SLOVENSKI STANDARD

oSIST prEN IEC 62496-2-5:2022

01-februar-2022

Plošče z optičnimi vezji - Osnovni preskusni in merilni postopki - 2-5. del: Preskušanje upogljivosti za zvijava optoelektrična vezja

Optical circuit boards - Basic test and measurement procedures - Part 2-5: Flexibility test for flexible opto-electric circuits

Ta slovenski standard je istoveten z: prEN IEC 62496-2-5:2021

ICS:

31.180	Tiskana vezja (TIV) in tiskane plošče	Printed circuits and boards
33.180.01	Sistemi z optičnimi vlakni na splošno	Fibre optic systems in general

oSIST prEN IEC 62496-2-5:2022 en

IEC

86/591/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

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SUPERSEDES DOCUMENTS: **86/570/CD, 86/582A/CC**	

IEC TC 86 : FIBRE OPTICS	
SECRETARIAT: United States of America	SECRETARY: Mr Steve Swanson
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 86,SC 86B,TC 91	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT	☐ QUALITY ASSURANCE ☐ SAFETY
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Optical circuit boards - Basic test and measurement procedures - Part 2-5: Flexibility test for flexible opto-electric circuits

PROPOSED STABILITY DATE: 2026

NOTE FROM TC/SC OFFICERS:

Formerly IEC 62496-2-61. Numbering change approved by Plenary decision (see 86/577/RM, Decision 2020-03).

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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OPTICAL CIRCUIT BOARDS – BASIC TEST AND MEASUREMENT PROCEDURES

Part 2-5: Flexibility test for flexible opto-electric circuits

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IEC 62496-2-5 has been prepared by IEC technical committee 86: FIBRE OPTICS. It is an International Standard.

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

Draft	Report on voting
86/XX/FDIS	86/XX/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.

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/standardsdev/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,
- replaced by a revised edition, or
- amended.

OPTICAL CIRCUIT BOARDS – BASIC TEST AND MEASUREMENT PROCEDURES

Part 2-5: Flexibility test for flexible opto-electric circuits

1 Scope

This part of IEC 62496-2 defines a test method for folding flexibility inspection of flexible opto-electric circuits with a MIT folding endurance tester and presents a guideline for a step stress test method for finding the predetermined minimum mechanical folding radii below which the flexible opto-electric circuits can be damaged by intended folding distortion. Here, test samples are used instead of products for the flexibility test of their flexible opto-electric circuits, and the test samples have the same layer structure as the products.

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.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60793-2 (all parts), *Optical fibres – Part 2: Product specifications*

IEC 62496-2-1, *Optical circuit boards - Part 2-1: Measurements - Optical attenuation and isolation*

ISO 5626:1993, *Paper – Determination of folding endurance*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in IEC 62496-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

3.1
flexible opto-electric circuit board
flexible circuit board that contains both optic and electric circuits integrated into a flexible sheet

Note 1 to entry: Figure 1 shows an example of the top view of a flexible opto-electric circuit board.

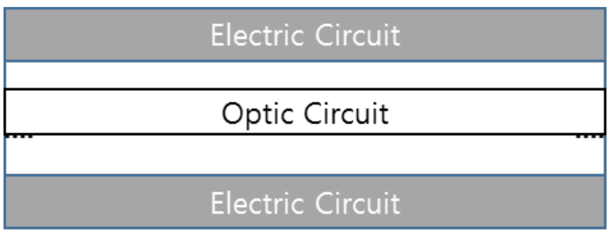


Figure 1 – Schematic diagram of flexible opto-electric circuit board (top view)

3.2
MIT test system
instrument for folding endurance test of flexible sheets with interchangeable folding heads, allowing a range of thickness up to 1,25 mm

Note 1 to entry: The name of the MIT folding endurance tester follows the Massachusetts Institute of Technology because it has been developed by the institute.

Note 2 to entry: There are two types of flexible opto-electric circuit board: optical fibre-types and planer optical waveguide-types.

[SOURCE: ISO 5626:1993, Clause 1]

