

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fibre optic interconnecting devices and passive components – Connectors
for optical fibres and cables –
Part 1: Generic specification**

**Dispositifs d'interconnexion et composants passifs à fibres optiques –
Connecteurs pour fibres et câbles optiques –
Partie 1: Spécification générique**

WILSON



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Withdrawn

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTORS FOR OPTICAL FIBRES AND CABLES –

Part 1: Generic specification

FOREWORD

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International Standard IEC 60874-1 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This sixth edition cancels and replaces the fifth edition published in 2006, and constitutes a technical revision. The specific technical changes from the previous edition include removal of quality assessment procedure, to add the definition of plug-socket configuration, to reconsider a drawing showing the relationship between IEC 60874, IEC 61753, IEC 61754 series of standards., and updating the normative references.

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

FDIS	Report on voting
86B/3272/FDIS	86B/3304/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.

A list of all parts of the IEC 60874 series, under the general title *Fibre optic interconnecting devices and passive components – Connectors for optical fibres and cables* can be found on the IEC website.

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- withdrawn,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.

Withdrawn

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – CONNECTORS FOR OPTICAL FIBRES AND CABLES –

Part 1: Generic specification

1 Scope

This part of IEC 60874 applies to fibre optic connector sets and individual components (i.e. adaptors, plugs, sockets) for all types, sizes and structures of fibres and cables. It includes:

- connector set requirements;

This part of IEC 60874 is divided into four clauses:

- Clauses 1 (Scope), 2 (Normative references) and 3 (Terms and definitions) contain general information pertaining to this generic specification;
- Clause 4 (Requirements) contains all the requirements to be met by connectors covered by this specification. This includes requirements for classification, the IEC specification system, documentation, materials, workmanship, quality, performance, identification, and packaging.

NOTE 1 Clauses 1 to 4 are applicable generally and refer to all connector standards

NOTE 2 This part of IEC 60874 applies also to the connectors covered by the IEC 61753, IEC 61754, and IEC 61755 series.

This standard does not cover test and measurement procedures, which are described in the IEC 61300 series.

2 Normative references

The following referenced documents are indispensable for the application of this document. 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*

IEC 60617, *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 and requirements*

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

IEC 61753 (all parts), *Performance standards*

IEC 61753-1: *Fibre optic interconnecting devices and passive components – Part 1: General and guidance for performance standards*

IEC 61754 (all parts), *Fibre optic connector interfaces*

IEC 61755 (all parts), *Fibre optic connector optical interfaces*

IEC/TR 61930, *Fibre optic graphical symbology*

IEC/TR 61931, *Fibre optic terminology*

ISO 129, *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: 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 part of IEC 60874, the definitions contained in IEC 60050-731 and IEC 61931, as well as the following definitions, apply.

3.1

adaptor

a component in which two or more ferrules are aligned

3.2

alignment pins

cylindrical rods used for alignment in some types of connectors

NOTE Typically these are used in pairs and inserted into specific guide holes in the two plugs (usually for multifibre connectors) to provide the alignment.

3.3

APC connector

connector with angled convex end-face ferrule capable of making an angled physical contact between the fibres

3.4

butting optical coupling

coupling in which the optical ports are in contact with each other

3.5

expanded beam optical coupling

coupling in which the optical ports use lens technology

3.6

ferrule

fibre holding component part of the plug, usually aligned in the sleeve of an adaptor. It confines the end(s) of a single or of multiple optical fibres

3.7

fully intermateable connector set

connector sets from different sources are considered fully intermateable when connector components from one source will mate with complementary components from other sources without mechanical damage and with optical properties maintained within specified limits

3.8

interchangeable connector set

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

3.9

mating face dimension

dimension of the features which determine the mating fit between components of an optical connector set

3.10

mechanically intermateable connector set

connector sets from different sources are considered mechanically intermateable when connector components from one source will mate with complementary components from other sources without mechanical damage but without regard to optical properties

3.11

mechanical reference plane (datum plane)

the plane of a plug or adaptor which is perpendicular to the fibre axis and is located on a physical feature of the component. It is the datum plane from which all features of the component are measured in the direction of the fibre axis

NOTE The mechanical reference planes of the plug and the adaptor should coincide when the two components are properly mated. Accordingly, each should be located on the feature that fixes or establishes the relative position of the two components when they are properly mated.

