BS EN 50174-3:2013

BSI Standards Publication

Information technology — Cabling installation

Part 3: Installation planning and practices outside buildings

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National foreword

This British Standard is the UK implementation of EN 50174-3:2013. It supersedes BS EN 50174-3:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TCT/7, Telecommunications - Installation requirements.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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European Committee for Electrotechnical Standardization
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Foreword

This document (EN 50174-3:2013) has been prepared by CLC/TC 215 “Electrotechnical aspects of telecommunication equipment”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-09-02
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2016-09-02

This document supersedes EN 50174-3:2003.

EN 50174 comprises three parts:

- EN 50174-1, *Information technology — Cabling installation — Part 1: Installation specification and quality assurance*;
- EN 50174-2, *Information technology — Cabling installation — Part 2: Installation planning and practices inside buildings*;
- EN 50174-3, *Information technology — Cabling installation — Part 3: Installation planning and practices outside buildings* (the present document).

All three parts support the specification, implementation and operation of information technology cabling. There are specific requirements for cabling systems that are in accordance with the design requirements of EN 50173 series. However, the three parts also apply to cabling systems of any design including those in accordance with standards such as EN 50098-1 or EN 50098-2.

This part, EN 50174-3, is concerned with the planning and installation of information technology cabling using metallic cabling and optical fibre cabling outside buildings; it is not confined to the border of a particular premises and includes wide area information technology cabling of any kind. It provides guidance as to the responsibilities of those involved and is intended to be referenced in relevant contracts.

EN 50174-3:2003 (the 1st edition) has been completely revised in the light of the technical evolution and the feedback received from the users of the 1st edition. Major changes include:

a) restructuring of the contents to align with the structure of EN 50174-1:2009 and EN 50174-2:2009 (including their associated amendments); in particular, the pertinent requirements and recommendations have been clearly distinguished and are presented in separate subclauses;

b) where appropriate, text has been aligned with that of EN 50174-1 and EN 50174-2;

c) requirements and recommendations for wide area information technology cabling have been elaborated in greater detail;

d) a new Annex A on EMC and protection (the existing Annex A is renumbered as Annex B) and a new Annex C on the application of responsibilities have been added.

Introduction

The importance of services delivered by information technology cabling infrastructure is similar to that of utilities such as heating, lighting and electricity supplies. As with those utilities, interruptions to service can have a serious impact. Poor quality of service due to lack of planning, use of inappropriate components, incorrect installation, poor administration or inadequate support can threaten an organisation's effectiveness.

There are four phases in the successful implementation of information technology cabling. These are:

a) design;

b) specification – the detailed requirement for the cabling, including the planning of its accommodation and associated building services addressing specific environments (e.g. electromagnetic) together with the quality assurance requirements to be applied;

c) installation – in accordance with the requirements of the specification;

d) operation – the management of connectivity and the maintenance of transmission performance during the life of the cabling.

This European Standard is in three parts and addresses the specification, installation and operational aspects. EN 50173 series and other application standards cover design issues.

EN 50174-1 is used during the specification phase. It addresses the:

– installation specification, quality assurance documentation and procedures;

– documentation and administration;

– operation and maintenance.

This part, EN 50174-3, and EN 50174-2 are intended to be used by the personnel directly involved in the planning aspects (of the specification phase) and installation phase. EN 50174-2 is applicable inside buildings and EN 50174-3 is applicable outside buildings.

This European Standard is applicable to all types of information technology cabling outside buildings, including generic cabling systems designed in accordance with EN 50173 series. The requirements and recommendations of this European Standard may be applied to cabling that is defined as part of the building.

The planning of the pathway systems, spaces and structures within the core and access network cabling as described in Figure 2 that are owned by access providers is excluded except for requirements and recommendations that provide basic safety, function and environmental objectives for mechanical, ingress and climatic characteristics (i.e. excluding pathway dimensions, distribution of spaces and similar constraints based on specific transmission methods).

This European Standard is also relevant to:

- architects, building designers and builders;
- main contractors;
- designers, suppliers, installers, inspectors (auditors), maintainers and owners of information technology cabling;
- public network providers and local service providers;
- end users.

This part, EN 50174-3, contains requirements and recommendations relating to the installation planning and practices by defining:

i) planning strategy (road map) and guidance depending on the application, electromagnetic environment, building infrastructure and facilities, etc.;

ii) planning and installation requirements for metallic and optical fibre information technology cabling depending on the application, electromagnetic environment, building infrastructure and facilities, etc.;

iii) the practices and procedures to be adopted to ensure that the cabling is installed in accordance with the specification.

Figure 1 and Table 1 show the schematic and contextual relationships between the standards produced by CLC/TC 215 for information technology cabling, namely:

1) this part and other parts of EN 50174 series;

2) generic cabling design (EN 50173 series);

3) application dependent cabling design (e.g. EN 50098 series);

4) testing of installed cabling (EN 50346);

5) equipotential bonding requirements (EN 50310).

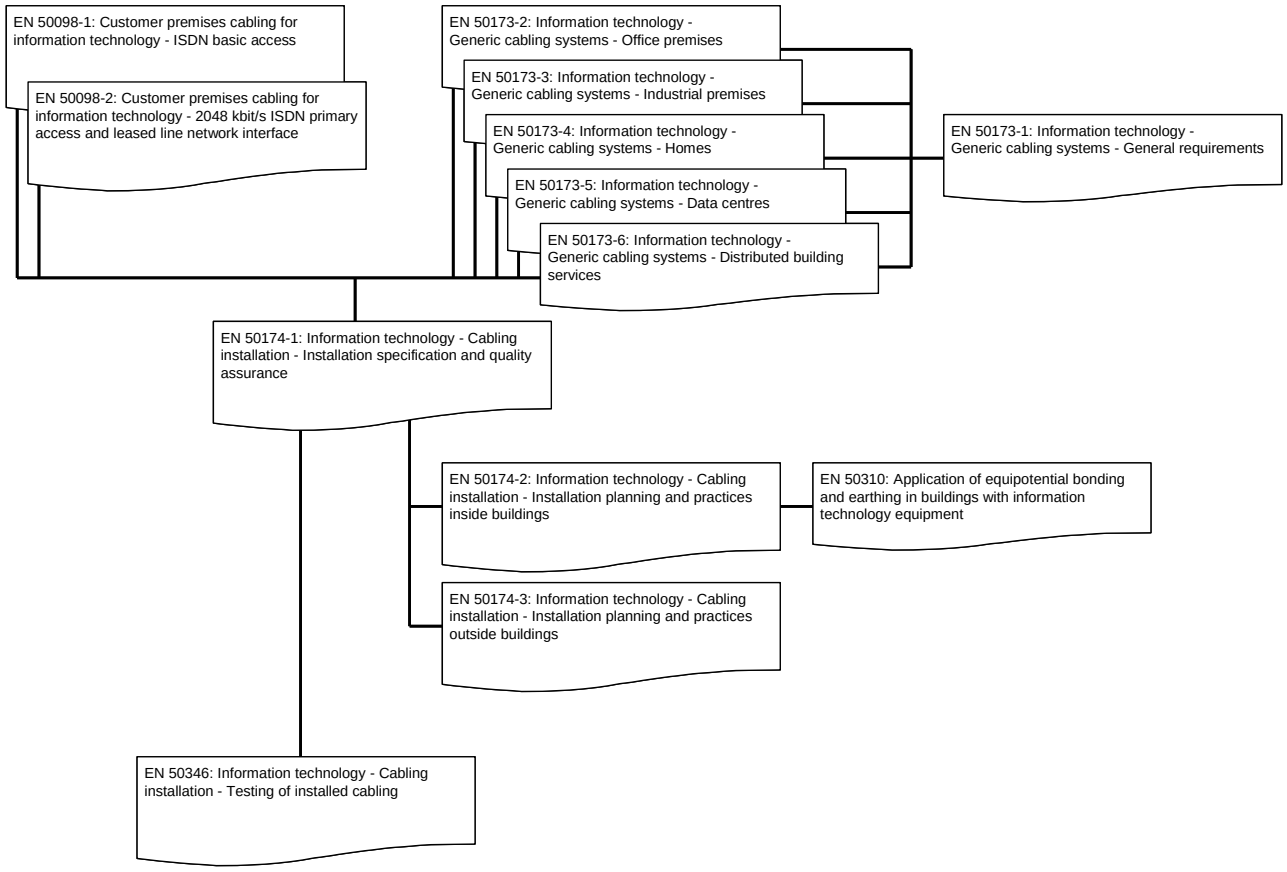


Figure 1 — Schematic relationship between EN 50174 series and other relevant standards

Table 1 — Contextual relationship between EN 50174 series and other standards relevant for information technology cabling systems

<table>
<tr><th>Building design phase</th><th>Generic cabling design phase</th><th>Specification phase</th><th>Installation phase</th><th>Operation phase</th></tr>
<tr><td>EN 50310

6. Earthing networks</td><td>EN 50173 series
except
EN 50173-4

4: Structure
5: Channel performance
7: Cable requirements
8: Connecting hardware requirements
9: Requirements for cords and jumpers
A: Link performance limits

and
EN 50173-4

4 and 5: Structure
6: Channel performance
8: Cable requirements
9: Connecting hardware requirements
10: Requirements for cords and jumpers
A: Link performance limits</td><td>EN 50174-1

4: Requirements for specifying installations of information technology cabling
5: Requirements for installers of information technology cabling

Planning phase

EN 50174-2

4: Requirements for planning installations of information technology cabling
6: Segregation of metallic information technology cabling and power supply cabling
7: Electricity distribution systems and lightning protection

and
EN 50174-3

and
(for equipotential bonding)
EN 50310</td><td>EN 50174-2

5: Requirements for the installation of information technology cabling
6: Segregation of metallic information technology cabling and power supply cabling

and
EN 50174-3

and
(for equipotential bonding)
EN 50310

and
EN 50346

4: General requirements
5: Test parameters for balanced cabling
6: Test parameters for optical fibre cabling</td><td>EN 50174-1

4: Requirements for specifying installations of information technology cabling</td></tr>
</table>

1 Scope and conformance

1.1 Scope

This European Standard specifies requirements and provides recommendations for the following aspects of information technology cabling:

a) planning;

b) installation practice.

This European Standard is applicable to all types of information technology cabling outside buildings including generic cabling systems designed in accordance with EN 50173 series. The requirements and recommendations of this European Standard may be applied to cabling that is defined as part of the building.

The requirements and recommendations of Clauses 4, 5 and 6 of this European Standard are subject to any site-specific requirements and recommendations of Clause 7.

The planning of the pathway systems, spaces and structures within the core and access network cabling as described in Figure 2 that are owned by access providers is excluded except for requirements and recommendations that provide basic safety, function and environmental objectives for mechanical, ingress and climatic characteristics (i.e. excluding pathway dimensions, distribution of spaces and similar constraints based on specific transmission methods).

The installation practices applicable to all cabling installation methods are included by the provision of the necessary planning requirements and recommendations associated with each one with the exception of information technology cabling installed:

– around or within aerial power supply or associated earth conductors;

– on infrastructures carrying power supplies in excess of AC/DC 25 kV.

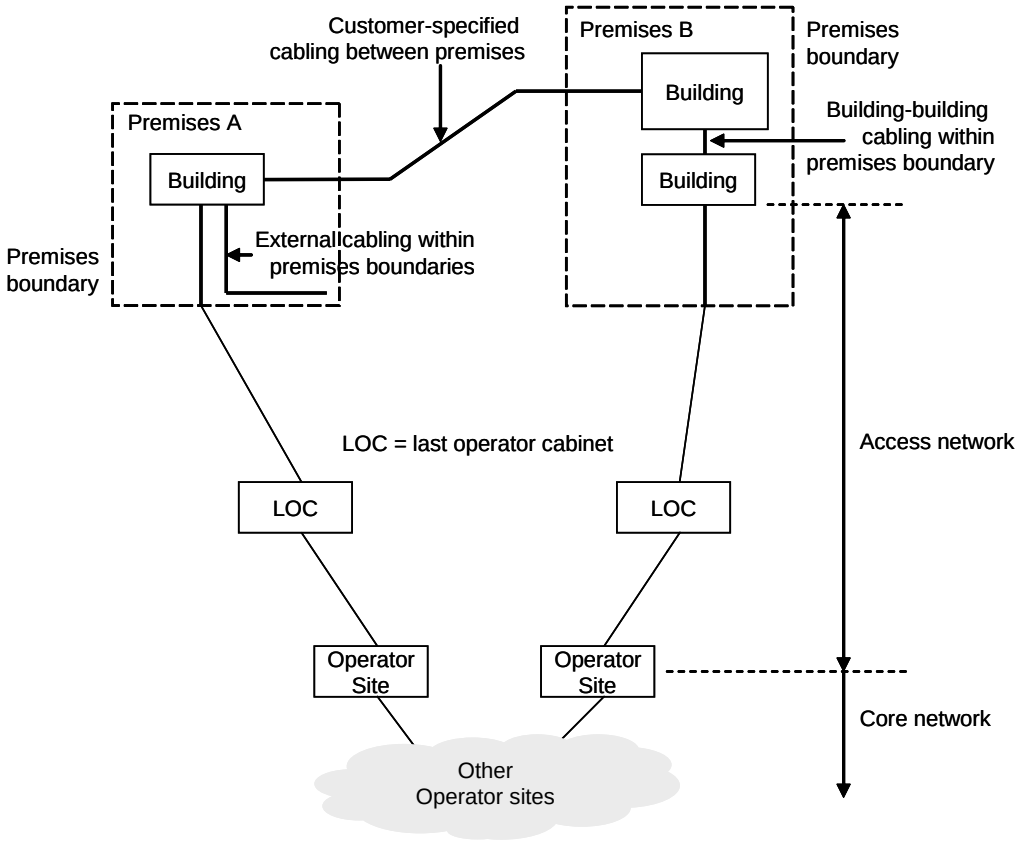
This European Standard:

1) details the considerations for satisfactory installation and operation of information technology cabling;
2) excludes specific requirements applicable to other cabling systems (e.g. power supply cabling); however, it takes account of the effects other cabling systems may have on the installation of information technology cabling (and vice versa) and gives general advice;
3) excludes those aspects of installation associated with the transmission of signals in free space between transmitters, receivers or their associated antenna systems (e.g. wireless, radio, microwave or satellite).

This European Standard is applicable to certain hazardous environments. It does not exclude additional requirements which are applicable in particular circumstances, defined by e.g. electricity supply and electrified railways.

The requirements within this European Standard do not cover any additional requirements for the information technology cables installed in hazardous or stressful environments e.g. electricity supply and electric railway locations (see Clause 7).

Examples of areas covered by this European Standard are shown in Figure 2.



NOTE Pathways and spaces between premises A and B are assumed to be designed to meet specific networking objectives, whereas the pathways and spaces between the premises boundary and the buildings in the premises, if provided by the premises owner, are aimed to be more generic to meet the needs of multiple access providers and transmission systems within their access networks.

Figure 2 — Examples of areas covered by this document

1.2 Conformance

For a cabling installation to conform to this European Standard:

a) the planning of the installation shall meet the requirements of Clause 4;

b) the installation practices shall meet the requirements of Clause 5;

c) local regulations, including safety, shall be met.

The responsibilities for specific elements of conformance may be made by national-specific amendment of Annex C.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 124:1994 [1)], *Gully tops and manhole tops for vehicular and pedestrian areas - Design requirements, type testing, marking, quality control*

EN 12613, *Plastics warning devices for underground cables and pipelines with visual characteristics*

1) To be replaced by series EN 124, which is at draft stage.

EN 50085-1, *Cable trunking systems and cable ducting systems for electrical installations — Part 1: General requirements*

EN 50085-2 (all parts), *Cable trunking systems and cable ducting systems for electrical installations*

EN 50173-1:2011, *Information technology — Generic cabling systems — Part 1: General requirements*

EN 50173-2, *Information technology — Generic cabling systems — Part 2: Office premises*

EN 50173-3, *Information technology — Generic cabling systems — Part 3: Industrial premises*

EN 50173-4, *Information technology — Generic cabling systems — Part 4: Homes*

EN 50173-5, *Information technology — Generic cabling systems — Part 5: Data centres*

EN 50173-6, *Information technology — Generic cabling systems — Part 6: Distributed building services*

EN 50174-1, *Information technology — Cabling installation — Part 1: Installation specification and quality assurance*

EN 50310, *Application of equipotential bonding and earthing in buildings with information technology equipment*

EN 50346, *Information technology — Cabling installation — Testing of installed cabling*

EN 50411-2-2, *Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2-2: Sealed pan fibre splice closures Type 1, for category S & A*

EN 50411-2-3, *Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2-3: Sealed inline fibre splice closures Type 1, for category S & A*

EN 50411-2-4, *Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2-4: Sealed dome fibre splice closures Type 1, for category S & A*

EN 50411-2-5, *Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2-5: Sealed closures for air blown fibre microduct, type 1, for category S & A*

EN 50411-2-9, *Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2-9: Non-sealed closures for air blown fibre microduct cable, for category S & A*

EN 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements (IEC 60079-0)*

EN 60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection (IEC 60079-14)*

EN 60079-17, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance (IEC 60079-17)*

EN 60332-1-2, *Tests on electric and optical fibre cables under fire conditions — Part 1-2: Test for vertical flame propagation for a single insulated wire or cable — Procedure for 1 kW pre-mixed flame* (*IEC 60332-1-2)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60601-1-2, *Medical electrical equipment — Part 1-2: General requirements for basic safety and essential performance — Collateral standard: Electromagnetic compatibility — Requirements and tests (IEC 60601-1-2)*

EN 60794-1-2:2003, *Optical fibre cables — Part 1-2: Generic specification — Basic optical cable test procedures (IEC 60794-1-2:2003)*

EN 60794-3, *Optical fibre cables — Part 3: Sectional specification — Outdoor cables (IEC 60794-3)*

EN 60794-3-10, *Optical fibre cables — Part 3-10: Outdoor cables — Family specification for duct, directly buried and lashed aerial optical telecommunication cables (IEC 60794-3-10)*

EN 60794-3-11, *Optical fibre cables — Part 3-11: Outdoor cables — Product specification for duct, directly buried and lashed aerial single-mode optical fibre telecommunication cables (IEC 60794-3-11)*

EN 60794-3-12, *Optical fibre cables — Part 3-12: Outdoor cables — Detailed specification for duct and directly buried optical telecommunication cables for use in premises cabling (IEC 60794-3-12)*

EN 60794-3-20, *Optical fibre cables — Part 3-20: Outdoor cables — Family specification for self-supporting aerial telecommunication cables (IEC 60794-3-20)*

EN 60794-3-21, *Optical fibre cables — Part 3-21: Outdoor cables — Detailed specification for optical self-supporting aerial telecommunication cables for use in premises cabling (IEC 60794-3-21)*

EN 60794-3-30, *Optical fibre cables — Part 3-30: Outdoor cables — Family specification for optical telecommunication cables for lakes, river crossings and coastal application (IEC 60794-3-30)*

EN 60794-3-40, *Optical fibre cables — Part 3-40: Outdoor cables — Family specification for sewer cables and conduits for installation by blowing and/or pulling in non-man accessible storm and sanitary sewers (IEC 60794-3-40)*

EN 60794-3-50, *Optical fibre cables — Part 3-50: Outdoor cables — Family specification for gas pipe cables and subducts for installation by blowing and/or pulling/dragging in gas pipes (IEC 60794-3-50)*

EN 60794-3-60, *Optical fibre cables — Part 3-60: Outdoor cables — Family specification for drinking water pipe cables and subducts for installation by blowing and/or pulling/dragging/floating in drinking water pipes (IEC 60794-3-60)*

EN 60794-4-20, *Optical fibre cables — Part 4-20: Aerial optical cables along electrical power lines — Family specification for ADSS (All Dielectric Self Supported) optical cables (IEC 60794-4-20)*

EN 60794-5-10 [2)], *Optical fibre cables — Part 5-10: Family specification for outdoor microduct optical fibre cables, microducts and protected microducts for installation by blowing (IEC 60794-5-10 [2)])*

EN 60794-5-20 [2)], *Optical fibre cables — Part 5-20: Family specification for outdoor microduct fibre units, microducts and protected microducts for installation by blowing (IEC 60794-5-20 [2)])*

EN 60825 (all parts), *Safety of laser products (IEC 60825)*

EN 60825-2, *Safety of laser products — Part 2: Safety of optical fibre communication systems (OFCS) (IEC 60825-2)*

EN 60950 (all parts), *Information technology equipment — Safety* (*IEC 60950)*

EN 60950-1, *Information technology equipment — Safety — Part 1: General requirements (IEC 60950-1)*

EN 61386-1, *Conduit systems for cable management — Part 1: General requirements (IEC 61386-1)*

EN 61386-2X (all parts), *Conduit systems for cable management — Part 2X: Particular requirements (IEC 61386-2X series)*

EN 61534 (all parts), *Powertrack systems (IEC 61534)*

EN 61537, *Cable management — Cable tray systems and cable ladder systems (IEC 61537)*

EN 61643 (all parts), *Low-voltage surge protective devices (IEC 61643)*

EN 61969-1, *Mechanical structures for electronic equipment — Outdoor enclosures — Part 1: Design guidelines (IEC 61969-1)*

EN 61969-2, *Mechanical structures for electronic equipment — Outdoor enclosures — Part 2: Coordination dimensions (IEC 61969-2)*

HD 384/HD 60364 (all parts), *Electrical installations of buildings / Low-voltage electrical installations (IEC 60364 series)*

HD 60364-4-444, *Low-voltage electrical installations — Part 4-444: Protection for safety — Protection against voltage disturbances and electromagnetic disturbances (IEC 60364-4-44:2007 (Clause 444), modified)*

HD 60364-5-534, *Low-voltage electrical installations — Part 5-53: Selection and erection of electrical equipment — Isolation, switching and control — Clause 534: Devices for protection against overvoltages (IEC 60364-5-53:2001/A1:2002 (Clause 534), modified)*

———————

2) In preparation.

