

INTERNATIONAL STANDARD

ISO/IEC 11801

Edition 1.2

2000-01

Edition 1:1995 consolidated with amendments 1:1999 and 2:1999

Information technology – Generic cabling for customer premises

*Technologies de l'information –
Câblage générique des locaux d'utilisateurs*



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Withdrawn

FOREWORD

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialised system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 11801 was prepared by the Joint Technical Committee ISO/IEC JTC 1, Information Technology, Subcommittee 25, Interconnection of Information Technology Equipment.

This International Standard has taken into account requirements specified in application standards listed in annex G. It refers to International Standards for components and test methods whenever an appropriate International Standard was available.

This consolidated version of ISO/IEC 11801 is based on the first edition (1995), its amendments 1 (1999) and 2 (1999) and the corrigendum 1 (December 1996) and the corrigendum 2 (June 1997).

It bears the edition number 1.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2, and corrigenda 1 and 2.

Annexes A, B and C form an integral part of this International Standard.
Annexes D, E, F, G, H and J are for information only.

INTRODUCTION

Within customer premises, the importance of the cabling infrastructure is similar to that of other fundamental building utilities such as heating, lighting and mains power. As with other utilities, interruptions to service can have serious impact. Poor quality of service due to lack of design foresight, use of inappropriate components, incorrect installation, poor administration or inadequate support can threaten an organisation's effectiveness.

Historically, the cabling within a premises comprised both application specific and multipurpose networks. Appropriate use of this International Standard will enable a controlled migration to generic cabling. Certain circumstances may warrant the introduction of application specific cabling; these instances should be minimised.

This International Standard provides:

- a) users with an application independent generic cabling system and an open market for cabling components;
- b) users with a flexible cabling scheme such that modifications are both easy and economical;
- c) building professionals (for example, architects) with guidance allowing the accommodation of cabling before specific requirements are known; that is, in the initial planning either for construction or refurbishment;
- d) industry and applications standardisation bodies with a cabling system which supports current products and provides a basis for future product development.

This International Standard specifies a multi-vendor cabling, and is related to:

- a) International Standards for cabling components developed by committees of the IEC; for example, copper cables IEC/TC 46 ¹⁾, copper connectors IEC/TC 48, optical fibre cables and connectors IEC/TC 86;
- b) applications developed by the sub-committees of ISO/IEC JTC 1 ²⁾ and study groups of ITU-T ³⁾; for example, LANs: ISO/IEC JTC 1/SC 6 and SC 25/WG 4 ⁴⁾; ISDN: ITU-T SG 13 ⁵⁾;
- c) planning and installation guides for the implementation and use of generic cabling systems.

The applications listed in annex G have been analysed to determine the requirements for a generic cabling system. These requirements, together with statistics concerning premises geography from different countries and the model described in 6.1.1, have been used to develop the requirements for cabling components and to stipulate their arrangement into cabling systems. As a result, generic cabling defined within this International Standard is targeted at, but not limited to, the general office environment.

It is anticipated that the generic cabling system defined by this International Standard will have a life expectancy in excess of 10 years.

¹⁾ International Electrotechnical Commission – Technical Committee 46

²⁾ International Organization for Standardization/International Electrotechnical Commission – Joint Technical Committee 1

³⁾ International Telecommunication Union – Telecommunications

⁴⁾ Subcommittee 25 – Working Group 4

⁵⁾ Study Group 13

INFORMATION TECHNOLOGY – GENERIC CABLING FOR CUSTOMER PREMISES

1 Scope

International Standard ISO/IEC 11801 specifies generic cabling for use within commercial premises, which may comprise single or multiple buildings on a campus.

The International Standard is optimised for premises having a geographical span of up to 3 000 m, with up to 1 000 000 m² of office space, and a population between 50 and 50 000 persons. It is recommended that the principles of this International Standard be applied to installations that do not fall within this range.

Cabling defined by this International Standard supports a wide range of services including voice, data, text, image and video.

This International Standard specifies:

- a) the structure and minimum configuration for generic cabling ¹⁾,
- b) implementation requirements,
- c) performance requirements for individual cabling links and
- d) conformance requirements and verification procedures.

Although safety (electrical, fire, etc.) and Electromagnetic Compatibility (EMC) requirements are outside the scope of this International Standard, and may be covered by other standards and regulations, information given in this International Standard may be of assistance in meeting these requirements.

¹⁾ Cables and cords used to connect application specific equipment to the generic cabling system are outside of the scope of this standard. Since they have significant effect on the transmission characteristics of the channel, assumptions and guidance are provided on their performance and length.

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of ISO/IEC 11801. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and 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. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-1:1988, *Basic environmental testing procedures – Environmental testing – Part 1: General and guidance*

IEC 60068-2-2:1974, *Basic environmental testing procedures – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-6:1982, *Basic environmental testing procedures – Part 2: Tests – Tests Fc and guidance: Vibration (sinusoidal)*

IEC 60068-2-14:1984, *Basic environmental testing procedures – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-38:1974, *Basic environmental testing procedures – Part 2: Tests – Test Z/AD: Composite temperature/humidity cyclic test*

IEC 60068-2-60 TTD:1990, *Basic environmental testing procedures – Part 2: Tests – Test Ke: Corrosion tests in artificial atmosphere at very low concentration of polluting gas(es)* [Technical Trend Document]

IEC 60096-1:1986, *Radio-frequency cables – Part 1: General requirements and measuring methods*

IEC 60189-1:1986, *Low-frequency cables and wires with p.v.c. insulation and p.v.c. sheath – Part 1: General test and measuring methods*

IEC 60227-2:1979, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60512-1:1994, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 1: General*

IEC 60512-2:1985, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 2: General examination, electrical continuity and contact resistance tests, insulation tests and voltage stress tests*
Amendment 1 (1988)

IEC 60603-7:1990, *Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8 way, including fixed and free connectors with common mating features*

IEC 60708-1:1981, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath – Part 1: General design details and requirements*

IEC 60793-1:1992, *Optical fibres – Part 1: Generic specification*

IEC 60793-1 (all parts), *Optical fibres – Part 1: Generic specification*

IEC 60793-2:1992, *Optical fibres – Part 2: Product specifications*

IEC 60794-1:1993, *Optical fibre cables – Part 1: Generic specification*

IEC 60794-2:1989, *Optical fibre cables – Part 2: Product specifications*

IEC 60807-8:1992, *Rectangular connectors for frequencies below 3 MHz – Part 8: Detailed specification for connectors, four signal contacts and earthing contacts for cable screen*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*

IEC 60874-1:1993, *Connectors for optical fibres and cables – Part 1: Generic specification*

IEC 60874-10:1992, *Connectors for optical fibres and cables – Part 10: Sectional specification for fibre optic connector – Type BFOC/2,5*

IEC 60874-14:1993, *Connectors for optical fibres and cables – Part 14: Sectional specification for fibre optic connector – Type SC*

IEC 60874-19 (all parts), *Connectors for optical fibres and cables*

IEC 61035-1, *Specification for conduit fittings for electrical installations – Part 1: General requirements*

IEC 61073-1:1994, *Splices for optical fibres and cables – Part 1: Generic specification – Hardware and accessories*

IEC 61156-1:1994, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61280-4 (all parts), *Fibre optic communication subsystem basic test procedures – Part 4: Fibre optic requirements*

IEC 61935-1, — *Generic specification for the testing of generic cabling in accordance with ISO/IEC 11801 – Part 1: Test methods*¹⁾

ISO/IEC 8802-5:1992, *Information technology – Local and metropolitan area networks – Part 5: Token ring access method and physical layer specifications*

CISPR 22:1993, *Limits and methods of measurement of radio disturbance characteristics of information technology equipment*

ITU-T Rec. G.117:1988, *Transmission aspects of unbalance about earth (definitions and methods)*

ITU-T Rec. G.650:1993, *Transmission media characteristics – Definition and test methods for the relevant parameters of single-mode fibres*

ITU-T Rec. G.651:1993, *Characteristics of a 50/125 µm multimode graded index optical fibre cable*

¹⁾ To be published.

