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Edition 3.0 2015-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Fibre optic filters – Generic specification

Dispositifs d'interconnexion et composants passifs fibroniques – Filtres fibroniques – Spécification générique

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – FIBRE OPTIC FILTERS – GENERIC SPECIFICATION

FOREWORD

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International Standard IEC 61977 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2010. It constitutes a technical revision.

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

a) harmonization of a number of terms and definitions with other generic specifications;
b) deletion of the quality assessment level clause.

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

CDV	Report on voting
86B/3861/CDV	86B/3917/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.

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – FIBRE OPTIC FILTERS – GENERIC SPECIFICATION

1 Scope

This International Standard applies to the family of fibre optic filters. These components have all of the following general features:

– they are passive for the reason that they contain no optoelectronic or other transducing elements which can process the optical signal launched into the input port;

– they modify the spectral intensity distribution in order to select some wavelengths and inhibit others;

– they are fixed, i.e. the modification of the spectral intensity distribution is fixed and cannot be tuned;

– they have input and output ports or a common port (having both functions of input and output) for the transmission of optical power; the ports are optical fibre or optical fibre connectors;

– they differ according to their characteristics. They can be divided into the following categories:

- short-wave pass (only wavelengths lower than or equal to a specified value are passed);
- long-wave pass (only wavelengths greater than or equal to a specified value are passed);
- band-pass (only an optical window is allowed);
- notch (only an optical window is inhibited).

It is also possible to have a combination of the above categories.

This standard establishes uniform requirements for the following:

– optical, mechanical and environmental properties.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-731, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication* (available at http://www.electropedia.org)

IEC 60617 (all parts), *Graphical symbols for diagrams* (available at http://std.iec.ch/iec60617)

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 60825 (all parts), *Safety of laser products*

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

IEC TR 61930, *Fibre optic graphical symbology*

ISO 129-1, *Technical drawings – Indication of dimensions and tolerances – Part 1: General principles*

ISO 286-1, *Geometrical product specifications (GPS) – ISO code system for tolerances on linear sizes – Part 1: Basis of tolerances, deviations and fits*

ISO 1101, *Geometrical product specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 60050-731 and the following apply.

3.1 Basic terms

3.1.1
port
optical fibre or optical fibre connector attached to a passive component for the entry and/or exit of the optical power (input and/or output port)

3.2 Component terms

3.2.1
BPF
band-pass filterfibre optic filter designed to allow signals between two specific wavelengths to pass

Note 1 to entry: This note applies to the French language only.

3.2.2
etalon
device consisting of a transparent plane-parallel plate with two reflecting surfaces, or two parallel reflecting mirrors

Note 1 to entry: The varying transmission function of an etalon is caused by interference between the multiple reflections of light between the two reflecting surfaces.

Note 2 to entry: Annex A describes the outline of etalon technology.

3.2.3
FBG
fibre Bragg grating
fibre optic device which has a short periodic variation to the refractive index of the fibre core along the fibre

Note 1 to entry: An FBG can reflect particular wavelengths of light and transmit other wavelengths.

Note 2 to entry: Annex B describes the outline of FBG technology.

Note 3 to entry: This note applies to the French language only.

3.2.4
fibre optic filter
passive component used in fibre optic transmission to modify the spectral intensity distribution of a signal in order to transmit or attenuate some wavelengths and block some others

Note 1 to entry: The wavelength band which transmits or attenuates the signal is called the passband. There may be more than one passband.

3.2.5
GFF
GEQ
gain flattening filter
gain equalizer
device designed to have the inverse characteristic of the wavelength dependent insertion loss of an optical device

Note 1 to entry: A GFF (GEQ) is used for the purpose of minimizing the wavelength dependent loss of a fibre optic device.

Note 2 to entry: A GFF (GEQ) is typically used with (in) an optical amplifier.

Note 3 to entry: This note applies to the French language only.

Note 4 to entry: This note applies to the French language only.

3.2.6
long wavelength pass filter
LWPF
fibre optic filter that passes long wavelength signals but reduces the amplitude of short wavelength signals

Note 1 to entry: This note applies to the French language only.