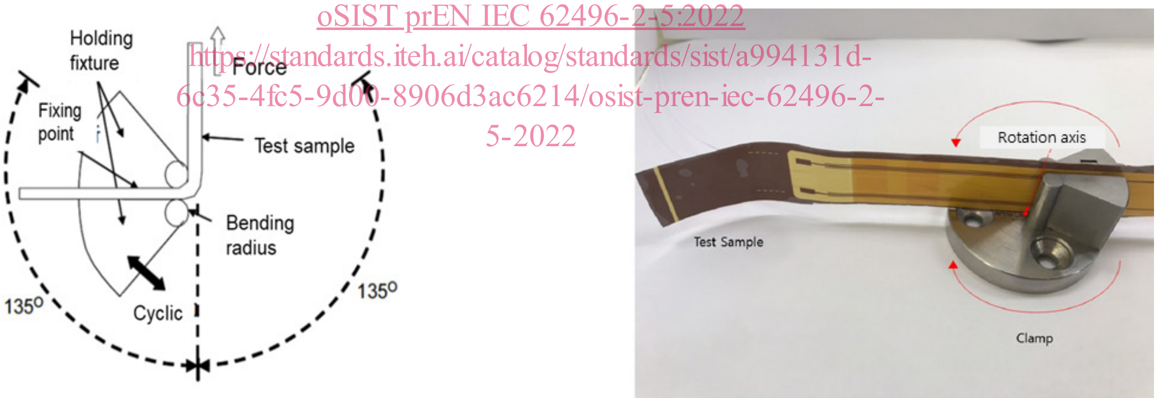
4 Apparatus

4.1 General description

The MIT test system for flexibility test of the flexible opto-electric circuit board (hereafter FOECB) shall be used for finding of the minimum folding radii of both optic and electric circuits of the FOECB before any functional damage occurs. An existing MIT folding method has been used for testing the folding flexibility of only electric circuits. However, in this proposed standard, it shall be used for testing the folding flexibility of both optic and electric circuits.

Since the test sample for fibre optical type should be connected to the MIT test system through an optical fibre, real-time monitoring may be possible. Accordingly, the MIT tester shall be configured with a real-time monitoring system using a laser signal device to accurately know the time of breakage of the optical fibres.

Test samples for planar waveguide optical circuits are difficult to measure through real-time monitoring because it is not easy to connect to an MIT test device through an optical fibre. Therefore, the test sample should be tested by connecting only electric circuits as in the existing MIT folding method. The failure time of the test sample should be measured separately using a visual light on the planar waveguide circuits. In addition, these tests should be measured in the process of replacing the holding jig.The test sample shall be clamped by the folding jig within the main controller as shown in Figure 2.



a) Photograph diagram of the folding jig b) Photograph of a folding jig and test sample

Figure 2 – Overview of the folding jig

4.2 MIT tester for flexibility test of FOECBs

4.2.1 FOECBs test sample of fibre optical types

The MIT test system for fibre optical circuits should be configured to stop the folding action of the test sample if any damage starts to appear in its optical and electrical sections. Therefore, the MIT test system shall be composed of an optic-electric signal control source (hereafter referred as O-E signal control source), test sample, and main controller, as shown in Figure 3.

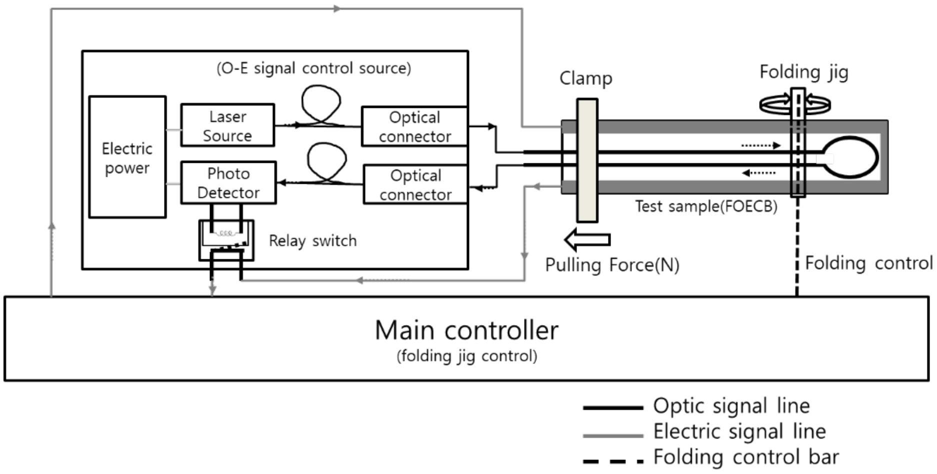


Figure 3 – Schematic diagram of the MIT test system for fibre optical circuits

4.2.2 FOECBs test sample of planer waveguide optical circuit types

The MIT tester system for planer waveguide optical circuits shall be constructed in the same form as the folding flexibility test method for existing electrical circuits, as shown in Figure 4.