HD 60364-5-54, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective conductors (IEC 60364-5-54)*

ITU-T K.68, *Operator responsibilities in the management of electromagnetic interference by power systems on telecommunication systems*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50174-1 and the following apply.

Where the cabling is designed in accordance with standards in EN 50173 series, the additional definitions of those standards are applicable.

3.1.1
access network
functional elements (equipment and infrastructure) that enable communication between the core network and a customer network

[SOURCE: CLC/TR 50173-99-2:2012, 3.1.1]

3.1.2
access provider
operator or another entity providing the means to enable external telecommunications service provision to a subscriber

3.1.3
anchor wire
guy wire
tensioned cable designed to add stability to a supporting structure for information technology or other cabling

3.1.4
access point
location in pathways where access is intended to be provided

Note 1 to entry: Examples are maintenance holes, hand holes, buried closures, spaces and structures.

3.1.5
campus
premises containing one or more buildings

[SOURCE: EN 50173-1:2011, 3.1.23]

3.1.6
catenary wire
wire hung at a specific tension between supporting structures for information technology cabling

3.1.7
core network
functional elements (that is equipment and infrastructure) that enable communication between operator sites and/or network data centres

3.1.8
hand hole
point off access to a pathway that is too small for a person to enter to perform work but that allows the routing of cables during the cable installation process such that bending and pulling requirements are met

Note 1 to entry: An example of a hand hole within a building is called a drawbox.

3.1.9
high-voltage
voltage over AC 1 000 V r.m.s. or DC 1 500 V

[SOURCE: EN 50174-2:2009/A1:2011, 3.1.13]

3.1.10
hot zone
area around a high-voltage installation (e.g. substation, transformer, pylon) whose earth potential rise in normal operation or when an earth fault occurs, is over the limits given in ITU-T K.68 for typical fault situations

3.1.11
maintenance hole (for telecommunications)
vault/chamber located in the ground or earth as part of an underground conduit system and used to facilitate placing, connectorisation, and maintenance of cables as well as the placing of associated equipment, in which it is expected that a person will enter to perform work

3.1.12
rural area
area which has a low density of local metallic structures in direct electrical contact with soil

Note 1 to entry: In a rural environment the earthing systems of the substations have their own earth electrodes which are not normally connected together.

3.1.13
sacrificial pathway
pathway which has been selected while recognising that, due to its location, any cable(s) and/or pathway system(s) installed within that pathway may be damaged by other trades

3.1.14
segregation
use of earthed electrically conductive barriers or physical separation to prevent electromagnetic interference between external noise sources, including power supply cabling, and information technology cabling

[SOURCE: EN 50174-2:2009/A1:2011, 3.1.27]

3.1.15
service provider
operator of any service that furnishes telecommunications content (transmissions) delivered over access provider facilities

Note 1 to entry: The access provider and the service provider can be a single entity

3.1.16
stay
strut
device designed to add stability to a supporting structure for information technology or other cabling

3.1.17
surge protective device
device intended to protect the electrical apparatus from high transient over-voltages and to limit the duration and the amplitude of the follow-on current

Note 1 to entry: The device contains at least one non-linear component.

[SOURCE: EN 50174-2:2009/A1:2011, 3.1.30]

3.1.18
urban area
area which contains a high density of local metallic structures in direct electrical contact with soil such as water pipes, cables with bare metal sheaths, tracks of tramways or underground or overground traction systems and earth-terminations and structures of buildings, masts and foundations

3.2 Abbreviations

For the purposes of this document, the abbreviations given in EN 50174-1 and the following apply.

Where the cabling is designed in accordance with standards in EN 50173 series, the additional abbreviations of those standards are applicable.

AC Alternating Current

ADSS All Dielectric Self Supporting

BEF Building Entrance Facility

CMS Cable Management System

CSA Cross-Sectional Area

DC Direct Current

EMC Electromagnetic Compatibility

EMI Electromagnetic Interference

EPR Earth Potential Rise

ESD Electrostatic Discharge

ffs for further study

GPS Global Positioning System

HV high-voltage

LV low-voltage

PEC Parallel Earthing Conductor

SPD Surge Protective Device

4 Requirements for planning installations of information technology cabling

4.1 Safety

4.1.1 Personnel

Internal procedures, in accordance with local regulations, shall be in place to ensure that all persons are aware of:

a) the locations and boundaries of hazardous areas;
b) the procedures to be adopted when working in or in proximity to these hazardous areas;
c) fire precautions;
d) escape routes.

4.1.2 Power supply cabling

The proper implementation of the requirements of this European Standard require that electrical installations are undertaken in accordance with the HD 384/HD 60364 series and/or local regulations as appropriate.

4.1.3 Optical fibre cabling

The hazard classification of areas containing optical fibre information technology equipment and optical fibre information technology cabling shall be undertaken in accordance with EN 60825-2 in order to define appropriate installation and labelling practices.

4.1.4 Transmission and terminal equipment

Information technology cabling shall be connected to equipment that incorporates safe signal circuitry complying with the SELV circuit and the TNV requirements as defined in the EN 60950 series.

Equipment connected shall comply with the requirements for protection against electric shock of the relevant product safety standards.

The connection of active equipment to information technology cabling shall not introduce hazards for users or operators of the system.

4.1.5 Cells and batteries

If cells and batteries that produce gases and fumes (e.g. lead-acid batteries that produce hydrogen and oxygen) are to be installed, provision shall be made for the necessary ventilation and recommended environmental conditions (see HD 60364-5-54). Local regulations shall be complied with.

4.1.6 Pathways and pathway systems

The selection of pathways and pathway systems shall enable the installation of fire barriers, if required.

4.1.7 Closures

NOTE The following requirements apply unless specifically allowed otherwise by local regulations.

Closures and combined terminal and distribution devices (fittings) providing facilities for the termination or (and) distribution of both information technology cables and power supply cables shall be designed to provide separate covers for the two cabling types.

Alternatively, a single overall cover is allowed provided that the power supply cabling remains protected to prevent electric shock after removal of the cover.

Where both information technology cabling and power supply cabling are contained within a closure then:

a) if the closure is metallic, it shall be provided with a protective earth in accordance with 4.1.2;

b) the compartment in the closure shall have a barrier (either conducting or non-conducting) between the two cable types. If compartment barriers are conductive, they shall be earthed in accordance with the relevant wiring regulations for protective earth;

c) the front covers on the closure shall allow separate access to the information technology cabling and the power supply cabling and shall be retained such that the use of a tool is necessary to gain access thereby preventing inadvertent connection between the power supply and the information technology cabling;

d) the entry for the information technology cables and the power supply cables shall be separately removable.

4.1.8 Cables

The selection of cables shall be based upon the relevant product standards or manufacturer's recommendations for appropriate use in chemical hazard areas.

4.1.9 Termination points

Termination points for both information technology cables and power supply cables shall be located and oriented in such a way as to prevent ingress of moisture or other contaminants and to reduce the risk of damage to the cables connected to them. Connecting hardware selected for information technology cabling shall not be interchangeable with the sockets or plugs used for power supply distribution.

4.2 Documentation

In addition to the documentation required by EN 50174-1, the information produced by observing the requirements and recommendations of Clause 4 shall be provided to those installing the information technology cabling.

4.3 Pathways

4.3.1 General

4.3.1.1 Requirements

Pathways between buildings use a variety of ground level, underground, underwater (e.g. river crossings), piping infrastructures (e.g. sewers) and aerial pathways together with spaces and structures (e.g. hand holes, maintenance holes and telecommunications cabinets) that are constructed to assist cabling installation and to house closures.

The plan for selection of pathways shall take into account:

a) existing buildings and structures;

b) anticipated placement of new buildings or structures;

c) requirements, where appropriate, for redundancy of both pathways and cabling;

d) requirements, where appropriate, for external service provision between the premises boundary and BEFs;

e) risk assessment of unauthorised access, accidental or intentional damage to the installation (which may define additional requirements for protection);

f) planning and building regulations

g) existing underground infrastructures;

h) ownership of land and associated boundaries.

Where risk analysis suggests the installation of multiple pathways the pathways shall be separated by the maximum practicable distance required to mitigate the risks identified

4.3.1.2 Recommendations

Within pathways, as shown in the example of Figure 3, it is common to have to consider other factors (visible and hidden) which might have an environmental impact on the information technology cabling. These include:

a) high-voltage underground cables, overhead lines or electrified traction systems (electromagnetic impact);

b) steam pipes (temperature impact);

c) flooding (ingress impact);

d) chemical contamination (liquid, gas);

e) roads or railroad tracks (mechanical impact).

Where possible, the installation of information technology cabling in such areas affected by these factors should be avoided. However, where national or local regulations allow, mitigation in the form of appropriate pathway systems, spaces and components selection may be applied.

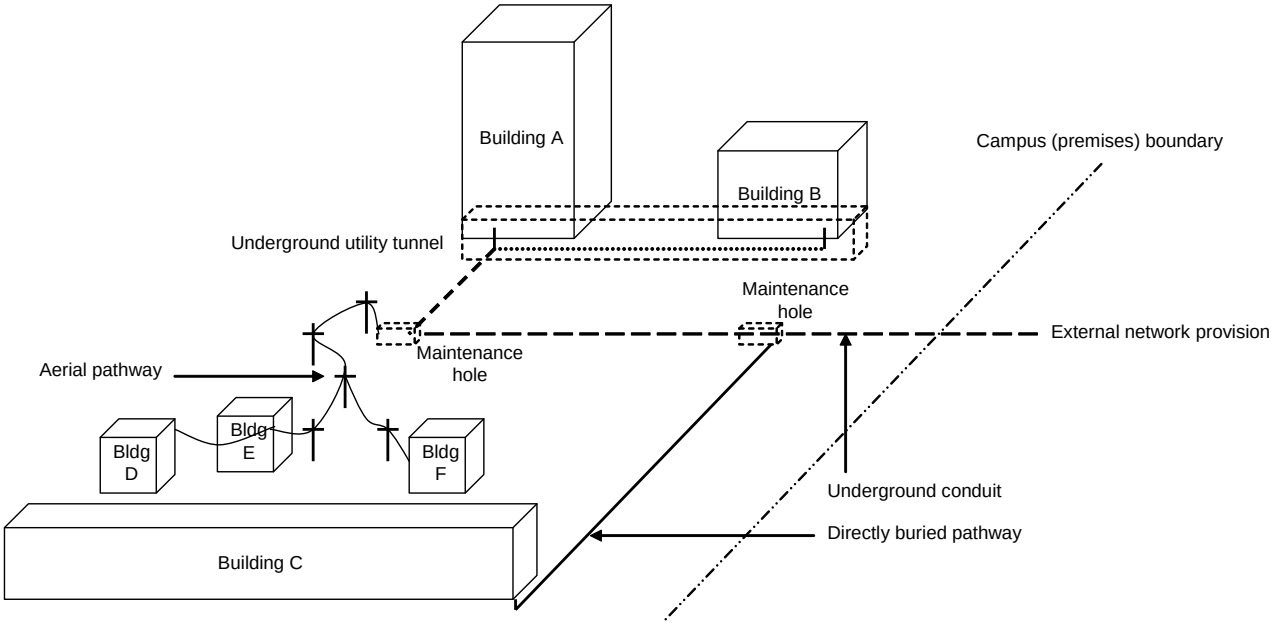


Figure 3 — Example of cabling installations outside buildings

4.3.2 Cable segregation

The segregation of pathways containing information technology cabling and the pathways containing other types of infrastructure and services (including power supply cabling) shall be in accordance with the requirements of Clause 6.

Where separation between different pathway systems is required this shall be maintained by physical separation to prevent unintended change during installation or extensions to the installation.

4.3.3 Protection of installed cabling

Cable pathways shall provide protection to the installed cabling, except in zones where the cabling can neither be damaged nor have its transmission properties adversely affected (e.g. rising zones, connecting ducts, equipment rooms, etc.). Additional and appropriate protection shall be applied in specific areas in which there is a history of, or identified risk of, rodent damage.

Rodent protection may be achieved by selection of appropriate components.

Appropriate space shall be allocated to the storage of cable loops (service loops).

4.3.4 Underground pathways

4.3.4.1 General

4.3.4.1.1 Introduction

Underground pathways may be:

a) dedicated to the installation of information technology cables (e.g. direct buried cable, buried conduit) - see Table 2 for a non-exhaustive list of design and planning issues;

b) shared with other services (e.g. a utility tunnel designed to deliver electricity, steam or water).

Information technology cabling pathways within utility tunnels may consist of indoor pathway systems in accordance with EN 50174-2.

Table 2 — Design and planning of underground pathways

Dedicated underground pathways
– **excavation;**
– **clearances and separations from other utilities;**
– **depth of burial;**
– **buried road and rail crossings;**
– **casing;**
– **trenching;**
– **boring (pipe pushing);**
– **ploughing;**
– **backfill;**
– **landscape restoration.**

4.3.4.1.2 Requirements

The placement of pathways shall be in accordance with national and local regulations in relation to proximity to:

a) existing underground services,

b) trees and tree roots,

c) building foundations.

The planned location of, and distance between access points shall take into account:

1) the maximum tensile load of the cable;

2) the installation method;

3) requirements for future expansion of the cabling to service additional buildings;

4) need for access.

The following planning information shall be documented:

– the installation method;

– the location of access points.

It shall be assumed that dedicated underground pathways will become at least partially water filled due to leaking and condensation, unless specific design features are employed to prevent ingress. The provision of effective drainage shall be considered during the design, installation and operation of access points (see 4.8).

The environment within shared pathways is defined by the construction of the pathway.

4.3.4.1.3 Recommendations

When cables with metallic components are buried in rural areas with high risk of lightning strikes, extra protection should be considered (see 4.9.8).

4.3.4.2 Direct buried cabling

4.3.4.2.1 Requirements

Solutions include:

a) cable constructions which provide the required environmental protection to the transmission media;

b) conduits, which may contain sub-conduits, into which cables or bundles of cable elements (typically optical fibre) are installed by blowing by the use of compressed air; in which case the conduits shall provide the required environmental protection to the cable elements.

NOTE The common term for such conduits and sub-conduits is ducts and sub-duct or microduct respectively. This does not match the definition of duct used by CLC/TC 213 who treat duct as non-circular conduit.

Underground cables without suitable protection shall be drawn into conduits, pipes or other suitable structures to protect them from mechanical, electrolytic or chemical danger.

Unless otherwise specified by national or local regulations the minimum planned depths of pathways shall be in accordance with the requirements of Table 3, unless additional measures are to be applied to protect the cable(s). The depths indicated are additional to the diameters of the cable(s) such that the top of the installed cable(s) shall meet the requirements of Table 3.

The depth of dig may be significantly greater than that shown in Table 3 in order to allow any protective layers to be installed below the cables.

Pathways that do not meet the requirements of planned depths of Table 3 without effective mitigation are considered to be sacrificial.

Table 3 — Requirements and recommendation for pathway depths below finished surface

Location of pathway [a]	Requirement	Recommendation
Footpath	0,5 m	0,5 m
Road - including parking areas	0,6 m	0,6 m
Motorway	1,0 m [b]	1,0 m [b]
Railway	1,0 m [b]	1,0 m [b]
Agricultural land	0,9 m	0,9 m
Uncultivated or landscaped land	0,5 m	0,9 m

[a] Increased depths may be required in accordance with agreements between the planner and the owners/operators of the land.

[b] The depth of dig may be significantly greater than that shown in Table 3 in order to allow any protective layers to be installed below the conduits.

The width of the planned route shall allow adequate space for the installation process.

Requirements for marker tapes or equivalent products shall comply with national or local regulations.

Cables shall be installed inside protective conduits at crossings with roadways and railways.

At crossings of railways the conduits shall provide protection and insulation and shall extend to the base of the slope of the railway embankment and shall extend at least 1,75 m beyond the outside edge of the outermost rails.

4.3.4.2.2 Recommendations

Soil conditions should be carefully considered when a cable is to be buried directly in the ground. For example, if subsoil conditions are known to be corrosive, the cable may require additional protection and the cable supplier should be consulted.

4.3.4.3 Conduit

4.3.4.3.1 Requirements

Conduit-based pathways take two forms:

a) conduits, which may contain sub-conduits, into which cables are installed by either pulling or by blowing by the use of compressed air or water in which case the combined performance of the conduit and the cable construction shall provide the required environmental protection to the transmission media;

b) conduits, which may contain sub-conduits, into which bundles of cable elements (typically optical fibre) are installed by blowing by the use of compressed air; in which case the conduits shall provide the required environmental protection to the cable elements.

NOTE The common term for such conduits and sub-conduits is ducts and sub-duct or microduct respectively. This does not match the definition of duct used by CLC/TC 213 who treat duct as non-circular conduit.

Unless otherwise specified by national or local regulations the minimum planned depths of pathways shall be in accordance with the requirements of Table 3, unless additional measures are to be applied to protect the conduit(s). The depths indicated are additional to the diameters of the conduit(s) such that the top of the installed conduit(s) shall meet the requirements of Table 3.

Pathways that do not meet the requirements of planned depths of Table 3 without effective mitigation are considered to be sacrificial.

The width of the planned route shall allow adequate space for the installation process.

Conduit shall be selected to:

1) withstand the predicted mechanical loading;

2) avoid colours of cable management systems which are used exclusively by other services e.g. power, gas, water;

3) allow the installation and replacement of sub-conduits, cables or cable elements (as applicable).

Where appropriate, the conduits, sub-conduits and accessories shall be able to support the air pressure required to blow the cables or cable element.

