SLOVENSKI STANDARD
SIST EN 61300-3-40:1999

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Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-40: Examinations and measurements - Extinction ratio of a polarization maintaining (pm) fibre pigtailed connector (IEC 61300-3-40:1998)

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Lichtwellenleiter - Verbindungselemente und passive Bauteile - Grundlegende Prüf- und Meßverfahren -- Teil 3-40: Untersuchungen und Messungen - Messung der Verminderung des Extinktionsverhältnisses eines Steckverbinders mit einer polarisationserhaltenden (PM) Anschlußfaser

Dispositifs d'interconnexion et composants passifs à fibres optiques - Méthodes fondamentales d'essais et de mesures -- Partie 3-40: Examens et mesures - Rapport d'extinction d'un connecteur à fibre amorce maintenant la polarisation (pm)

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English version

Fibre optic interconnecting devices and passive components Basic test and measurement procedures Part 3-40: Examinations and measurements Extinction ratio of a polarization maintaining (pm) fibre pigtailed connector (IEC 61300-3-40:1998)

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Lichtwellenleiter-Verbindungselemente und passive Bauteile Grundlegende Prüf- und Meßverfahren Teil 3-40: Untersuchungen und Messungen - Messung der Verminderung des Extinktionsverhältnisses eines Steckverbinders mit einer polarisationserhaltenden (PM) Anschlußfaser (IEC 61300-3-40:1998)

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Foreword

The text of document 86B/1040/FDIS, future edition 1 of IEC 61300-3-40, 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 was approved by CENELEC as EN 61300-3-40 on 1998-04-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-01-01
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Endorsement notice

The text of the International Standard IEC 61300-3-40:1998 was approved by CENELEC as a European Standard without any modification.

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

Part 3-40: Examinations and measurements – Extinction ratio of a polarization maintaining (pm) fibre pigtailed connector

FOREWORD

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International Standard IEC 61300-3-40 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/1040/FDIS	86B/1060/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.

IEC 61300 consists of the following parts, under the general title *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures:*

– Part 1: General and guidance

– Part 2: Tests

– Part 3: Examinations and measurements

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

Part 3-40: Examinations and measurements – Extinction ratio of a polarization maintaining (pm) fibre pigtailed connector

1 General

1.1 Scope and object

This part of IEC 61300 describes the procedure to measure the ability of an optical fibre connector to maintain a given extinction ratio across the connection in pm fibre. In this test we limit the measurement to the most common case of nearly linearly polarized light propagating in pm fibre. The term “extinction ratio” used here refers to the proportion of light propagating in the two orthogonal polarization axes of the fibre and is more properly defined as “polarization crosstalk”. “Extinction ratio” is the commonly used term.

This procedure has been designed for use with dedicated equipment in a manufacturing environment and thus incorporates a rather elaborate test configuration. It should be noted that other more direct test configurations can be used in suitably equipped optical laboratories. These may be the subject of additional test procedures in the future. It should be noted that this test procedure is not designed for long term continuous testing; drift of polarization alignment can occur particularly in the single-mode fibre. Hence, repeated rather than continuous measurement is required for long term testing of components.

1.2 General description

Polarization maintaining fibre has the ability to maintain the proportions of light polarized parallel to the two axes of symmetry of the fibre even when there is moderate bending of the fibre. A connector system intended for use with pm fibre should accordingly create minimum disturbance to this proportioning of the propagating light. In the case of light highly polarized along one axis of the fibre the ratio of these two portions of the light is called the extinction ratio and is usually expressed in decibels. A connector can degrade the extinction ratio in two ways. Firstly, the connector can have non-ideal keying so that the two ends of the fibres being joined are not perfectly aligned with respect to their axes of birefringence. Secondly, the connector-to-fibre fixing mechanism can cause distortions or non-symmetrical stresses to the fibre which result in extinction ratio degradation. This test is intended to measure the extinction ratio for connectors in which the former mechanism is the dominant source of extinction ratio degradation. The degree to which the latter mechanism affects the extinction ratio must be measured during the pigtailing process and hence would be applicable to field mountable pm fibre connectors or to the assembly process at the connector pigtail manufacturer’s location.

2 Apparatus

The apparatus and arrangement necessary to make this measurement is shown in figure 1. It consists of:

– an optical source, S of known characteristics (wavelength, spectral width, etc.) and a compatible detector, D. The accuracy of this test will be affected by interference effects among elements of the test apparatus and the device under test and therefore care should be taken on the coherence of the light source. This test procedure requires that the light source has a low degree of coherence since use of a highly coherent source, such as a DFB laser, can produce false measurement results. A Fabry-Perot laser with three or more primary longitudinal modes of oscillation is suitable for this test. Ideally, an LED is the preferred source if the spectral characteristics of the test component and the dynamic range of the measurement required can accommodate this type of source. Specifically, the source must launch enough power into the fibre so that the minimum signal measured through the test component is at least 3 dB higher than the noise floor of the detector;

– an in-line polarization assembly of polarizer, quarter-wave retardation plate and half-wave retardation plate in an expanded beam formed by two lenses L1 and L2. The polarizer linearly polarizes the light to a high extinction ratio; the quarter-wave plate converts the state of polarization (SOP) from linear to elliptical or circular; and the half-wave plate rotates the direction of polarized light. With this combination of elements, it can be seen that every possible SOP can be produced;

– a temporary joint, TJ;

– a reference pm fibre pigtail. This could be a pigtail of the type to be measured which has previously been determined to be accurate (tolerances to be specified in relevant specification) dimensionally (keying, core alignment, etc.);

– an analyzer, A, to determine the extinction ratio of light.

