

**Harmonized system of quality
assessment for electronic components**

Generic specification Fibre optic branching devices

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British Standard

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- BECCAMA (BEAMA Electrical Cable and Conductor Accessory Manufacturers' Association)
- British Approvals Service for Cables
- British Cable Makers' Confederation
- Department of Trade and Industry (National Physical Laboratory)
- ERA Technology Ltd.
- Federation of the Electronic's Industry
- Fibreoptic Industry Association (FIA)
- Ministry of Defence
- National Supervising Inspectorate — BSI QA
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National foreword

This British Standard has been prepared by Technical Committee EPL/86 and is the English language version of EN 181000:1994 *Generic specification: Fibre optic branching devices*, published by the Electronic Components Committee (CECC) of the European Committee for Electrotechnical Standardization (CENELEC).

Cross-references

Publication referred to ^a	Corresponding British Standard
CECC 00109:1974	BS CECC 00109:1991 <i>Rule of Procedure 9. Certified test records</i>
CECC 00114-I:1990	BS EN 100114 <i>Rule of Procedure 14. Quality assessment procedures</i> Part 1:1994 <i>Approval of manufacturers and other organizations</i>
CECC 00114-II:1992	BS CECC 00114 <i>Rule of Procedure 14. Quality assessment procedures</i> Part 2:1993 <i>Qualification approval of electronic components</i>
CECC 86000	BS EN 186000 <i>Generic specification. Connector sets for optical fibres and cables</i> Part 1:1994 <i>Requirements, test methods and qualification approval procedures</i>
CECC 87000	BS EN 187000:1994 <i>General specification for optical fibre cables</i>
CECC 88000	BS EN 188000:1994 <i>Generic specification for optical fibres</i>
IEC 68-1:1982	BS 2011 <i>Environmental testing</i> Part 1.1:1989 <i>General and guidance</i>
IEC 68-2-1:1990	BS EN 60068 <i>Environmental testing</i> BS EN 60068-2-1:1993 <i>Tests A. Cold</i>
IEC 68-2-2:1974	BS EN 60068-2-2:1993 <i>Test B. Dry Heat</i>
IEC 68-2-3:1969	BS 2011 <i>Environmental testing</i> Part 2.1Ca:1977 <i>Test Ca. Damp heat, steady state</i>
IEC 68-2-5:1975	Part 2.1Sa:1977 <i>Test Sa. Stimulated solar radiation at ground level</i>
IEC 68-2-6:1982	Part 2.1Fc:1983 <i>Test Fc. Vibration (sinusoidal)</i>
IEC 68-2-7:1983	BS EN 60068 <i>Environmental testing</i> BS 60068-2-7:1993 <i>Acceleration steady state</i>
IEC 68-2-9:1975	BS 2011 <i>Environmental testing</i> Part 2.2Sa:1977 <i>Test Sa. Guidance for solar radiation testing</i>
IEC 68-2-10:1984	Part.2.1J:1989 <i>Test J and guidance. Mould growth</i>
IEC 68-2-11:1981	Part 2.1Ka:1982 <i>Test Ka. Salt mist</i>
IEC 68-2-13:1983	Part 2.1M:1984 <i>Test M. Low air pressure</i>
IEC 68-2-14:1984	Part 2.1N:1985 <i>Test N. Change of temperature</i>
IEC 68-2-17:1978	Part 2.1Q:1981 <i>Test Q. Sealing</i>
IEC 68-2-27:1987	BS EN 60068 <i>Environmental testing</i> BS EN 60068-2-27:1993 <i>Test Ea and guidance. Shock</i>
IEC 68-2-29:1987	BS EN 60068-2-29:1993 <i>Test Eb and guidance. Bump</i>
IEC 68-2-30:1980	BS 2011 <i>Environmental testing</i> Part 2.1Db:1981 <i>Test Db and guidance. Damp heat, cyclic (12 + 12 hour cycle)</i>
IEC 73:1991	BS EN 60073:1993 <i>Specification for coding of indicating devices and actuators by colours and supplementary means</i>

^a Where the publication referred to in the EN text has been superseded, the latest edition is listed.

Publication referred to ^a	Corresponding British Standard
IEC 410:1973	BS 6001 <i>Sampling procedures for inspection by attributes</i> Part 1:1991 <i>Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection</i>
IEC 617	BS 3939 <i>Graphical symbols for electrical power, telecommunications and electronics diagrams</i>
IEC 695-2-2:1991	BS 6458 <i>Fire hazard testing for electrotechnical products</i> Part 2 <i>Test methods</i> Section 2.2:1993 <i>Needle-flame test</i>
IEC 825:1984	BS EN 60825:1992 <i>Radiation safety of laser products, equipment classification, requirements and user's guide</i>
ISO 129:1985	BS 308 <i>Engineering drawing practice</i> Part 2:1985 <i>Recommendations for dimensioning and tolerancing of size</i>
ISO 286-1:1988	BS EN 20286 <i>ISO system of limits and fits</i> BS EN 20286-1:1992 <i>Bases of tolerances, deviations and fits</i>

^a Where the publication referred to in the EN text has been superseded, the latest edition is listed.