3.12

non-butting optical coupling

coupling in which the ports are not in contact with each other

3.13

optical datum target

theoretical datum point on a connector interface where the optical fibre core centre should be positioned by the plug or by the adaptor receptacle

3.14

optical fibre connector

component normally attached to an optical cable or piece of apparatus, for the purpose of providing frequent optical interconnection/disconnection of optical fibres or cables. This usually consists of two plugs mated together in an adaptor

3.15

optical fibre connector set

complete assembly of components required to provide demountable coupling between two or more optical fibre cables

3.16

optical fibre connector set kit

series of components necessary to make a complete connector set

3.17**optical fibre patchcord or jumper**

length of optical fibre or cable, permanently terminated at both ends with two plugs

3.18**optical fibre pigtail**

length of optical fibre or cable, permanently terminated at one end with a plug

3.19**PC connector**

connector with convex end-face ferrule capable of making a physical contact between the fibres

3.20**plug**

male-type part of a connector

3.21**plug-adaptor-plug configuration**

configuration in which two plugs mate through an adaptor. The mechanical coupling takes place between the plugs and the adaptor

3.22**plug-receptacle configuration**

configuration in which a plug mates in a receptacle

3.23**plug-socket configuration**

configuration in which a plug mates in a socket. The mechanical coupling takes place between the plug and the socket

3.24**receptacle**

structure for interfacing a plug with an active component. Typically it is formed by a semi-adaptor and a structure containing and aligning the active component

3.25**reference connector component**

tighter tolerated or selected connector component (e.g. plug, adaptor, etc.) which is used for measuring purposes

NOTE Test and measurement methods may refer to this. The characteristics or the selection procedure are given in the relevant specification.

3.26**sleeve**

precision part of the adaptor used to mechanically align two ferrules

3.27**small form factor connector (SFF)**

an optical fibre connector with a ferrule with an outside diameter of less than 2.0 mm or a connector designed to accommodate two or more optical fibres with at least the same mounting density as the RJ-45 connector

NOTE SFF connectors have a smaller cross-sectional area, about one-half that of traditional connectors.

3.28

socket

the female part of a two part connector

4 Requirements

4.1 General

The requirements for connectors covered by this generic specification are specified in this clause and in the detail specification.

4.2 Classification

4.2.1 General

Fibre optic connector sets are classified, either totally or in part, according to the following categories:

- type;
- arrangement;
- style;
- interface standard;
- standardization system;
- variant;
- assessment level;
- normative reference extensions.

See Table 1 for an example of a complete connector set classification.

4.2.2 Type

Connector set types shall be defined by four elements: the type name, the configuration, the coupling mechanism and the mating face dimensions.

Examples of type names:

- type SC;
- type LC.

Examples of configurations:

- plug-adaptor-plug configuration;
- plug-receptacle configuration.

Examples of coupling mechanisms:

- screw thread;
- bayonet;
- push-pull.

Table 1 – Example of a typical connector set classification

Type	– Name: type SC – Configuration: plug-adaptor-plug – Coupling: push -pull – Mating face dimensions: plug: see Figure 2^a adaptor: see Figure 4 ^a
Arrangement	– Kit
Style	– Fibre retention: adhesive – Cable retention: crimp – Optical coupling: PC – Alignment: resilient bushing
Variants	– Twelve plug permutations of: • fibre diameters 0,125 mm • cable jacket diameters 2,4 mm 3,0 mm • coupling styles: push –pull plastic housing. – Two adaptor variants: • non-mountable (in-line) • four-hole flange mount
^a Indicates figures in a hypothetical detail specification	

4.2.3 Arrangement

The connector set arrangement shall define the delivered connector set form.

Examples of connector set arrangements:

- kit arrangement for plug and adaptor;
- pigtail arrangement for plug,
- patch-cord arrangement for plugs.