ITU-T Rec. G.652:1993, *Characteristics of a single-mode optical fibre cable*

ITU-T Rec. O.9:1988, *Measuring arrangements to assess the degree of unbalance about earth*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this International Standard, the following definitions are applicable.

3.1.1

application

a system, with its associated transmission method which is supported by telecommunications cabling

3.1.2

balanced cable

a cable consisting of one or more metallic symmetrical cable elements (twisted pairs or quads)

3.1.3

building backbone cable

a cable that connects the building distributor to a floor distributor. Building backbone cables may also connect floor distributors in the same building

3.1.4

building distributor

a distributor in which the building backbone cable(s) terminate(s) and at which connections to the campus backbone cable(s) may be made

3.1.5

building entrance facility

a facility that provides all necessary mechanical and electrical services, that complies with all relevant regulations, for the entry of telecommunications cables into a building

3.1.6

cable

an assembly of one or more cable units of the same type and category in an overall sheath. It may include an overall shield

3.1.7

cable element

the smallest construction unit (for example pair, quad, or single fibre) in a cable. A cable element may have a shield

3.1.8

cable unit

a single assembly of one or more cable elements of the same type or category. The cable unit may have a shield

NOTE A binder group is an example of a cable unit.

3.1.9

cabling

a system of telecommunications cables, cords, and connecting hardware that can support the connection of information technology equipment

3.1.10

campus

a premises containing one or more buildings

3.1.11

campus backbone cable

a cable that connects the campus distributor to the building distributor(s). Campus backbone cables may also connect building distributors directly

3.1.12

campus distributor

the distributor from which the campus backbone cabling emanates

3.1.13

channel

the end-to-end transmission path connecting any two pieces of application specific equipment. Equipment and work area cables are included in the channel

3.1.14

cross-connect

a facility enabling the termination of cable elements and their connection, primarily by means of patch cords or jumpers

3.1.15

distributor

the term used for the functions of a collection of components (such as, patch panels, patch cords) used to connect cables

3.1.16

equipment cable

a cable connecting equipment to a distributor

3.1.17

equipment room

a room dedicated to housing distributors and application specific equipment

3.1.18

floor distributor

the distributor used to connect between the horizontal cable and other cabling subsystems or equipment. (See telecommunications closet)

3.1.19

generic cabling

a structured telecommunications cabling system, capable of supporting a wide range of applications. Generic cabling can be installed without prior knowledge of the required applications. Application specific hardware is not a part of generic cabling

3.1.20

horizontal cable

a cable connecting the floor distributor to the telecommunications outlet(s)

3.1.21

hybrid cable

an assembly of two or more different types of cable units, cables or categories covered by an overall sheath. It may be covered by an overall shield

3.1.22

individual work area

the minimum building space which would be reserved for an occupant

3.1.23

interconnect

a location at which equipment cables are terminated and connected to the cabling subsystems without using a patch cord or jumper

3.1.24

interface

a point at which connections are made to the generic cabling

3.1.25

jumper

a cable unit or cable element without connectors, used to make a connection on a cross-connect

3.1.26

keying

a mechanical feature of a connector system, which guarantees correct orientation of a connection, or prevents the connection to a jack or optical fibre adapter of the same type intended for another purpose

3.1.27

link

the transmission path between any two interfaces of generic cabling. It excludes equipment and work area cables

3.1.28

optical fibre cable (or optical cable)

a cable comprising one or more optical fibre cable elements

3.1.29

optical fibre duplex adapter

a mechanical device designed to align and join two duplex connectors

3.1.30

optical fibre duplex connector

a mechanical termination device designed to transfer optical power between two pairs of optical fibres

3.1.31

pair

a twisted pair or one side circuit (two diametrically facing conductors) in a star quad

3.1.32

patch cord

flexible cable unit or element with connector(s), used to establish connections on a patch panel

3.1.33

patch panel

a cross-connect designed to accommodate the use of patch cords. It facilitates administration for moves and changes

3.1.34

permanent link

the transmission path between two mated interfaces of generic cabling, excluding equipment cables, work area cables and cross-connections

3.1.35

public network interface

a point of demarcation between public and private network. In many cases the public network interface is the point of connection between the network provider's facilities and the customer premises cabling

3.1.36

quad

see star quad

3.1.37

side circuit

see pair

3.1.38

shielded cables

an assembly of two or more balanced twisted pair cable elements, or one or more quad cable elements, wrapped by an overall screen or shield contained within a common sheath or tube

3.1.39

shielded twisted pair cables

an electrically conducting cable comprising one or more elements, each of which is individually shielded. There may be an overall shield, in which case the cable is referred to as a shielded twisted pair cable with an overall shield

3.1.40

splice

a joining of conductors and fibres, generally from separate sheaths

3.1.41

star quad

a cable element which comprises four insulated conductors twisted together. Two diametrically facing conductors form a transmission pair

NOTE Cables containing star quads can be used interchangeably with cables consisting of pairs, provided the electrical characteristics meet the same specifications.

3.1.42

telecommunications

a branch of technology concerned with the transmission, emission and reception of signs, signals, writing, images and sounds; that is, information of any nature by cable, radio, optical or other electromagnetic systems. The term telecommunications has no legal meaning when used in this International Standard

3.1.43

telecommunications closet

an enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. The telecommunications closet is a recognized cross-connect point between the backbone and horizontal cabling subsystems

3.1.44

telecommunications outlet

a fixed connecting device where the horizontal cable terminates. The telecommunications outlet provides the interface to the work area cabling

3.1.45

transition point

a location in the horizontal cabling where a change of cable form takes place; for example flat cable connects to round cable or cables with differing numbers of elements are joined

3.1.46

twisted pair

a cable element which consists of two insulated conductors twisted together in a regular fashion to form a balanced transmission line

3.1.47

unshielded twisted pair cable

an electrically conducting cable comprising one or more pairs none of which is shielded. There may be an overall shield, in which case the cable is referred to as unshielded twisted pair with an overall shield

3.1.48

work area

a building space where the occupants interact with telecommunications terminal equipment

3.1.49

work area cable

a cable connecting the telecommunications outlet to the terminal equipment

3.2 Abbreviations

a.c.	alternating current
ACR	Attenuation to Crosstalk Ratio
BD	Building Distributor
BEF	Building Entrance Facilities
BFOC	Bayonet Fibre Optic Connector
B-ISDN	Broadband ISDN
BRI	Basic Rate ISDN
CD	Campus Distributor
c	speed of light
CISPR	International Special Committee on Radio Interference
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
d.c.	direct current
DCE	Data Circuit Terminating Equipment
DTE	Data Terminal Equipment
DUT	Device Under Test
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ER	Equipment Room
FD	Floor Distributor
FDDI	Fibre Distributed Data Interface
f.f.s.	for further study
FOIRL	Fibre Optic Inter-Repeater Link
FWHM	Full Width Half Maximum
IC	Integrated Circuit
IDC	Insulation Displacement Connection
IEC	International Electrotechnical Commission
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization

ITU-T	International Telecommunication Union – Telecommunications (formerly CCITT)
JTC	Joint Technical Committee
LAN	Local Area Network
LCL	Longitudinal Conversion Loss
LCTL	Longitudinal Conversion Transfer Loss
N/A	Not Applicable
N-BNC	N type to BNC Converter
NEXT	Near End Crosstalk
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
PDAM	Proposed Draft Amendment
PMD	Physical Layer Medium Dependent
PVC	Polyvinyl chloride
SC	Subscriber Connector (optical fibre connector)
SC-D	Duplex SC connector
STI	Surface Transfer Impedance
TC	Telecommunications Closet
TDR	Time Domain Reflectometer
TO	Telecommunications Outlet
TP	Transition Point

4 Conformance

For a cabling installation to conform to this International Standard the following applies.