Typographical error. In Figure 31, “Swivel puiley” should be read as “Swivel pulley”.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 90, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

UDC

Descriptors: Quality, electronic components, fibre optic branching devices

English version

Generic Specification: Fibre Optic Branching Devices

Spécification générique:
Coupleurs à fibres optiques

Fachgrundspezifikation:
Faseroptische Verzweiger

This European Standard was approved by the CENELEC Electronic Components Committee (CECC) on 27 January 1992. CENELEC members are bound to comply with the 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 Central Secretariat or to any CENELEC member.

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CECC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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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 granting 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 181000 on 27 January 1992.

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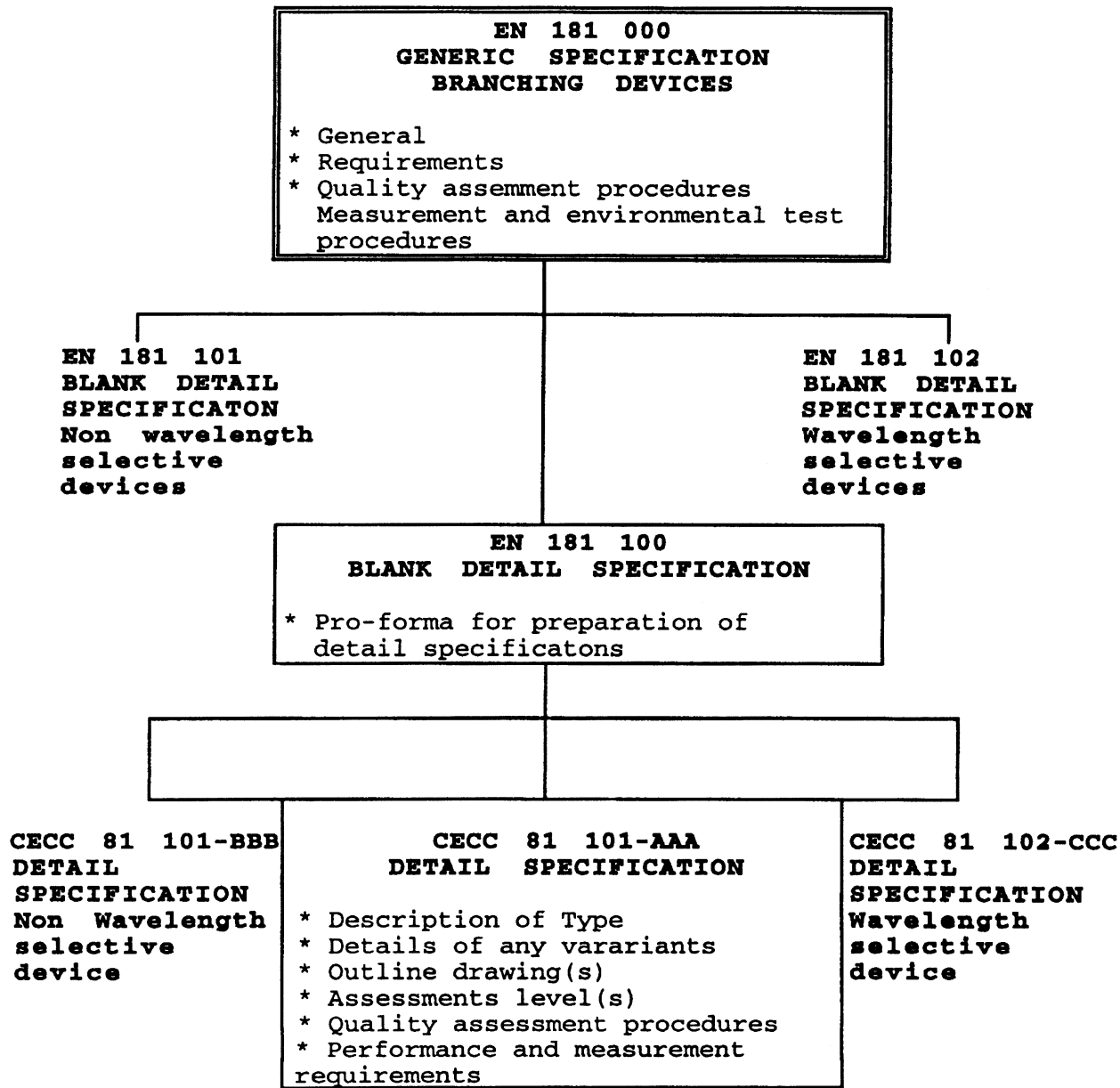
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NOTE A detail specification is a “completed” blank detail specification.