Requirements for marker tapes or equivalent products shall comply with national or local regulations.

4.3.4.3.2 Recommendations

Conduits under roads and railways should be installed in co-operation with the relevant authorities in order to define requirements for:

a) access;

b) safety;

c) reinstatement including depth of cover and materials (see 5.3.4.4.1).

4.3.5 Existing piping infrastructures

4.3.5.1 Requirements

Established techniques exist for the installation of cabling into existing infrastructures including sewer, gas and drinking water pipes.

Appropriate surveys shall be undertaken to ensure that the chosen solution (cables, associated fixings and installation method):

a) does not produce unacceptable modification to fluid flow in the piping infrastructures (or otherwise accelerate the development of blockages);

b) does not restrict the normal repair and maintenance procedures undertaken on the piping infrastructure.

4.3.5.2 Recommendations

None.

4.3.6 Underwater pathways

4.3.6.1 Requirements

Pathway planning shall include co-ordination with the authorities responsible for the management of the water course (risk of dredging, ships anchors, tides).

Only cables that are specifically designed or protected by means of a protective cover shall be laid in the vicinity of the shore. The term “vicinity of the shore” shall mean the entire embankment down to the bottom of the waterway and the shore-line between the high and low water marks.

4.3.6.2 Recommendations

Proposed pathways should be evaluated using detailed maps. The optimum pathway should avoid critical areas (e.g. risk of dredging, ships anchors, tidal flow) and steep underwater gradients.

Where vessels are to be used to install the cable, computer aids should be applied to manage the positioning and movement of the vessel in order to control the pulling force applied to, and the feeding of cable.

4.3.7 Aerial pathways

4.3.7.1 Pathways dedicated to information technology cabling

4.3.7.1.1 General

Aerial pathways may comprise:

a) poles, towers, catenary (or suspension) wires, anchor (or guy) wires, stays, struts and closures - see Table 4 for a non-exhaustive list of design and planning issues;

b) self-supporting cables, which may include a catenary wire - see Table 4 for a non-exhaustive list of design and planning issues.

Aerial pathways may support:

1) cable constructions which shall provide the required environmental protection to the transmission media;

2) conduits, which may contain sub-conduits, into which bundles of cable elements (typically optical fibre) are installed by blowing by the use of compressed air; in which case the conduits shall provide the required environmental protection to the cable elements.

NOTE The common term for such conduits and sub-conduits is ducts and sub-duct or microduct respectively. This does not match the definition of duct used by CLC/TC 213 who treat duct as non-circular conduit.

Table 4 — Design and planning of dedicated aerial pathways

Dedicated aerial pathways
– **pole type**
– **pole height**
– **burial depth of pole**
– **poles anchors**
– **pole stays (struts)**
– **pole spacing**
– **slack span**
– **pole to building span**
– **earthing**
– **clearance and separation**
– **pole attachment**
– **lashing**
– **riser protection**
– **catenary wire**
– **catenary wire tension**
– **cable sag**

4.3.7.1.2 Requirements

Supporting structures, e.g. poles, shall be selected to be of dimensions and strength suitable for their length and the load they are intended to carry, taking into account influences due to climatic and soil conditions.

Supporting structures shall be suitably treated to prevent decay and any such treatment shall be suitable for the environment in which the structures are to be erected, taking account of the risk of contamination of the water table (see ITU-T L.88 for additional information).

The planning of installation requires detailed information regarding:

a) the type and location of supporting structures;

b) the local variation of temperature;

c) local wind and ice loads.

A survey shall be undertaken of all supporting structures that are to be used and shall document the following:

1) the distances between supporting structures;

2) physical/mechanical condition of supporting structures;

3) restrictions of installation access below or between towers or poles;

The survey shall identify:

– the nature and extent of work required at each point of support;

– requirements for replacement, refurbishment or strengthening (such as anchor wires or stays) of any supporting structures;

– storage locations for installation equipment, cable drums (or reels);

– installation methods and special tools;

– fittings required to attach information technology cabling to the supporting structures (including special fitting to implement changes in direction or gradient at towers or poles);

– location of joint closures and service loops on supporting structures.

The position and selection of supporting structures and associated strengthening components (anchor wires, stays, struts) shall be designed to allow repair, development or removal of information technology cables without affecting the mechanical strength of supporting structures. Any anchor points installed on building structures or supplementary poles shall be at least 2,5 m above the ground.

The information technology cable route shall be installed to respect the minimum clearances above ground given in Table 5.

Table 5 — Minimum installed clearances above ground for aerial cables

Location	Clearance m
Motorway, main roads	6
Non electric railway	6
Minor road crossings, areas accessible to vehicular traffic, field path, campus entrance	5,5
Minimum clearance no traffic crossing	4
Non-navigable waterways	5

The sag during operation (including any maintenance activities) of the information technology cable between supporting structures shall be determined based upon the information provided by the supplier of the information technology cable (or catenary wire, if present) that is relevant to the following conditions:

- the distance between supporting structures;
- the predicted supplementary loadings of wind, ice and maintenance activity;
- the predicted temperature range.

The minimum height of cables shall comply with national or local regulations during installation, maintenance and operation.

Where multiple cables are to be installed on a common aerial pathway, the sag of the different cables shall be calculated and measures taken to prevent risk of damage.

Clause 7 provides additional requirements for overhead routes in close proximity to, or crossing, railways.

Special consideration shall be given to overhead routes in close proximity to, or crossing, tramways, trolley bus cables, cable railways, cable ways, ski and chair lifts.

For aerial crossings of waterways (navigable rivers, canals and other stretches of water), details shall be obtained in respect of the stipulated minimum clearance between the cables at maximum sag and the surface of the water at the highest navigable water level. Any measures, required for the protection of shipping, shall be ascertained from the authorities responsible for waterways and shipping.

For crossings of high water protection installations (dikes), the presence of above ground information technology cables shall not interfere with the maintenance of such installations; the responsible authorities shall be involved at the planning stage of the information technology cabling.

4.3.7.1.3 Recommendations

Aerial pathways should not be used to cross roads. Where there is no practicable alternative:

a) the pathway should cross the road using the shortest possible route;

b) stays or struts should be used to reinforce the stability of two poles adjacent to the road.

Attachment of catenary wires to buildings should be:

1) permitted only when it is clear that the load on the fixing point will not exceed its design strength and the structure of the building is capable of sustaining the load with a safety factor;

2) should be avoided in earthquake zones.

The information technology cable route should be as straight as possible.

Stays or struts, cables, closures, cabinets and accessories should be positioned in such a way to facilitate safe access for installers and maintainers.

Clause 7 provides additional recommendations for overhead routes that in close proximity to, or crossing, railways.

4.3.7.2 Pathways shared with overhead power supply infrastructures

4.3.7.2.1 General

Aerial pathways comprise self-supporting cables, which may include a catenary wire.

4.3.7.2.2 Requirements

An agreement shall be reached with the owner of the overhead power supply infrastructure (and where relevant, also the owner of the supporting structures) for joint use giving special consideration to:

a) the voltage in the power supply system;

b) the mechanical capacities of supporting structures (e.g. poles or towers);

c) the requirements described in this European Standard for earthing systems, aerial to underground junctions and aerial connections.

Before undertaking mechanical calculations, it is necessary to determine the following:

1) the technical characteristics of the power supply system;

2) future possible modifications, such as the transformation of LV into HV;

3) the reservation of zones of the overhead power supply infrastructure to allow subsequent installation of light fittings.

Overhead power supply infrastructures may be shared by more than one information technology system provided that agreement has been reached with the owners of the overhead power supply infrastructure and the information technology systems.

The planning of installations requires detailed information regarding:

– the type and location of supporting structures;

– the available moment of inertia capacity of supporting structures to be used (i.e. the difference between the initial moment of inertia capacity of the most stressed tower or pole and the moment of inertia capacity used by the installation of the overhead power supply cabling and related equipment, including any reserve maintained to allow the installation of additional power supply cabling on the same structures);

– the voltages carried by the overhead power supply cabling;

– layout of power conductors on the supporting structures;

– the local variation of temperature;

– local wind and ice loads.

A survey shall be undertaken of all supporting structures that are to be used to support the information technology cabling which shall document the following:

i) the type (e.g. line, angle-turn, terminating, special purpose) and height of supporting structures;

ii) the distances between supporting structures;

iii) physical/mechanical condition of supporting structures;

iv) anti-corrosion protection (metallic structures);

v) the height above the ground of the planned suspension points of the information technology cabling;

vi) restrictions of installation access below or between supporting structures.

The information obtained during the survey shall be used to determine the following:

I) requirements for refurbishment or replacement of supporting structures;

II) clearances and separations on supporting structures available to be used by the information technology cabling;

III) storage locations for installation equipment, cable drums (or reels);

IV) installation methods and special tools;

V) fittings required to attach information technology cabling to supporting structures (including special fitting to implement changes in direction or gradient at towers or poles);

VI) location of joint closures and service loops on supporting structures.

Where the physical characteristics of the information technology cable in combination with its proposed location of the cable on the supporting structure uses more than the available moment of inertia capacity, consideration shall be given to either replacing the relevant supporting structures or by strengthening them e.g. by installing stays or struts.

The information technology cable route shall be installed to respect the minimum clearances above ground given in Table 5.

The sag during operation (including any maintenance activities) of the information technology cable between supporting structures shall be determined based upon the information provided by the supplier of the information technology cable (or suspension wire, if present) that is relevant to the following conditions:

- the distance between supporting structures;
- the predicted supplementary loadings of wind, ice and maintenance activity;
- the predicted temperature range.

The minimum height of cables shall comply with national or local regulations during installation, maintenance and operation.

The sag of the information technology and power supply cables shall be calculated and measures taken to ensure that the segregation requirements of Clause 6 are maintained.

Where an earthing system exists on a supporting structure then it shall be dedicated to only one of the following applications:

α) power supply cabling,

β) lighting,

χ) information technology cabling.

4.3.7.2.3 Recommendations

The information technology cable route should be as straight as possible.

Stays or struts, cables, closures and accessories should be positioned in such a way to facilitate safe access for installers and maintainers.

4.3.7.3 The provision of a parallel earthing conductor (PEC)

4.3.7.3.1 General

A PEC reduces the common mode current through leads that carry differential mode signals by reducing common impedance and loop areas.

The types of conductive elements used to create a PEC include:

a) structural metallic elements within the construction of the cables e.g. armouring or strength members;

b) metallic elements of catenary wires;

c) conductive cable management systems.

4.3.7.3.2 Requirements

A cable screen shall not be used where a PEC is required to withstand large currents (e.g for lightning protection or as power fault current return).

A PEC shall be earthed at least at one point. The planning of any additional earthing arrangements shall be in accordance with the HD 384/HD 60364 series and/or local regulations as appropriate.

Earthing connections at the PEC shall be made to the external surface of the conductor material.

Conductive pathway systems in close proximity to HV power supply cabling shall be protected from electrical hazards by means of protection earthing and/or sectioning.

4.3.7.3.3 Recommendations

For distances above 50 m, additional connections of the parallel earthing conductor to earth should be implemented at irregular intervals including points of deviations from a straight line (as per plan). These connections provide an early return path for the disturbance current through the PEC.

4.4 Pathway systems

4.4.1 General

4.4.1.1 Introduction

The requirements and recommendations of this sub-clause are applicable to all pathway systems.

If a pathway system is selected to support a specific cable technology, it may not be suitable for installations of other cabling technologies in the future.

4.4.1.2 Requirements

The selection of pathway systems and cable management systems shall allow installation and removal of the cable without risk of damage.

The selection of pathway systems and cable management systems shall consider:

a) the strength of the electromagnetic fields along the pathway (proximity of electromagnetic conducted and radiated disturbing sources);

b) the authorised level of conducted and radiated emissions;

c) the type of cabling, e.g. coaxial, category of balanced cable (if a cable management system is selected to support a specific cable technology, it may not be suitable for installations of other cabling technologies in the future);

d) the immunity of the equipment connected to the information technology cabling system (if a cable management system is selected to support the interconnection of equipment having a specific level of electromagnetic immunity, it may not be suitable for other equipment);

e) other environment constraints (chemical, mechanical, climatic, fire, etc.);

f) the MICE environmental classification of EN 50173-1;

g) any future information technology cabling system extension;

h) where appropriate, Annex A.

Cable management systems of the types listed below shall comply with the relevant European Standards:

1) conduit systems: EN 61386-1 and the relevant Part 2;

2) cable trunking systems and cable ducting systems: EN 50085-1 and the relevant Part 2;

3) power track systems: EN 61534 series;

4) cable tray systems and cable ladder systems: EN 61537.

The selection of cable management system shall be made by considering in combination:

– the cabling products to be contained;

– the electromagnetic performance of the cable management system;

– the segregation requirements of Clause 6.

Pathways, entry points to the pathways and the pathway systems selected shall ensure cables are able to be installed and, where appropriate, fixed in accordance with the applicable minimum bend radius (during installation, during operation – static and during operation – dynamic). This may be achieved by the use of pre-fabricated curved corners, drop-outs, radius limiters or other means. Where multiple cable types are involved, the largest minimum bend radius shall apply. The techniques employed shall:

- be designed to maintain the relevant minimum radius of the cable(s) to be installed; where multiple cable types are involved, the largest minimum bend radius shall apply;
- not introduce deformation of the cable sheath;
- not apply compressive loads exceeding that specified for the cable.

Minimum bending radius is determined by manufacturers instructions. If instructions do not exist the minimum bending radius shall be 20 times the cable diameter.

Pathway systems that do not allow such an approach may restrict the type and use of cables installed in the pathways and cable management systems selected.

Specific cable constructions, e.g. armoured cables, may require greater bend radii than those specified above.

Appropriate space shall be allocated to drawboxes and the storage of cable loops (service loops).

The maximum stacking height in pathway systems is specified by manufacturers instructions. If instructions do not exist the following shall apply:

I) for pathway systems that provide continuous support (e.g. trays), the stacking height shall not exceed 150 mm;

II) for pathway systems that provide non-continuous support (e.g. basket, ladder or hooks):

α) the maximum distance allowed between supporting elements of the pathway system is 1 500 mm;

β) the maximum stacking height shall be calculated according to Formula (1) (the integer values shown in Table 6 are calculated using Formula (1) and are for information only).

$$h = 150/(1 + L \times 0{,}000\ 7) \quad (1)$$

Where

h maximum stacking height (mm);

L distance between points of support (mm).

Table 6 — Stacking height for typical distances L

L mm	h mm
0	150
100	140
150	136
250	128
500	111
750	98
1 000	88
1 500	73

Pathway systems protruding through a horizontal surface shall not be terminated less than 50 mm above the finished floor surface.

NOTE This protrusion aids in preventing construction debris from entering the pathway during construction and protects cabling from mechanical damage.

4.4.1.3 Recommendations

It is recommended to plan the pathway systems for the maximum predicted deployment of cabling. This can be achieved either by deploying sufficient pathway systems at the time of installation or by planning and reserving space for sufficient additional pathway systems.

Provided that the cabling is installed in accordance with EN 50174 series, the cable management system can contribute to reduce electromagnetic interference:

a) through a screening effect on the circuits within the cable management system;

b) by improving the cohabitation between circuits contained in the cable management system;

c) by reducing perturbations transferred from current flowing through the cable management system onto circuits contained in the cable management system.

For the purposes of electromagnetic screening within trays as shown in Figure 4:

1) the inner corners provide the greatest effect;

2) for a given internal cross-sectional area, high sidewalls provide greater useable capacity.

For the purposes of electromagnetic screening, where cables are to be installed on metallic building structural members (e.g. beams), inner corners provide the greatest effect.

Non-metallic cable management systems are neutral products from the electromagnetic point of view. They do not provide electromagnetic screening to the contained cabling, but they do not perturb the cabling by transferring induced currents or leakage currents. Non-metallic cable management systems should be used where electromagnetic screening is not required by the cables to be installed within them.

The design of ducts, conduit and trunking should allow installation and removal of the cable without risk of damage.

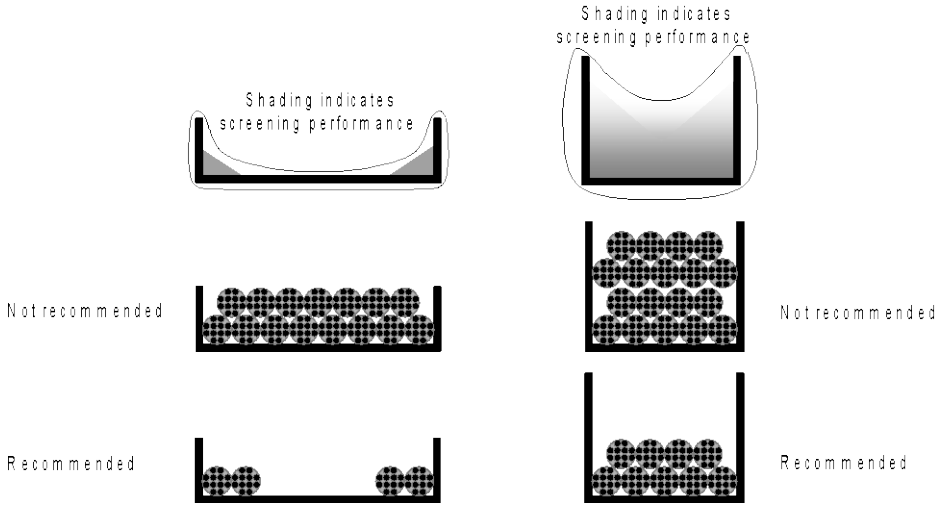


Figure 4 — Cable arrangement in a metallic section

4.4.2 Underground pathway systems

4.4.2.1 Requirements

The environmental compatibility of the location and materials used in the construction of underground pathway systems shall be considered.

4.4.2.2 Recommendations

During any given installation phase, additional pathway systems should be installed to enable the subsequent installation of additional cables to minimise the number of future excavations that are both disruptive and costly.

Underground cable management systems (e.g. pipes, ducts) should be made from suitable material. All underground cable management systems should be made of a non-porous material.

4.4.3 Underwater pathway systems

4.4.3.1 Requirements

The environmental compatibility of the location and materials used in the construction of underwater pathway systems shall be considered.

4.4.3.2 Recommendations

None.

4.4.4 Aerial pathway systems

4.4.4.1 Pathway systems dedicated to information technology cabling

4.4.4.1.1 General

Components of the pathway systems include:

a) fittings to attach the information technology cables to the supporting structures;

b) fittings to accommodate service loops on the supporting structures;

c) joint closures installed on the supporting structures;

d) fittings to attach the joint closures to the supporting structures;

e) wind vibration dampers.

4.4.4.1.2 Requirements

The following shall be implemented for all supporting structures:

a) adjacent supports for information technology cabling shall be separated by at least 0,3 m;

b) crossing of information technology bundles is not allowed unless an additional support at the pole is used;

c) protection against lightning and proximity of lightning rods.

Where stays or struts are used to strengthen the supporting structure (e.g. at the resultant load points of the cables or at road crossings) they shall be suitably insulated when required (e.g. when passing power supply cables), and also when using a metallic catenary wire to ensure the safety of the public from hazardous voltages.

4.4.4.1.3 Recommendations

To avoid placing an unbalanced load on support poles, temporary or permanent stays, struts or guys should be installed at any location where the cable is to be tensioned.

4.5 Pathway systems other than for core and access networks

4.5.1 General

4.5.1.1 Introduction

The requirements and recommendations of this sub-clause are applicable to pathway systems other than those owned by access providers.

4.5.1.2 Requirements

Where metallic or composite cable management systems are planned to be used specifically to provide electromagnetic screening for the information technology cables to be contained within them the requirements and recommendations of 5.3.4.2.2 shall be included in the planning of the installation. Any covers used shall provide the required electromagnetic screening performance.