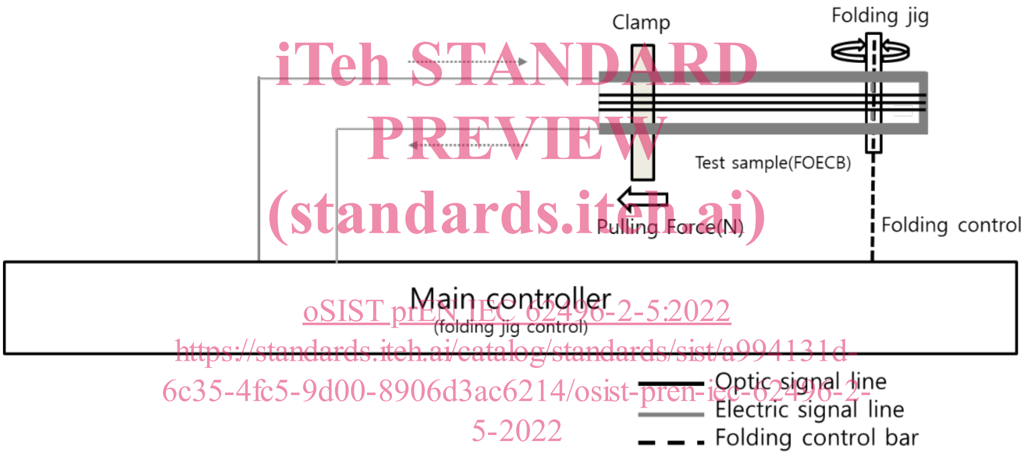


Figure 4 – Schematic diagram of the MIT test system for planar waveguide optical circuits

4.3 O-E signal control source

An O-E signal control source shall be composed of a laser source, photo detector, relay switch, electric power source, optical fibre, and optical connectors. The O-E signal control source supplies an optical signal to the test sample, and allows the photo detector to control the relay switch based on detected optical signal for on-off switching of the electric signal flow (current) within the MIT test system.

4.4 Laser source

The optical output power of the laser source shall have enough larger of the minimum detected power of optical detector and attenuation (optical loss) of samples. The laser source in the O-E signal control source sends an optical signal to the test sample via its optical input terminal connected to the protruded optical fibre. The wavelength and mode of the laser source should be chosen according to the application to be used. The launching mode of the laser source should be appropriate to the application of the relevant specification of O-E circuit board.

4.5 Photo detector

The minimum detected optical power of the photo detector shall be enough to detect the optical power after attenuating the optical power by the test sample and light source power. The photo detector detects the optic signal flow in the test sample. The photo detector output controls the relay switch inside the O-E signal control source. Therefore, the output current of the photo detector should be above the minimum operating voltage of the relay switch with a proper resistance for the current output. The photo detector shall have enough response frequency to detect the optical power change (deviation) by the attenuation change caused by the folding distortion. At minimum, the response frequency for the photo detector should be 10 times or more than the folding duration (0 °to 90 °), or kHz order will be necessary.

4.6 Folding jig

The size of the jig shall be selected according to the test samples. Several types of folding jigs with different bending radii are required to apply various bending tests to the test sample. Folding jigs of 6 different curvature radii (1,0 mm, 2,0 mm, 3,0 mm, 4,0 mm, 5,0 mm, and 10,0 mm) should be prepared (see Figure 5).

Figure 5 – MIT folding jigs (from the left, folding radius r is 1,0 mm, 2,0 mm, 3,0 mm, 4,0 mm, 5,0 mm and 10,0 mm)

4.7 Relay switch

The switching time shall be at least one tenth of the folding speed. The relay switch plays a role of direct on-off switching control of the electric circuit in the MIT test system. That is, once the photo detector detects the optic signal flow in the test sample, the relay switch stays in the on-state. If the photo detector fails to detect the optic signal flow in the test sample, the relay switch turns to the off-state. The relay switch operates the MIT test system depending on the detected optical signal output at the photo detector, which is subject to the physical state of the test sample (e.g., either broken or non-broken state of the optic circuit).

4.8 Main controller

The main controller shall control the electrical current to fold the folding jig with enough accuracy to test. The main controller supplies an electric current to the test sample and mechanically controls the folding action of the test sample. The main controller may consist of the main controller and the mechanical control means of folding, separately. Generally, the main controller emits the electric signal by itself to perform the mechanical folding operation on the test sample. The typical electric current flowing through the main controller ranges from 1 mA to 10 mA

5 Test sample

5.1 FOECB test samples of optical fibre-types

Test samples of optical fibre-types shall have a pigtailed shape (see Figure 6). The optical fibres used in the test samples may be single-mode and/or multimode fibres. Depending on applications, glass optical fibres, polymer optical fibres, and specialty optical fibres may be used to form the optical circuits.

The optical circuits shall be positioned at a central part of the entire FOECB test samples. The electrical circuits shall be positioned at peripheral areas of the optical circuit in a symmetrical structure. The symmetrical structure shall have superior characteristics in size stability from the viewpoint of design and reliability for the FOECB test samples, as shown in Figure 6.

The test samples of the optical fibre-types shall have a protruded structure with a length of l_9 at one side. The protruded length (l_9) shall be maintained with sufficient length over 100 mm for easy connection with other fibres (e.g., fibre fusion splicing). The other side of the test samples shall