Section 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 00114-I, *Approval of manufacturers and other organisations (1990).*

CECC 00114-II, *Qualification approval of electronic components (1992).*

CECC 00109, *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 88000, *Generic specification — Optical fibres.*

CECC 87000, *Generic specification — Optical fibre cables.*

CECC 86000, *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 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 $n \times n$ 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:

$$T = \begin{bmatrix} t_{11} & t_{12} & . & . & . & t_{1n} \\ t_{21} & & & & & \\ . & & & & & \\ . & & & t_{ij} & & \\ . & & & & & \\ t_{n1} & & & & & t_{nn} \end{bmatrix}$$

where with the adopted convention described in Annex B 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 , 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 ports, 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:

$$\begin{array}{c} \text{L} \\ \text{A} \\ \text{U} \\ \text{N} \\ \text{C} \\ \text{H} \\ \text{P} \\ \text{O} \\ \text{R} \\ \text{T} \\ \text{S} \end{array} \begin{array}{c} 1 \\ 2 \\ . \\ . \\ . \\ n \end{array} \left[\begin{array}{cccccc} 1 & 2 & . & . & . & n \\ t_{11} & t_{12} & . & . & . & t_{1n} \\ t_{21} & & & & & \\ . & & & t_{ij} & & \\ . & & & & & \\ t_{n1} & & & & & t_{nn} \end{array} \right]$$

NOTE 2 In a wavelength selective branching device, the coefficients t_{ij} are functions of the input wavelength. For any branching device, t_{ij} 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:

$$\begin{array}{c} \text{L} \\ \text{A} \\ \text{U} \\ \text{N} \\ \text{C} \\ \text{H} \\ \text{P} \\ \text{O} \\ \text{R} \\ \text{T} \\ \text{S} \end{array} \begin{array}{c} 1 \\ 2 \\ . \\ . \\ . \\ n \end{array} \left[\begin{array}{cccccc} \text{RECEIVE PORTS} & 1 & 2 & . & . & . & n \\ a_{11} & a_{12} & . & . & . & a_{1n} \\ a_{21} & & & & & \\ . & & & a_{ij} & & \\ . & & & & & \\ a_{n1} & & & & & a_{nn} \end{array} \right]$$

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 a_{ij} 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:

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

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 EL_i 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

1.3.18**splitting ratio**

the nominal ratio t_{ij}/t_{ik} between two specified coefficients of the transfer matrix, where j and k are the output ports and i is the common input port. The particular coefficients concerned, if any, are specified in the detail specification

1.3.19**symmetric branching device**

a device whose transfer matrix is diagonally symmetric, i.e. where for all i and j , t_{ij} and t_{ji} are nominally equal

1.3.20**asymmetric branching device**

a device whose transfer matrix is diagonally asymmetric, i.e. where there exists at least one i and j for which t_{ij} and t_{ji} are nominally unequal

1.3.21**operating wavelength**

the nominal wavelengths at which a non-wavelength selective branching device is designed to operate or one of the nominal wavelengths λ_i at which a wavelength selective branching device is designed to operate. A wavelength selective branching device will, in general, have different operating wavelengths corresponding to each conducting port

1.3.22**operating wavelength range**

the specified range of wavelengths from $\lambda_i \text{ min}$ to $\lambda_i \text{ max}$ about a nominal operating wavelength λ_i , within which a branching device is designed to operate, with the specified insertion loss and crosstalk performance

NOTE For a branching device with more than one operating wavelength, the corresponding wavelength ranges are not necessarily equal.

1.3.23**operating wavelength spacing**

for a wavelength selective branching device with more than one operating wavelength, the operating wavelength spacing is the difference $\lambda_i + 1 - \lambda_i$ between two adjacent operating wavelengths. Sometimes referred to as channel spacing

NOTE For a branching device with more than one operating wavelength, the corresponding channel spacings are not necessarily equal.

1.3.24**anti-reflection termination**

a stable device, fixture or process for suppressing reflection from an optical fibre end

1.3.25**reference fibre**

a precisely made or selected fibre used for measurement purposes

1.3.26**cladding mode stripper**

a stable device, fixture or process for removing cladding mode power propagating in an optical fibre

1.3.27**fibre optic connector set**

the total connector components required to provide demountable coupling between two or more optical fibre cables

1.3.28**reference connector set**

a precisely made or selected connector set of a particular type used for measurement purposes. Such a connector set may be in the form of a precision jig incorporated in the test equipment. The performance or selection criterion shall be given in the relevant specification

1.3.29

reference connector set component

a precisely made or selected connector set component which is used for measuring purposes (e.g. plug, adapter, etc.). The component may be in the form of a precision jig incorporated in the test equipment

1.3.30

interchangeable branching devices

branching devices are considered to be interchangeable when they share common installation geometry and have the same functional performance

1.3.31

reflection loss

a term synonymous with return loss

Section 2. Requirements

The requirements for branching devices covered by this specification are intended to aid in fully classifying a fibre optic branching device in a detail specification (DS).