3.2.7
notch filter
fibre optic filter that passes all wavelengths except those in a stop band centred on a particular wavelength

3.2.8
reflecting type fibre optic filter
fibre optic filter in which the input and output ports are coincident

3.2.9
short wavelength pass filter
SWPF
fibre optic filter that passes short wavelength signals but reduces the amplitude of long wavelength signals

Note 1 to entry: This note applies to the French language only.

3.2.10
thin-film filter
TFF
fibre optic filter which passes particular wavelength band(s) and reflects all other wavelengths by using the interference effect of thin-film

Note 1 to entry: One of the typical TFF is a dielectric multi-layer film filter. Annex C describes the outline of TFF technology.

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

3.2.11
transmitting type fibre optic filter
fibre optic filter in which the input and output ports are separated

3.3 Performance terms

3.3.1
operating wavelength
nominal wavelength λ_h, at which a fibre optic filter operates with the specified performances

Note 1 to entry: The term "operating wavelength" includes the nominally transmitting wavelength, and designated attenuation/isolation wavelength.

3.3.2
operating wavelength range
specified range of wavelengths including all operating wavelengths

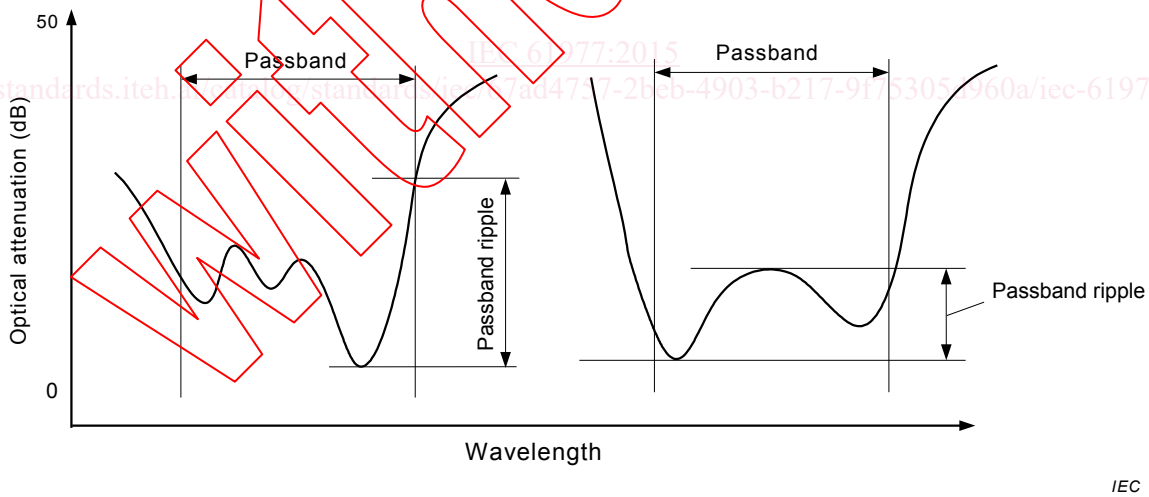
Note 1 to entry: It includes all passbands and isolation wavelength ranges.

3.3.3
passband
wavelength range within which a passive optical component is required to operate with optical attenuation less than or equal to a specified optical attenuation value

Note 1 to entry: There may be one or more passbands for a fibre optic filter.

3.3.4
passband ripple
maximum peak-to-peak variation of the insertion loss (absolute value) over the passband

Note 1 to entry: See Figure 1.



a) – Passband ripple at band edges **b) – Passband ripple in band**

Figure 1 – Illustration of passband ripple

Note 2 to entry: For a WWDM (wide wavelength division multiplexing) fibre optic filter which has only one passband, the term spectral ripple or flatness is used instead of passband ripple.

3.3.5
insertion loss
reduction of optical power in a passband, when transmitted between the ports of a two-port fibre optic filter

Note 1 to entry: The insertion loss is expressed in decibels and defined as:

$$a = -10\log_{10}\left(\frac{P_{out}}{P_{in}}\right)$$

where

P_{in} is the optical power launched into one of the two ports

P_{out} is the optical power received from the other port

Note 2 to entry: The insertion loss is a function of wavelength.

