SLOVENSKI STANDARD
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Generic Specification: Fibre optic branching devices

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Fachgrundspezifikation: Faseroptische Verzweiger

Spécification générique: Coupleurs à fibres optiques

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This European Standard was approved by the CENELEC Electronic Components Committee (CECC) on 27 January 1992. CENELEC members are bound to comply with CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the General Secretariat of the CECC or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CECC General Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom. The membership of the CECC is identical, with the exception of the national electrotechnical committees of Greece, Iceland and Luxembourg.

CECC

CENELEC Electronic Components Committee
Comité des Composants Electroniques du CENELEC
CENELEC- Komitee für Bauelemente der Elektronik
General Secretariat: Gartenstr. 179, D - 60596 Frankfurt am Main

FOREWORD

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby acceptable in all member countries without further testing.

This specification was prepared by CECC WG 27.

The text of the draft based on document CECC (Secretariat)2755 was submitted to the formal vote; together with the voting report, circulated as document CECC(Secretariat)3001, it was approved by CECC as EN 181 000 on 27 January 1992.

The following dates were fixed:

-	latest date of announcement of the EN at national level	(doa)	**1993 - 01 - 12**
-	latest date of publication of an identical national standard	(dop)	**1993 - 07 - 12**
-	latest date of declaration of national standards obsolescence		**1993 - 07 - 12**
-	latest date of withdrawal of conflicting national standards	(dow)	**2003 - 01 - 12**

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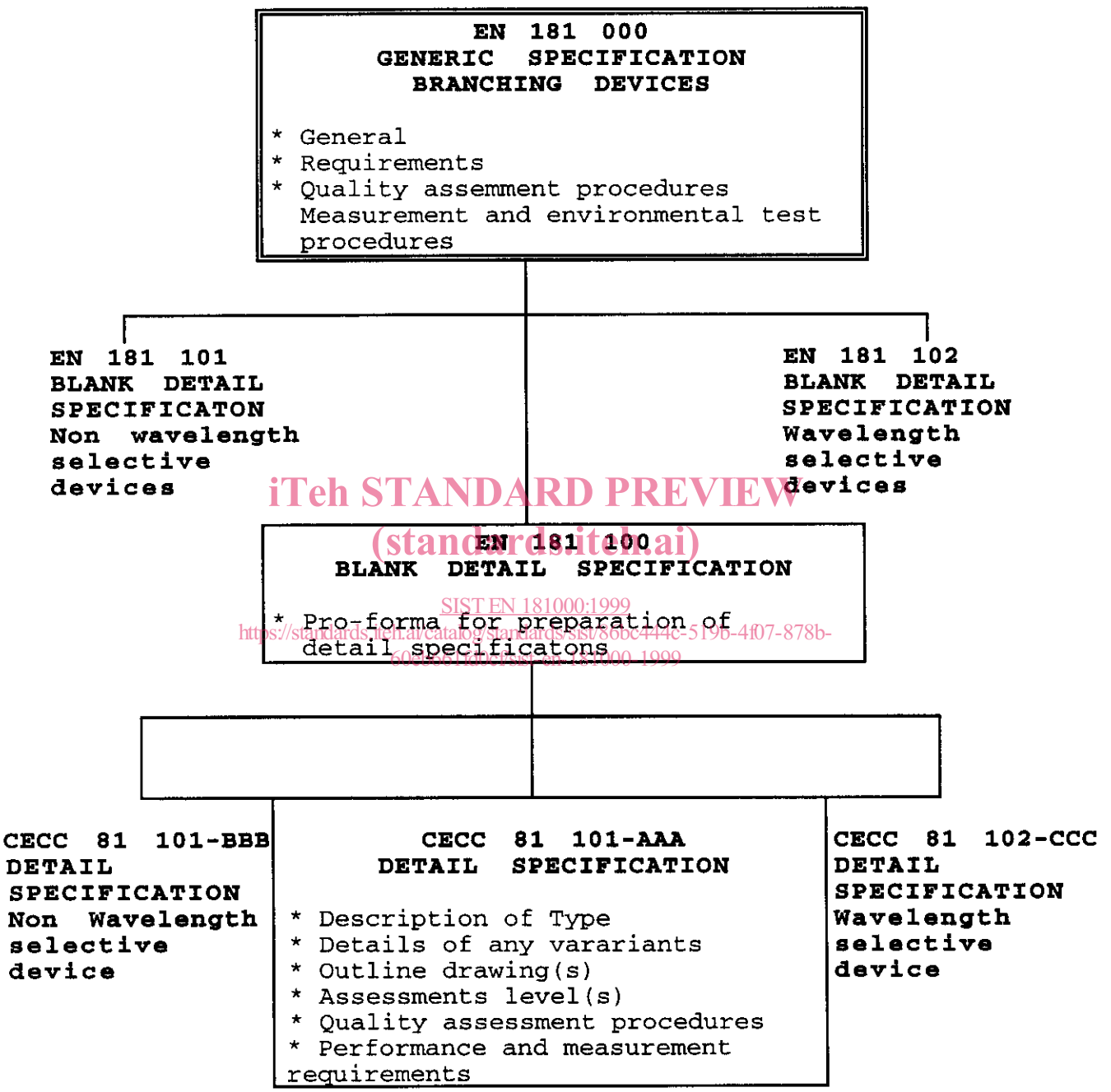

NOTE: A detail specification is a "completed" blank detail specification.