- The configuration shall conform to the requirements outlined in clause 5.
- The interfaces to the cabling shall conform to the requirements of clause 9.
- The entire system shall be composed of links that meet the necessary level of performance specified in clause 7. This shall be achieved by installing components which meet the requirements of clauses 8 and 9, according to the design parameters of clause 6, or by a system design and implementation ensuring that the prescribed performance class of clause 7, and the reliability requirements of clause 9, are met.
- System administration shall meet the requirements of clause 11.
- Local regulations concerning safety and EMC shall be met.

The link performance specified in clause 7 is in accordance with clause 6. The link performance is met when components specified in clauses 8 and 9 are installed in a workmanlike manner and in accordance with supplier's and designer's instructions, over distances not exceeding those specified in clause 6. It is not required to test the transmission characteristics of the link in that case.

Conformance testing to the specifications of clause 7 should be used in the following cases:

- the design of links with lengths exceeding those specified in clause 6;
- the design of links using components different from those described in clauses 8 and 9;
- the evaluation of installed cabling to determine its capacity to support a certain group of applications;
- performance verification, as required, of an installed system designed in accordance with clauses 6, 8 and 9.

Specifications marked "f.f.s." (for further study) are preliminary specifications, and are not required for conformance to this International Standard.

References to the requirements and classifications specified in this International Standard shall specifically differentiate components and systems conforming to ISO/IEC 11801 (1995) from those that are qualified according to ISO/IEC 11801 (1995), including amendment 1 (1999) and amendment 2 (1999), by specifically referencing ISO/IEC 11801 (1995), including amendment 1 (1999) and amendment 2 (1999). For the purpose of component marking and system identification, it is appropriate to directly reference the year of publication of the second amendment, or to use a specific designation that provides linkage to it.

5 Structure of the generic cabling system

This clause identifies the functional elements of generic cabling, describes how they are connected together to form subsystems, and identifies the interfaces at which application specific components are interconnected by the generic cabling. General requirements for implementing generic cabling are also provided.

Applications are supported by connecting equipment to the telecommunications outlets and distributors. The components used to make this connection do not form part of generic cabling.

5.1 Structure

5.1.1 Functional elements

The functional elements of generic cabling are as follows:

Campus Distributor	[CD]
Campus Backbone Cable	
Building Distributor	[BD]
Building Backbone Cable	
Floor Distributor	[FD]
Horizontal Cable	
Transition Point (optional)	[TP]
Telecommunications Outlet	[TO]

Groups of these functional elements are connected together to form cabling subsystems.

5.1.2 Cabling subsystems

Generic cabling contains three cabling subsystems: campus backbone, building backbone and horizontal cabling. The composition of the subsystems are described in 5.1.3, 5.1.4 and 5.1.5. The cabling subsystems are connected together to create a generic cabling structure as shown in figure 1. The distributors provide the means to configure the cabling to support different topologies like bus, star and ring.

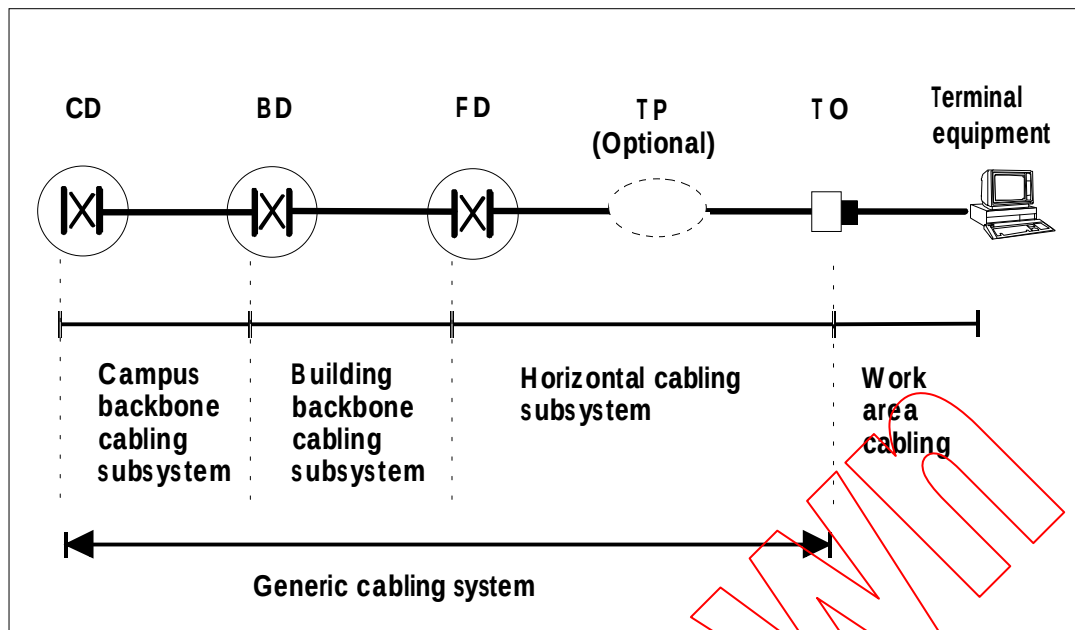


Figure 1 – Structure of generic cabling

5.1.3 Campus backbone cabling subsystem

The campus backbone cabling subsystem extends from the CD to the BD(s) usually located in separate buildings. When present, it includes the campus backbone cables, the mechanical termination of the campus backbone cables (at both the CD and BD(s)) and the cross-connections at the CD. The campus backbone cable may also interconnect BD(s).

5.1.4 Building backbone cabling subsystem

A building backbone cabling subsystem extends from BD(s) to the FD(s). The subsystem includes the building backbone cables, the mechanical termination of the building backbone cables (at both the BD(s) and FD(s)) and the cross-connections at the BD. The building backbone cables shall not contain TP, copper backbone cables should not contain splices.

5.1.5 Horizontal cabling subsystem

The horizontal cabling subsystem extends from FD(s) to the TO(s). The subsystem includes the horizontal cables, the mechanical termination of the horizontal cables at the FD, the cross-connections at the FD and the TOs.

Horizontal cables should be continuous from the FD to the TOs. If necessary, one TP is permitted between an FD and any TO. The transmission characteristics of the horizontal cabling shall be maintained. The incoming and outgoing pairs and fibres at the TP shall be connected so that a 1:1 correspondence is maintained. All cable elements at the TP shall be mechanically terminated. The TP shall not be used as a point of administration (that is, not used as a cross-connect), and application specific equipment shall not be located there. The TP may only contain passive connecting hardware. Refer to 8.3 for restrictions on the use of multi-unit cables.