2.1 Classification

Fibre optic branching devices shall be classified as follows:

- type, (wavelength selectivity, transfer matrix and schematic diagram);
- style (port configuration) see 2.1.2;
- variant (housing shape, orientation of ports) see 2.1.3;
- climatic category 2.1.4;
- assessment level see 2.1.5.

2.1.1 Type

Each type is defined in terms of a schematic diagram and a general form of transfer matrix as shown in the examples of Annex A related to

- non wavelength selective transmissive star;
- non wavelength selective reflective star;
- wavelength multiplexer;
- wavelength demultiplexer;
- wavelength multiplexer and demultiplexer.

the main characteristics of each type are as follows:

- wavelength selective or non selective;
- transmissive or reflective;
- bidirectional or unidirectional;
- tree or star;
- any combination of the above.

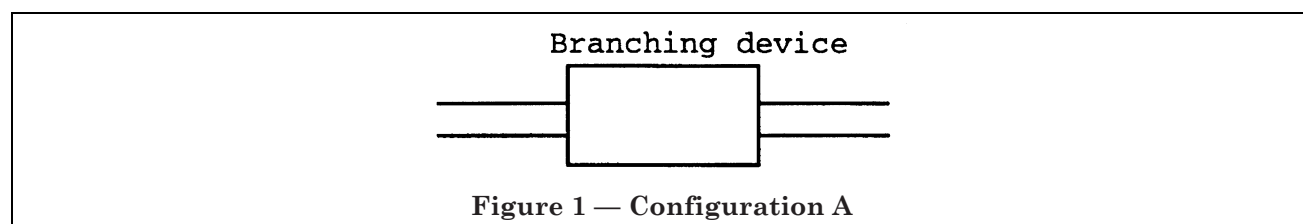
2.1.2 Style

The style shall be defined by the following elements: the input and output port configuration, the fibre type(s), the connector set type(s) if any.

Configuration A

A device containing integral fibre optic pigtails, without connectors.

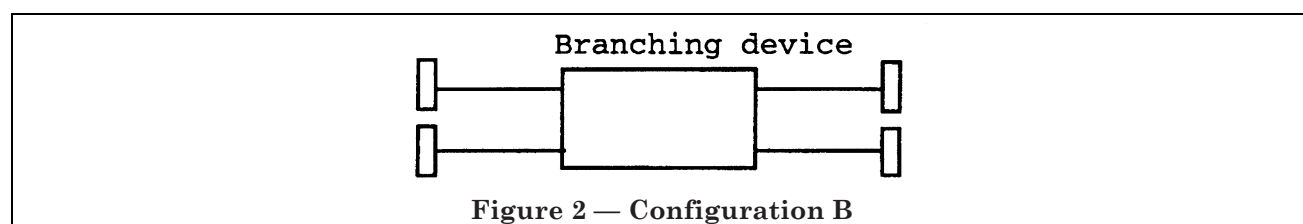
EXAMPLE:



Configuration B

A device containing integral fibre optic pigtails, with a connector on each pigtail.

EXAMPLE:



Configuration C

A device containing fibre optic connectors as an integral part of the device housing.

EXAMPLE:

Branching device

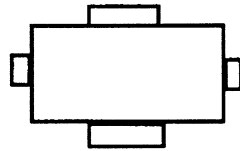


Figure 3 — Configuration C

Configuration D

A device containing some combination of the interfacing features of the preceeding configurations.

EXAMPLE:

Branching device

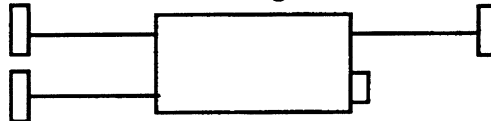


Figure 4 — Configuration D

2.1.3 Variant

The variant defines the variety of structurally similar components (see 3.2).

Examples of feature variables which create variants:

- fibre;
- cable type;
- Housing;
- orientation of ports;
- means of mounting.

2.1.4 Climatic category

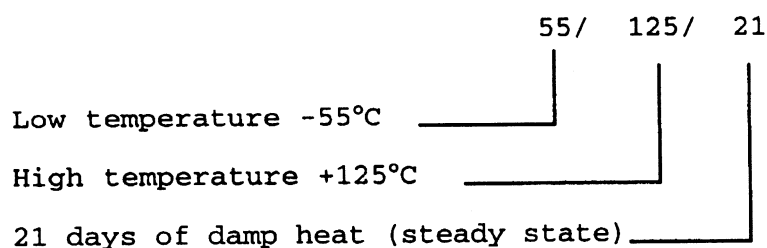
The branching device shall be classified by climatic category. This category defines, in a generalized way, the climatic conditions of cold temperatures, hot temperatures and damp heat for which a component is suited.