Where non-metallic cable management systems are planned to be used and if the equipment to be connected to the cabling (by unscreened cables) is not affected by low frequency disturbances then a metallic conductor (cable or barrier) may be installed within the cable management system to improve the

electromagnetic protection provided to the cabling by reducing the common mode loop area. Where used, the metallic conductor shall be:

a) designed to withstand large common mode and power fault currents;

b) connected to the local protective earthing system at both ends using a low impedance conducting element (e.g. a large metal wall of the apparatus cabinet).

4.5.1.3 Recommendations

During initial planning, the initial quantity of cables should not use more than 40% of the usable cross-sectional area within the chosen pathway system subject to the following definition for useable cross-sectional area:

a) for uncovered pathway systems and cable management systems (e.g. tray, basket), cables are not installed above the sidewalls (note electromagnetic screening performance of the selected cable management system may require modified criteria - see Clause 6);

b) bends in the pathway systems may restrict the useable space dependent upon the specified bend radii of the cable to be installed;

c) for non-enclosed pathway systems to which cables are to be attached or supported by (e.g. suspension/catenary wires or designated routes) then the cross-sectional area shall be considered to be the minimum available area surrounding the pathway system.

4.5.2 Underground pathway systems

4.5.2.1 Requirements

In view of the cost and disruption associated with excavation of underground pathways, consideration shall be given to the installation of pathways systems in excess of those initially required.

For pathways between a premises boundary and building entrance facility (BEF):

a) in commercial or multi-tenant residential premises, conduits without sub-conduits shall be 90 mm minimum internal diameter;

b) on residential premises, conduits without sub-conduits shall be of 38 mm (consistent with Size 40 conduits of the EN 61386 series) minimum internal diameter.

Between any two access points including the premises boundary and the BEF:

1) there shall not be more than one pre-formed bend of up to 90 degrees;

2) deviations shall not exceed a total of 90 degrees;

3) bends shall be of 600 mm radius minimum,

4) bends in the conduit shall not contain any kinks or other discontinuities that may have a detrimental effect on the cable sheath during cable pulling operations.

The inside radius of a bend in conduit shall be at least 6 times the internal conduit diameter. Bends within conduit shall be accessible and able to act as pulling points unless:

– no additional cables are to be installed within the conduit, following the initial installation of cable;

– cables are to be removed before any additional installation takes place.

4.5.2.2 Recommendations

During any given installation phase, additional pathway systems should be installed to enable the installation of additional cables without any associated excavation.

The following examples are included as guidance:

a) conduit without sub-conduits:

   1) a minimum of one additional conduit should be installed during each excavation phase;

   2) where there is a known number of excavation phases, the number of conduits to be installed should be calculated as the number of planned phases x the initial number of filled ducts;

b) conduit with sub-conduits:

   1) an alternative is to apply multi-conduit/sub-conduit constructions that provide the required capacity (this approach reduces the available cross-sectional area within the overall conduit and requires additional cable installation resource but provides significantly more flexibility).

Additional conduits may be required to support management of services/technologies.

Conduit pathways should follow point-to-point straight lines with maintenance holes or hand holes installed at all points where deviation will exceed 3 degrees horizontally or 1,5 degrees vertically.

4.5.3 Underwater pathway systems

4.5.3.1 Requirements

Where the cable comes ashore it shall be:

a) secured mechanically to a fixed point using the strength member of the cable;

b) be protected mechanically in the tidal zone and to a depth of 3 m (ffs) below the lowest tide level;

c) marked to prevent anchoring of vessels etc. in the tidal zone and to a depth of 3 m (ffs) below the lowest tide level.

Cables with metallic cable elements shall be provided with overvoltage protection.

4.5.3.2 Recommendations

None.

4.5.4 Aerial pathway systems

4.5.4.1 Pathway systems dedicated to information technology cabling

4.5.4.1.1 General

None.

4.5.4.1.2 Requirements

Catenary wires shall not be spliced in the field.

4.5.4.1.3 Recommendations

Wind vibration damping should be considered where wind is considered to be a particular problem.

Solutions include:

a) cables with intrinsic resistance to Aeolian vibration;

b) where aerial cables are integrated with a catenary wire in a “figure of 8” cross-section, the cable should be twisted between each point of suspension (or with one twist per 10 m between points of suspension);

c) for other cables, wind vibration dampers should be added as shown in the example in Figure 5.

NOTE The dampers reduce Aeolian vibrations (resonant vibration caused by low velocity wind blowing across a cylindrical cable under tension.

Figure 5 — Example of wind vibration damper

4.5.4.2 Pathway systems on overhead power supply infrastructures

4.5.4.2.1 General

The planning of pathway systems depends on the voltages supported by the overhead power supply infrastructure and the type of information technology cable to be installed.

Components of the pathway systems include:

a) fittings to attach the information technology cables to the supporting structures;

b) fittings to accommodate service loops on the supporting structures;

c) joint closures installed on the supporting structures;

d) fittings to attach the joint closures to the supporting structures;

e) insulation components used to separate any metallic components from the supporting structures;

f) wind vibration dampers;

g) local earthing fittings to allow electrostatic discharge of the information technology cable sheath at each end of the pathway.

4.5.4.2.2 Requirements for metallic information technology cables

The positioning of the fittings on the supporting structures shall be in accordance with the segregation requirements of Clause 6 and shall be arranged to allow staff access to the circuits mounted above them without risk of accident.

On conducting structures, all fittings and closures of the information technology system shall be either:

a) insulated from the supporting structure or

b) connected to the earth of power supply system; this connection also includes that of accessible conductive elements (other than signal conductors) of the cables.

Conductive elements of the catenary and IT cables (not signal conductors) and closures shall be earthed at least at the ends of the shared routes.

4.5.4.2.3 Recommendations for metallic information technology cables

Metallic information technology cables should not be installed on overhead high-voltage (> AC 1 000 V, DC 1 500 V) power supply infrastructures.

4.5.4.2.4 Requirements for all-dielectric self-supporting (ADSS) cables

The positioning of the fittings on the towers or poles shall be in accordance with the segregation requirements of Clause 6.

The position of fittings on the towers or poles shall ensure that the lowest point of the information technology cables between any two towers or poles, taking the sag into account, shall be in accordance with Table 5, for towers or poles supporting power supply cables $<$ 25 kV.

To avoid arcing phenomena between the information cable technology sheath and the structure of the tower or pole (which reduces the operational life of the cable), the position of the fittings shall be in locations where the potential to earth, created by the power conductors, does not exceed:

a) 10 kV for all-dielectric cables with a high density polyethylene sheath;

b) 20 kV for all-dielectric cables with a high density polyethylene sheath and containing an foil to prevent arcing phenomena.

The information required to determine the potential to earth on a given tower or pole shall be obtained from the owner of the overhead power supply infrastructure.

Arcing phenomena are created due to the build up of conductive particles (e.g. soot) which become embedded with the cable sheath over time. Cables in accordance with EN 60794-4-20 shall have specified performance in relation to these phenomena.

4.5.4.2.5 Recommendations for all-dielectric cables

Where the voltage carried by the overhead power supply is ≥ 20 kV, insulator fittings of at least 0,3 m length should be used to isolate the fittings used to attach both cables and joint closures from the structure of the tower or pole.

4.6 Closures

4.6.1 General

Closures are installed at access points to provide access to the cable elements within, or to protect joints in, the installed cables.

European Standards have been prepared which specify closures for the accommodation and protection of optical fibre splices and products in accordance with the standards shall be used where applicable. These include the pan, inline and dome types specified in EN 50411-2-2, EN 50411-2-3 and EN 50411-2-4 respectively.

European Standards have been prepared which specify closures for air blown optical fibre microduct systems and products in accordance with the standards shall be used where applicable. These include EN 50411-2-5 and EN 50411-2-9 respectively.

4.6.2 Requirements

Closures (other than direct burial types) shall be located such that:

a) it is possible to undertake subsequent measurements, repair, expansion or extension of the installed cabling with minimal disruption and in safety;

b) unauthorised access is limited in accordance with the appropriate risk level.

The cable entrance to closures shall:

1) maintain the environmental performance of the closure;

2) provide the necessary cable support and prevent kinking at the point of entry into the closure;

3) provide strain relief for the cable if not already done by separate fixtures within the closure;

4) be capable of accepting suitable glands.

4.7 Cabling

4.7.1 Cable design

4.7.1.1 Requirements

Cables shall have mechanical strength and environmental characteristics that are compatible with the pathway systems within which they are to be installed and the installation methods to be used.

Outdoor optical fibre cables shall be in accordance with EN 60794-3 and the appropriate family, detailed and product specifications detailed in Table 7.

Table 7 — Family and detailed specifications for outdoor optical fibre cables

Environment	Family specification	Product/detailed specification	Detailed aspect
Conduit (duct)	EN 60794-3-10	EN 60794-3-11	Singlemode telecommunications
		EN 60794-3-12	Premises cabling
Direct burial	EN 60794-3-10	EN 60794-3-11	Singlemode telecommunications
		EN 60794-3-12	Premises cabling
Lashed aerial	EN 60794-3-10	-	-
Self-supporting aerial	EN 60794-3-20	EN 60794-3-21	Premises cabling
ADSS	EN 60794-4-20	-	-
Blown	EN 60794-5-10	-	-
Blown	EN 60794-5-20	-	-
Lakes River crossings Coastal applications	EN 60794-3-30	-	-
Storm and sanitary sewers	EN 60794-3-40	-	-
Gas pipes	EN 60794-3-50	-	-
Drinking water pipes	EN 60794-3-60	-	-

For cables with multiple types of optical fibres, some means of segregating the fibres by type shall be employed.

European Standards have been prepared which specify outdoor metallic cables; where applicable, products in accordance with these standards shall be used. These include EN 50406 series and EN 50407 series.

4.7.1.2 Recommendations

It is recommended that cables contain spare cable elements to support future applications.

4.7.2 Cable installation

4.7.2.1 Requirements

The installation of the cabling shall be in accordance with Clause 5.

4.7.2.2 Recommendations

Under consideration.

4.7.3 Treatment of cable screens within a channel

4.7.3.1 Requirements

Mixing of unscreened and screened components within a channel may cause transmission performance to be adversely affected and shall only be implemented in accordance with manufacturers or suppliers instructions.

4.7.3.2 Recommendations

None.

4.8 Spaces and structures

4.8.1 General

4.8.1.1 Introduction

The requirements and recommendations of this sub-clause are applicable to all spaces and structures.

Access to pathways between buildings is provided by spaces and structures that typically comprise maintenance holes, hand-holes and telecommunication cabinets.

The spaces and structures are frequently located in unrestricted access areas and are subject to considerable physical risk.

4.8.1.2 Requirements

Spaces shall not be located in emergency escape ways (where they obstruct).

The spaces and structures shall be located such that it is possible for subsequent measurements, repair, expansion or extension of the installed cabling to be undertaken with minimal disruption and in safety.

Spaces and structures shall be designed to survive the estimated risk and shall be constructed and installed in accordance with the required design.

Dimensions of spaces shall take into account the initial volume and future expansion of information technology cabling and associated equipment.

All openings to spaces and structures shall maintain the environmental performance of the space or structure.

Cable entrances to spaces and structures shall:

a) be provided with the necessary cable support to prevent kinking at the point of entry,

b) provide strain relief for the cable if not already done by separate fixtures.

Material used to construct spaces and structures shall resist deterioration when exposed to sunlight.

Where the spaces and structures are intended to contain active equipment:

1) the temperature and humidity shall be maintained to allow continuous operation of the active equipment;

2) adequate power supply shall be provided.

The location of the spaces and structures and any relevant mounting shall be capable of supporting the loads applied during the construction of the structure and does not exceed the loading limit of the supporting structure.

Spaces shall be located to provide appropriate levels of security (restricted access) to the cabling and equipment to be contained within them.

Signage shall be in accordance with the security plan for the premises.

4.8.2 Maintenance holes and hand holes

4.8.2.1 Requirements

4.8.2.1.1 General

Maintenance holes and hand holes shall be used to:

a) facilitate a safe and secure pathway system between buildings;

b) ease the installation or removal of cables;

c) enable changes of direction of underground pathway systems;

Maintenance holes shall be used to enable:

d) changes of depth of underground pathway systems;

e) changes in volume and quantity of underground pathway systems;

f) the future installation of additional pathway systems;

g) the accommodation of closures.

The location and distances between maintenance holes and hand holes shall be determined in accordance with the relevant instructions for the cables to be installed and the installation technique to be employed.

Maintenance holes shall be:

1) designed to maintain the relevant minimum radius of the cable(s) to be installed, where multiple cable types are involved, the largest minimum bend radius shall apply;

2) large enough to contain closures and “feed in”, if required;

3) contain adequate fittings to support closures, if required.

Routing of cables through maintenance holes shall enable the installation requirements of Clause 5 to be complied with.

Pathway systems or ducts connected to the maintenance holes shall not act as a drain. However, it is expected that water will pass through these ducts in some circumstances.

The appropriate type of maintenance holes shall be selected following an analysis of ground water table conditions. Sump-sealed maintenance holes shall not be used where the water table may damage it and/or the pathway systems connected to it.

Covers for maintenance holes shall conform to EN 124. Armoured cover plates with security locks shall be considered where it is desirable to prevent unauthorised access.

4.8.2.1.2 Sump-sealed maintenance holes

Sealed maintenance holes are useful where the ground water table is low but shall be expected to fill with water.

4.8.2.1.3 Sump-pumped maintenance holes

The pump shall be maintained in order to prevent gradual ingress of water.

4.8.2.1.4 Hand holes

The selection of the type of hand hole shall consider:

a) access volume required;

b) location: armoured cover plates with security locks shall be considered where it is desirable to prevent unauthorised access.

c) loading: covers for hand holes are specified in EN 124;

d) available space;

e) local regulations;

f) risk of damage: direct burial could provide a solution but would present access difficulties.

4.8.2.2 Recommendations

Maintenance holes are preferred over hand holes as they provide greater flexibility for extension and expansion of the installed cabling infrastructure e.g. additional pathways.

Maintenance holes and hand holes should be provided at both ends of a conduit route, positioned as close as practicable (normally within 5 m) to the external building walls and adjacent to the equipment room in which the cables terminate.

Maintenance holes should be located at the sides of crossings of roadways or railways.

4.8.3 Telecommunication cabinets

4.8.3.1 Requirements

Telecommunications cabinets shall be in accordance with the design guidelines of EN 61969-1 and EN 61969-2.

Telecommunications cabinets shall be located to:

a) minimise the impact on the surrounding environment;

b) far as possible from any source of possible interference (e.g. electricity substation, aerial power supply infrastructure, radio transmitters).

Furthermore,

1) accessible outside cabinets shall prevent vandalism;

2) cabinets shall be labelled and identified according to the installation specification;

3) any electrical or optical equipment in cabinets shall be installed in a way that avoids damage to it from dust and water.

4.8.3.2 Recommendations

It is recommended that

a) telecommunications cabinets are installed next to walls to ensure better protection;

b) accessible telecommunications cabinets are provided with a lock to prevent unauthorised access.

4.9 Spaces and structures other than for core and access networks

4.9.1 General

The requirements and recommendations of this sub-clause are applicable to spaces and structures other than those owned by access providers.

4.9.2 Maintenance holes and hand holes

4.9.2.1 Requirements

Maintenance holes and hand holes shall be located either side of a road or rail crossing.

4.9.2.2 Recommendations

Where practicable, pathways should be chosen to allow the subsequent construction of maintenance holes, hand holes or structures.

4.9.3 Telecommunication cabinets

4.9.3.1 Requirements

The design of the telecommunications cabinets shall consider any requirements for the accommodation of climate control equipment, power supplies (including uninterruptible power supplies), earth connection and alarms systems to advise of unauthorised access.

4.9.3.2 Recommendations

None.

4.9.4 Building entrance facilities

4.9.4.1 General

4.9.4.1.1 Requirements

Provision shall be made to allow the sealing of pathway systems at or near to the entrance point inside the building to prevent the ingress of dust, water, animals, gas etc.

Information technology cables that do not comply with the minimum recommended performance requirements of EN 60332-1-2 shall either be:

a) terminated inside the building, within 2 m (unless an alternative distance if specified by local regulations) of the point of internal penetration of the external fire barrier (e.g. floor/ceiling/wall)

or

b) any length exceeding 2 m (unless an alternative distance if specified by local regulations) is installed within trunking or conduit that is considered as a fire barrier in accordance with local fire regulations.

NOTE This also applies where the cable has to pass through a space between two external fire barriers within a building.

Incoming cabling management systems shall ensure continuity of cabling, and be connected directly by the shortest possible distance to the equipment room of campus or building, without exceeding constraints (e.g. bending radius or ducts of constant cross sectional area).

Structural metallic elements of cables (e.g. armouring or strength members) shall be treated in accordance with HD 60364-4-444. Screens of metallic cables shall be treated in accordance with HD 60364-4-444. Where required, surge protection shall be applied to metallic cable elements in accordance with 4.9.8.

4.9.4.1.2 Recommendations

It is assumed that buildings are provided with BEFs in accordance with EN 50174-2.

Cables should enter buildings as close as possible to any conducting pipes (e.g. gas, water, heating) in order to:

a) minimise induction loops,

b) assist the earthing and bonding arrangements.

The entrance point inside the building should be located in the basement or at least at the ground floor. It is recommended that the cable ducts are arranged as shown in Figure 6.

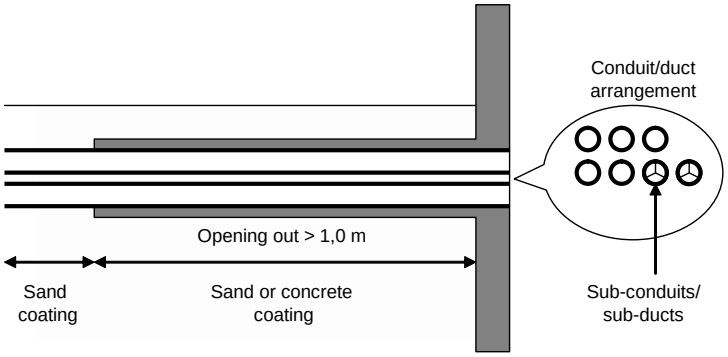


Figure 6 — Example of an underground conduit entrance for information technology cables into a building

Structual metallic elements of cables (e.g. armouring or strength members) and cable screens should be directly connected to earth provided that:

- corrective actions have been implemented for hazards caused by earth potential rise (EPR) between buildings;
- any circulating currents, due to potential differences between buildings, will not disturb or damage services.

Surge protection devices should be installed at all building entrances if the information technology cable contains metallic cable elements (see 4.9.8) and where inadequate protective measures have been provided in the external information technology network. Surge protection devices should be fitted to all pairs and located as close as possible to the main earth terminal of the building.

4.9.4.2 Hot zone entrance facilities

4.9.4.2.1 Requirements

To identify a hot zone the owner of the high-voltage installation shall be consulted.

When using information technology cabling containing metallic elements to provide a connection across the boundary of a hot zone, provisions shall be made to:

a) avoid flashover between the local earth and the remote earthing system of the information technology cabling, e.g. central exchange,

b) protect people and information technology systems against over-voltages,

c) avoid part of the current flowing towards the distant earth through information technology cabling,

d) generally allow a continuity of information technology services in the hot zones even during electrical fault conditions.

Where the information technology cable crossing the boundary of the hot zone contains metallic conductors the following three steps shall be taken as shown in Figure 7:

1) installation of a connection closure outside the hot zone as a physical interface with the external information technology cabling: this closure shall be used only for the connection of the information technology cabling entering the hot zones;

2) installation of an galvanic insulation device at one or more locations inside the hot zone for each metallic information technology conductor, that has transmission characteristics to guarantee the quality of the link;

3) installation between the connection closure and the galvanic isolation device of an information technology cable with sufficient sheath dielectric strength to withstand the EPR or by use of non-conductive cable ducts.