SECTION ONE - GENERAL

1. General

1.1 Scope

This specification is applicable to fibre optic branching devices. These have all of the following general features :

- they are passive in that they contain no optoelectronic or other transducing elements;
- they have three or more ports for the ingress and/or egress of optical power and share optical power among these ports in a predetermined fashion;
- the ports are optical fibres or optical fibre connectors.

In this generic specification, fibre optic branching devices are classified by wavelength dependance into two sub-families; wavelength selective devices and non-wavelength selective devices, each of which will be covered by a separate blank detail specification.

1.2 Related documents

The following specification contains provisions which, through reference in this text, constitute provisions of this specification. At the time of publication, the editions indicated were valid. All specifications are subject to revision, and parties to agreements based on this specification are encouraged to apply the most recent editions of the referenced specifications. Members of CECC, IEC and ISO maintain registers of currently valid International Standards.

References made to a specific clause or sub-clause of a specification includes all sub-clauses to the reference unless otherwise specified.

CECC 00 114/I : Approval of manufacturers and other organisations (1990)

CECC 00 114/II : Qualification approval of electronic components (1992)

CECC 00 109 : Certified test records (1974)

IEC 27 : Letter symbols to be used in electrical technology, (1971)

IEC 68-1 : Basic environmental testing procedures, Part 1 : General and guidance (1982)

IEC 68-2-1 : Test A : Cold (1974)

IEC 68-2-2 : Test B : Dry heat (1974)

IEC 68-2-3 : Test Ca : Damp heat, steady state (1969)

IEC 68-2-5 : Test Sa : Simulated solar radiation at ground level (1975)

IEC 68-2-6 : Test Fc and guidance : Vibration (sinusoidal) (1982)

IEC 68-2-7 : Test Ga and guidance : Acceleration, steady state (1983)

IEC 68-2-9 : Guidance for solar radiation testing (1975)

IEC 68-2-10 : Test J : Mould growth (1984)

IEC 68-2-11 : Test Ka : Salt mist (1981)

IEC 68-2-13 : Test M : Low air pressure (1983)

IEC 68-2-14 : Test N : Change of temperature (1984)

IEC 68-2-17 : Test Q : Sealing (1978)

IEC 68-2-27 : Test Ea : Shock (1972)

IEC 68-2-29 : Test Eb : Bump (1968)

IEC 68-2-30 : Test Db and guidance : Damp heat, cyclic (12 + 12 hour) (1980)

IEC 410 : Sampling plans and procedures for inspection by attributes (1973)

IEC 617 : Graphical symbols for diagrams

IEC 695-2-2 : Fire hazard tests, Part 2 : Test methods - needle-flame test (1980)

IEC 825 : Radiation safety of laser products, equipment, classification, requirements and users's guide (1984)

IEC 875-1 : Fibre optic branching devices, Part 1: Generic specification (1986)

CECC 88 000 : Generic specification - Optical fibres

CECC 87 000 : Generic specification - Optical fibre cables

CECC 86 000 : Generic specification for connectors for optical fibres and cables

IEC 73(central office)1270 : Optical communications (1987)

ISO 129 : Technical drawings - dimensioning - general principles, definitions, methods of execution and special indications

ISO/R 286 : ISO System of limits and fits - Part 1: General, tolerances and deviations

ISO 370 : Toleranced dimensions - Conversion from inches into millimeters and vice versa (1975)

ISO 1101 : Technical drawings - geometrical tolerancing - tolerancing of form, orientation, location and run-out - Generalities, definitions, symbols, indications on drawings

ISO 2015 : Numbering of weeks (1976)

Directives ISO/CEI - Part 3- : Drafting and presentation of international standards (1989)

1.3 Definitions

The definitions given in IEC 73, with the following definitions, apply to this specification. They also apply to all blank detail specifications (BDSs) and detail specifications (DSs) written to this specification.

1.3.1 Passive fibre optic branching device

A device possessing three or more optical ports which shares optical power among its ports in a predetermined fashion, without any amplification, switching, or other active modulation of the optical power.

1.3.2 Passive fibre optic coupler

A term which is frequently used as a synonym for a passive fibre optic branching device. The term is also used to connote a structure for transferring an optical signal between two fibres or between an active device and a fibre. It will not be used in this generic specification or in the sectional or detail specifications for fibre optic branching devices. It is a generic term and its use in this context is deprecated.

1.3.3 Port

An optical fibre or optical fibre connector attached to a branching device for the ingress and/or egress of the optical power.

1.3.4 Input port, output port

A port designated for the ingress or egress respectively of an optical power. In some branching devices, a particular port may be used for either function. In others, a port may be used for only one function. In the latter case, the designation of fixed input and/or output ports will be provided in the detail specification.

