

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –  
Part 2-5: Tests – Torsion**

**Dispositifs d'interconnexion et composants passifs fibroniques – Procédures fondamentales d'essais et de mesures –  
Partie 2-5: Essais – Torsion**



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**Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING  
DEVICES AND PASSIVE COMPONENTS –  
BASIC TEST AND MEASUREMENT PROCEDURES –****Part 2-5: Tests – Torsion**

## FOREWORD

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IEC 61300-2-5 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 fourth edition cancels and replaces the third edition published in 2009. This edition constitutes a technical revision.

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

- a) The terms and definitions clause was added;
- b) the procedure description was modified;
- c) new subsections are included in Clause 6 for a better sequence description;
- d) Figure 1 was improved and Figure 2 was updated in text descriptions;

e) the severity of the test was updated according to the component and operation conditions.

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

Draft	Report on voting
86B/4641/FDIS	86B/4662/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts of 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.

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- withdrawn,
- replaced by a revised edition, or [IEC 61300-2-5:2022](http://www.iec.ch/standardsdev/publications)
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# FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

## Part 2-5: Tests – Torsion

### 1 Scope

The purpose of this part of IEC 61300 is to determine the ability of the cable attachment element of the device under test (DUT) to withstand torsional loads that can be experienced during installation and normal service.

### 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 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-2-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-38: Tests – Sealing for pressurized fibre optic closures*

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 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

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*

IEC 61300-3-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61300-1 apply.

ISO and IEC maintain terminological 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>

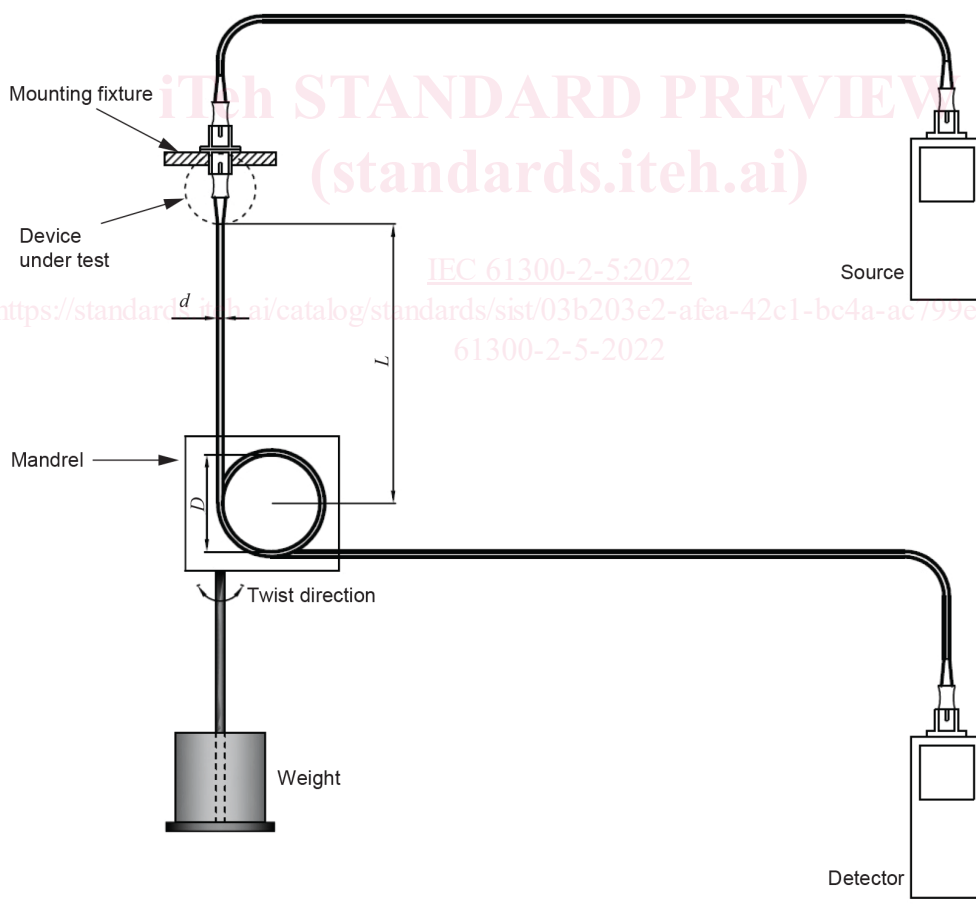
## 4 General description

The cable-to-device attaching points are subjected to a torsional load or twisting action to determine the effects of this action on optical performance and physical integrity of the DUT.