5.1.6 Work area cabling

The work area cabling connects the TO to the terminal equipment. It is non-permanent and application specific and therefore lies outside the scope of this International Standard. Assumptions have been made concerning the length and the transmission performance of the work area cable; these assumptions are identified when relevant.

5.2 Overall structure

The generic cabling is a hierarchical star structure which may take the form shown in figure 2. The number and type of subsystems that are included in a generic cabling implementation depends upon the geography and size of the campus or building, and upon the strategy of the user. For example, in a campus having only one building the primary distribution point is the BD, and there is no need for a campus backbone cabling subsystem. On the other hand, one large building may be treated as a campus, with a campus backbone subsystem and several BDs. Further information on the application of the cabling structure is given in D.3 of annex D.

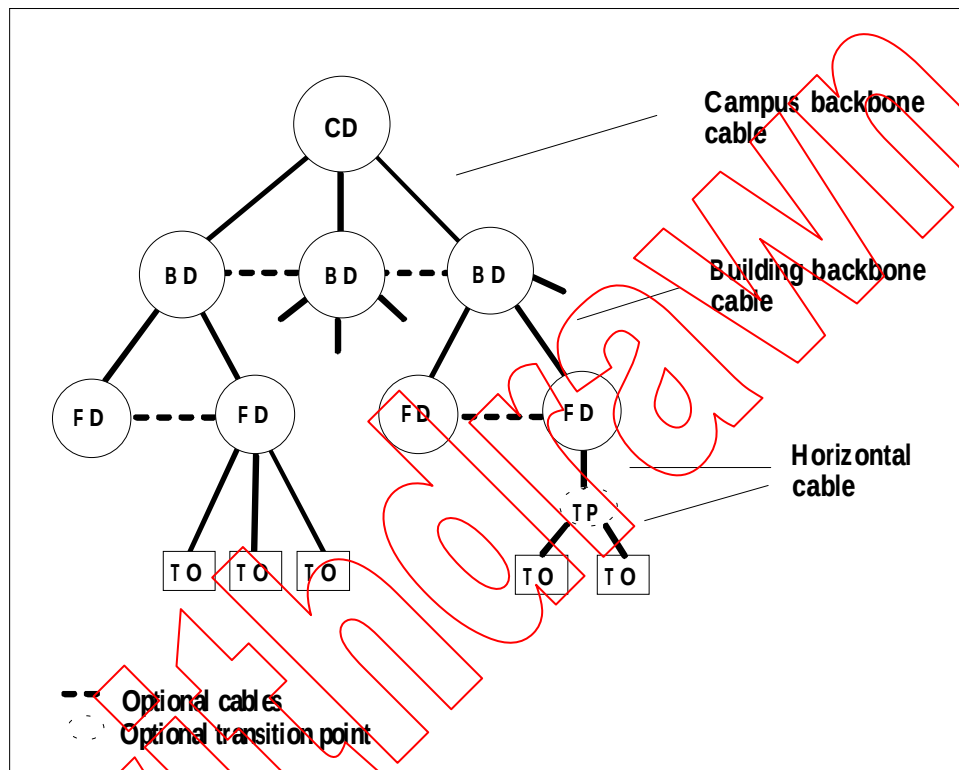


Figure 2 – Inter-relationship of functional elements

Cables shall be installed between adjacent levels in the structure. This forms a hierarchical star as shown in figure 2, and provides the high degree of flexibility needed to accommodate a variety of applications. Annex D details how to configure various networks within the boundaries of the hierarchical star topology. These topologies are established by the inter-connection of the cable elements at cross-connects, and at the application specific equipment.

For some applications, additional direct connections between FDs or BDs are desirable and are permitted. The building backbone cable may also interconnect FDs. However, such connections shall be in addition to those required for the basic hierarchical star topology.

The functions of multiple distributors may be combined. Figure 3 shows an example of generic cabling. The building in the foreground shows each distributor housed separately. The building in the background shows that the functions of the BD and FD have been combined into a single distributor.

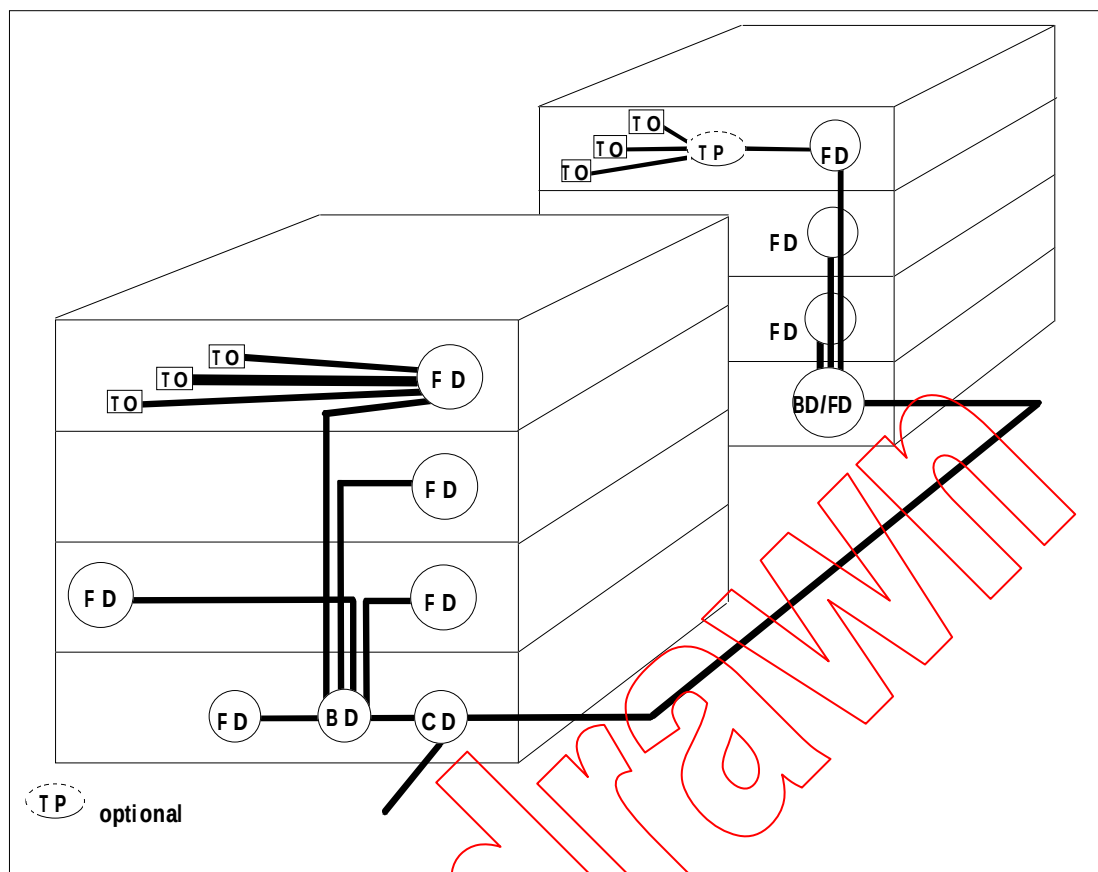


Figure 3 – Example of the generic cabling system

Information about additional cabling for fault tolerance can be found in annex D.