The components shall be subjected to, as a minimum, the environmental tests of cold (see 4.5.17), dry heat (see 4.5.18) and damp heat — steady state (see 4.5.19).

Climatic category shall be expressed by a series of three numbers separated by oblique strokes corresponding respectively to the temperatures, low and high, and the number of days of exposure to damp heat (steady state) to which the components are assessed.

- First number: two digits denoting the minimum ambient temperature ($-^{\circ}\text{C}$);
- Second number: three digits denoting the maximum ambient temperature ($+^{\circ}\text{C}$). Two digit values shall be prefixed by the digit “0”;
- Third number: two digits denoting the number of days of damp heat (steady state). One (1) digit values shall be prefixed by the digit “0”.

EXAMPLE:



The following are preferred values which may be specified.

Table 1 — Climatic Category

Low temperature (°C)	High temperature (°C)	Damp heat duration (days)
+ 5	—	4
— 5	+ 30	10
— 10	+ 40	21
— 25	+ 55	56
— 40	+ 70	
— 55	+ 85	
— 65	+ 100	
	+ 125	
	+ 155	
	+ 175	
	+ 200	

2.1.5 Assessment level

Assessment level defines the relationship between groups A and B inspection level/AQL and groups C and D inspection periods. DSs shall specify one or more assessment levels, each of which shall be designated by a capital letter.

The following are preferred levels:

Assessment level A:

- group A inspection: inspection level II, AQL = 4 %;
- group B inspection: inspection level II, AQL = 4 %;
- group C inspection: 24 month periods;
- group D inspection: 48 month periods.

Assessment level B:

- group A inspection: inspection level II, AQL = 1 %;
- group B inspection: inspection level II, AQL = 1 %;
- group C inspection: 18 month periods;
- group D inspection: 36 month periods.

Assessment level C:

- group A inspection: inspection level II, AQL = 0,4 %;
- group B inspection: inspection level II, AQL = 0,4 %;
- group C inspection: 12 month periods;
- group D inspection: 24 month periods.

An assessment level (other than the preferred specified in the generic specification) can be given in the DS. When this is done, capital letter X shall be used.

2.2 Minimum mandatory test sequence

Table 2 and Table 3 give the minimum mandatory test sequence for qualification and quality inspection of fibre optic branching devices. DS writers may add tests or groups of tests to this minimum mandatory test sequence. The Ds shall specify the total test sequence to be applied.

Table 2 — Non-wavelength selective branching devices minimum mandatory test sequence

Qualification test sequence	Lot by lot inspection
<u>Group 0</u> — (all specimens) — Visual inspection (see 4.5.1) — Dimensions (see 4.5.2)	<u>Group A</u> same as group 0 of the qualification test sequence <u>Group B</u> same as group 1 of the qualification test sequence
<u>Group 1</u> — (optical performance) — Insertion loss (see 4.5.5) (Non diagonal coefficients a_{ij} of the transfer matrix, with $i = j$)	PERIODIC INSPECTION
<u>Group 2</u> — (climatic category) — Cold (see 4.6.17) — Dry heat (see 4.6.18) — Damp heat (steady state) (see 4.6.19)	<u>Group CO</u> Same as group 0 of the qualification test sequence <u>Group C1</u> Same as group 1 of the qualification test sequence <u>Group C2</u> Same as group 2 of the qualification test sequence
<u>Group 3</u> — (construction) — Vibration (see 4.6.1)	<u>Group D</u> Repeat all of the qualification test sequence

Table 3 — Wavelength selective branching devices minimum mandatory test sequence

Qualification test sequence	Lot by lot inspection
<u>Group 0</u> — (all specimens) — Visual inspection (see 4.5.1) — Dimensions (see 4.5.2) <u>Group 1</u> — (optical performance) — Insertion loss (see 4.5.5) (Non diagonal coefficients a_{ij} of the transfer matrix, with $i = j$) — Spectral dependence of the transfer matrix (see 4.5.9) (Non diagonal coefficients a_{ij} of the transfer matrix, with $i = j$) <u>Group 2</u> — (climatic category) — Cold (see 4.6.17) — Dry heat (see 4.6.18) — Damp heat (steady state) (see 4.6.19) <u>Group 3</u> — (construction) — Vibration (see 4.6.1)	<u>Group A</u> same as group 0 of the qualification test sequence <u>Group B</u> same as group 1 of the qualification test sequence PERIODIC INSPECTION <u>Group CO</u> Same as group 0 of the qualification test sequence <u>Group C1</u> Same as group 1 of the qualification test sequence <u>Group C2</u> Same as group 2 of the qualification test sequence <u>Group D</u> Repeat all of the qualification test sequence

2.3 Documentation

2.3.1 Symbols

Graphical and letter symbols shall, whenever possible, be taken from IEC 27 and 617.