## 5 Apparatus

### 5.1 General

The test apparatus shall be capable of applying simultaneously tension and a torsional load or twisting action to the cable-to-component-or-device attaching point. Figure 1 and Figure 2 show basic test arrangement examples for a component or device and protective housing test set-up, respectively.



#### Key

$d$  diameter of fibre, cord or cable

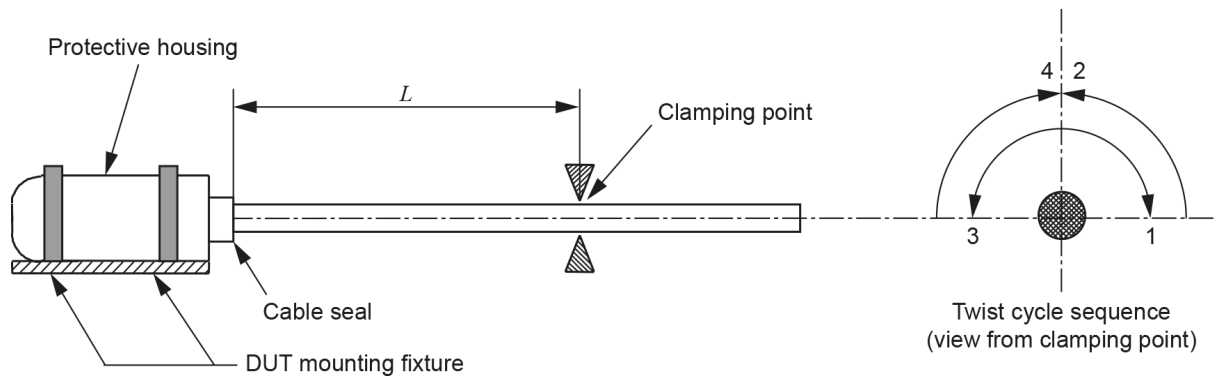
$D$  mandrel diameter

$L$  distance from rearmost portion of the cable fixing component to mandrel.

NOTE Source and detector can be exchanged.

**Figure 1 – Component or device test set-up**





IEC

**Key**

1, 2, 3, 4 sequence of twist on each cycle

 $L$  distance from fixed component to clamping point.**Figure 2 – Protective housing test set-up****5.2 Mounting fixture for component or device**

The mounting fixture should be rigidly based to hold the DUT properly aligned and allow stable optical connection for monitoring optical properties during the test as required by the relevant specification.

**5.3 Clamp/mandrel**

The mandrel or clamp is the point at which the torsional load is applied. This point can also be used to attach a weight to apply the tension load when specified; in this case, the clamp may consist of a capstan or mandrel.

If used, the capstan or mandrel shall be of diameter  $D$  at least 25 times the diameter  $d$  of the fibre, cord or cable of the DUT and shall be located at a distance  $L$ , measured from the rearmost portion of the cable fixing component, to the tangent point on mandrel as indicated in Figure 1. Use sufficient turns around the mandrel to grasp and secure the fibre, cord or cable so that it does not turn or slip in the holder when loads are applied.

The clamp, indicated in Figure 2, shall not crush the optical fibres of the DUT nor cause a change in the attenuation.

Unless otherwise specified in the relevant specification, the clamping distance  $L$  for connectors, passive components or splices shall be  $250 \text{ mm} \pm 50 \text{ mm}$  and  $400 \text{ mm} \pm 50 \text{ mm}$  for hardened connectors, wall outlets, boxes, optical distribution frame modules (ODFM), closures and street cabinets. For devices that include rigid cables with diameter  $> 25 \text{ mm}$ , the clamping distance,  $L$ , shall be  $1\,000 \text{ mm} \pm 5 \text{ mm}$ .

**5.4 Tensile load**

Tension load to be applied on the DUT shall be specified in the relevant specification. Required tensile load may be created by weights or another suitable mechanism. Values of recommended loads are given in Table 1. In the case of duplex cordage, the loads shall not be doubled and the cordage shall be bent over the mandrel in the minor axis direction.

## 5.5 Measurement equipment

For optical properties measurement, the equipment and measurement methods shall be according IEC 61300-3-4 for attenuation and IEC 61300-3-6 for return loss measurement. For active monitoring of changes in attenuation and return loss, the measurement equipment shall be according IEC 61300-3-3 or IEC 61300-3-28. The optical performance measurement shall be performed at the wavelength(s) specified in the relevant specification. When sealing performance is requested to be evaluated, the equipment and measurement method shall be according IEC 61300-2-38 and visual examination shall be applied according IEC 61300-3-1.