5.3 Location of distributors

Distributors are located in equipment rooms (ER) or telecommunications closets (TC). Figure 4 shows how the functional elements are typically accommodated in a building.

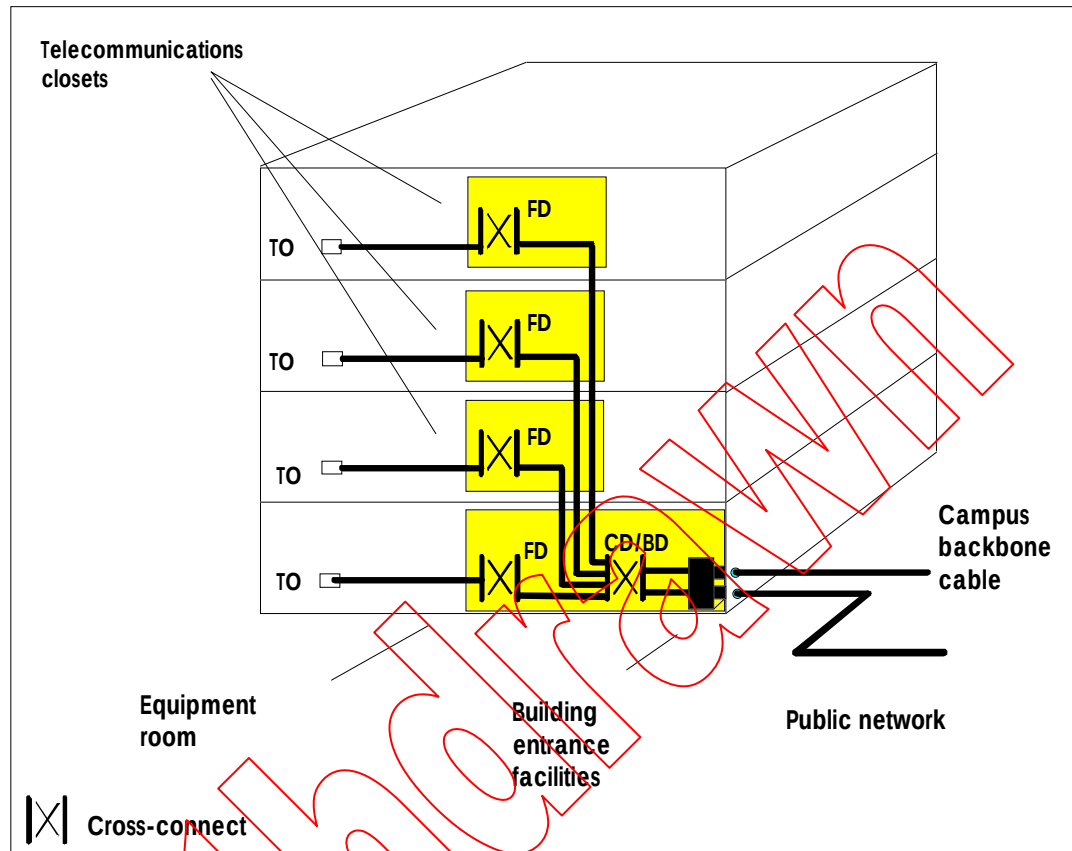


Figure 4 – Typical accommodation of functional elements

Cables are placed in appropriate pathways which may take a variety of forms including ducts, tunnels, cable trays, etc.

5.4 Interfaces to the generic cabling system

Interfaces to generic cabling are located at the ends of each subsystem. Application specific equipment can be connected at these points. Figure 5 shows potential interfaces at the distributors and TO. Any distributor may have an interface to an external services cable, and may use either interconnects or cross-connects.

The distance from external services to the CD can be significant. The performance of the cable between these points should be considered as part of the initial design and implementation of customer applications.

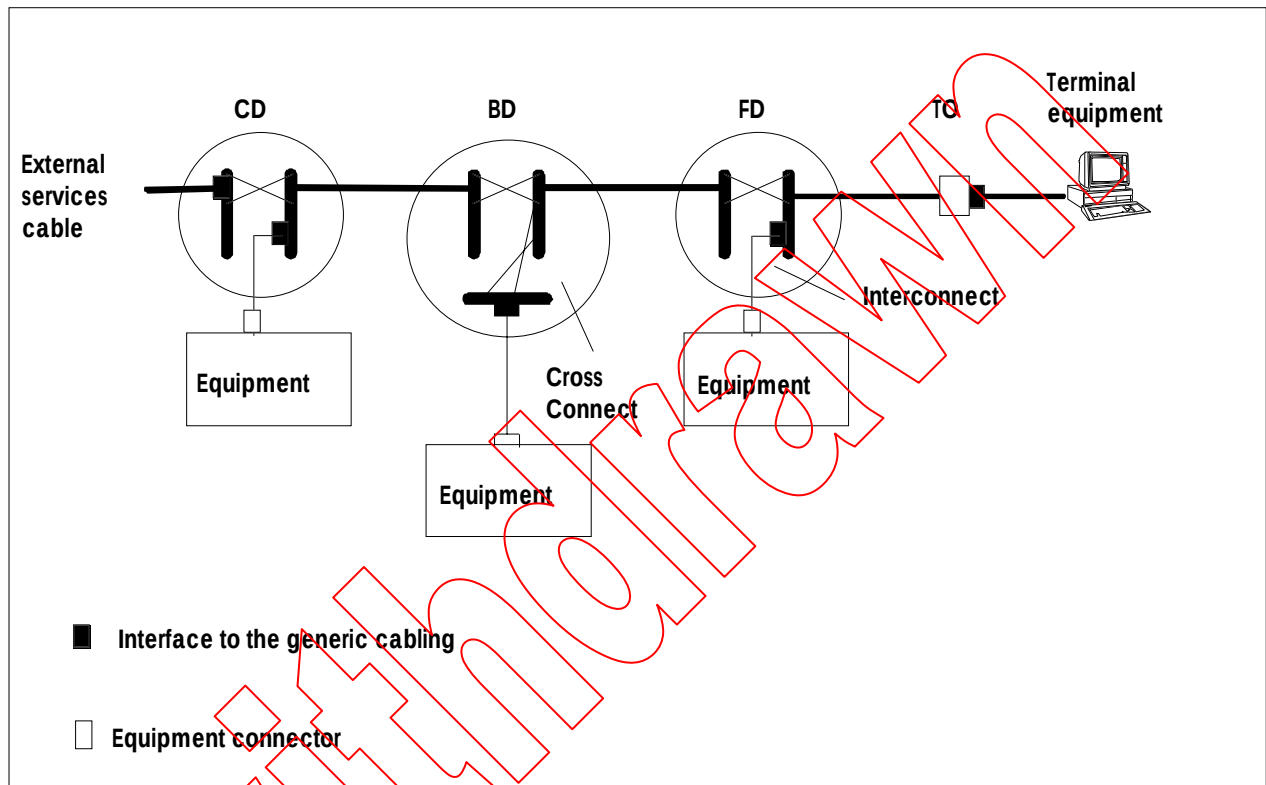


Figure 5 – Potential interfaces to generic cabling

5.4.1 Public network interface

Connections to the public network for the provision of public telecommunications services are made at the public network interface. The location of the public network interface, if present, and the facilities which must be provided may be regulated by national, regional, and local regulations. If the public network interface is not connected directly to a generic cabling interface the performance of the intermediate cabling should be taken into account. The type of cross-connect and the intermediate cable may be governed by national regulations. These regulations should be considered in planning the generic cabling.