3.3.6
free spectral range
in the case of a periodic spectral response of a fibre optic filter, difference between two adjacent operating wavelengths

3.3.7
isolation wavelength
nominal wavelength λ_k (where $\lambda_h \neq \lambda_k$), that is nominally suppressed by a fibre optic filter

3.3.8
isolation wavelength range
stopband
specified range of wavelengths from λ_{kmin} to λ_{kmax} around the isolation wavelength λ_k, that are nominally suppressed by a fibre optic filter

Note 1 to entry: There may be one or more isolation wavelength ranges (stopbands) for a fibre optic filter.

Note 2 to entry: The term stopband is an antonym of the term passband.

Note 3 to entry: See Figure 2.

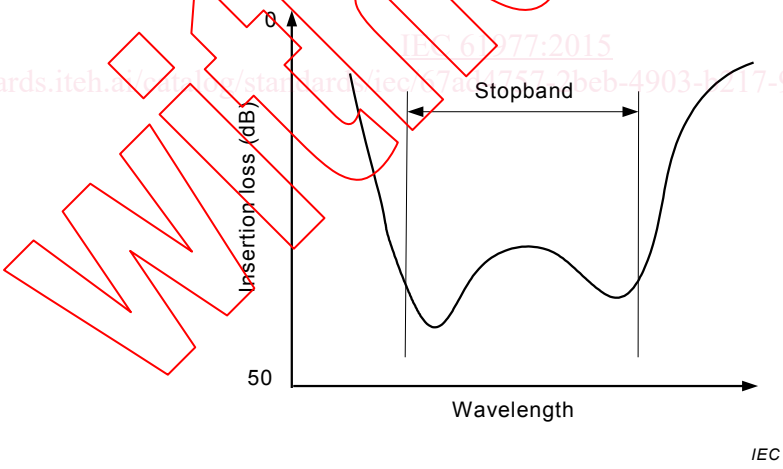


Figure 2 – Illustration of a stopband

3.3.9
maximum insertion loss within a passband
maximum value of the insertion loss within a passband

Note 1 to entry: Figure 3 shows passband and maximum insertion loss within a passband.

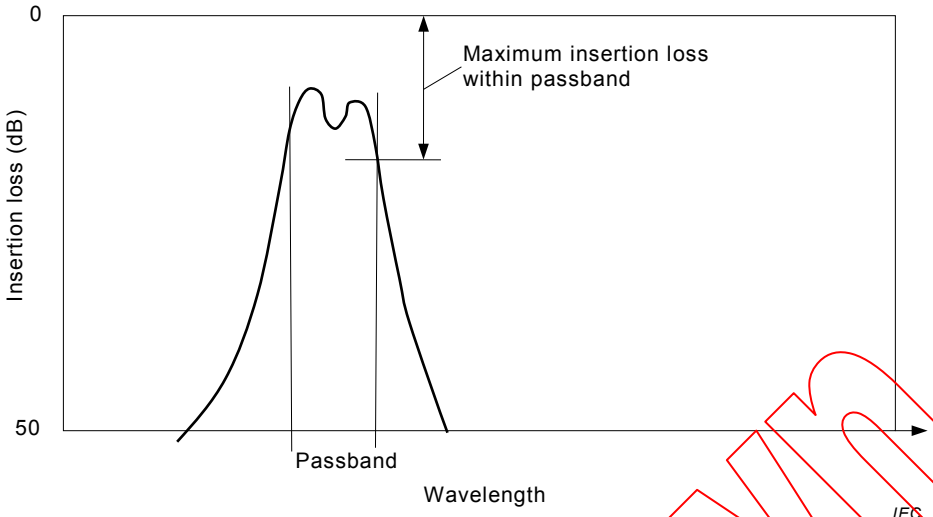


Figure 3 – Illustration of maximum insertion loss within a passband

3.3.10
maximum slope of passband ripple
maximum value in fibre optic filter of the derivative of the insertion loss (for transmitting type fibre optic filter) or return loss (for reflecting type fibre optic filter) as a function of wavelength over the passband

3.3.11
minimum insertion loss within a passband
minimum value of the insertion loss within a passband

Note 1 to entry: Figure 4 shows passband and minimum insertion loss within a passband.

