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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical circuit boards – Part 3-1: Performance standards – Flexible optical circuit boards using unconnectorized optical glass fibres

Cartes à circuits optiques – Partie 3-1: Norme de performance – Cartes à circuits optiques souples utilisant des fibres optiques en verre, non connectorisées

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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.

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International Standard IEC 62496-3-1 has been prepared by IEC technical committee 86: Fibre optics.

This bilingual version (2011-11) corresponds to the monolingual English version, published in 2009-08.

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

CDV	Report on voting
86/319/CDV	86/342/RVC

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

The French version of this standard has not been voted upon.

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

A list of all parts of IEC 62496 series, published under the general title *Optical circuit boards,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

OPTICAL CIRCUIT BOARDS –

Part 3-1: Performance standards – Flexible optical circuit boards using unconnectorized optical glass fibres

1 Scope

This part of IEC 62496 defines the performance of flexible optical circuit boards (FOCBs) using unconnectorized optical glass fibres for controlled environment. This standard clarifies the requirements for quality classification of the flexible OCBs incorporating optical glass fibres.

2 Normative references

The following referenced documents are indispensable for the application 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 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

ISO 5999, *Flexible cellular polymeric materials – Polyurethane foam for load-bearing applications excluding carpet underlay – Specification*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
FFOCB (fibre flexible OCB)
an OCB on which arbitrary routing patterns are made by fixing optical fibres and covered by a protection layer as illustrated in Figure 1. The fibre flexible OCB consists of a portion where the optical fibre is adhered to the flexible substrate as a routing pattern (OCB body) and “OCB tails” where the optical fibre is stacked out from the OCB body. The substrate for

FFOCB is a mechanically flexible polymer sheet on which optical fibres are adhered using adhesive or attached to the polymer sheet

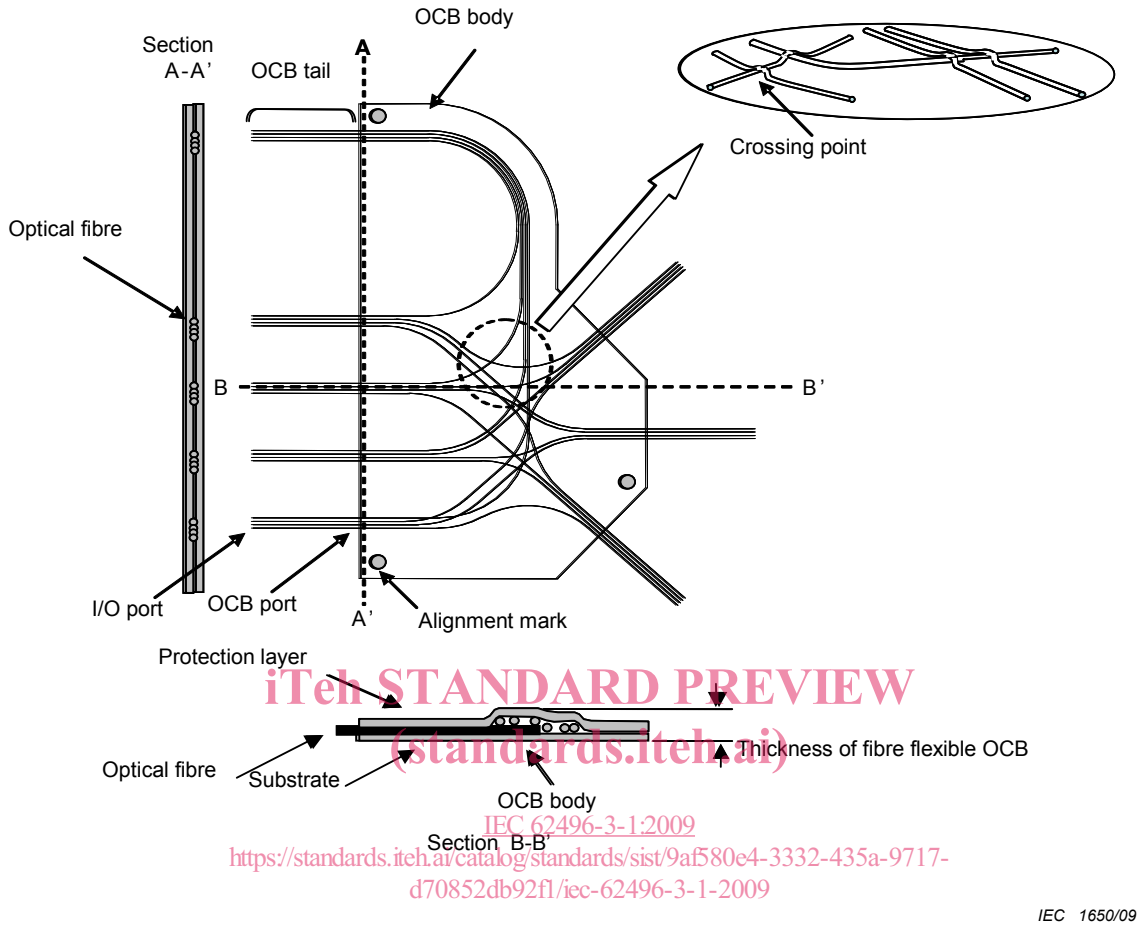

Figure 1 – Example of fibre flexible OCB

3.2
optical fibres for FFOCB
categories of optical fibres to be used for fibre flexible OCB are multimode fibres and single-mode fibres with glass core/glass cladding (see Tables 1 and 2)

NOTE 1 IEC 60793-2 provides the specifications for the fibres.