2.3.2 Specification system

This specification is part of a three level CECC specification system. Subsidiary specifications shall consist of BDS and DS. This system is shown in Table 4.

Table 4 — Tree level CECC specification structure

Specification level	Examples of Information to be included	Applicable to
Basic	Assessment system rules Inspection rules Environmental test methods Sampling plans Identification rule Marking standards Dimensional standards Terminology standards Symbol standards Preferred number series SI units	Two or more component families or sub-families
Generic	Specific terminology Specific symbols Specific units Preferred values Marking Quality assessment procedures Test and measurement methods Selection of tests Qualification approval and/or Capability approval procedures	Component family
Blank detail	Quality conformance test schedule Inspection requirements Information common to a number of types	Groups of types having a common test schedule
Detail	Individual values Specific information Completed quality conformance test schedules	Individual type

Blank detail specifications

BDSs are not, by themselves, a specification level. There can be more than one BDS to specify different usage applications.

Each BDS shall contain the preferred format for stating the required information in the DS.

Detail specifications

DSs shall specify the following as a minimum:

- the type (see 2.1.1);
- the styles (see 2.1.2);
- the variants (see 2.1.3);
- the climatic category (see 2.1.4);
- the assessment level (see 2.1.5);
- the qualification procedure method (see 3.3);
- the part identification number for each variant (see 2.7.1);
- the mandatory test sequence (see 2.2);
- the performance requirements (see 2.6).

2.3.3 Drawings

The drawings and dimensions given in DSs shall not restrict details of construction nor shall be used as manufacturing drawings.

Projection system

Either first angle or third angle projection shall be used for the drawings in documents covered by this specification. All drawings within a document shall use the same projection system and the drawings shall state which system is used.

Dimensional system

All dimensions shall be given in accordance with ISO 129, ISO Recommendation 286 and ISO 1101. The metric system shall be used in BDSs and DSs.

Dimensions shall not contain more than five significant digits.

Intermountability

The dimensional limits of tolerance (maximum and/or minimum) for the dimensions necessary to the mounting shall be defined in the DS. These limits are intended to ensure but not guarantee interchangeability of branching devices.

2.3.4 Measurements

Measurement method

The size measurement method to be used shall be specified in the relevant specification for dimensions which are specified within a total tolerance zone of 0,01 mm or less (see Annex B).

Reference components

Reference components, if required, shall be specified in the relevant specification.

Gauges

Gauges, if required, shall be specified in the relevant specification.

2.3.5 Test data sheets

Test data sheets shall be prepared for each test conducted to a DS. The data sheets shall be included in the qualification report (see 3.3.8) and in the Periodic Inspection Report (see 3.4.2.).

Data sheets shall contain the following information as a minimum:

- title of test and date;
- specimen description including the type of fibre.

The description shall also include the variant identification number (see 2.7.1);

- test equipment used and date of latest calibration;
- all applicable test details;
- all measurement values and observations;
- sufficiently detailed documentation to provide traceable information for failure analysis (see 3.3.6 and 3.4.2.).

2.3.6 Instructions for use

Instructions for use shall be given when required by the manufacturer and shall consist of:

- assembly and termination instructions;
- cleaning method as necessary;
- additional information as necessary.

2.4 Design and construction

2.4.1 Materials

Corrosion resistance

All materials used in the construction of branching devices shall be corrosion resistant or suitably finished to meet the requirements of the DS.

Non flammable materials

When non-flammable materials are required, the requirement shall be specified in the relevant specification and, IEC 695-2-2 shall be referenced.

2.4.2 Workmanship

Components and associated hardware shall be manufactured to a uniform quality and shall be free of sharp edges, burrs or other defects that will affect life, serviceability or appearance. Particular attention shall be given to neatness and thoroughness of marking, plating, soldering, bonding, etc.

2.5 Quality

Branching devices shall be controlled by the quality assessment procedures of Section 3. The measurement and test procedures of Section 4 shall be used, as applicable, for quality assessment.

2.6 Performance requirements

Branching devices shall meet the performance requirements specified in the DS.