Where the information technology cable crossing the boundary of the hot zone only contains optical fibres the galvanic insulation device is replaced by optoelectronic converters.

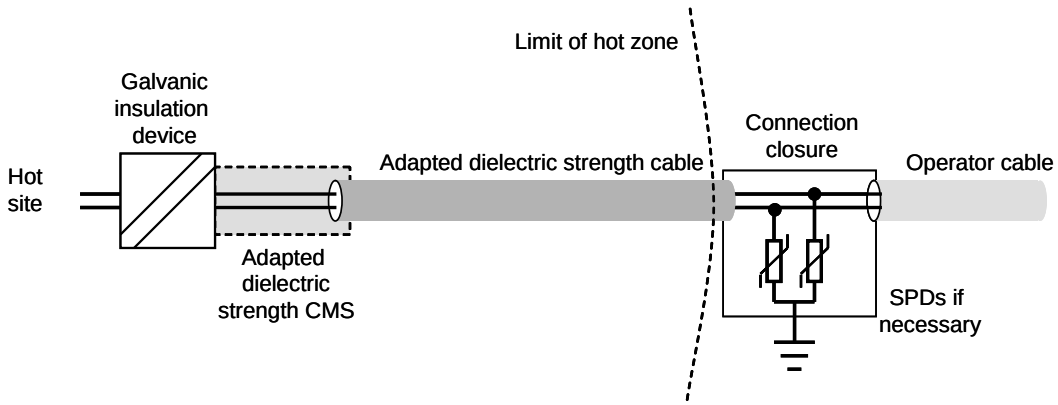


Figure 7 — Example of the use of a galvanic isolation device

4.9.4.2.2 Recommendations

None.

4.9.5 Protection against very low frequency fields

See A.3.1 for detailed information.

4.9.6 Electrical isolation components

See A.3.2 for detailed information.

4.9.7 Surge protective devices (SPDs)

4.9.7.1 General

See A.3.3, ITU-T K.12 and ITU-T K.28 for detailed information.

4.9.7.2 Requirements

The following shall be considered:

a) protection against overvoltages (parallel protection) or overcurrents (series protection) or both;

b) the location of the surge protective device (at termination points, transition points between overhead and under ground, and when the number of overhead spans exceeds three);

c) the type of transmitted signals (AC, DC, data, high frequency, etc.) – the required transmission performance shall not be degraded by the presence of SPDs.

In the selection of the nominal breakdown voltage, the tolerances of any feeding voltage as well as the tolerances of the surge protective device shall be taken into account.

The earthing arrangements of SPD's forming part of a protection system shall be designed to prevent any possibility of a bypass of the protection arrangements.

4.9.7.3 Recommendations

The installation of surge protection devices should be considered:

a) in areas with high lightning probability;

b) where the attached equipment shows a considerable impulse transfer ratio from the power supply to the information technology port or from an antenna port to the information technology port.

To protect underground information technology cables against lightning surges, protective devices may be placed at the points of connection to overhead lines as well as at the entrances of buildings. See ITU-T K.20 and ITU-T K.21 for information.

Protection systems against overvoltage surges should be installed at both ends of each information technology cable having four or more spans of cable. See EN 61663 series for information.

Where surge protective devices are used to reduce high-voltages appearing in information technology cabling due to induction from power line fault currents, they should be fitted to all individual information technology cables at suitable intervals and at both ends of the affected length of line, or as near to this as practicable.

In cases where the power supply cabling within the building is susceptible to surges, an isolation transformer should be considered (see 4.9.6) in order to reduce the peak value of the surge.

Surge protective devices should not be mounted in rooms where fire or explosion risk exists unless special precautions are taken (such as enclosing the surge protective devices in a suitable enclosure).

4.9.8 Lightning

4.9.8.1 General

Generally cabling installed in urban areas does not need protection from lightning. Protection is generally needed if cables containing metallic parts are installed in rural areas.

For more detailed information refer to EN 61663-1 for optical fibre cable and to EN 61663-2 for copper cable as well as EN 62305 series.

Other common protection methods are

a) use of all dielectric optical cables,

b) use of shield conductor(s),

c) use of surge protective devices.

The use of combined protective measures is also possible to reduce the likelihood of damage due to lightning.

4.9.8.2 Requirements

Any structural elements of cables (e.g. armouring or strength members) shall be earthed at least at one end for purposes of safety.

4.9.8.3 Recommendations

To reduce the risk of damage, any structural metallic elements of cables (e.g. armouring or strength members) should be electrically continuous along the length of cable.

Additional connections to earth of any structural metallic elements of cables (e.g. armouring or strength members) should be applied following consideration of EN 61663-1 for optical fibre cable and to EN 61663-2 for copper cable as well as EN 62305 series.

4.10 Administration

4.10.1 General

The administration (installation) requirements shall be Level 3 of EN 50174-1. The administration (operation) requirements shall be Level 2 of EN 50174-1.

4.10.2 Pathway systems other than for core and access networks

The requirements are applicable to pathway systems other than those owned by access providers.

The administration (installation) requirements shall be Level 3 of EN 50174-1. The administration (operation) requirements shall be Level 2 of EN 50174-1.

5 Requirements for the installation of information technology cabling

5.1 Safety

5.1.1 General

5.1.1.1 Power supply cabling

Electrical installations shall be undertaken in accordance with the HD 384/HD 60364 series and/or local regulations as appropriate.

5.1.1.2 Explosive or flammable environments

The installation of information technology equipment and information technology cabling in situations where explosive or flammable materials are generated, prepared, processed, handled, stored or otherwise encountered shall be carried out in accordance with EN 60079-0, EN 60079-14 and EN 60079-17 as appropriate.

5.1.1.3 Optical fibre cabling

The following practices shall be adopted:

a) exposed optical fibre ends shall be kept away from the skin and eyes;

b) the quantity of optical fibre waste shall be minimised;

c) waste fragments shall be treated with care and collected (not by hand) and disposed of in suitable containers via an approved agency or according to local regulations;

d) connector end faces, prepared optical fibres or fractured optical fibres shall not be viewed directly unless the power emitted from the optical fibre is known to be safe (as defined within the EN 60825 series) and under local control.

Installation practice shall be in accordance with the requirements and recommendations of EN 60825-2 for the relevant hazard classification (see 4.1.3).

5.1.1.4 Guards and signs

All necessary guards, protective structures and warning signs shall be used to protect both personnel and cabling components.

Relevant local regulations for safe working practices shall be complied with.

If any measures have been made in the information technology cabling to prevent overvoltages exceeding the defined values, installers and service personnel shall be made aware of how and where these measures have been applied.

Installers and service personnel shall be made aware of safety warning signs that may be present on shared infrastructures.

5.1.2 Pathways

It is possible for explosive, asphyxiating or toxic gases to build up in ducts, draw pits, maintenance holes or other closed chambers. Before entering any such areas, the atmosphere shall be tested to detect any potentially hazardous gases and, if necessary, they shall be well ventilated. Where a gas hazard is detected the installer shall inform the nominated site contact and appropriate action shall be agreed and undertaken.

Personnel installing or maintaining information technology cabling on shared infrastructure shall be made aware of safety rules or local regulations relating to access including any local designations that advise as the power supply on the structures of the shared infrastructure.

The function of similar type of underground cable management systems shall be identifiable in accordance with local regulations.

5.1.3 Closures

Before installing information technology cabling within closures containing power supply cabling the following shall be ensured:

a) the compartment shall prevent inadvertent contact with the power supply cabling;

b) where a barrier is used between the mains power cabling and the information technology cabling (either conducting or non-conducting) it shall meet a minimum of IP20 as specified in EN 60529;

c) metallic closures and conductive compartment barriers shall be earthed in accordance with 5.1.1.1.

5.1.4 Cables

Measures shall be taken to prevent any liquids and/or gels present within the information technology cable from leaking in pathways, closures or at any point of termination.

Information technology cables that enter buildings and that do not comply with the minimum recommended performance requirements of EN 60332-1-2 shall be installed according to the instructions of the planner (see 4.9.5.1).

5.2 Documentation

5.2.1 Requirements

In addition to the documentation required by EN 50174-1, the additional information resulting from the planning process (see Clause 4) shall be obtained.

5.2.2 Recommendations

The location of point deviations from a straight line within underground (or underwater) pathways that are not otherwise identifiable should be documented e.g. by their global positioning system (GPS) co-ordinates.

The location of curves within underground (or underwater) pathways should be documented on as-built drawings.

5.3 Installation practices

5.3.1 Storage of cabling components and equipment

5.3.1.1 Requirements

The environmental conditions under which cabling components, inspection and test equipment are stored shall be compatible with the manufacturers'/suppliers' specifications.

Cabling components shall be inspected for damage following delivery. Documentation supplied with the components shall be checked for compliance with the procurement specification and shall be retained.

If required by the quality plan, detailed component inspection and acceptance testing shall be undertaken as soon as practicable. Any packaging removed to allow inspection and/or testing shall be replaced in order to provide the required environmental and physical protection to the components.

Where protective caps, or equivalent, have been used to protect components, they shall not be removed until necessary and shall be replaced or renewed as necessary until the installation is completed.

5.3.1.2 Recommendations

The ends of stored cable should be sealed to prevent ingress of contaminants.

5.3.2 Pathways

5.3.2.1 General

The requirements and recommendations of this sub-clause are applicable to all pathways.

5.3.2.2 Requirements

The accessibility and availability of pathways in accordance with the installation specification and the installation schedule shall be confirmed. The client shall be advised of all necessary deviations or actions required.

The accessibility and availability of proposed locations of cable drums (or reels) and associated installation equipment in accordance with the installation schedule shall be confirmed. The client shall be advised of all necessary deviations or actions required.

The accessibility and availability of proposed locations of cable service loops shall be confirmed. The client shall be advised of all necessary deviations or actions required.

The installer shall ensure that all necessary installation accessories are available.

Where it is necessary, and relevant permission has been obtained, to open:

a) covers of maintenance holes or cable management systems, only the minimum number shall be removed and these shall be replaced on completion of works;

b) fire barriers and gas seals, they shall be opened only when necessary and resealed on completion of works.

5.3.2.3 Recommendations

None.

5.3.2.4 Underground pathways

NOTE Unless otherwise specified the requirements and recommendations apply to both pathways constructed to accommodate direct buried cabling or conduits

5.3.2.4.1 Requirements

None.

5.3.2.4.2 Recommendations

Installation methods employed should minimise any disruption or inconvenience (e.g. traffic, dust, reduced access, etc.) to the surrounding properties.

5.3.2.5 Underwater pathways

5.3.2.5.1 Requirements

The points where the information technology cables come ashore shall be marked.

5.3.2.5.2 Recommendations

None.

5.3.2.6 Aerial pathways

5.3.2.6.1 Requirements

The installation process shall not cause damage to, or overload, the supporting infrastructures or create unsafe situations for the surrounding environment.

At the crossing of two or more information technology cables, the installation process shall ensure that the cables do not touch.

5.3.2.6.2 Recommendations

None.

5.3.3 Pathways other than for core and access networks

5.3.3.1 General

The requirements and recommendations of this sub-clause are applicable to pathways other than those owned by access providers.

5.3.3.2 Underground pathways

NOTE Unless otherwise specified the requirements and recommendations apply to both pathways constructed to accommodate direct buried cabling or conduits.

5.3.3.2.1 Requirements

None.

5.3.3.2.2 Recommendations

None.

5.3.3.3 Underwater pathways

5.3.3.3.1 Requirements

The points where the information technology cables come ashore shall be marked.

5.3.3.3.2 Recommendations

None.

5.3.3.4 Aerial pathways

5.3.3.4.1 Requirements

None.

5.3.3.4.2 Recommendations

None.

5.3.4 Pathway systems

5.3.4.1 General

The requirements and recommendations of this sub-clause are applicable to all pathway systems.

5.3.4.2 Requirements

5.3.4.2.1 Construction

Any structures, fixtures and fittings used to support the telecommunications cabling within the pathways shall be installed in accordance with instructions provided by the manufacturer(s) and/or supplier(s) of the fixtures and fittings.

Pathway systems shall be left clean and free from obstruction with all separators and bridging pieces in place before the cabling installation commences.

Cleats or temporary structures (to assist cabling installation) shall be fitted where necessary. Abrasive supports (e.g. threaded rod) installed within the cable fill area shall have that portion within the pathway system protected with a smooth, non-scratching covering so that cable can be pulled without physical damage.

Cable management systems shall be installed:

a) in accordance with the requirements of Clause 4;

b) to allow installation and removal of the cable without risk of damage to the cable;

c) without sharp edges or corners that could damage the cabling installed within or upon them;

d) to enable the creation of fire barriers in accordance with local regulations;

e) taking into account relevant external/environmental influences – in particular:

   1) cable management systems shall be installed to ensure that water or other contaminant liquids cannot collect;
   2) where required, sections of cable management systems shall be jointed to prevent ingress of gases, liquids, etc.

5.3.4.2.2 Electromagnetic screening using cable management systems

The following requirements apply to metallic or composite cable management systems that are required specifically to provide electromagnetic screening for the information technology cables to be contained within them (see 4.4.1.3):

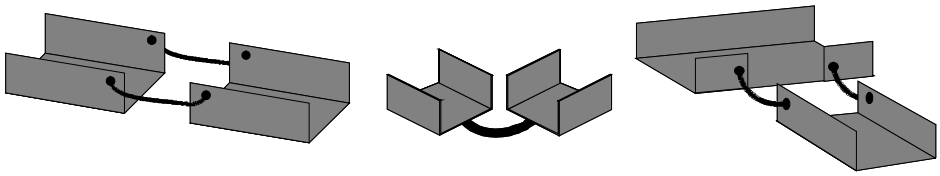
a) if the cable management system is constructed from multiple sections:

   1) the sections shall be interconnected to ensure continuity;
   2) bonds shall have performance in accordance with EN 50310 (illustrated in Figure 8b) and 8c));

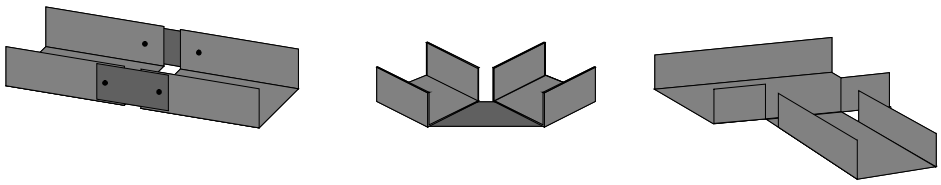
b) cable management systems shall be functionally bonded in accordance with EN 50310;

c) Figure 9 shows cable management systems crossing a wall at which a fire barrier is to be re-instated following cable installation. Unless specifically allowed by local regulations, the fire-stop materials or fire-stopping techniques, the cable management system shall be interrupted and the two metallic sections shall be bonded. The bonds shall have performance in accordance with EN 50310;

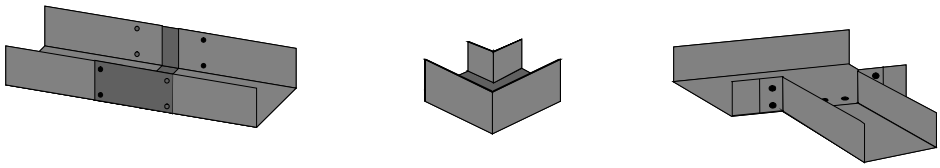
d) if adjustments or extensions to the pathways system are carried out, the component used shall maintain the intended electromagnetic performance (e.g. a metallic sections shall not be replaced by plastic sections).



a) non-conformant



b) conformant



c) recommended

Figure 8 — Continuity of metallic cable management systems

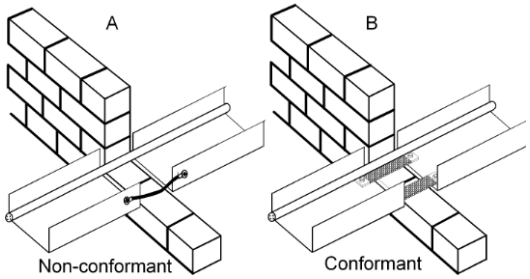


Figure 9 — Interruption of metallic cable management systems at fire barriers

5.3.4.3 Recommendations

5.3.4.3.1 Construction

Cable management systems should be installed in such a way that the transmission of acoustic noise is minimised.

5.3.4.3.2 Electromagnetic screening using cable management systems

The following recommendations apply to metallic or composite cable management systems that are required specifically to provide electromagnetic screening for the information technology cables to be contained within them (see 4.4.1.3):

a) the shape of the metallic section should be maintained over its full length;

b) if the cable management system is constructed from multiple sections, continuity between these sections should be provided – examples of solutions are (in order of preference):

   1) a full perimeter weld or solder to ensure a very low impedance connection;
   2) spot welded, riveted, bolted or screwed joints provided that the surfaces in contact are good conductors (no paint or insulating coat), safeguarded against corrosion and a good electrical

contact between the all parts is ensured (periodic maintenance may be required in harsh environments);

3) braided, stranded or mesh straps of less than 10 cm in length where the cross-sectional area (CSA) of each strap is a minimum of 2,5 mm^2.

NOTE 1 It is possible that local regulations and the EN 60950 series require a greater CSA for electrical safety.

c) when trunking or cable trays with covers are used, the continuity between the base and the cover should be provided – examples of solutions are (in order of preference):

1) many contacts over the full length;

2) as a minimum, connections at both ends using braided, stranded or mesh straps of less than 10 cm in length where the CSA of each strap is a minimum of 2,5 mm^2.

NOTE 2 It is possible that local regulations and the EN 60950 series require a greater CSA for electrical safety.

d) all bonds should be as short as possible.

NOTE 3 The long term stability of earth connections and connections between sections or parts of cable management systems depends on the galvanic coupling of the materials used.

NOTE 4 A short single lead connection between two parts of the cable management system will result in high local impedance and, therefore, degrades its electromagnetic performance (see Figure 8a)). From frequencies of a few MHz upwards, a 10 cm mesh strap between the two parts of the cable management system will improve the impedance by more than a factor of 10.

5.3.4.4 Underground pathway systems – conduit

5.3.4.4.1 Requirements

Sections shall be jointed to prevent ingress of water.

The materials surrounding the pathway system shall be selected to protect the pathway system from damage.

The ends of any conduits or sub-conduits that are not intended to be subjected to the imminent installation of cables or cable elements shall be sealed to prevent ingress of water.

On completion of the underground conduit installation (including compaction of the backfill) between any two access points, the integrity of the conduit diameter and its inner surface shall be confirmed by appropriate techniques which should also remove any foreign matter that may have entered.

5.3.4.4.2 Recommendations

All underground conduit should be of a non-porous material and should have smooth internal walls. Existing draw ropes should be checked for satisfactory function.

Conduits should have draw ropes installed prior to the installation of the cable as required. Draw ropes should not be installed concurrently with the cable.

5.3.4.5 Existing piping systems

5.3.4.5.1 Requirements

Pipes should have draw ropes installed prior to the installation of the cable as required. Draw ropes should not be installed concurrently with the cable.

5.3.4.5.2 Recommendations

None.

5.3.4.6 Aerial pathway systems

5.3.4.6.1 Requirements

Metallic elements of the pathway system shall be earthed in accordance with the planning information. The connections shall be safeguarded against corrosion and a good electrical contact between all parts ensured (maintenance periods may be dependent upon the environment, see EN 50174-1).

The ends of any conduits or sub-conduits that are not intended to be subjected to the imminent installation of cables or cable elements shall be sealed to prevent ingress of water.