Table 1 – Optical fibres for FFOCB-1

Class	Category	Type	Reference
A – Multimode fibres	A1	Graded index fibre	IEC 60793-2-10
	A2	Quasi step index fibre	IEC 60793-2-20
B – Single-mode fibres	B1.1	Dispersion unshifted	IEC 60793-2-50
	B1.2	Cut-off shifted	
	B1.3	Extended band	
	B2	Dispersion shifted	
	B4	Non-zero dispersion shifted	
	B5	Wideband non-zero dispersion-shifted	
	B6	Bending loss insensitive	

NOTE 2 IEC 60793-2-60 also specifies the specification of single-mode intraconnection optical fibres for wiring in OCB.

Table 2 – Optical fibres for FFOCB-2

Family	Transmission window	Nominal MFD (mode field diameter)	Reference
C1	1 300 nm to 1 625 nm	8,6 μm -9,5 μm at 1 310 nm	IEC 60793-2-60
C2	1 310 nm	5,0 μm -7,0 μm at 1 310 nm	
C3	1 550 nm	5,5 μm -7,5 μm at 1 550 nm	
C4	980 nm	4,0 μm -7,0 μm at 980 nm	

3.3
crossing point of optical fibres
position where optical fibres cross each other in the OCB body. The optical fibre overrides another optical fibre at the crossing point (see Figure 1). Bending endurance and static pressure endurance tests are carried out for checking mechanical strength of this point

4 Tests

All test methods shall be in accordance with IEC 61300-2-18, IEC 61300-2-19, IEC 61300-2-22, IEC 61300-3-1, IEC 61300-3-6, and Annexes A through D of this standard. The test method to be used is defined for each test in 9.2, Table 3.

5 Test report

Fully documented test reports and supporting evidence shall be prepared and available for inspection as evidence that the tests have been carried out and the results are satisfactory.

6 Reference components

No reference components are required to perform the tests described in this standard.

7 Visual inspection

The OCB body and OCB tails of a product or a test specimen described in Annex B shall be inspected for confirmation of damage that degrades performance, such as delamination of substrate and protection layer and breaking points of the optical fibres as defined in IEC 61300-3-1. The routing pattern of the test specimen is also checked, comparing it with the design described in Figure B.1. Visual inspection shall be undertaken using an optical magnifier and/or eye observation.

8 Connectivity inspection

The correspondence between the input and output ports of a product shall be confirmed, that is, a from/to port table should be obtained. This is because the input and output ports are not regularly placed in a 2D-plane although the positions are defined against the original coordinate. It is recommended that light is transmitted through each optical path, and output light from each output port is observed with a CCD camera or by visual inspection.

NOTE The preferred light source is a laser diode, LED, or lamp source (halogen or xenon). The wavelength is arbitrary.

9 Performance requirements

9.1 Sample size, test sequencing and grouping

The test sample to be used for the tests shall be as defined in Annex C.

9.2 Performance details

Attenuation of fibre flexible optical circuit board shall be measured by using method AT1, method AT2 or method AT3 of IEC 61300-3-4.

Table 3 – Performance details

No.	Test	Requirements	Details
1	Bending endurance of OCB body	Change in attenuation: maximum variation of <0,3 dB There is no delamination of substrate and protection layer and breaking point of fibre for measurement	See Annex A Use test specimen described in Annex B Bending radius of OCB body: 30 mm Number of cycles: 10 Measurement of attenuation shall be made before and after test Test wavelength to be measured at the following wavelengths: 1 550 nm ± 30 nm (for single-mode) 850 nm ± 30 nm (for multimode)
2	Static pressure endurance of OCB body	Change in attenuation: maximum variation of <0,3 dB There is no delamination of substrate and protection layer and breaking point of fibre for measurement	See Annex D Use test specimen described in Annex B Measurement of attenuation shall be made before and after test Test wavelength to be measured at the following wavelengths: 1 550 nm ± 30 nm (for single-mode) 850 nm ± 30 nm (for multimode)
3	Dry heat / high temperature	Change in attenuation: maximum variation of <0,3 dB There is no delamination of substrate and protection layer	IEC 61300-2-18 Use test specimen described in Annex B Temperature: +60 ºC ± 2 °C Measurement of attenuation shall be made at initial and 96 h Test wavelength to be measured at the following wavelengths: 1 550 nm ± 30 nm (for single-mode) 850 nm ± 30 nm (for multimode)
4	Damp heat (Steady state)	Change in attenuation: maximum change of attenuation <0,3 dB There is no delamination of substrate and protection layer	IEC 61300-2-19 Use test specimen described in Annex B Temperature: +40 °C± 2 °C Relative humidity: 93 % +2 %, -3 % RH Measurement of attenuation shall be made at initial and 96 h Test wavelength to be measured at the following wavelengths: 1 550 nm ± 30 nm (for single-mode) 850 nm ± 30 nm (for multimode)