2.7 Identification and marking

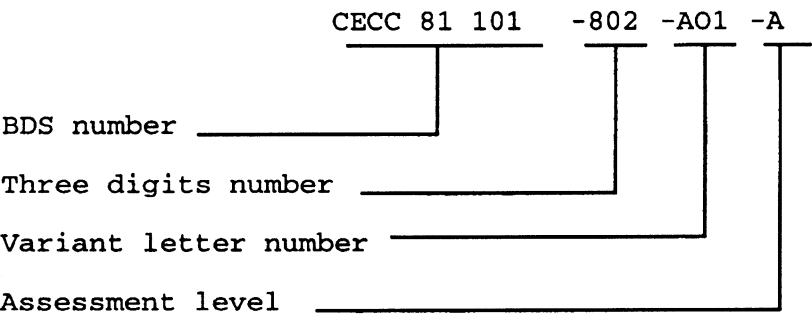
Components, associated hardware and packages shall be permanently and legibly identified and marked when required by the DS.

2.7.1 Variant identification number

Each variant in a DS shall be assigned a unique identification number. This number shall be set out as follows (see example):

- BDs number;
 - three digit numbers,
- This number shall be allocated sequentially except for working group prepared DS(s) where the first digit shall be “8”;
- the variant number with a letter allocated in the DS followed by a two digit number allocated sequentially to individual variants;
 - letter indicating assessment level.

EXAMPLE:



2.7.2 Component marking

Component marking, if required when possible, shall be specified in the DS. The preferred order of marking is:

- 1) manufacturer's identification mark;
- 2) manufacturing date code;
- 3) manufacturer's part number;
- 4) variant identification number.

2.7.3 Package marking

Package marking, if required, shall be specified in the DS. The preferred order of marking is:

- 1) manufacturer's identification mark;
- 2) manufacturer's part number;
- 3) manufacturing date code (year/week, see ISO 2015);
- 4) variant letter number(s) (see 2.7.1);
- 5) the type designation (see 2.1.1);
- 6) the assessment level;
- 7) any additional marking required by the relevant specification.

When applicable, individual unit packages (within the sealed package) shall be marked with the reference number of the certified record of released lots, the manufacturer's factory identity code and the component identification.

2.8 Packaging

Packages shall include instructions for use when required by the relevant specification (see 2.3.6).

2.9 Ordering information

Under consideration.

Section 3. Quality assessment procedures

Procedures for quality assessment and release of components consist of:

- Qualification Approval Procedures (see 3.3);
- Quality Conformance Inspection (see 3.4).

3.1 Primary stage of manufacture

The manufacturing stage when the parts which make up the individual component(s) are aggregated into the product defined in the detail specification. Sub-contracting of the primary stage and subsequent stages is permitted (see 1.2 of CECC 00114-II).

3.2 Structural similarity

The grouping of structurally similar components for the purpose of qualification approval and quality conformance inspection is prescribed by the following boundary limits.

Structurally similar components shall:

- be manufactured from essentially the same materials;
- be manufactured to essentially the same design;
- be manufactured utilizing essentially the same processes and methods.

Structurally similar components may:

- accept various orientation of ports;
- accept various cable sizes.

The specific grouping of structurally similar components for the purpose of qualification approval and quality conformance testing shall be approved by the National Supervising Inspectorate.

3.3 Qualification approval procedures

Qualification approval procedures are specified herein and in the relevant specification.

Manufacturers shall:

- comply with the general requirements of CECC 00114-II;
- comply with the requirements of the primary stage of manufacture (see 3.1);
- produce test evidence showing successful completion of the qualification test procedures.

The procedures of 3.3.1 and 3.3.2 are alternative methods for qualification as prescribed in 1.4 of CECC 00114-II. The DS shall specify which procedure is to be used.

3.3.1 Fixed sample procedure

The fixed sample procedure consists of subjecting a sample of specimens to the fixed sample qualification test sequence as specified in the DS. The sample shall be drawn from current production.

3.3.2 Lot-by-lot and periodic procedure

The lot-by-lot and periodic procedure consists of performing the lot-by-lot inspections on a specified number of inspection lots (with a minimum of three) taken in as short a time as possible. The periodic tests are then performed on samples selected from at least one of the lots.

Samples shall be selected from the lots in accordance with IEC 410. Normal inspection shall be used.

3.3.3 Sample size

The sample size for qualification approval by the fixed sample procedure shall be specified in the DS.

The specimens shall be units produced with equipment and procedures used in current production. The sample shall be representative of the range of devices for which approval is sought.

Following completion of the Group 0 tests, the specimens for the other groups shall be randomly selected from the Group 0 specimens.

3.3.4 Preparation of specimens

The relevant specification shall specify the fibre/cable sizes, types and lengths to be used. Specimens shall be mounted according to the manufacturer's instructions for use (see 2.3.6).

3.3.5 Qualification testing

Qualification specimens shall meet the performance requirements given in the relevant specification.

3.3.6 Qualification failures

Manufacturers shall immediately notify the National Supervising Inspectorate (ONS) when a failure occurs during qualification testing. If the ONS determines that the failure has not been adequately explained and corrected, the manufacturer's Chief Inspector may be directed to conduct a formal failure analysis. When complete, the manufacturer shall prepare and submit a failure report to the ONS. Failure reports shall describe the failure and its cause along with recommended corrective action to be taken. The ONS shall then decide the steps to be taken.

