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2001-12

Fibre optic filters –

Generic specification

Filtres à fibres optiques –

Spécification générique

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC FILTERS – Generic specification

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

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

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

FDIS	Report on voting
86B/1603/FDIS	86B/1637/RVD

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 3.

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

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

INTRODUCTION

This standard is divided into three elements.

The first element, made up of clauses 1 to 3, contains general information which pertains to this standard.

The second element, consisting of clause 4, Requirements, contains all requirements which should be met by fibre optic filters covered by this standard. Requirements for classification, the IEC specification system, documentation, materials, workmanship, quality, performance, identification, and packaging are covered.

The third element, composed of clause 5, Quality assessment procedures, contains all of the procedures which must be followed for proper quality assessment of products covered by this standard.

FIBRE OPTIC FILTERS –

Generic specification

1 Scope

IEC 61977 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 can not be tuned;

– they have a maximum of two ports 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;

– measurement and test procedures for quality assessment.

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.

IECQ 001001:2000, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IECQ 001002 (all parts), *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure*

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

IEC 60050(731):1991, *International Electrotechnical Vocabulary – Chapter 731: Optical fibre communication*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60695-2-2:1991, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*

IEC 60825-1:1993, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide*

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

ISO 129:1985, *Technical drawings – Dimensioning – General principles, definitions, methods of execution and special indications*

ISO 286-1:1988, *ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits*

ISO 1101:1983, *Technical drawings – Geometrical tolerancing – Tolerancing of form, orientation, location and run-out – Generalities, definitions, symbols, indications on drawings*

ISO 8601:2000, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Definitions

For the purposes of this standard the definitions given in IEC 60050(731) and the following apply.

3.1
fibre optic filter
a passive component used in fibre optic transmission to modify the spectral intensity distribution of a signal in order to pass some wavelengths and block some others

3.2
port
an 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)

3.3
unidirectional fibre optic filter
a fibre optic filter whose specified filtering action is in one direction only or requires designation of its input and output ports

3.4
bidirectional fibre optic filter
a fibre optic filter in which each port may be used either as an input or output port

3.5
transmitting type fibre optic filter
a fibre optic filter in which the input and output ports are different

3.6
reflecting type fibre optic filter
a fibre optic filter in which the input and output ports are coincident

3.7
operating wavelength
a nominal wavelength λ_h, at which a fibre optic filter operates with the specified performances

3.8
operating wavelength range, bandpass
the specified range of wavelengths from λ_{hmin} to λ_{hmax} around the operating wavelength λ_h, within which a fibre optic filter operates with the specified performances

3.9
isolation wavelength
a nominal wavelength λ_k (where $\lambda_h \neq \lambda_k$), that is nominally suppressed by a fibre optic filter

3.10
isolation wavelength range, stopband
the 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

3.11
attenuation
the reduction of optical power, when transmitted between the ports of a two-port fibre optic filter expressed in decibels. It is defined as:

$$a = -10 \log (P_{out}/P_{in})$$

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.

The attenuation is a function of wavelength

3.12
transmittance
the percentage of optical power transmitted by the filter at the operating wavelength

3.13
return loss
the fraction of input power that is returned from a port of a fibre optic filter expressed in decibels. It is defined as:

$$RL = -10 \log (P_{refl}/P_{in})$$

where

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

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

The return loss is a function of wavelength

3.14
reflectance
the percentage of optical power reflected by the filter at the operating wavelength

3.15
X dB-bandwidth
a) for transmitting-type fibre optic filters: defined through the spectral dependence of the attenuation as the minimum wavelength range about the operating wavelength λ_h within which the variation of the attenuation is less than "*X*" dB; the minimum wavelength range is determined considering the worst case shift due to temperature operating range and polarisation;

b) for reflecting-type fibre optic filters: defined through the spectral dependence of the return loss as the minimum wavelength range about the operating wavelength λ_h within which the variation of the return loss is less than "*X*" dB. The minimum wavelength range is determined considering the worst case shift due to temperature operating range and polarisation.

3.16
free spectral range
in the case of a periodic spectral response of a fibre optic filter, the difference between two adjacent operating wavelengths

3.17
spectral ripple (flatness)
the maximum peak-to-peak variation in attenuation (for transmitting-type fibre optic filter) or return loss (for reflecting-type fibre optic filter) over the bandpass

3.18
maximum slope of spectral ripple
the maximum value in module of the derivative of the attenuation (for transmitting-type fibre optic filter) or return loss (for reflecting-type fibre optic filter) as a function of wavelength over the bandpass

3.19
polarization dependent loss (PDL)
the maximum variation of attenuation over all the polarization states

3.20
polarization mode dispersion (PMD)
the maximum differential delay for all the polarization states of signals when they pass through a filter

4 Requirements

The requirements for filters covered by this section are intended to aid in classifying a filter in a detail specification.

4.1 Classification

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

– type;
– style;
– variant;
– environmental category;
– assessment level;
– normative reference extensions.

An example of a typical filter classification is as follows:

Type	Fixed
Style	– Configuration C – Fibre type: IEC type A1a – SC connector
Variant	Means of mounting
Assessment level	A