## 6 Procedure

### 6.1 Preparation of DUT

Prepare and clean the DUT according to the manufacturer's instructions or as specified in the relevant specification. The DUT shall be terminated onto a sufficient length of fibre cable to facilitate interfacing with the optical measurement equipment.

### 6.2 Preconditioning

Pre-condition the DUT for at least 2 h at the standard atmospheric conditions specified in IEC 61300-1, unless otherwise specified in the relevant specification. If the test is performed at other ambient temperatures, allow at least 4 h of conditioning.

### 6.3 Mount the device under test

The DUT shall be rigidly mounted to a mounting fixture or device, which is secured in a fixed position (see Figure 1 and Figure 2).

### 6.4 Measure of initial optical properties

Measure the optical properties specified in the detail specification, such as attenuation and return loss. These values shall be recorded and used as a reference for the test evaluation.

### 6.5 Clamp the cable and apply the tensile load

The clamp, or mandrel if used to apply a load, shall be fastened to the cable in such a manner that the optical fibre or cable is not crushed. The length of the clamp shall be specified in the detail specification or as indicated in 5.3 (see Figure 1 and Figure 2). Gradually apply the tensile load, as recommended in Table 1 or as specified in the relevant specification, to the clamp, being careful to avoid any sudden jerking or straining of cable.

After the load is applied, it is recommended to re-measure the optical properties of the DUT.

NOTE If changes on optical properties are observed at this step, this can be indication of residual stress in the DUT.

### 6.6 Monitoring sealing performance of closures

When sealing performance of sealed closures is requested, the DUT shall be pressurized and sealed off at the test temperature. An over-pressure of 20 kPa  $\pm$  2 kPa for categories G and A closures and 40 kPa  $\pm$  2 kPa for category S closures shall be used. For closures used in pressurized networks, the evaluation should be carried out at 98,0 kPa  $\pm$  9,8 kPa over-pressure level. For continuously monitoring pressure during the test, a pressure gage device shall be attached to the DUT. The change in pressure (pressure loss) shall be monitored according to IEC 61300-2-38, method B.

The gage device shall not be disconnected from the DUT until the end of the test.

## 6.7 Monitoring optical properties

When monitoring of optical performance is requested, the optical properties shall be measured at the specified interval or in the position of the twist angle as specified in the relevant specification. The change in optical properties, such as attenuation and return loss of the DUT, shall be monitored during and after the load and twist angles are applied, as described in IEC 61300-3-3 or IEC 61300-3-28, unless otherwise specified in the relevant specification. Any deviation in the DUT attenuation or return loss from that measured in 6.4 shall be considered attributable to the cable/device attaching point, fibre-to-fibre interfaces or fibre-to-source/detector interfaces in the device. In the case of connector plugs, record whether the connector plug uncouples during test.

If there are unacceptable changes in optical properties and it is questionable whether the device or cable itself can be at fault, a control test to determine the cable contribution shall be performed in the same manner using a piece of cable and two cable clamps.

## 6.8 Twist the cable

Apply a twisting motion to the mandrel or clamp, being careful to control the vertical and horizontal motion of the load. One twist cycle shall consist of a twist angle (as indicated in Table 1 or in the relevant specification) in one direction, a return to the original position, a twist angle (as indicated in the relevant specification or in Table 1) in the opposite direction and a final return to the original position. Repeat the twist cycle as many times as specified in the relevant specification or as indicated in Table 1.

After completion of the cable twist cycling, remove the tensile load (when applicable) and remove the mandrel or clamp.

## 6.9 Recovery

Unless otherwise specified in the relevant specification, allow the DUT to recover under standard atmospheric conditions for a minimum of one minute, as defined in IEC 61300-1. When the torsion test is performed at other ambient temperatures, then allow the DUT to recover under standard atmospheric conditions for a minimum of 4 h, unless otherwise specified in the relevant specification.

## 6.10 Final measurements and examinations

On completion of the test, perform the final measurements, as defined in the relevant specification. The results of the final measurement shall be within the limits established in the relevant specification.

Remove the DUT from the mounting fixture and visually examine the evaluated DUT in accordance with IEC 61300-3-1. Check for evidence of any degradation in the evaluated device. Examples of failures are as follow:

- broken, loose or damaged parts or accessories;
- breaking or damage to the cable jacket, seals, strain relief, or fibres;
- displaced, bent, broken or chipped parts;
- excessive movement of seals, cable clamps or elements;
- scratching of any interface areas.

For sealing evaluation of devices such as sealed closures, the final sealing performance shall be checked in accordance with IEC 61300-2-38, method A, with the DUT taken out of the fixture. Free breathing closures final evaluation shall be according to the specified IP level according to IEC 60529.