No.	Test	Requirements	Details
5	Change of temperature	Change in attenuation: maximum change of attenuation <0,3 dB After the test, bending endurance of OCB body test (No.1) using the same test specimen shall be passed There is no delamination of substrate and protection layer	IEC 61300-2-22, Test Nb Use test specimen described in Annex B. High temperature dwell: +60 °C± 2 °C Low temperature dwell: -10 °C± 2 °C Duration at each dwell temperature: 1 h Ramp time = 1 °C/min Number of cycles: 5 Measurement of attenuation shall be made before and after test Test wavelength to be measured at the following wavelengths: 1 550 nm ± 30 nm (for single-mode) 850 nm ± 30 nm (for multimode)

Annex A
(normative)

Test method of bending endurance of fibre flexible OCB

A.1 Preparation

The instrument of the bending endurance test consists of a flat base plate and a mandrel to specify the bending radius (30 mm) of a specimen as shown in Figure A.1. Optical attenuation shall be able to be confirmed before and after the test. The test specimen shall be prepared with reference to Annex B.

A.2 Test

The purpose of the bending test is to check the degradation of fibres and delamination of the substrate and protection layer due to repeatedly bending. Bending test shall be made with a plate-gap of 60 mm unless otherwise specified by detailed specification of the OCB. The test specimen shall be placed on two base plates and fixed with plates for fixing as shown in Figure A.1. One base plate plate turns over and is setup above and parallel to another base plate, as shown in Figure A.1. After keeping in this position for 1 min, the top base plate is back to the first position. The number of this cycle is 10. The optical attenuation is measured before and after the test. The construction (optical fibre, substrate, protection layer) of the OCB body of test specimen used shall be reported in the test report. The outer surface at the bending of the test specimen shall be clearly specified if the surfaces at the bend are different due to the structure of the test specimen. The appearance shall be checked, includes break of the optical fibre and apparent deformation of the test specimen.

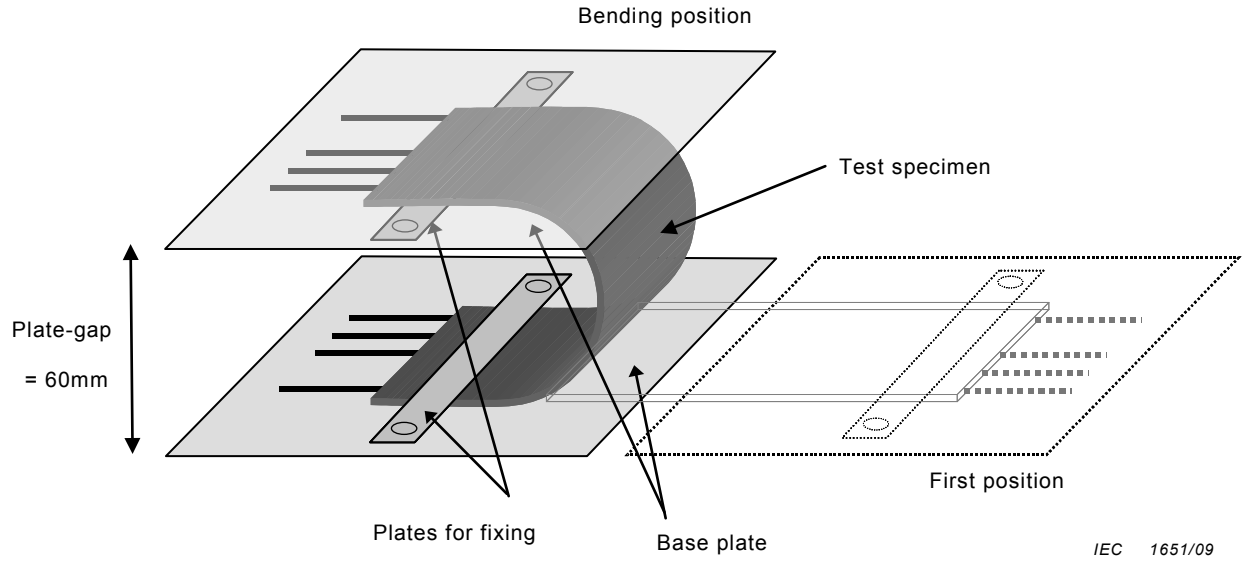

Figure A.1 – Configuration of the bending endurance test