5.5 Dimensioning and configuring

5.5.1 Floor distributor

There should be a minimum of one FD for every 1 000 m² of floor space reserved for offices. A minimum of one FD should be provided for every floor. If a floor is sparsely populated (for example, a lobby), it is permissible to serve this floor from the FD located on an adjacent floor.

5.5.2 Preferred cable types for pre-cabling and recommended use

Table 1 gives general guidelines regarding the use of different media in a particular subsystem for pre-cabling before applications used are known.

Table 1 – Recommended media for pre-cabling

Subsystem	Media Type	Recommended Use
Horizontal	Balanced cables	Voice and data (see table G.4) ¹⁾
	Optical fibre	Data (see table G.5) ¹⁾
Building backbone	Balanced cables	Voice and low to medium speed data
	Optical fibre	Medium to high speed data
Campus backbone	Optical fibre	For most applications – by using optical fibre – ground potential differences and other sources of interference may be overcome
	Balanced cables	As needed ²⁾
¹⁾ Under certain conditions, (for example, environmental conditions, security concerns, etc.), installation of optical fibre in the horizontal cabling subsystem should be considered. ²⁾ Balanced cables can be used in the campus backbone cabling subsystem in cases when the bandwidth of optical fibre is not required, for example PBX lines.		

5.5.3 Telecommunications outlets

TOs are located on the wall, floor, or elsewhere in the work area, depending on the design of the building. The design of generic cabling should provide for TOs to be installed in readily accessible locations throughout the usable floor space. A high density of TOs will enhance the flexibility of the cabling to accommodate changes. In many countries two TOs are provided to serve a maximum of 10 m² of usable floor space.

TOs may be presented singly, or in groups, but each work area shall be served by a minimum of two.

A minimum of one TO served by 100 Ω or 120 Ω cable shall be provided at each work area¹⁾ (100 Ω preferred). Other TOs shall be supported by either balanced cable or by fibre optical cable²⁾. In the horizontal cabling, at least one TO shall be configured as specified in item b of 6.1.3 (balanced or optical fibre cable) or at least one TO shall be served by either class D or optical class, as identified in 7.1.1. When a TO is supported by balanced cable, 2 pairs³⁾ or 4 pairs shall be provided at each TO; all pairs shall be terminated. If less than four pairs are provided, the outlet shall be clearly marked⁴⁾. Emerging balanced cable applications may be limited by differential delay of pairs that serve a single telecommunications outlet. See clause 9 for TO specifications that correspond to each of the cables listed above.

¹⁾ When the greatest flexibility is desired, four pair or two quad cable should be used (see annex G).

²⁾ When the largest bandwidth is desired the use of optical fibre is recommended.

³⁾ Installation of 2 pairs not capable of forming class D links may limit the applications supported.

⁴⁾ See annex G for number and performance of pairs needed for different applications and their pin assignment.

Outlets shall be marked with a permanent label that is visible to the user. Care should be taken that the initial pair assignment, and all subsequent changes, are recorded (see clause 10). Devices such as baluns and impedance matching adapters, if used, shall be external to the outlet. Pair reassignment by means of inserts is allowed.

5.5.4 Telecommunications closets and equipment rooms

A TC should provide all the facilities (space, power, environmental control etc.) for passive components, active devices, and public network interfaces housed within it. Each TC should have direct access to the backbone.

An ER is an area within a building where telecommunications equipment is housed and may or may not contain distributors. ERs are treated differently from TCs because of the nature or complexity of the equipment (e.g. PBXs or extensive computer installations). More than one distributor may be located in an ER. If a telecommunications space houses more than one distributor it should be considered an ER.

5.5.5 Building entrance facilities

Building entrance facilities are required whenever campus backbone, public and private network cables (including antennae) enter buildings and a transition is made to internal cables. It comprises an entrance point at a building wall and the pathway leading to the campus or building distributor. Local regulations may require special facilities where the external cables are terminated. At this termination point, a change from external to internal cable can take place.

5.6 Electromagnetic compatibility

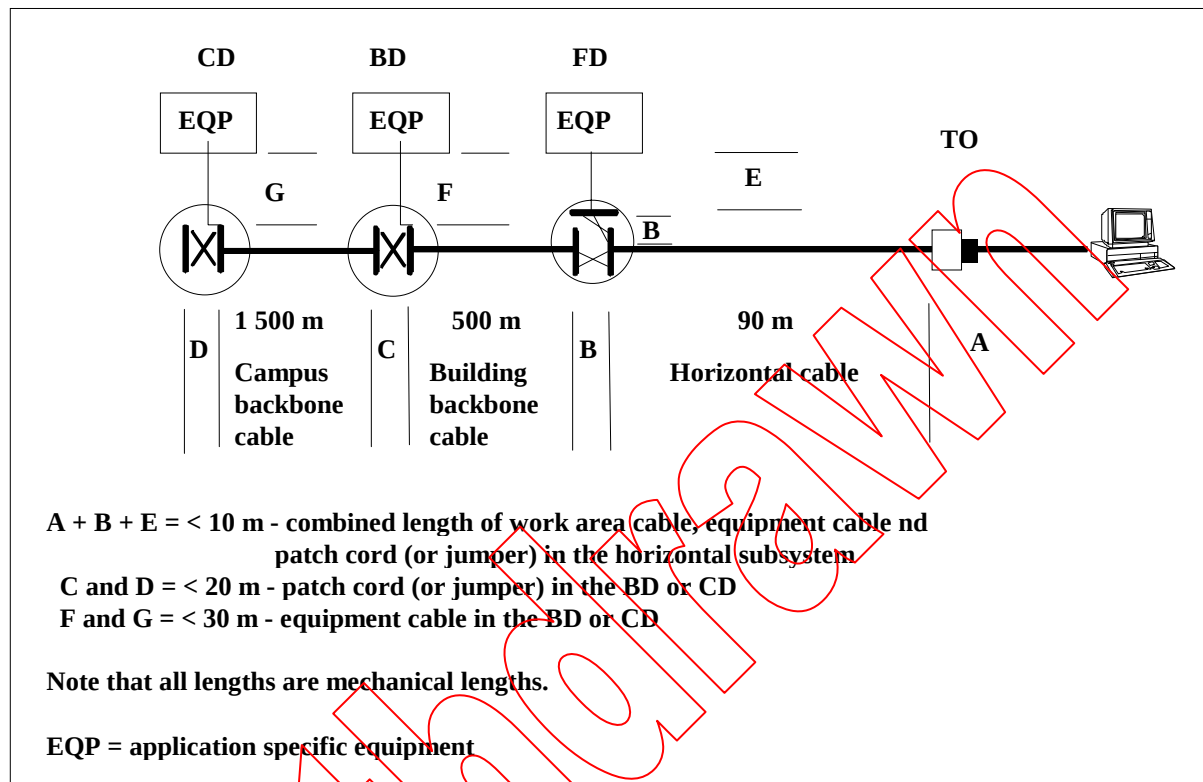
Where applicable, International Standards on electromagnetic emissions and immunity (such as CISPR 22), and local regulations shall be taken into account. Premises cabling is considered as a passive system and cannot be tested for EMC compliance individually. The active equipment which is designed for one specific medium is required to meet relevant EMC standards on this medium.