1.3.5 Transfer Matrix

The optical properties of a fibre optic branching device can be defined in terms of an n x n matrix of coefficients. n is the number of ports, and the coefficients represent the fractional optical power transferred between designated ports. In general, the transfer matrix T is :

$$T = \begin{bmatrix} t11 & t12 & . & . & . & t1n \\ t21 & & & & & \\ . & & & & & \\ . & & & tij & & \\ . & & & & & \\ tn1 & & & & & tnn \end{bmatrix}$$

where with the adopted convention described in Annex B tij is the ratio of the optical power Pij transferred out of Port j with respect to input power Pi into port i, i.e.

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

The transfer matrix is used to classify the different types of branching devices which are specified in clause 2.1 of the generic specifications.

NOTE 1: It is usual practice to label ports of common use in branching devices as follows:

- 1,2,...N, N+1,... N+M for transmissive and transmissive/reflective star branching device. 1,2...N are input ports and N+1... N+M are output ports (see 2.1.2);

- 1,2...N for reflective star branching device where the N ports are input and output ports (see 2.1.2);

- 0,1,2,...N for wavelength selective branching devices, where for example for a wavelength multiplexer 1,2,...N are input ports and 0 is the common output port.

Consequently, as n is the total number of ports and a matrix row contains the fractional power transferred from an individual port to every port in the device:

- n is respectively equal to N=M, N, N+1 for transmissive and transmissive/reflective star branching devices, reflective star branching devices, wavelength selective branching devices;

- the transfer matrix defines the optical power transferred out of nominal output ports and also out of nominal input ports with respect to the optical power launched into nominal input ports and also into nominal output ports (the definition of input ports and output p orts, see 1.3.4, needs that clarification). Therefore, coefficients of the transfer matrix associated with isolated ports are nominally equal to zero.

Furthermore a transfer matrix is generally displayed in tabular form with row subscript (i) and column subscript (j) equal to port labels and numbered consecutively down the left hand side and across the top respectively.

So, for an easier reading of the transfer matrix, the following representation will be used in this document and in the detail specifications for fibre optic branching devices :

LAUNCH PORTS	1	2	.	.	.	n
1	t11	t12	.	.	.	t1n
2	t21					
.	.					
.	.			tij		
.	.					
n	tn1					tnn

NOTE 2: In a wavelength selective branching device, the coefficients tij are functions of the input wavelength. For any branching device, tij may also be a function of the input polarization or modal power distribution. Therefore, the transfer coefficients are, in general, completely defined only when these parameters are precisely specified. The values of these parameters will, when necessary, be provided in the detail specification.

NOTE 3: Most single mode branching devices may operate in a coherent fashion with respect to multiple inputs. Consequently, the transfer coefficients may be affected by the relative phase and intensity of simultaneous coherent optical power inputs at two or more ports.

1.3.6 Transfer coefficient

An item t_{ij} of the transfer matrix.

1.3.7 Logarithmic transfer matrix

In general, the logarithmic transfer matrix is:

RECEIVE PORTS

LAUNCH PORTS	1	2	.	.	.	n
1	a11	a12	.	.	.	a1n
2	a21					
.	.					
.	.			aij		
.	.					
n	an1					ann

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

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

where t_{ij} is the transfer matrix coefficient.

1.3.8 Insertion loss

This is the reduction in optical power out of port j relative to power into port i, i.e. a coefficient a_{ij} of the logarithmic transfer matrix.

1.3.9 Return loss

The measure of the fraction of input power that is returned along the input path of an optical component such as a branching device. It is defined as :

$$a_r = - 10 \log (P_1/P_0)$$

where P_0 is the optical power launched into the input port and P_1 the optical power received back from the same port.

1.3.10 Conducting ports

Two ports i and j between which t_{ij} is nominally greater than zero.

1.3.11 Isolated ports

Two ports i and j between which t_{ij} is nominally zero, and aij is nominally infinite.

1.3.12 Isolation

The value of a_{ij} between two isolated ports.

1.3.13 Crosstalk

Another term of isolation.

1.3.14 Directivity

Another term for isolation, usually applied to a three or a four port directional branching device (see Annex A).

1.3.15 Directional branching device

See transmissive star branching device (Annex A).

1.3.16 Excess loss

A measure of the total power lost in a branching device. When an optical signal is launched into Port i, it is determined by the equation:

$$ELi = -10 \log \sum t_{ij}$$

where the summation is performed only over those values j for which i and j are conducting ports. For a branching device with N output ports, there will be an array of N values of excess loss, one for each input port i.

NOTE: It is a common practice to specify the maximum excess loss of a branching device to be the maximum of those values ELi in the array for which i is an operational input port.

1.3.17 Uniformity

The logarithmic transfer matrix of a branching device may contain a specified set of coefficients which are nominally finite and equal. In this case, the range of these coefficients, expressed in decibels, is termed the uniformity of the branching device.