

Fibre optic circulators — Generic specification

The European Standard EN 62077:2001 has the status of a
British Standard

ICS 33.180.20

National foreword

This British Standard is the official English language version of EN 62077:2001. It is identical with IEC 62077:2001.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/2, Interconnecting devices and passive components, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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**Fibre optic circulators -
Generic specification
(IEC 62077:2001)**

Circulateurs à fibres optiques -
Spécification générique
(CEI 62077:2001)

Lichtwellenleiter-Zirkulatoren -
Fachgrundspezifikation
(IEC 62077:2001)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 86B/1443/FDIS, future edition 1 of IEC 62077, prepared by SC 86B, Fibre optic interconnecting devices and passive components, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62077 on 2001-04-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2004-04-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62077:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068	NOTE: Harmonized in the EN 60068 and HD 323 series.
IEC 60874	NOTE: Partly harmonized as EN 60874 series.
IEC 60974	NOTE: Partly harmonized as EN 60974 series.
IEC 61753	NOTE: Partly harmonized as EN 61753 series.
IEC 61754	NOTE: Partly harmonized as EN 61754 series.
IEC 61754-2	NOTE: Harmonized as EN 61754-2:1997 (not modified).
IEC 61754-4	NOTE: Harmonized as EN 61754-4:1997 (not modified).
IEC 61754-13	NOTE: Harmonized as EN 61754-13:1999 (not modified).
IEC 62005	NOTE: Harmonized as EN 62005 series.

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INTRODUCTION

This standard, which is a generic specification, is divided into three clauses.

Clause 1 entitled "General" contains the scope, normative references and definitions which pertain to this generic specification.

Clause 2 entitled "Requirements" contains all the requirements which shall be met by circulators covered by this standard. The requirements for classification, the IEC specification system, documentation, materials, workmanship, quality, performance, identification, and packaging are described.

Clause 3 entitled "Quality assessment procedures" contains all of the procedures to be followed for proper quality assessment of products as covered by this standard.

FIBRE OPTIC CIRCULATORS – GENERIC SPECIFICATION

1 General

1.1 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 optical fibre connector;
- they are passive components containing no opto-electronic or other transducing elements;
- they have three or more ports for directionally transmitting optical power.

This standard establishes uniform requirements for the following:

- fibre optic circulator requirements;
- quality assessment procedures.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC QC 001001:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic rules*

IEC QC 001002-2:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure – Part 2: Documentation*

IEC QC 001002-3:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Part 3: Approval procedures*

IEC Guide 102:1996, *Electronic components – Specification structures for quality assessment (Qualification approval and capability approval)*

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

IEC 60050(731):1991, *International Electrotechnical Vocabulary (IEV) – 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 61300-1:1995, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

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

IEC 61300-3 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3: Examinations and measurements*

IEC 61930:1998, *Fibre optic graphic symbology*

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/FDIS 1101, *Geometrical Product Specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out*¹⁾

ISO 8601:1988, *Data elements and interchange formats – Information interchange – Representation of dates and times*

1.3 Definitions

For the purpose of this International Standard, the definitions given in IEC 60050(731), together with the following definitions, apply.

1.3.1

fibre optic circulator

passive component possessing three or more ports numbered sequentially (1, 2, ----, n) through which optical power is transmitted non-reciprocally from port 1 to port 2, ----, from port (i) to port (i + 1)

1.3.2

port

optical fibre or optical fibre connector attached to a passive component for the entry and/or exit of the optical power

1.3.3

transfer matrix

optical properties of a fibre optic circulator can be defined in terms of an $n \times n$ matrix of coefficients where n is the number of ports, and the coefficients represent the fractional optical power transferred between designated ports

¹⁾ To be published.

NOTE In general, the transfer matrix T is:

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

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:

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

In a circulator, the coefficients t_{ij} ($j = i + 1$) (and t_{n1} in the case of completely circulated type) are nominally greater than zero and other coefficients are nominally zero.

1.3.4

transfer coefficient

element t_{ij} of the transfer matrix

1.3.5

logarithmic transfer matrix

in general, the logarithmic transfer matrix is as follows:

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

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.

1.3.6

attenuation

element a_{ij} (where $j = i + 1$) and a_{n1} of the logarithmic transfer matrix. 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.

1.3.7

isolation

element a_{ij} (where $j = i - 1$) of the logarithmic transfer matrix. 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.