5.3.4.6.2 Recommendations

None.

5.3.4.7 Aerial pathway systems dedicated to information technology cabling

5.3.4.7.1 Requirements

None.

5.3.4.7.2 Recommendations

None.

5.3.5 Pathway systems other than for core and access networks

5.3.5.1 General

The requirements and recommendations of this sub-clause are applicable to pathway systems other than those owned by access providers.

5.3.5.2 Underground pathway systems – conduit

5.3.5.2.1 Requirements

None.

5.3.5.2.2 Recommendations

None.

5.3.5.3 Existing piping systems

5.3.5.3.1 Requirements

None.

5.3.5.3.2 Recommendations

None.

5.3.5.4 Aerial pathway systems dedicated to information technology cabling

5.3.5.4.1 Requirements

None.

5.3.5.4.2 Recommendations

None.

5.3.5.5 Aerial pathway systems on overhead power supply infrastructure

5.3.5.5.1 Requirements

None.

5.3.5.5.2 Recommendations

None.

5.3.6 Closures

5.3.6.1 Requirements

The accessibility and availability of proposed locations of closures in accordance with the installation schedule shall be confirmed. The client shall be advised of all necessary deviations or actions required.

Closures shall be:

a) fixed or mounted in position using the recommended fittings;

b) labelled and identified according to the installation specification.

Optical fibre adaptors within closures shall be fixed or fitted with suitable protective caps to prevent the ingress of foreign material.

Documentation shall be provided to enable subsequent installation of the cabling into the closures.

5.3.6.2 Recommendations

Closures should only be used where the design can accommodate correct use of cables and connecting hardware i.e. minimum bend radii of cables and cable elements and environmental protection.

5.3.7 Cable installation

5.3.7.1 General

Installation of cables shall be in accordance with the instructions supplied by their manufacturers/suppliers.

Installation of cable shall be undertaken according to the installation schedule.

Metallic information technology cabling and power supply cabling shall be segregated in accordance with the requirements of Clause 6.

NOTE Testing of secure/safe/sufficient separation is described in EN 61140 (for mains power AC frequencies of 50 Hz to 60 Hz).

When installing cables, cords or jumpers appropriate techniques shall be applied to:

a) eliminate cable stress caused by:

   1) tension in suspended cable runs;
   2) tightly cinched cable bundles;

b) ensure that minimum bend radii are as specified by the cable manufacturer, supplier or in accordance with the relevant product standard (rollers or other devices shall be used to avoid damage);

c) ensure that the tensile load applied to the cables and cable bundles as specified by the cable manufacturer, supplier or in accordance with the relevant product standard. When pulling-in cables, (particularly optical fibre cables) mechanical fuses (or equivalent protection) shall be used to ensure that the maximum tensile loads established by the cable manufacturer are not exceeded.

d) unless otherwise stated in the suppliers/manufacturers specification, the maximum tensile load applied to a bundle shall be that specified for a single cable;

e) prevent pressure marks (e.g. through improper fastening or crossovers) on the cable sheath or the cable elements;

f) prevent optical fibre within cables experiencing direct stress following installation (where long vertical runs are proposed optical fibre cables may need to deviate from the vertical by the inclusion of short horizontal runs or loops at intervals as recommended by the manufacturer);

g) avoid joints other than those in accordance with the installation specification.

Where it is necessary, and relevant permission has been obtained, to open:

1) covers of maintenance holes or cable management systems, only the minimum number shall be removed and these shall be replaced on completion of works.

2) fire barriers and gas seals shall be opened only when necessary and resealed on completion of works.

5.3.7.2 Environments and contaminants

Cabling components shall be acclimatised at the recommended environmental condition before installation.

Cables shall not be exposed to humidity levels or temperatures outside their specified limits; this includes localised effects such as those from hot air blowers or gas burners.

The installation process shall not degrade the intended environmental performance of the pathway/cable management system e.g. water seals and fire barriers shall be re-fitted upon completion of the installation.

Where there is an identified risk of ingress to a cable of water or contaminants during installation, the cable ends shall be sealed.

5.3.7.3 Installation into pathways

5.3.7.3.1 Requirements

Precautions shall be taken during the installation of draw ropes, where used, to prevent the draw ropes becoming entangled with cables.

Where cable is to be installed in shared pathways precautions shall be taken to avoid damage to existing cables or structures within those routes.

When simultaneously pulling multiple cables within a pathway the loose ends of each cable shall be labelled with a unique identifier. Where cable elements cannot be otherwise identified, labels shall be applied.

The position of information technology cables and the location of closures in cable management systems shall be in accordance with the instructions provided by the manufacturers/suppliers of the cable management systems (subject to meeting the segregation requirements of Clause 6). When installing cables into cable management systems they shall be secured as specified in the installation specification.

The final placement of cables and cable bundles shall take into account the risk of damage due to external influences.

The re-instatement of the fire rating of fire barriers in accordance with local regulations shall be implemented using the specified fire-stop materials and/or fire-stopping techniques.

The reinstatement of gas seals in accordance with local regulations shall be implemented using the specified materials and/or techniques.

Any information technology cables rising from the ground shall be mechanically protected to a height of at least 2 m.

Cables containing structural metallic elements (e.g. armouring or strength members) shall be earthed in accordance with the planning information. The connections shall be safeguarded against corrosion and a good electrical contact between all parts ensured (maintenance periods may be dependent upon the environment, see EN 50174-1).

Subsequent installations by other suppliers shall not obstruct existing cables or access points.

5.3.7.3.2 Recommendations

When installing in vertical pathways (e.g. risers), cables should be lowered rather than pulled upwards.

Cables should be installed in the inner corners of metallic building structural members (e.g. beams), where used, in order to provide the most effective electromagnetic screening.

5.3.7.4 Underground cables – direct burial

5.3.7.4.1 Requirements

The cable shall be designed to be compatible with the proposed method of installation. Alternatively, the materials surrounding the cable shall be selected to protect the cable from damage.

A marker tape/wire shall be installed which allows the position of the cable to be detected using an appropriate cable locator equipment. Alternatively, the location of direct buried cables shall be documented on a site plan.

A marker tape in accordance with EN 12613 shall be laid between 0,1 m and 0,2 m above any directly buried cable.

5.3.7.4.2 Recommendations

None.

5.3.7.5 Underground cables within conduit

5.3.7.5.1 Requirements

Existing draw ropes shall be checked for satisfactory function.

5.3.7.5.2 Recommendations

A marker tape in accordance with EN 12613 should be laid between 0,1 m and 0,2 m above each conduits or group of conduits.

5.3.7.6 Cables within existing piping systems

5.3.7.6.1 Requirements

None.

5.3.7.6.2 Recommendations

None.

5.3.7.7 Underwater cables

5.3.7.7.1 Requirements

None.

5.3.7.7.2 Recommendations

None.

5.3.7.8 Aerial cables

5.3.7.8.1 Requirements

Following the cable installation, sagging and tensioning shall be conducted according to the cable manufacturer's recommendations.

5.3.7.8.2 Recommendations

None.

5.3.7.9 Pathway systems on overhead power supply infrastructure

None.

5.3.7.10 Installation into closures

Cables entering closures shall use appropriate glands and fittings or similar to:

a) maintain the environmental performance of the closure;

b) provide the necessary cable support and prevent cable kinking;

c) provide strain relief for the cable if not already provided by separate fixtures within the closure.

An excess length of cable shall be provided at each closure to enable subsequent access to the closure for termination, jointing and repair of the cable. Where the quality plan requires installed cable tests to be undertaken, prior to the termination or jointing of the cable, the excess length shall take this into account.

The bend radii of telecommunications cables and telecommunications cable elements within closures shall be in accordance with the instructions provided by the telecommunications cable manufacturer and/or supplier.

Any cabling not contained within a cable management system shall be protected from physical damage by use of appropriate measures.

Within closures, each cable element shall be uniquely identifiable using one or more of the following methods:

1) colour coding;

2) labelling;

3) physical position routing.

Closures containing optical fibre terminations or joints shall be labelled in accordance with EN 60825-2 for the relevant hazard classification (see 4.1.3).

If required by the quality plan, installed cable tests shall be undertaken as soon as practicable following cable installation.

Following installation of cables and if required by the installation specification, pressurisation tests shall be carried out. See EN 60794-1-2:2003, method F8, for information.

5.3.8 Jointing and termination of cables

5.3.8.1 General

Cables shall be jointed or terminated in accordance with the instructions provided by the manufacturer or supplier of the connecting hardware. If special tools are required for jointing or termination, then only those recommended by the manufacturer shall be used.

Cable elements not terminated within connecting hardware shall be treated as detailed in the installation specification.

Sharp bending that would compromise transmission performance of cables shall be avoided.

Following jointing or termination, the cable elements shall be arranged within the closure in a manner that allows access to individual connectors, joints and cable elements with minimal disruption to neighbouring components during subsequent repair, expansion or extension of the installed cabling.

The presentation of cable elements within joints, terminating and connecting hardware and closures shall be in accordance with the installation specification.

The ends of unterminated cables shall be fitted with protective caps, or equivalent.

5.3.8.2 Balanced cabling

The connecting hardware used for balanced cabling shall be installed to provide minimal signal impairment by preserving wire pair twists and conductor separation as closely as possible to the point of mechanical termination (by not changing the original twist). In addition only a minimum of the cable sheath shall be removed in accordance with the manufacturer's instructions.

5.3.8.3 Screened cabling

The cable screen shall totally surround the cable along its entire length (a screening contact applied only through the drain wire has little effect at high frequencies).

Cable screens shall be terminated at each termination point to maintain the intended performance of the cable screen termination of connecting hardware. Where instructions for termination of a specific cable are not available from the manufacturer/supplier of the connecting hardware:

a) special attention shall be paid to the assembly of connection elements. The screen contact shall be applied over 360 degrees according to the Faraday cage principle. The screening connection shall be of a low impedance design;

b) the screening shall continue through an appropriate screen connection; normal pin contacts alone shall not be used;

c) discontinuities in the screening shall be avoided: e.g. even small holes in the screen, pigtails or loops;

NOTE Discontinuity dimensions of the order of 1 % to 5 % of the wavelength can reduce the overall screening effectiveness

d) screen connections shall be firmly fixed, for instance by strapping or clamping;

e) screens shall not be used as a strain relief;

f) screens shall be bonded in accordance with the installation specification and additional planning information (see 4.7.3);

g) screen connections shall be safeguarded against corrosion and a good electrical contact between all parts is ensured (maintenance periods may be dependent upon the environment, see EN 50174-1).

5.3.8.4 Optical fibre cabling

5.3.8.4.1 Requirements

Joints (fusion or mechanical splices) and their strain relief mechanisms shall be fixed and supported within the optical fibre management system of the closure.

Within joints the protection and retention of the optical fibres shall be in accordance with manufacturers' instructions.

Labelling of installations shall be such that the polarisation of optical fibre connections of more than one optical fibre is known and consistent throughout the installation.

The end-faces of terminated optical fibres shall be subjected to visual inspection as defined in EN 50346.

5.3.8.4.2 Recommendations

None.

5.3.9 Cords and jumpers

Cords and jumpers shall be secured in such a way that mechanical damage is avoided during subsequent access.

See 5.3.7.1 for additional requirements that apply to cords and jumpers.

5.3.10 Spaces and structures

5.3.10.1 Maintenance holes and handholes

5.3.10.1.1 Requirements

The installer shall identify proposed locations, the accessibility and availability of maintenance holes according to the installation schedule.

The cable entrance to maintenance hole shall:

a) maintain the environmental and functional conditions of the maintenance hole;

b) provide the necessary cable support and prevent kinking at the point of entry;

c) provide strain relief for the cable if not already done by separate fixtures.

Covers of maintenance holes shall be sized according to the maximum foreseeable load.

5.3.10.1.2 Recommendations

Any cabling not installed within a cable management system should be protected from physical damage by use of appropriate sleeving.

5.3.10.2 Telecommunications cabinets

5.3.10.2.1 Requirements

Telecommunications cabinets shall be installed in a position according to the installation schedule and shall:

a) minimise the impact on the surrounding environment;

b) be positioned as far as practicable from any source of possible interference (e.g. electricity substation, aerial power plant, radio transmitters);

c) permit easy access for repair and maintenance.

Telecommunications cabinets shall be labelled and identified according to the installation specification.

Any electrical equipment in cabinets shall be installed in a way that avoids damage to it from water.

The cable entrance to a telecommunications cabinet shall:

1) maintain the environmental and functional conditions of the cabinet;

2) provide the necessary cable support and prevent kinking at the point of entry;

3) provide strain relief for the cable if not already done by separate fixtures.

Where earth potential rise (EPR) is expected, see 5.3.11.5.

5.3.10.2.2 Recommendations

Where possible, power supply distribution equipment should be separated from cabling, patch panel and other passive components.

5.3.11 Spaces and structures other than for core and access networks

5.3.11.1 General

The requirements and recommendations of this sub-clause are applicable to spaces and structures other than those owned by access providers.

5.3.11.2 Maintenance holes and handholes

5.3.11.2.1 Requirements

None.

5.3.11.2.2 Recommendations

None.

5.3.11.3 Telecommunications cabinets

5.3.11.3.1 Requirements

None.

5.3.11.3.2 Recommendations

None.

5.3.11.4 Building entrances

5.3.11.4.1 Requirements

Incoming cabling management systems shall be sealed at or near to the entrance point inside the building to prevent the ingress of dust, water, animals, gas etc.

5.3.11.4.2 Recommendations

None.

5.3.11.5 Hot zone entrance facilities

5.3.11.5.1 Requirements

The screen of the information technology cables between the connection enclosure (see Figure 7) and the galvanic isolation device, if any, shall be insulated at both ends. The following applies:

a) high dielectric strength sheath cabling entering the hot zone shall be run in separate ducts or a dedicated cabling management system;

b) spare (unused) pairs shall be safely terminated or their free ends enclosed in a high dielectric strength cap;

c) where additional protection against lightning is necessary, surge protective devices shall be installed and earthed in the connection enclosure.

Annex B gives examples of installation practices.

5.3.11.5.2 Recommendations

None.

5.3.12 Protection against very low frequency fields

The installer shall apply the solutions defined in the planning information. See A.3.1.

5.3.13 Electrical isolation components

The installer shall apply the solutions defined in the planning information. See A.3.2.

5.3.14 Surge protection devices

5.3.14.1 Requirements

The installer shall apply the solutions defined in the planning information. Suppliers' installation instructions shall be complied with. See A.3.3.

All metal sheaths, screens, etc., shall be connected together at each end to form an overall bonded network. Overvoltage protectors shall be connected between the conductors and this bonded metal work, which shall be correctly bonded to earth via the lowest possible impedance.

The earthing arrangements of SPD's forming part of a protection system shall be installed to prevent any possibility of a bypass of the protection arrangements.

When surge protective devices are installed, special care shall be taken to ensure equipotential bonding of the surge protective devices earth together with the main earth and the equipment's earth in accordance to installation requirements of HD 60364-5-534 and the EN 61643 series.

5.3.14.2 Recommendations

None.

5.3.15 Protection against lightning

The installer shall apply the solutions defined in the planning information.

5.3.16 Protection against electrostatic discharge (ESD)

For information see EN 50174-1.

5.4 Labelling

See EN 50174-1 in addition to the requirements of this European Standard.

5.5 Testing

If required by the quality plan, final cabling inspection and tests shall be undertaken as soon as practicable following marking, labelling and fitting of all components associated with the telecommunications cabling into their final locations.

5.6 Contractual acceptance

If required within the installation specification, acceptance procedures shall be undertaken as soon as practicable following marking, labelling and fitting of all components associated with the telecommunications cabling into their final locations.

5.7 Operation

5.7.1 Requirements

Provided that there is no risk of damage to cables or the pathway system additional cables may be installed within pathway systems according to the following rules:

a) using all the useable cross-sectional area (see 4.4.2) within:

   1) uncovered pathway systems and cable management systems;

   2) pathway systems and cable management systems from which covers are removed before installation of cables;

   3) non-enclosed pathway systems and cable management systems;

b) using up to 40 % of the useable cross-sectional area (see 4.4.2) within conduit (unless the conduit contains empty sub-conduits).

5.7.2 Recommendations

None.

6 Segregation

6.1 General

Clause 6 specifies requirements and recommendations for unscreened and screened cables in accordance with the transmission performance requirements of EN 50288 series together with other balanced and unbalanced (including coaxial) cables. Where appropriate the requirements and recommendations are specific to particular cable specifications.

The segregation requirements and recommendations of this clause in relation to safety are applicable to all information technology cables containing conducting components (whether or not used for signal transmission) and power supply cabling operating at ≤ 25 kV.

The segregation requirements and recommendations of this clause are those required with regard to safety and electromagnetic interference (EMI). Local regulations for safety may contain different segregation

requirements. In all circumstances, safety has highest priority but the more stringent requirement shall take precedence.

Clause 7 may contain modified segregation requirements. Where manufacturers' instructions require more stringent installation practices, these shall be followed.

6.2 Segregation of underground information technology cabling

6.2.1 General

6.2.1.1 Power supply cabling ≤ AC 1000 V r.m.s. or DC 1 500 V

6.2.1.1.1 Requirements (Safety)

Unless the cables are insulated to the highest voltage present in accordance with HD 60364 series, the minimum separation between information technology cables and power supply cables shall be 0,05 m.

6.2.1.1.2 Recommendations (Safety)

Where the information technology cables and power supply cables are required to cross (see 6.2.1.1.3), an additional barrier should be installed between the cables to provide electrical isolation.

6.2.1.1.3 Requirements (EMI)

Where the information technology cables and power supply cables are required to cross, the angle of their crossing shall be maintained at 90 degrees on either side of the crossing for a distance no less than the applicable minimum separation requirement.

6.2.1.1.4 Recommendations (EMI)

None.

6.2.1.2 Power supply cabling > AC 1000 V r.m.s or DC 1 500 V

6.2.1.2.1 Requirements (Safety)

If either the information technology cables or the power supply cables are not installed in non-conducting conduit or duct or they are separated by a non-conducting barrier of equivalent insulating performance, the minimum separation between information technology cables and power supply cables shall be 0,3 m (see Figure 10).

If either the information technology cables or the power supply cables are installed in non-conducting conduit or duct or they are separated by a non-conducting barrier of equivalent insulation performance then no separation is required (additional to that provided by the barrier).

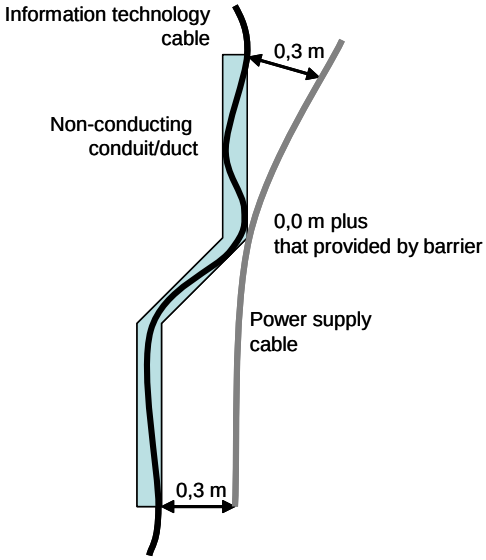


Figure 10 — Example showing the protection of underground information technology cables when located next to power supply cables

Where the information technology cables and power supply cables are required to cross (see 6.2.1.2.3):

a) the upper cable shall be the information technology cable;

b) if a minimum separation of 0,3 m is maintained at the point of crossing, the information technology cable shall be provided with mechanical protection, extending at least 0,5 m each side of the crossing;

c) if a minimum separation of 0,3 m cannot be maintained at the point of crossing, both the information technology cable and the power supply cable shall be installed within a non-conducting conduit or duct or separated by a non-conducting barrier, extending at least 0,5 m each side of the crossing.

