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INTERNATIONAL STANDARD

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

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

FOREWORD

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International Standard IEC 62077 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. This edition constitutes a technical revision.

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

a) harmonization of some terms and definitions with other generic specifications,
b) deletion of assessment level.

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

CDV	Report on voting
86B/3862/CDV	86B/3918/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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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

1 Scope

This International Standard applies to circulators used in the field of fibre optics bearing all of the following features:

– they are non-reciprocal optical devices, in which each port is either an optical fibre or fibre optic connector;
– they are passive devices in accordance with the categorization and definition provided in IEC TS 62538;
– they have three or more ports for directionally transmitting optical power.

An example of optical circulator technology is described in Annex A.

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, *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*

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 60050-731and 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

3.1.2
transfer matrix
$n \times n$ matrix of coefficients where n is the number of ports, and the coefficients represent the fractional optical power transferred between designated ports

Note 1 to entry: In general, the transfer matrix T is:

$$T = \begin{bmatrix} t_{11} & t_{12} & \cdots & t_{1n} \\ & t_{22} & & \\ & & t_{ij} & \\ t_{n1} & t_{n2} & & t_{nn} \end{bmatrix} \quad (1)$$

where

t_{ij} is the ratio of the optical power P_{ij} transferred out of port j with respect to input power P_i into port i, that is:

$$t_{ij} = \frac{P_{ij}}{P_i} \quad (2)$$

3.1.3
transfer coefficient
element t_{ij} of the transfer matrix

3.1.4
logarithmic transfer matrix
$n \times n$ matrix of logarithmic transfer coefficients of a_{ij} where n is the number of ports

Note 1 to entry: In general, the logarithmic transfer matrix A is:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ & a_{22} & & \\ & & a_{ij} & \\ a_{n1} & a_{n2} & & a_{nn} \end{bmatrix} \quad (3)$$

where a_{ij} is the optical power reduction, in decibels, out of port j with unit power into port i, that is:

$$a_{ij} = -10 \log_{10} t_{ij} \quad (4)$$

where t_{ij} is the transfer matrix coefficient.

3.1.5
conducting port pair
two ports i and j between which t_{ij} is nominally greater than zero

3.1.6
isolated port pair
two ports i and j between which t_{ij} is nominally zero, and a_{ij} is nominally infinite

3.2 Component terms

3.2.1
fibre optic circulator
passive component possessing three or more ports which input and output are cyclic

Note 1 to entry: In the case of 3 ports circulator with port 1, port 2 and port 3, supposing optical power is transmitted from port 1 to port 2, optical power from port 2 is transmitted to port 3.

3.2.2
completely circulated type
type of circulator where all ports can function as both input and output

Note 1 to entry: In the case of a 3 port circulator with port 1, port 2 and port 3, where optical power is transmitted from port 1 to port 2, optical power from port 2 is also transmitted to port 3 and optical power from port 3 is also transmitted to port 1 (see Figure 1).

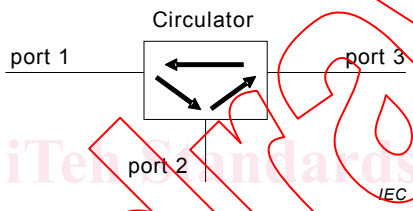

Figure 1 – Completely circulated type configuration

3.2.3
incompletely circulated type
type of circulator where a port is either an input or an output

Note 1 to entry: In the case of 3 ports circulator with port 1, port 2 and port 3, supposing optical power is transmitted from port 1 to port 2, optical power from port 2 is transmitted to port 3 and optical power from port 3 is not transmitted to port 1 (see Figure 2).

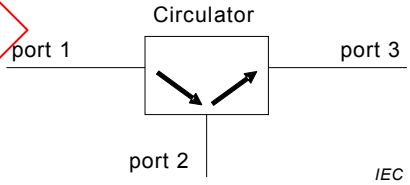

Figure 2 – Incompletely circulated type configuration

3.3 Performance parameters

3.3.1
insertion loss
element a_{ij} of the logarithmic transfer matrix of an input port i and output port j to which optical power is transmitted

Note 1 to entry: The insertion loss is the reduction in optical power between an input and output port of a passive component (see Figure 3), expressed in decibels and defined as follows:

$$a_{ij} = -10 \log_{10} \left(\frac{P_j}{P_{in}} \right) \quad (5)$$