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INTERNATIONAL STANDARD

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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 second edition cancels and replaces the first edition published in 2001. It constitutes a technical revision.

The changes with respect to the previous edition are listed below:

– having substantially increased the number of terms;
– having added an informative annex for example of filtering technologies;
– having deleted quality assessment procedures.

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

CDV	Report on voting
86B/2871/CDV	86B/2950/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 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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- withdrawn,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 62538;

– they have three or more ports for directionally transmitting optical power.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For update 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 (IEV) – Chapter 731: Optical fibre communication*

IEC 60617-SN, *Graphical symbols for diagrams*

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

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

IEC/TR 61282-9, *Fibre optic communication system design guides – Part 9: Guidance on polarization mode dispersion measurements and theory*

IEC 61300 (all parts), *Fibre optic interconnecting devices and passive components*

IEC 61930, *Fibre optic graphic symbology*

IEC/TS 62538, *Categorization of optical devices*

IEC Guide 102, *Electronic components – Specification structures for quality assessment (Qualification approval and capability approval)*

IECQ 01, *IEC Quality Assessment System for Electronic Components (IECQ Scheme) – Basic Rules*

IECQ 001002-3, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 3: Approval procedures*

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

ISO 286-1, *ISO system of limits and fits – Part 1: Bases 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), together with the following definitions, 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
optical properties of a fibre optic circulator can be defined in terms of an n × n matrix of coefficients where n is the number of ports, and the coefficients represent the fractional optical power transferred between designated ports

NOTE In general, the transfer matrix T is:

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

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:

$$t_{ij} = P_{ij}/P_i$$

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

3.1.4
logarithmic transfer matrix
in general, the logarithmic transfer matrix is as follows:

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

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

$$a_{ij} = -10 \log t_{ij}$$

where t_{ij} is the transfer matrix coefficient

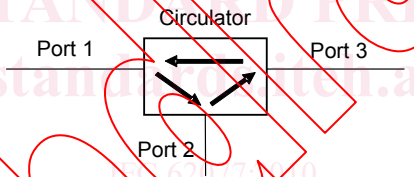
3.1.5
conducting ports
two ports i and j between which t_{ij} is nominally greater than zero

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

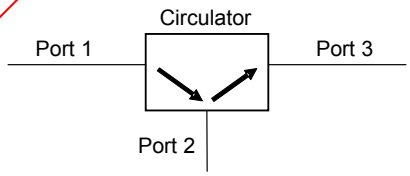
3.2 Component terms

3.2.1
fibre optic circulator
passive component possessing three or more ports which input and output are cyclic. 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 which all ports is input and output. 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 transmitted to port 1



3.2.3
incompletely circulated type
type of circulator which a port is input or output. 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



3.3 Performance parameters

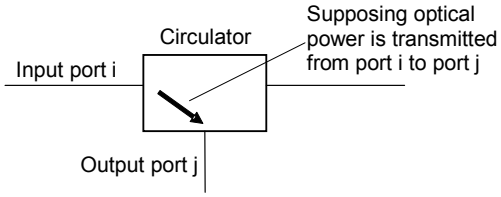
3.3.1
insertion loss
element a_{ij} of the logarithmic transfer matrix of an input port i and output port j which optical power is transmitted. It is the reduction in optical power between an input and output port of a passive component expressed in decibels and defined as follows:

$$a_{ij} = -10 \log (P_j/P_i)$$

where

P_i is the optical power launched into the input port;

P_j is the optical power received from the output port



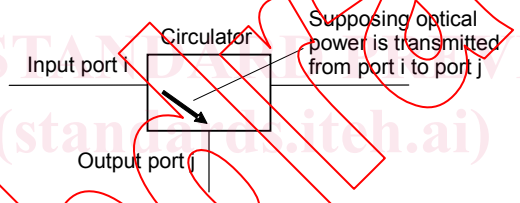
3.3.2
isolation
element a_{ji} of the logarithmic transfer matrix of an output port j and input port i which optical power is transmitted direction opposite to the insertion loss. It is the reduction in optical power between an input and output port of a passive component, expressed in decibels and defined as follows:

$$a_{ji} = -10 \log (P_i/P_j)$$

where

P_i is the optical power received from the input port;

P_j is the optical power launched into the output port



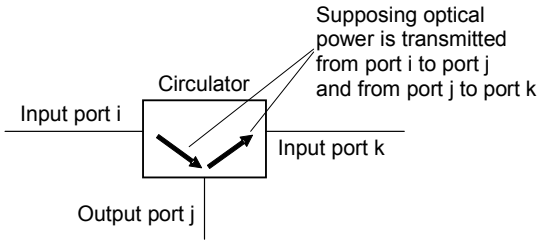
3.3.3
directivity
element a_{ik} of the logarithmic transfer matrix of an port i and port k which optical power is not transmitted. It is the reduction in optical power between i port and k port of a passive component expressed in decibels and defined as follows:

$$a_{ik} = -10 \log (P_k/P_i)$$

where

P_i is the optical power launched into the input port;

P_k is the optical power received from the output port



3.3.4
polarization dependent loss
PDL
for polarization independent circulators, the maximum variation of insertion loss for any state of polarization of P_j