6.2.1.2.2 Recommendations (Safety)

None.

6.2.1.2.3 Requirements (EMI)

Where the information technology cables and power supply cables are required to cross, the angle of their crossing shall be maintained at 90 degrees on either side of the crossing for a distance no less than the applicable minimum separation requirement.

6.2.1.2.4 Recommendations (EMI)

None.

NOTE Further information with regard to the interference to information technology cabling from other services is given, for instance, in HD 637 S1.

6.2.1.3 Earthing systems

6.2.1.3.1 General

Where there are buried parts of earthing systems, clearances should be maintained from earth electrodes and, in general, from metallic buried parts of power cables. In this case the safety clearance strongly depends on soil resistivity. Safety separation also depends on the dielectric strength of the sheath of the information technology cables.

6.2.1.3.2 Safety requirements

The segregation requirements of Table 8 and Table 9 apply between information technology cabling and parts of buried earthing systems provided that:

a) if the information technology cable is direct buried its sheath has a dielectric strength of at least 1,5 kV at 50 Hz;

b) if the information technology cable is installed in a non-conducting conduit or duct, the conduit or duct is constructed of a material having an equivalent dielectric strength to a).

Table 8 — Minimum distance between information technology cables and earthed electrodes of power systems in rural and urban environments

Soil resistivity Ωm	**Low voltage (≤ 1 kV)** **(neutral earthing electrode [a])**	**High-voltage (≤ 25 kV) earthing system** **(with isolated neutral or arc suppression coil)**		**High-voltage (≤ 25 kV) earthing system** **(directly earthed neutral)**	
		Rural	Urban	Rural	Urban
< 50	2 m	2 m		4 m	
50 to 500		4 m		8 m	
500 to 5 000		8 m	See 6.2.1.2.1	20 m	See 6.2.1.2.1
5 000 to 10 000		8 m		40 m	
> 10 000		8 m		80 m	

[a] This distance is considered sufficient to avoid irreparable damage to the cable elements or construction of the information technology cables due to lightning on the power supply cabling. The separation may be reduced based upon the conclusions of a relevant risk assessment.

Table 9 — Minimum distance between information technology cables and earthed electrodes of power systems in accordance with ITU-T K.8

Soil resistivity Ωm	**High-voltage (≤ 132 kV) earthing system** **(with isolated neutral or arc suppression coil)**		**High-voltage (≤ 132 kV) earthing system** **(directly earthed neutral)**	
	Rural	Urban	Rural	Urban
< 50	5 m	2 m	10 m	5 m
50 to 500	10 m	5 m	20 m	10 m
500 to 5 000	10 m	10 m	100 m	50 m
5 000 to 10 000	20 m	10 m	100 m	50 m
> 10 000	20 m	10 m	200 m	50 m

Further information is provided in ITU-T K.8.

In locations identified as containing hot zones (see 4.9.5.3), the installer shall contact the owner of the HV installation concerning the risks (probability, duration, etc.) and the size of the hot zone.

6.2.1.3.3 Recommendations (Safety)

In all cases as great a separation as is practicable should be provided between the information technology cables and buried metallic parts of power cables.

Where it is necessary to run cables closer together than the distances given in Table , cables containing metallic parts shall be fitted in an insulated outer sheath. The outer sheath should extend sufficiently to ensure compliance with the limits.

6.2.1.3.4 Requirements (EMI)

See Annex B.

6.2.1.4 Other infrastructures

6.2.1.4.1 Requirements

None.

6.2.1.4.2 Recommendations

Unless national or local regulations specify other requirements, the segregation and protective measures of Table 10 should be observed.

Table 10 — Minimum clearances and protective measures at crossings between information technology cables and various underground services

Other services	Clearances at crossing	Protection measures to be applied to the information technology cabling
Inflammable gas or liquid ducts (operating pressure ≤ 500 kPa)	0,5 m	Conduit or duct extending for at least 1,0 m each side of the crossing.
Inflammable gas or liquid ducts (operating pressure > 500 kPa)	1,5 m	Conduit or duct extending for at least 1,0 m each side of the crossing.
Water pipes sewers and ducts	0,3 m	Conduit or duct extending for at least 0,5 m each side of the crossing.
District heating pipes	1,0 m	Conduit or duct extending for at least 0,5 m each side of the crossing.

6.2.2 Segregation other than for core and access networks

See 6.2.1

6.3 Segregation of aerial information technology cabling

6.3.1 General

6.3.1.1 Requirements

Precautions shall be taken in order to avoid contact with parts of power supply cables and associated equipment. Information technology cables shall be lower than power supply cables.

The methods (components and construction techniques) employed to maintain the segregation requirements shall take into account all relevant operating and environmental conditions (e.g. sun, rain, wind, ice etc.).

6.3.1.2 Overhead power supply infrastructures

6.3.1.2.1 Requirements (Safety)

Unless otherwise specified by national or local regulations, if the supporting structures of the information technology cabling are non-conducting (e.g. wooden) or insulated, the minimum clearance between aerial information technology and overhead power supply cabling shall be as specified in Table 11.

Table 11 — Minimum clearances between aerial information technology and overhead power supply cabling

	Overhead power supply < AC 1 000 V r.m.s. or DC 1 500 V			Overhead power supply > AC 1 000 V r.m.s. or DC 1 500 V	
	Power supply cables (insulated)	Power supply cables (uninsulated)	Power supply poles	Power supply cables/ conductors [a]	Power supply poles
Information technology cables	0,5 m	1,0 m	0,5 m	2,0 m [b]	1,0 m
Information technology poles	0,5 m	1,0 m	0,5 m	2,0 m [b]	1,0 m

a) National or local regulation may require HV cables only.

b) Further information with regard to the interference to information technology cabling from other services is given, for instance, in EN 50341-1 and HD 637 S1.

Where power supply cables (≤ AC 1 000 V or DC 1 500 V) and information technology cables are fixed on the external surfaces of buildings or other structures they shall be separated by at least:

a) 0 m if the cables are insulated to the highest voltage present in accordance with HD 60364 series;

b) 1,0 m in all other cases.

6.3.1.2.2 Recommendations (Safety)

The horizontal separation between information technology and power supply cabling infrastructures should be greater than the height of the highest infrastructure (see Figure 11) unless:

a) measures are implemented to avoid possible contact between aerial information technology cables and overhead power supply cables following mechanical faults (e.g. fallen wires or supporting structures) or

b) the information technology cables are insulated to the highest voltage present.

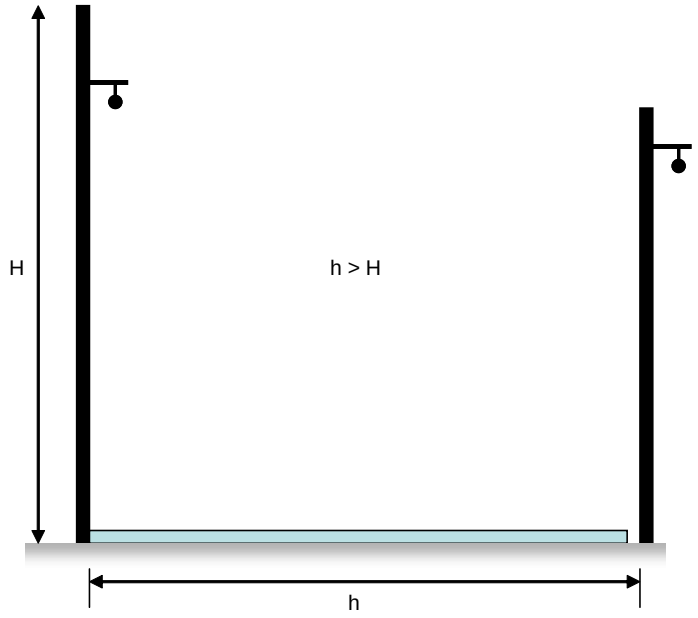


Figure 11 — Separation of adjacent infrastructures

The pathway system for information technology cables should rather be underground than overhead when crossing under HV lines exceeding 25 kV.

6.3.1.2.3 Requirements (EMI)

None.

6.3.1.2.4 Recommendations (EMI)

None.

6.3.1.3 Sharing of infrastructures carrying ≤ AC 1000 V r.m.s. or DC 1 500 V

6.3.1.3.1 Requirements (safety)

Special care shall be taken where there are antennas on poles.

The sharing of supporting structures with power supply cabling for information technology cabling implies the installation of:

a) information technology cables;

b) fittings used to attach the information technology cabling to the poles;

c) stays or struts;

d) closures and accessories (connection, protection, amplification, radio, etc.).

Fittings used to attach the information technology cabling to the supporting structures shall be specified to have a voltage insulation of 4 kV at 50 Hz for one minute (minimum).

Information technology cables shall always be fixed below power supply cabling and associated equipment (including lighting device and feeder cables).

Closures and accessories shall be installed below the information technology cables. The dimensions and locations of such closures and accessories shall be agreed between the owner of the supporting structure and the installer of the information technology cabling.

The information technology cabling shall be supported such that the minimum vertical distance on the supporting structure between power supply and information technology cabling and fittings, is at least:

1) 1 m in cases where power supply conductors have no insulation (see Figure 12);

2) 0,50 m in cases of power supply cables (insulated) (see Figure 12).

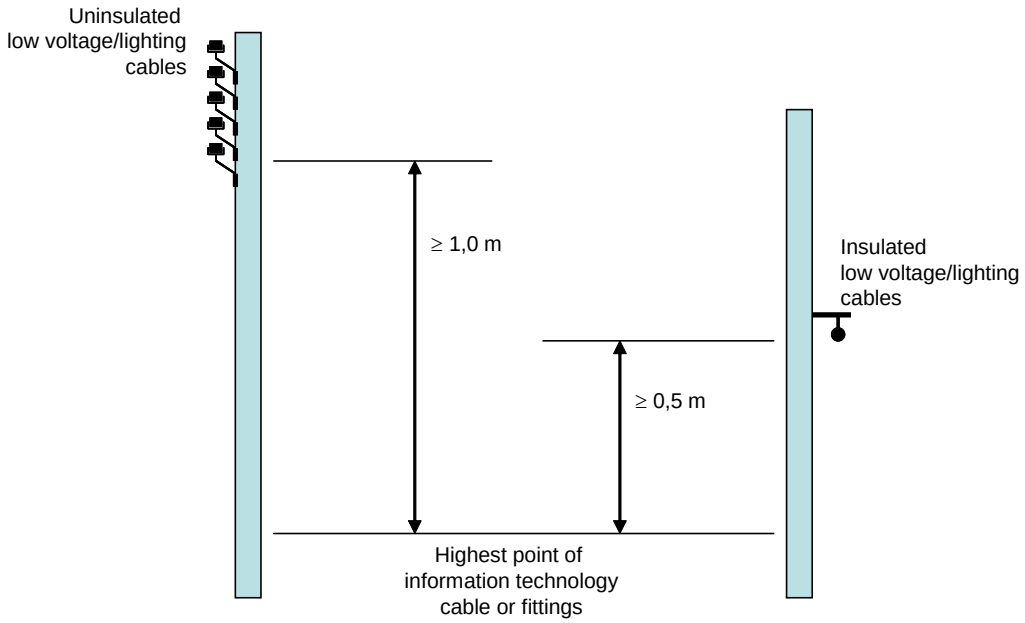


Figure 12 — Separation distances on supporting structures

The minimum separation at any point, allowing for sag produced by operating and environmental conditions, between information technology cables and insulated power supply cables shall be 0,3 m.

If the supporting structures has, or may in the future have, a lighting device fitted, the information technology cabling and fittings shall be installed at least 0,2 m below the lowest point of the location of the device and its feeder cable (see Figure 13).

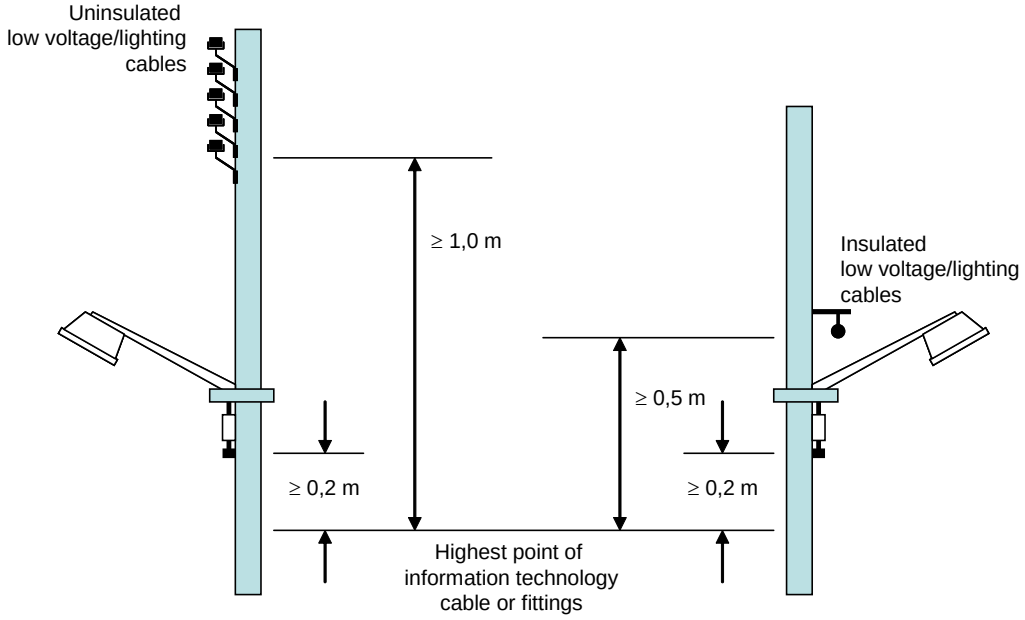


Figure 13 — Separation distance on supporting structures with lighting devices

Earthing systems for information technology cabling shall not be installed on poles containing, or intended to contain, the earthing systems of the power supply cabling.

6.3.1.3.2 Recommendations (safety)

A marker should be placed to show the voltage levels of cables above the information technology cables.

6.3.1.3.3 Requirements (EMI)

None.

6.3.1.3.4 Recommendations (EMI)

None.

6.3.1.4 Sharing of infrastructures carrying > AC 1 000 V r.m.s. or DC 1 500 V

NOTE Further information with regard to the interference to information technology cabling from other services is given in HD 637 S1.

6.3.1.4.1 Requirements (safety) of infrastructures carrying < AC 25 kV

The information technology cabling shall be supported such that the minimum vertical distance on the supporting structures between power supply and information technology cabling and fittings, is at least 2,0 m.

The minimum separation at any point, allowing for sag produced by operating and environmental conditions, between information technology cables and insulated power supply cables shall be 2,0 m.

Earthing systems for information technology cabling shall not be installed on supporting structures containing, or intended to contain, the earthing systems of the power supply cabling.

6.3.1.4.2 Recommendations (safety)

A marker should be placed to show the voltage levels of cables above the information technology cables.

6.3.1.4.3 Requirements (EMI)

None.

6.3.1.4.4 Recommendations (EMI)

None.

6.3.2 Segregation other than for core and access networks

See 6.3.1.

6.4 Segregation with respect to specific sources of EMI

6.4.1 Power distribution (equipment of power stations) and electrified traction infrastructures

6.4.1.1 Requirements (safety)

Where there is inductive coupling, each case should be treated individually and protection is needed where calculations or measurements show that the induced voltage exceeds the values in ITU-T K.68.

It is normally possible to avoid any calculations in the following cases:

a) normal operating conditions for infrastructures below AC 30 kV r.m.s;

NOTE Inductive coupling from HV DC lines may also be relevant. For infrastructures operating > DC 100 kV, the residual AC components may be in the range of AC 10 kV to 50 kV. The frequency spectrum is dependent on the rectifier system used.

b) fault conditions for power cables operating with a voltage below 25 kV and where the affected length of information technology cabling is less than 5 000 m.

Table 12 shows examples from ITU-T K.68 of the separation between power distribution and electrified traction infrastructures (> AC 25 kV) and information technology cabling below which calculations or measurements are necessary and protection measures may need to be applied to the information technology circuits.

Table 12 — Example of limit distances

Length of affected information technology cabling	Soil resistivity Ωm	Overhead power supply		Underground power supply	
		Rural	Urban	Rural	Urban
Short (Access networks)	50	550 m	70 m	-	-
	500	1 700 m	100 m	-	-
	5 000	5 400 m	100 m	300 m	-
Long (Core networks)	50	1 200 m	500 m	300 m	20 m
	500	3 700 m	1 200 m	1 000 m	20 m
	5 000	12 000 m	2 400 m	3 100 m	20 m

When the calculated results show it is necessary to reduce the induced voltage, it is possible to apply one or more mitigation methods.

A general protective method for metallic screened cable is to earth the screen of the information technology cabling at both ends of the cable and if necessary at some specific points along the cable. For metallic cable, protection of inner conductors can be performed using surge protective devices.

Other protective methods exist that are specifically for optical fibre cables or for metallic cables. To ensure continuity of transmission for metallic cables it is possible to install isolation transformers instead of or in combination with surge protective devices.

In the case of underground cables and when the methods described above are not enough to mitigate the induced voltage, it is possible to lay cables inside a completely closed metallic conduit which is earthed at both ends.

6.4.1.2 Recommendations

None.

6.4.2 Low frequency electrical fields

6.4.2.1 Requirements

None.

6.4.2.2 Recommendations

See A.1.6

6.4.3 Radar emissions and broadcast emitters

6.4.3.1 Requirements

None.

6.4.3.2 Recommendations

See A.2.

7 Additional installation practices for specific sites and services

7.1 Hospitals

Different sources of electromagnetic noise exist in the vicinity of hospitals.

Emitters and receivers can produce or be affected by high frequency electrical fields. If hospital equipment is affected it could be life threatening and special care has to be taken (see EN 60601-1-2).

7.2 Airports

Different sources of electromagnetic noise exist in the vicinity of airports.

Navigation emitters (e.g. Instrument Landing System) and radar (e.g. air traffic control, air and surface search, airborne systems) produce high frequency electric fields and large peak pulse powers in a wide zone.

For mitigation techniques see Annex A.

Care shall be taken to minimise any emissions which could affect navigation systems (e.g. landing systems).

7.3 Nuclear areas

High levels of electromagnetic noise are produced in the vicinity of nuclear power plant installations.

The three main electromagnetic couplings are:

a) galvanic coupling due to return current by the soil (stray current) and particular attention should be given to corrosion effects, and EPR areas;

b) inductive coupling due to alternating currents;

c) radiated coupling due to high-voltage sources (electrostatic influence) and due to antennas for communication and surveillance services.

They produce:

1) low frequency electric and magnetic fields in a wide zone;

2) low frequency harmonics (up to 9 kHz);

3) transients, flashover discharges (e.g. heavy current faults, switching voltage surges);

4) high frequency electric fields in a wide zone;

5) arcing phenomena (due to very high-voltage).

For mitigation techniques see Annex A.

This area is subject to EPR due to the presence of very high-voltage and infrastructure protections against lightning (lightning rods). See Annex B.

Relevant national regulation for safe working practices in nuclear and EPR areas shall be complied with.

7.4 Chemical manufacturing areas

Chemical manufacturing areas may feature controlled, earth-free power supply installations.

In chemical environments, the main stress for equipment and accessories is corrosion. All metallic parts like earthing and bonding connections, EMC gaskets and seals, connectors and connection points, closures and cabinets, cable management systems are very sensitive to corrosion. EN 50310 provides further information.

In such environments, use of non-metallic cable management systems is often recommended. For closures, refer to 5.3.6, for information.

The selection of cables, connectors, cable management systems and accessories shall be based upon the requirements of the relevant European product standards.