5.7 Earthing and bonding

Earthing shall meet the requirements mandated by the relevant authorities. Where compatible with required electrical codes, the earthing instructions and requirements of the equipment manufacturers should also be followed.

6 Implementation

This clause specifies a cabling design that, when properly installed, conforms to the requirements of this International Standard. The design should be applicable to the majority of installations. Maximum lengths are defined for the horizontal and backbone cabling subsystems (see figure 6).



NOTE 1 See annex C for further information on flexible cables.

NOTE 2 The 10 m (A + B + E) and 30 m (F and G) lengths are strongly recommended, but are of an advisory nature, because they include equipment cables which are outside the scope of this International Standard.

Figure 6 – Maximum cable lengths

The requirements for the cabling components to be used within this clause can be found in clause 8 (for cables) and clause 9 (for connecting hardware). Balanced cables of 100 Ω and 120 Ω characteristic impedance and the connecting hardware for these cables are specified by categories of increasing performance. The transmission characteristics of category 3, 4 and 5 components are specified up to 16 MHz, 20 MHz, and 100 MHz respectively.

Cables and connecting hardware of different categories may be mixed within a subsystem and/or the cabling link, but the transmission of the link will be determined by the category of the least performing component.

Cables of different nominal characteristic impedances shall not be mixed within a cabling link. Optical fibres of different core diameters shall not be mixed within a cabling link.

Multiple appearances of the same conductor or conductors continuing past the point of termination (bridged taps) shall not exist as part of the cabling system.

6.1 Horizontal cabling

6.1.1 Horizontal distances

The maximum horizontal cable length shall be 90 m independent of medium (see figure 6). This is the cable length from the mechanical termination of the cable in the floor distributor to the telecommunications outlet in the work area.

In establishing the maximum length of the horizontal channel, the optional use of a crossconnect or an interconnect places different requirements on the total length of the flexible cables used. Figure 7 shows examples of horizontal channel implementations which reflect these differing requirements of maximum cable length.

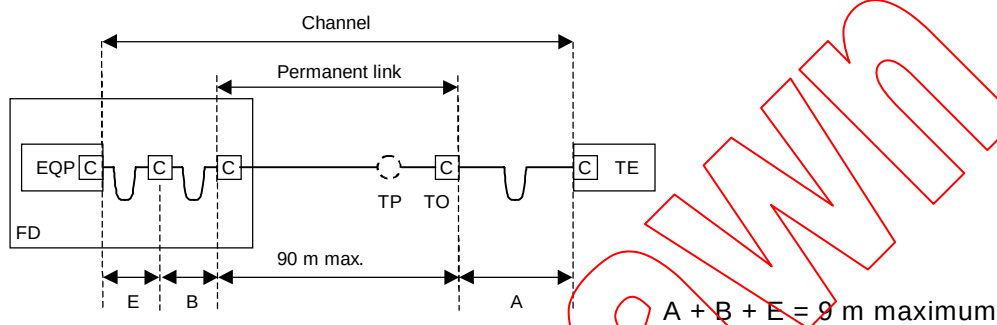


Figure 7a – Balanced copper horizontal cabling (with crossconnect)

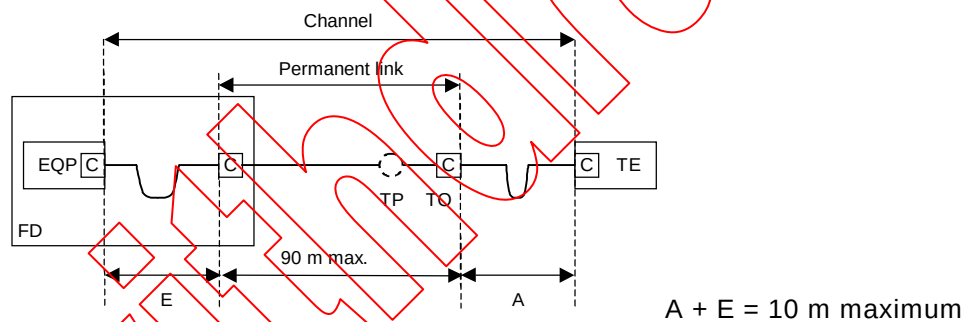


Figure 7b – Balanced copper horizontal cabling (with interconnect)

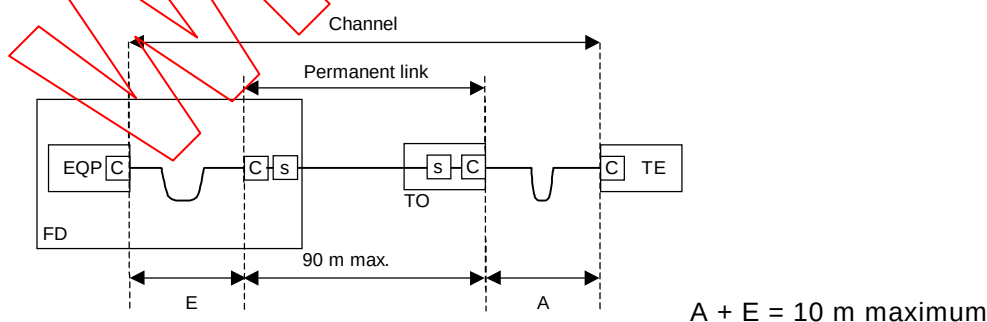


Figure 7c – Optical fibre cabling (with interconnect)

Key

C connection (e.g. plug and jack or mated optical connection)

S optical fibre splice

EQP application specific equipment

NOTE 1 All lengths are mechanical lengths.

NOTE 2 See annex C for further information on flexible cables.

Figure 7 – Examples of horizontal channel implementation

In figure 7a, the maximum total length of work area cable, equipment cable and patch cord is 9 m based upon flexible cables with 50 % greater attenuation than the horizontal cable and includes a crossconnect in the floor distributor. In figure 7b, the maximum total length of work area cable and equipment cable is 10 m also based upon flexible cables with 50 % greater attenuation than the horizontal cable and includes an interconnect in the floor distributor. In both cases the transition point is optional. It is required that the performance of the horizontal cabling is not degraded by the inclusion of the transition point.

For optical fibre, the implementation is shown in figure 7c. An optical fibre splice, in accordance with clause 9, is allowed at both ends of the horizontal cable.

See clause 9 and annex C for requirements for patch cords and other flexible cables. In all cases, equipment cables that meet or have better performance characteristics than patch cord requirements are recommended.

6.1.2 Choosing cable types

The following cable types are recommended for use in the horizontal cabling subsystem:

Preferred:

- a) 100 Ω balanced cable – (see 8.1).
- b) 62,5/125 μm multimode optical fibres – (see 8.4).

Alternative:

- a) 120 Ω balanced cable – (see 8.1).
- b) 150 Ω balanced cable – (see 8.2).
- c) 50/125 μm multimode optical fibres – (see 8.4).

The performance characteristics for the horizontal cable types, associated connecting hardware and cross-connects are described in clauses 8 and 9.

Hybrid and multi-unit cables that meet the requirements of 8.3 may be used in the horizontal cabling subsystem for serving more than one TO.

If shields or grounded metallic parts are present, refer to clause 10.

6.1.3 Configuring TOs

The two TOs in a work area corresponding to the minimum configuration of clause 5 are configured as follows.