All failure reports, including the directions of the ONS, shall be included in the qualification approval report (see 3.3.8).

One or more unresolved failures shall be cause for refusal to grant qualification approval.

3.3.7 Maintenance of qualification approval

Qualification approval shall be maintained for components by continuously submitting them to the quality conformance requirements as specified in 3.4.

Qualification approval shall be verified if any of the following conditions exist:

- the production programme is such that the periodic tests cannot be carried out at the specified frequency;
- the conformity of the components to the initial qualification approval is doubtful. For example, technical modifications may potentially change the performance of the component;
- a change has been made to the specification.

Qualification approval shall be verified by the procedures defined in 1.4 and 1.7 of CECC 00114-II.

3.3.8 Qualification report

Qualification testing results shall be recorded in a qualification approval report in accordance with 1.4 of CECC 00114-II.

3.4 Quality conformance inspection

Quality conformance inspection consists of the lot-by-lot and periodic inspections specified herein and in the DS.

Manufacturers shall comply with the general requirements of the rules and procedures governing quality conformance inspection of components (see 2.3 of CECC 00114-II).

Lot-by-lot and periodic inspection schedules shall specify the groupings and be established in accordance with 2.3 of CECC 00114-II.

3.4.1 Lot-by-lot inspection

Lot-by-lot inspection consists of subjecting a sample of specimens to the group A and B tests specified in the DS.

Specimens shall be drawn from each inspection lot in accordance with the specified sampling plan. They shall be drawn in a random fashion without regard to their quality.

In-process controls of component parts, unrelated to lot sizes of finished units, may be used for inspection in lieu of examination of these components in the finished product.

Formation of inspection lots

An inspection lot may consist of one production lot or of several lots which have been aggregated under the following safeguards:

- inspection lots shall consist of structurally similar production lots (see 3.2);
- the period over which the production lots were aggregated shall not exceed one (1) month.

The plan for the aggregation of production lots into inspection lots shall be approved by the National Supervising Inspectorate.

Rejected lots

Specimens found defective during lot-by-lot testing shall be treated in accordance with the requirements of 2.4 CECC 00114-II. Rejected lots may be reworked to correct the defects or to screen them out. The reworked lot shall then be submitted for reinspection using tightened inspection. They shall be separated from new lots and shall be clearly identified as reinspected lots.

3.4.2 Periodic inspection

Periodic inspection consists of subjecting a sample of specimens to the groups C and D tests specified in the DS. Each group shall be conducted at the period specified for the relevant assessment level (see 2.1.5).

The periods shall be maintained relative to each other so that the group D inspection replaces the group C inspection at the group D period.

Sample size

The sample size for periodic inspection shall be specified in the DS.

The sample shall be representative of the range of devices to be inspected. The specimens shall be selected from inspection lots which satisfied the lot-by-lot inspections of 3.4.1 during the time since the previous periodic inspection.

Following completion of the group C0 or D0 tests, the specimens for the other groups shall be randomly selected from the group C0 or D0 specimens.

Preparation of specimens

The relevant specification shall specify the fibre/cable sizes, types and lengths to be used. Specimens shall be mounted according to the manufacturer's instructions for use (see 2.3.6).

Periodic inspection

Periodic inspection specimens shall meet the performance requirements given in the relevant specification.

Periodic inspection failures

Failures shall be treated according to the procedures of 3.3.6.

If a specimen fails to satisfy the requirements of a periodic test, the manufacturers chief inspector shall immediately initiate the requirements of 1.8 of CECC 00114-II.

One or more unresolved failures shall be cause to withdraw qualification approval.

Periodic inspection report

Periodic testing results shall be maintained in accordance with the requirements of 2.5 of CECC 00114-II.

3.5 Certified records of released lots

Detail specifications shall specify if a certified record of released lots is required. When required, the record shall be prepared in accordance with 3 of CECC 00109 and contain the following information as a minimum:

- attribute information (i.e. number of components tested and number of defective components) for tests in the sub-groups covered by periodic inspection without reference to the parameter for which rejection was made;
- variable information for the change of optical performance after the endurance test, as required in the detail specification.

3.6 Delayed deliveries

Released components which have been in store for a period longer than two years following the release of the lot shall be re-examined before delivery. The re-examination procedure shall be recommended by the manufacturer and be approved by the National Supervising Inspectorate. Re-inspected product may be placed back into stores for another specified period.

3.7 Delivery release before completion of group B tests

When the conditions of IEC 410 for changing to reduced inspection have been satisfied for all group B tests, the manufacturer is permitted to release components before completion of these tests.