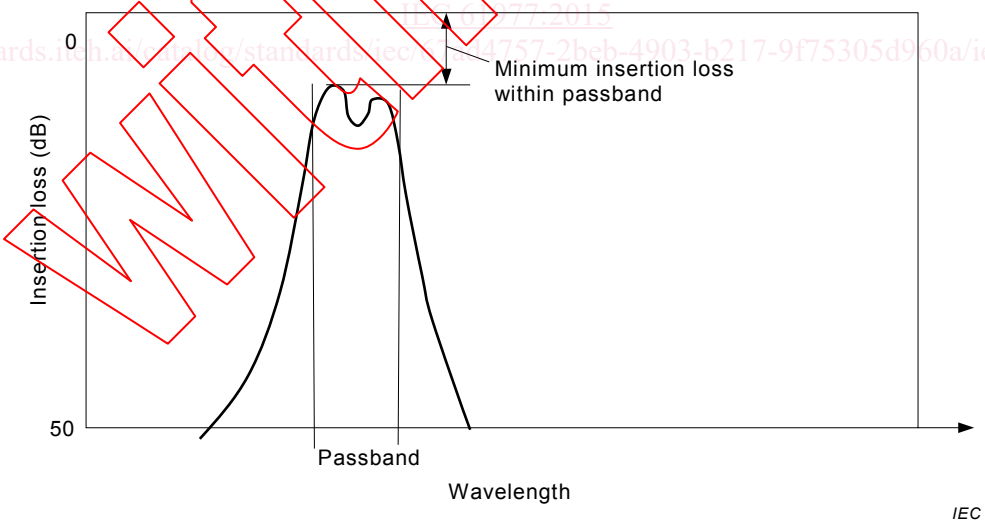


Figure 4 – Illustration of minimum insertion loss within a passband

3.3.12
return loss
fraction of input power that is returned from a port of a fibre optic filter

Note 1 to entry: The return loss is expressed in decibels and defined as:

$$RL = -10\log_{10}\left(\frac{P_{\text{refl}}}{P_{\text{in}}}\right)$$

where

P_{in} is the optical power launched into the port;

P_{refl} is the optical power received back from the same port

Note 2 to entry: The return loss is a function of wavelength.

3.3.13
wavelength dependent loss
variation of insertion loss of a fibre optic filter within passband(s).

Note 1 to entry: When there are two or more passbands, the wavelength dependent loss is generally defined as the maximum value of passband ripples.

3.3.14
***X* dB bandwidth**
minimum band width which the variation of insertion loss is X dB within a passband.

Note 1 to entry: X dB bandwidth shall be determined by considering the temperature dependency of wavelength, polarization dependency, long term stability of wavelength, etc.

Note 2 to entry: X is typically used as 0,5, 1, 3 or 20.

Note 3 to entry: See Figure 5.

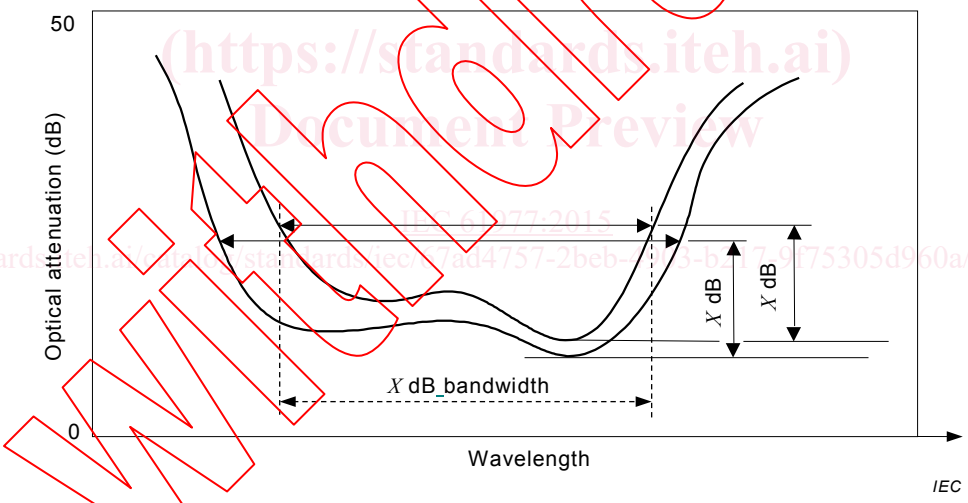


Figure 5 – Illustration of X dB bandwidth

4 Requirements

4.1 Classification

4.1.1 General

Filters are classified either totally or in part in the following categories:

– type;
– style;
– variant;
– environmental category;
– assessment level;