- a) One telecommunications outlet shall be supported by balanced cable category 3 or higher according to 8.1.
- b) A second telecommunications outlet shall be supported either by balanced cable of category 5, according to 8.1, a balanced cable according to 8.2, or an optical fibre cable according to 8.3.

NOTE See 9.2.5, 9.3.5 and 9.4.4 for TO requirements that correspond to each of the cables listed above.

A typical horizontal and work area cabling scenario is represented in figure 8.

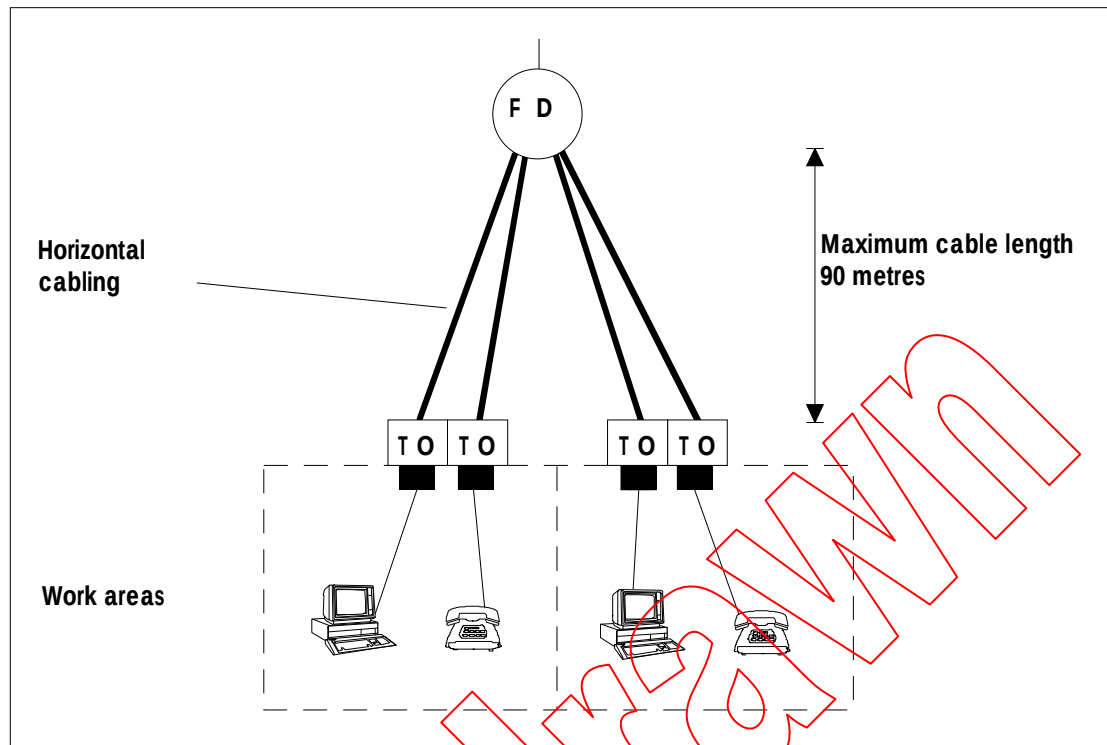


Figure 8 – Typical horizontal and work area cabling

6.2 Backbone cabling

6.2.1 Physical topology

There shall be no more than two hierarchical levels of cross-connects in the backbone cabling to limit signal degradation for passive systems and to simplify administration in keeping track of cables and connections. No more than one cross-connect shall be passed through to reach the CD when starting from a FD.

A single backbone cabling cross-connect may meet the cross-connect needs of the entire backbone subsystem. Backbone cabling cross-connects may be located in telecommunications closets or equipment rooms. See annex D for guidance on accommodating ring, bus, tree, etc. configurations within the hierarchical star.

The star topology is applicable to the cable elements of the transmission medium, such as individual fibres or pairs. Depending on the physical characteristics of a site, cable elements that are terminated at different locations may be part of the same cable over a portion of the distance, or may use individual cables over the entire distance. Hybrid and multi-unit cables that meet the requirements of 8.3 may be used in the backbone cabling subsystem.

An example of the backbone star topology is given in figure 9.

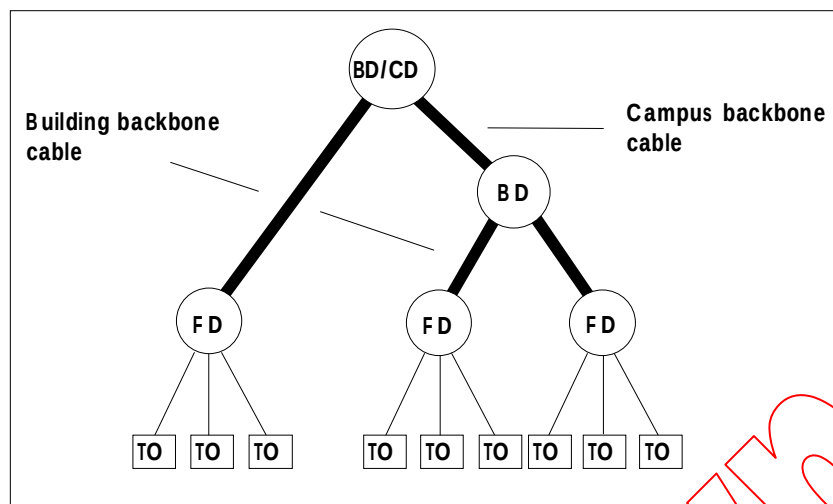


Figure 9 – Backbone star topology

6.2.2 Choosing cable types

This International Standard specifies five transmission media, more than one of these five general types may be present in the backbone cabling. The five media are:

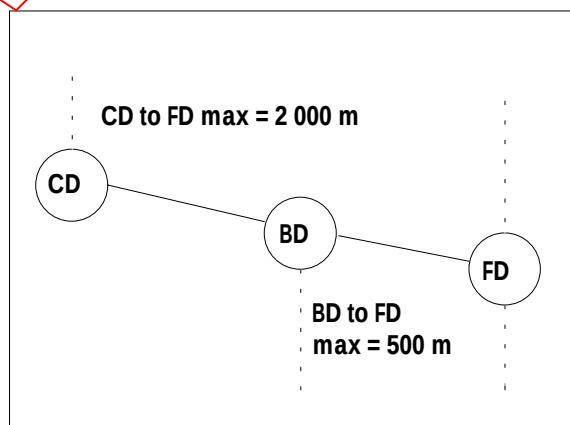
- multimode and singlemode optical fibre cable (see 8.4 and 8.5 respectively). The 62,5/125 μm multimode fibre is preferred;
- 100 Ω , 120 Ω or 150 Ω balanced cable (see 8.1 and 8.2 respectively). The 100 Ω cable is preferred. All high speed applications on copper shall be limited to horizontal distances as specified in 6.1.1.

If shields or grounded metallic parts are present, refer to clause 10.

6.2.3 Backbone cabling distances

6.2.3.1 Floor distributor to building/campus distributor

The maximum backbone distance between the CD and the associated distributor in the telecommunications closet shall comply with figure 10. Installations that exceed these distance limits may be divided into areas, each of which can be supported by backbone cabling, thus satisfying the distance requirements of this clause.



NOTE These maximum distances are not applicable for all combinations of cabling media and applications. It is recommended that equipment manufacturers, applications standards, and system providers be consulted before selecting a backbone medium. See also table 2.

Figure 10 – Maximum backbone distances