The polarization optics described in this test procedure is based on bulk optical elements; i.e. waveplates and a polarizer. It is also permissible to assemble the polarization optics by other means such as fibre loop polarization elements.

Comment on apparatus: the purpose of the section of sm fibre at the output of the polarization optics is to facilitate an optical joint to a variety of reference pm fibre pigtails. It is also permitted to eliminate this section of sm fibre and replace it with a direct coupling of the polarization optics to the reference pm pigtail. Furthermore, since the presence of cladding modes will degrade the accuracy of measurement, it is assumed that the fibre jacket for all single-mode and pm fibre sections acts as a cladding mode stripper.

3 Procedure

The first part of this procedure sets a high degree of linear polarization aligned to a fibre polarization axis at the output of the reference pigtail connector. During this procedure care should be taken not to move the singlemode fibre sections of the arrangement. With the measurement arrangement set up as in figure 1:

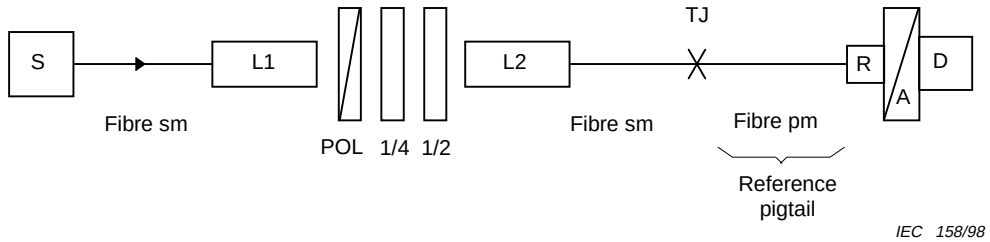

Figure 1 – Measurement set-up: reference measurement

a) with arbitrary settings of the quarter and half-wave retardation plates and the analyzer adjust the polarizer to get a maximum measurement at the detector;

b) adjust analyzer, A, to get a minimum measurement at the detector;

c) adjust quarter-wave plate to get minimum measurement at the detector;

d) adjust half-wave plate to get minimum measurement at the detector;

e) repeat steps b), c) and d) until the lowest measurement attainable is achieved (two or three iterations). Record this measurement as $DMIN_i$ (dBm). At this point of the procedure a check on the polarization alignment can be made by inducing gentle bending and twisting motion in the test pigtail while monitoring the power meter. Power fluctuations of greater than 1 dB indicate that the polarization alignments to the principal axes are not correct and realignment is necessary;

f) adjust the analyzer to obtain a maximum reading at the detector. Record this reading as $DMAX_i$ (dBm).

The initial extinction ratio of the light, ER_i , is given by $DMAX_i$ – $DMIN_i$ (dB). Since this value is a limit to the measurement range of the system, it is normal to require that this value be 10 dB greater than the maximum expected measurement of the extinction ratio made on the test pigtail.

The next part of this procedure measures the degree of linear polarization as an extinction ratio after the connection to the pigtail to be evaluated. A comparison to the initial extinction ratio will give the degradation in extinction ratio.

Taking care not to disturb the singlemode fibre parts of the arrangement, connect the pigtail to be tested to the reference connector and mate the fibre end (properly cleaved) or the connector (in the case of a patchcord) to the analyzer as shown in figure 2.

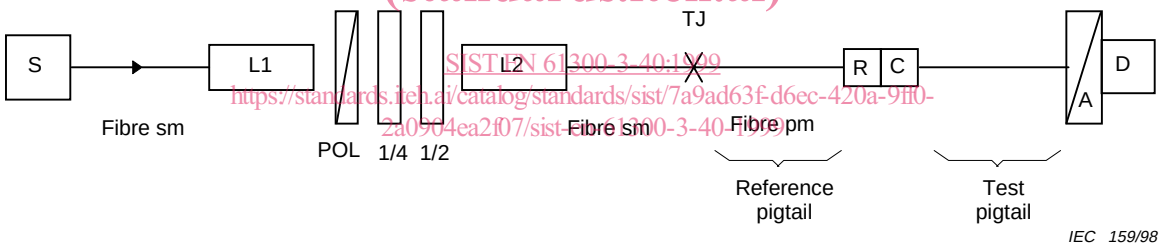

Figure 2 – Measurement set-up

g) adjust the analyzer to obtain a minimum reading at the detector. Record this reading as $DMIN_f$ (dBm).

h) adjust the analyzer to obtain a maximum reading at the detector. Record this reading as $DMAX_f$ (dBm).

The final extinction ratio of the light, ER_f, is given by $DMAX_f$ – $DMIN_f$ (dB).

The change in the extinction ratio, ER_i – ER_f, gives the extinction ratio caused by the polarization maintaining fibre pigtail, in combination with the reference connector.

Since this test will give results dependent on the particular alignment of the keying, repeated measurements will normally be made to determine the performance of a connector pigtail.