4.2.4 Style

The connector set style shall be defined by four elements: the fibre retention technology, the cable retention technology, the optical coupling technology and the alignment technology.

Examples of fibre retention technologies:

- adhesive fibre retention;
- crimp fibre retention.

Examples of cable retention technologies:

- adhesive cable retention;
- crimp cable retention.

Examples of optical coupling technologies:

- non-butting;
- physical contact (PC)
- angled physical contact (APC);

- expanded beam.

Examples of alignment technologies:

- clearance fit alignment;
- resilient bushing alignment;
- resilient tip alignment;
- spherical alignment;
- solid bore alignment sleeve;
- resilient alignment sleeve;
- V-groove alignment;
- guide pin alignment.

4.2.5 Interface standard

The connector interface standard defines the dimensions and the physical features essential for mating and unmating a fibre optic connector with other connectors or components conforming to the same standard interface (see 4.4.1).

4.2.6 Variant

The connector set variant defines the variety of structurally similar components.

Examples of feature variables which create variants:

- fibre type (category, core and cladding diameter);
- cable type and size;
- mounting scheme;
- coupling nut design (hexagonal, knurled, etc.).

4.2.7 Assessment level

Assessment level defines the inspection levels and the acceptable quality level (AQL) of groups A and B, and the periodicity of inspection of groups C and D. Detail specifications 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 11, AQL = 4 %
 - group B inspection: inspection level 11, AQL = 4 %
 - group C inspection: 24-month periods
 - group D inspection: 48-month periods
- Assessment level B
 - group A inspection: inspection level 11, AQL = 1 %
 - group B inspection: inspection level 11, AQL = 1 %
 - group C inspection: 18-month periods
 - group D inspection: 36-month periods
- Assessment level C
 - group A inspection: inspection level 11, AQL = 0,4 %

- group B inspection: inspection level 11, AQL = 0,4 %
- group C inspection: 12-month periods
- group D inspection: 24-month periods

4.2.8 Normative reference extensions

Normative reference extensions are used to identify integration of independent standards specifications or other reference documents into blank detail specifications.

Unless a specified exception is noted, additional requirements imposed by an extension are mandatory. Usage is primarily intended to merge associated components to form hybrid devices, or can involve integrated functional application requirements that are dependent on technical expertise other than fibre optics.

Published reference documents produced by ITU consistent with the scope statements of the relevant IEC specification series may be used as extensions. Published documents produced by other regional standardization bodies such as TIA, ETSI, JIS, etc, may be referenced in an informative annex attached to the generic specification.

Some optical fibre splice configurations require special qualification provisions which shall not be imposed universally. These accommodate individual component design configurations, specialised field tooling, or specific application processes and involve requirements necessary to assure repeatable performance or adequate safety. They also provide additional guidance for complete product specification. Such extensions are mandatory whenever used in the preparation, assembly or installation of an optical fibre splice, either for field application usage or preparation of qualification test specimens. The relevant specification shall clarify all stipulations. However, design and style dependent extensions shall not be imposed universally.

In the event of conflicting requirements, precedence shall be given, in descending order, as follows: generic over mandatory extension, over blank detail, over detail, over application specific extension.

Examples of optical connector extensions include:

- using IEC 61754-2 and IEC 61754-4 to partially define a future specification within the IEC 60874 series for a duplex type “SC/BFOC/2,5” hybrid connector adaptor;
- using IEC 61754-13 to partially define a future specification within the IEC 60874 series for an integrated type “FC” preset attenuated optical connector;
- using IEC 61754-2 to partially define a specification within the IEC 60874 series for a duplex “BFOC/2,5” receptacle incorporating integral mechanical splices.

Other examples of requirements in normative extensions:

- some commercial or residential building applications may require direct reference to specific safety codes and regulations, or incorporate other specific material flammability or toxicity requirements for specialised locations;
- specialised field tooling may require an extension to implement specific ocular safety, electrical shock, or burn hazard avoidance requirements, or require isolation procedures to prevent potential ignition of combustible gases.

4.3 Documentation

4.3.1 Symbols

Graphical and letter symbols shall, whenever possible, be taken from IEC 60027, IEC 60617 and IEC 61930.