see Annex C for~~. The fibre counting conventions~~)~~ shall be in accordance with Annex C. Calculate the adjacent fibre height differential HA for each fibre. For a given fibre, HA is the largest height difference with the ~~two~~ immediately neighbouring fibres, i.e. the fibres located on the left and right (single row ferrule case) ~~or four~~ as well as above and below (multi-row ferrule case ~~neighbour fibres~~).

k) Fit a bi-parabolic curve to data set "G" ~~(see Annex A for~~. The curve fitting routine~~)~~ shall be performed as specified in Annex A. Calculate the ferrule surface RX and RY radii values.

l) ~~determine the core dip (for multi-mode and singlemode fibres) CD of each fibre. See Annex E for a detailed procedure.~~ Skip this step for single-mode fibres. For multimode fibres, determine the core dip C_{DIP} of each fibre. The calculation method shall be in accordance with Annex E.

If ~~CD~~C_{DIP} of a given fibre is ~~positive and~~ larger than 10 nm, report ~~CD~~C_{DIP} and skip step m) for that given fibre.

If ~~CD~~C_{DIP} of a given fibre is ~~negative or~~ smaller than or equal to 10 nm, do not report ~~CD~~C_{DIP} for that given fibre and proceed to step m).

m) Determine radius RF of a given fibre tip. This is accomplished by fitting a sphere to the surface points of the averaging region of the fibre (~~see Annex A for~~ the curve fitting routine~~)~~ shall be performed as specified in Annex A). The radius of the fitted sphere is then taken as the fibre tip radius.

n) Determine the minus coplanarity CF. ~~See Annex D for a detailed procedure.~~ The procedure shall be in accordance with Annex D. Use the fibre plane to calculate GX and GY angles using the average of the guide ~~pin bore~~ holes axes as a reference ~~(see Annex B for end face~~. The endface angle sign conventions~~)~~ shall be in accordance with Annex B.

o) If ~~CD is negative or smaller than 10 nm~~ C_{DIP} was reported for ~~more than~~ 50 % or fewer of the fibres, determine the geometry limit GL using the median value of the RF values of the fibres which exhibited a negative ~~CD~~ C_{DIP}. ~~See Annex F.~~ The calculation method shall be in accordance with Annex F.

8 Details to be specified and reported

~~The following items shall be specified for this measurement:~~

~~– type of interferometry;~~

~~– nominal angle of tilt, for example physical contact (PC)/angled PC (APC);~~

~~– any deviation from this method;~~

~~– Measurement uncertainty.~~

The following details, as applicable, shall be specified in the relevant specification and shall be reported in the test report.

a) DUT characteristics:
   1) nominal angle of tilt, for example physical contact (PC)/angled PC (APC);
   2) ferrule type (see Table 1).
b) Measurement equipment specification and setup (see Clause 6):
   1) type of interferometry.
c) Measurement uncertainty (see 6.4).
d) Final examinations, measurements and calculations, and performance requirements (see Clause 7):
   1) ferrule surface x-angle SX;
   2) ferrule surface y-angle SY;
   3) fibre array minus coplanarity CF;
   4) fibre plane x-angle GX;
   5) fibre plane y-angle GY;
   6) fibre tip spherical radii RF;

7) core dip C_{DIP};
8) geometry limit GL (see Annex F);
9) ferrule surface x-radius RX;
10) ferrule surface y-radius RY;
11) fibre height H;
12) adjacent fibre height differential HA.

e) Deviations from this test procedure.