

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Fibre optic sensors –

Part 1-1: Strain measurement – Strain sensors based on fibre Bragg gratings

Capteurs fibroniques –

**Partie 1-1: Mesure de déformation – Capteurs de déformation basés
sur des réseaux de Bragg à fibres**



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FIBRE OPTIC SENSORS –**Part 1-1: Strain measurement –
Strain sensors based on fibre Bragg gratings****FOREWORD**

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International Standard IEC 61757-1-1 has been prepared by subcommittee SC 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

- a) update of cited standards;
- b) clarification of definitions and test specifications.

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

FDIS	Report on voting
86C/1642/FDIS	86C/1650/RVD

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

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

A list of all parts in the IEC 61757 series, published under the general title *Fibre optic sensors*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
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INTRODUCTION

The IEC 61757 series is published with the following logic: the sub-parts are numbered as IEC 61757-*M-T*, where *M* denotes the measure and *T*, the technology.

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FIBRE OPTIC SENSORS –

Part 1-1: Strain measurement – Strain sensors based on fibre Bragg gratings

1 Scope

This part of IEC 61757 defines detail specifications for fibre optic sensors using one or more fibre Bragg gratings (FBG) as the sensitive element for strain measurements. Generic specifications for fibre optic sensors are defined in IEC 61757.

This document specifies the most important features and characteristics of a fibre optic sensor for strain measurements, based on use of an FBG as the sensitive element, and defines the procedures for their determination. Furthermore, it specifies basic performance parameters and characteristics of the corresponding measuring instrument to read out the optical signal from the FBG. This document refers to the measurement of static and dynamic strain values in a range of frequencies.

A blank detail specification is provided in Annex B.

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 60050 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60068-2 (all parts), *Environmental testing – Part 2: Tests*

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 61300-2 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2: Tests*

IEC 61754 (all parts), *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces*

IEC 61757, *Fibre optic sensors – Generic specification*

IEC TR 61931, *Fibre optic – Terminology*

IEC 62129-1, *Calibration of wavelength/optical frequency measurement instruments – Part 1: Optical spectrum analyzers*

IEC 62129-2, *Calibration of wavelength/optical frequency measurement instruments – Part 2: Michelson interferometer single wavelength meters*

IEC 62129-3, *Calibration of wavelength/optical frequency measurement instruments – Part 3: Optical frequency meters internally referenced to a frequency comb*

ISO/IEC Guide 99, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61757, IEC 60050 (all parts), IEC TR 61931, ISO/IEC Guide 99 (VIM), 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/>

NOTE Long period gratings, non-uniform gratings, angled gratings, and FBG in polarization maintaining fibre are not considered.

3.1

fibre Bragg grating

FBG

phase diffraction grating integrated in optical single-mode silica-based fibres, according to category B of IEC 60793-2-50, to selectively reflect a very narrow range of wavelengths while transmitting others

Note 1 to entry: To achieve this characteristic, periodically spaced zones in the fibre core are altered to have different refractive indexes slightly higher than the core.

Note 2 to entry: This note applies to the French language only.

3.2

FBG strain sensor

device that uses one or more fibre Bragg gratings (3.1) as a sensitive element for strain measurements

Note 1 to entry: Different configurations are possible (see 5.2).

3.3

Bragg wavelength

λ_{Bref}

wavelength of the FBG (3.1), generally corresponding to the Bragg reflection peak or transmission minimum, without applied strain under reference ambient conditions

Note 1 to entry: If referred to as an FBG strain sensor (see 3.2), it refers to the configuration prior to its installation.

Note 2 to entry: λ_{B} is the wavelength of the FBG strain sensor indicated by the manufacturer without any further mechanical and ambient specification.

3.4

reference wavelength

λ_0

wavelength response of an FBG after installation or at the beginning of measurement to the affecting loading and ambient conditions