7.5 Railways (overground and underground)

7.5.1 General

The requirements and recommendations of this sub-clause:

a) apply in the absence of national or local regulations established for railway infrastructures;

b) are not applicable to information technology cables which lead to signalling and points installations which are used for the operation of the railway.

7.5.2 Requirements

The information technology cabling, supporting structures and accessories shall not obstruct the visibility of signals and road crossings.

The space to be left clear by the parts of the information technology cables shall be subject to agreement with the operator of the railway.

As an example of such an agreement, for a standard gauge railway on which vehicles with a width of 3 150 mm run, Figure 14 shows a shaded area that shall not be occupied by any part of the information technology cabling infrastructure including anchors and stays.

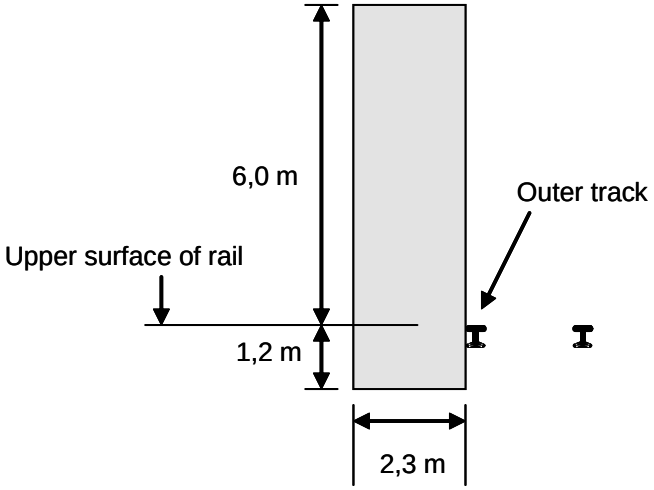


Figure 14 — Clearance between information technology cabling and standard gauge railways

The functioning of technical equipment of railway installations shall not be impaired.

The information technology cables shall be provided with a high degree of resistance to fracture.

7.5.3 Recommendations

The pathway should cross the railway using the shortest possible route.

Aerial crossing of railways should be avoided. Where necessary, stays or struts should be used to reinforce the stability of two poles adjacent to the railway.

7.5.4 Segregation of information technology cabling and electrified railway infrastructures

7.5.4.1 General

The requirements and recommendations of this sub-clause are in addition to those of 7.5.2 and 7.5.3.

Electromagnetic interference is produced in the vicinity of railway installations (for detailed information see EN 50121 series).

Electromagnetic coupling occurs in three main ways:

a) galvanic coupling (i.e. EPR) due to return current in the soil (stray current); particular attention should be given to corrosion in the case of direct current source feeders;

b) electrostatic influence due to high-voltage sources;

c) induction phenomenon due to alternating currents.

Direct current sources (600 V up to 3 000 V) and alternating current sources (16,7 Hz at 15 kV or 2 x 15 kV, 50 Hz at 25 kV or 2 x 25 kV) are used. They produce

1) low frequency electric and magnetic fields in a wide zone,

2) low frequency harmonics (up to 9 kHz),

3) transients, flashover discharge (e.g. short circuit catenary/rail, pantograph/catenary disconnection),

4) radio frequency (9 kHz to 400 GHz) fields from trains,

5) arcing phenomena.

DC railway and traction systems using the earth as a part of the current return path may have earth leakage.

7.5.4.2 Requirements for electrified railways

A railway is a complex installation with moving sources of electric and electromagnetic disturbances; the implementation of the electromagnetic immunity standards within information technology installations alone is not a guarantee of satisfactory performance. A documented plan addressing the management of electromagnetic interference shall be produced prior to any installation of information technology cabling which considered all sources of electromagnetic interference.

Information technology equipment shall be protected against overvoltages caused by the contact line voltage being exceeded, e.g. by means of a surge arrester or a protective transformer.

Users of information technology cables and equipment adjacent or near to DC traction systems experiencing earth leaking problems shall seek expert advice.

For mitigation techniques see Annex A.

Information technology cables shall not employ unsupported aerial crossing of electrified railways, i.e. the cables shall be provided with continuous support (e.g. a bridge of other similar fixed structure).

Information technology cables shall be positioned at a horizontal distance of at least 4 m from the centre line of the track.

Conductive pathway systems in close proximity to electrified railways shall be protected from electrical hazards by means of protection earthing and/or sectioning.

7.5.4.3 Tunnels and bridges including their associated services

On metallic bridges and in tunnels containing electric railway tracks, cables with an insulated covering shall be used. Information technology cables, of which the screen acts as protective earth conductor, shall be insulated from conductive parts of metallic bridges. A PEC should be used (see 4.3.7.3 for information).

Where it is not possible to provide reliable insulation between information technology cables and metallic bridges, any screens and armouring of the information technology cables shall at least be connected with the conductive parts of both ends of the bridges in such a way as to be electrically conductive. A PEC shall be used (see 4.3.7.3 for information). This, however, shall not apply in the case of direct current railway installations because of electrolytic corrosion (see EN 50310).

7.5.4.4 Recommendations for electrified railways

Where information technology cables cross beneath electrified railways, the crossing angle should be near to 90° in order to minimise the interference zone.

7.5.4.5 Additional requirements for electrified railways with HV contact wires

The vertical clearance between the lower surface of any structure supporting the information technology cables crossing a railway and the uppermost live conductor shall be 2,0 m.

As a means of preventing danger resulting from a falling contact wire a triangular space shall be kept free from conductive components of the information technology cabling. This space starts at a point 0,2 m above the uppermost live conductor and extends horizontally by 4,0 m to either side of the centre line of the track (see Figure 15).

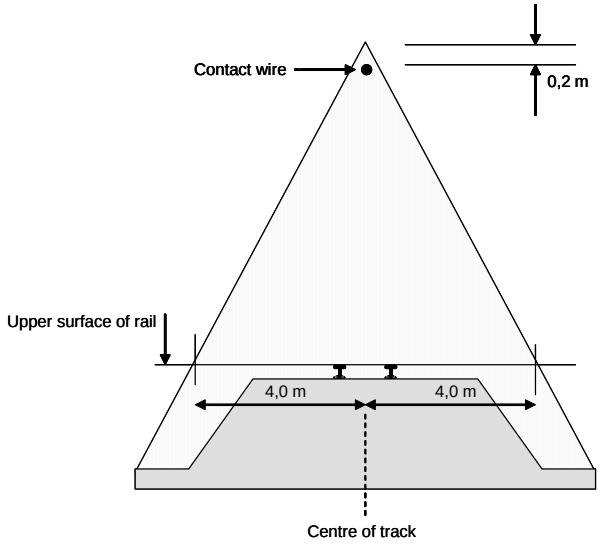


Figure 15 — Clearances providing protection to information technology cabling against falling contact wires

Annex A
(informative)

EMC and protection

A.1 Coupling mechanisms and countermeasures

A.1.1 General

EMC performance of installed cabling is influenced by several different coupling phenomena which may have adverse effects at different frequencies. These situations are explained in the following subclauses.

A.1.2 Countermeasures against galvanic or common mode impedance coupling

Impedances in common mode current paths, if they cannot be avoided, should be kept as low as possible.

The main countermeasures to minimise the effects of common mode impedance coupling are:

a) reduce the common mode impedance;

b) reduce the amplitude of the disturbing currents.

A.1.3 Countermeasures against capacitive coupling

The main countermeasures to minimise the effects of capacitive couplings are:

a) symmetrical transmission on balanced cabling:

   Conductors are identically exposed to the same electric field. Induced interfering voltages in both conductors have the same polarity and amplitude; the wanted differential mode signal remains unaffected up to certain frequencies. The interference appears as an unwanted common mode signal. Depending on its common mode rejection ratio, the correct operation of connected equipment is influenced by the presence of common mode voltages;

b) screened cabling and/or metallic or composite cable management systems specially designed for EMC purposes diminish the influence of electric fields if the cable screen is

   1) of low impedance;
   2) of large surface area;

   and if the cable screen or cable management system (see Figure A.1) is

   3) continuous along the cabling channel;
   4) earthed and bonded as detailed in this European Standard.

Since the cable management system is fixed at earth potential via the bonding network, unwanted electric charges cannot cause voltage rises. At high frequencies the method of grounding of the screen at the cable ends is very important. Even a few centimetres of unscreened lead (pigtail) can compromise the screen effectiveness.

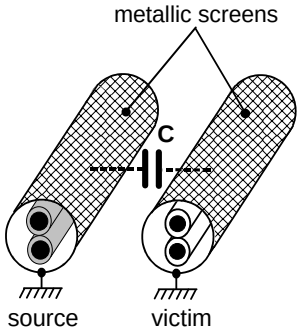


Figure A.1 — Screened cables reduce capacitive coupling

A.1.4 Countermeasures against inductive coupling

The main countermeasures to minimise the effects of inductive couplings are:

a) symmetrical transmission on balanced cabling:

Single conductors are twisted together; the surfaces of possible induction loops are very small. Only few magnetic field lines penetrate these loops. Adjacent twists create induced voltages in phase opposition which as a consequence cancel each other. The induced difference between the two conductors approaches close to zero. On the other hand a common mode disturbance is induced in the loop formed with the (twisted) conductors and the earth. The influence on the equipment is reduced by the common mode rejection of the connected port.

b) screened cabling:

Screened cabling provides – depending on the frequency and the materials used – protection against magnetic fields if the screen is earthed and/or connected to the equipment bonding system at both cable ends. In general, no adequate protection against magnetic fields is given, if the screen of the cable is not connected to ground. Exceptions to this rule exist e.g. when the unconnected cable screen is placed on the surface of or near to an equipotential bonding system.

c) metallic or composite cable management systems specially designed for EMC purposes:

Metallic or composite cable management systems specially designed for EMC purposes can diminish the influence of magnetic fields if:

– elements are properly bonded;

– the cable management system has a low impedance connection to the equipotential bonding system at both ends;

– the frequency is above a minimum value (depending on material and thickness).

The disturbing magnetic field also induces a current in the loop built up with the cable management system and the earth. This current creates an opposite magnetic field which compensates the initial one. At minimum the effect can be improved with a Parallel Earth Conductor to cable. The PEC principle is explained in IEC/TR 61000-5-3.

Since both capacitive and inductive coupling exist simultaneously, the composite takes into account the effect of each contributor, unless one of the two may be neglected.

A.1.5 Countermeasures against radiative coupling

The main countermeasure to minimise the effects of radiated couplings are:

a) for field to cable (see Figure A.2):

reduce the antenna effect of the disturbed cable (reduce the cable height h, put the cable into metallic or composite cable management systems specially designed for EMC purposes, use cables with improved electromagnetic immunity correctly installed (and bonded in the case of screened cables), add parallel earthing conductors, add filters or ferrite beads, etc.);

b) for field to loop (see Figure A.3):

reduce the disturbed loop area (reduce height and length of the cable, all the solutions of a) are also valid);

c) use the Faraday cage principle:

A screened cable connected at both ends with the screening of the equipment is a possible solution; the equipment need not be earthed in the case of high frequencies. When connecting both equipment to earth, current loops should be avoided or at least minimised. Radiated coupling decreases with distance and through the application of symmetrical transmission on balanced cabling.

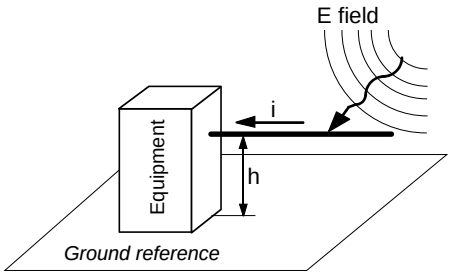


Figure A.2 — Electrical field to cable, capacitive coupling example

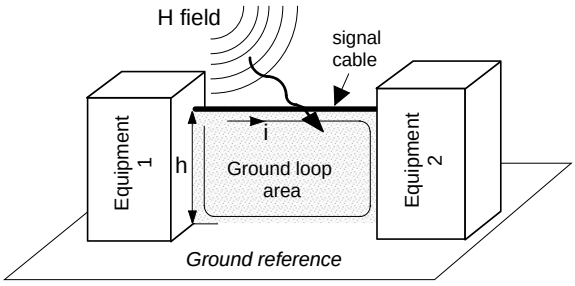


Figure A.3 — Magnetic field to loop, inductive coupling example

A.1.6 Protection against very low frequency fields

A.1.6.1 General

Electricity supply installations such as high and medium voltage lines and transformers, high-voltage distribution bus bar systems and electric traction installations create low frequency (electric and magnetic) fields which can disturb information technology equipment and installations.

A.1.6.2 Design

Very low frequency fields can be diverted with the aid of:

a) high permeability metals;

b) loop constructions compensating magnetic fields;

c) metallic walls or parts thereof, made of copper or aluminium of sufficient thickness.

Provided that the segregation distances are met cases and countermeasures against very low frequency fields are:

EXAMPLE 1

Power cabling produces too high magnetic field in relation to the environment in question.

Countermeasure: Use a power cable with a known/specified screening effectiveness or put an overall screen around the power cable, made of high permeability metal. Take in to account saturation and mechanical shocks.

EXAMPLE 2

A magnetic field arises, because part of the global (mains) current flows back through the earth and not through the cabling (see Figure A.4).

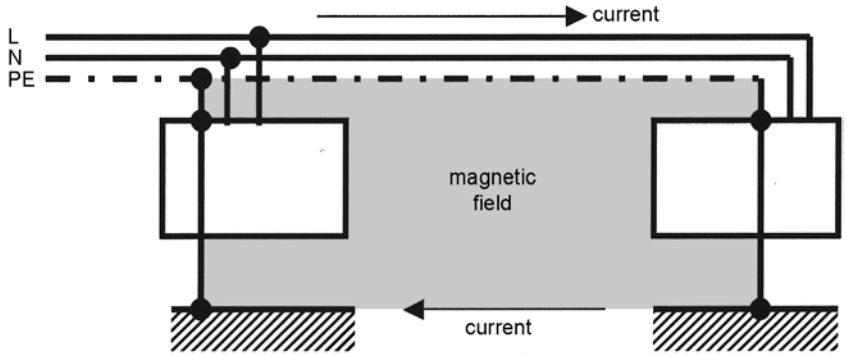


Figure A.4 — Magnetic field

Countermeasure: in this case the magnetic field produces disturbances, so this situation can be difficult. To overcome it, a short circuit loop made of high conductive metal (such as copper) could compensate in a good part this field and thus overcome the disturbing situation). Other countermeasures could be taken e.g. at the “sink“ side (see Example 1). The last possibility is to change the installation in such a way that no magnetic fields are created.

A.1.6.3 Installation guidelines

Some local codes impose other restrictions and requirements and will in most cases take precedence over other guidelines.

Avoid loops as explained in A.1 and shown in Figure A.4. Install instead as shown in Figure A.5.

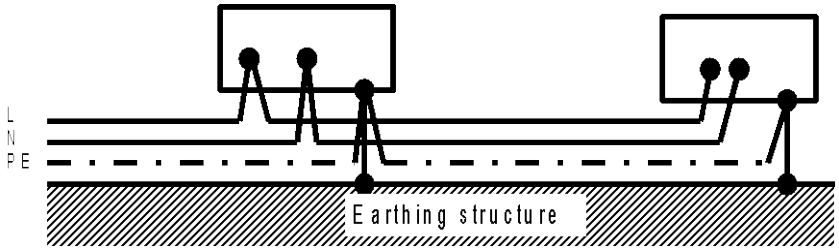


Figure A.5 — Earthing arrangement

Arrange the high-voltage distribution bus bar system in such a way as to minimise the emission of magnetic fields.

Avoid installing information technology equipment near to disturbing sources.

A.2 The EMC concept

In view of the practical realisation of EMC concepts the questions listed in Table A.1 should be answered for the underground or overhead installation of the following:

a) Conductive cable management systems;

b) Metallic cables;

c) Cables containing metallic structural elements.

Table A.1 — EMC checklist

No	Project information
1	**Lightning hazard**
1.1	Interconnection of buildings/structures, one or more of which has a height above ground of ≥ 30 m
1.2	Proximity (< 15 m) to buildings/structures, one or more of which has a height above ground of ≥ 30 m
1.3	Proximity (< 15 m) to isolated trees or to the edge of a forested area
1.4	Proximity to mountains/hills
1.5	Installation in an area with a record of frequent lightning strikes
1.6	Overhead lines
1.7	Connection to antenna-systems on tops of buildings/structures
1.8	Metallic cables or cables containing metallic structural elements, especially in areas with high soil resistance
2	**Interference from power systems supply infrastructures**
2.1	Proximity (crossing, parallel) to power supply systems > 1 kV up to < 110 kV (overhead lines/ high-power-cables)
2.2	Proximity (crossing, parallel) to power supply systems ≥ 110 kV (overhead lines/ high-power-cables) - considering the entire pathway
2.3	Sharing of supporting structures of a power supply infrastructure pylons of a power-line < 1 kV
2.4	Proximity to power supply systems and their earthing system (transformers, overhead supporting structures)
2.5	Entering/ connecting to power plants, power stations, transformers
3	**Interference from electrified railways**
3.1	Proximity to electrified railways – considering the entire pathway
3.2	Crossing of an electrified railway
3.3	Entering/connecting of electric power transformation substation for railways / railway-buildings
4	**Interference from radio transmission equipment having considered any impact of their operating frequencies on the telecommunications applications carried by the cabling and/or equipment connected to it**
4.1	Proximity to and power from the transmission equipment
4.2	Connections to transmission equipment
5	**Corrosion hazard**
5.1	Proximity of metal coated cables, conductive cable management systems or earthing systems of providers to DC railways and its earthing system < 20 m
5.2	Proximity of metal coated cables, conductive cable management systems or earthing systems of providers to corrosion protection system (field of anodes) < 100 m
5.3	Proximity of metal coated cables, conductive cable management systems or earthing systems of providers to cathodic protected lines (e.g. pipeline) < 20 m
6	**Other possible sources of interference**
6.1	Shared use of cable management systems for 3rd party cabling (other than power supply cabling)
6.2	Galvanic connections with third party networks.

A.3 Filtering and electrical isolation components and surge protective devices

A.3.1 Filtering

A.3.1.1 General

Filters are used in power systems and in information technology systems where, despite normal application of the general guidelines of installation and mitigating methods, disturbance levels exceed the immunity level

of the installed equipment. Filters are usually inserted into a circuit so that all intended circuit energy passes through them enabling them to perform their function without impairing normal circuit operation.

Filters can have a two-fold effect by protecting the environment from disturbances generated within equipment and also protect the equipment against disturbances generated externally to the equipment concerned.

Each installation will be different and an individual study is necessary.

A.3.1.2 Design

Filters should be located as near as possible to the apparatus which is the disturbing or disturbed apparatus, to minimise the impedance of the connection. Filters should be enclosed in the apparatus enclosure or mounted in a dedicated unit installed in its proximity (e.g. use of a transient suppression plate).

When surge protective devices are used, they often need to be located before filters.

A.3.1.3 Installation

A.3.1.3.1 General

Physical separation of input and output lines is facilitated by the feed-through mounting technique of the filters. Other mounting techniques can require proper screening of cables to assure their electromagnetic separation. Inputs and outputs of filters should be arranged as far apart as possible; leads from the input and output side shall never be in the same bundle. Filtered leads should never encounter the unfiltered ones to minimise coupling effects.

If screened conductors are to be connected to the filter case, EMI gland type connections should be used. The mounting of a filter is often more important than type of filter. Poor mounting of an otherwise good filter will produce poor filtering. The filter earth connection impedance should be as low as possible to avoid the generation of disturbances that would otherwise be applied in common mode to the apparatus to be protected. See Figure A.6 for an example.

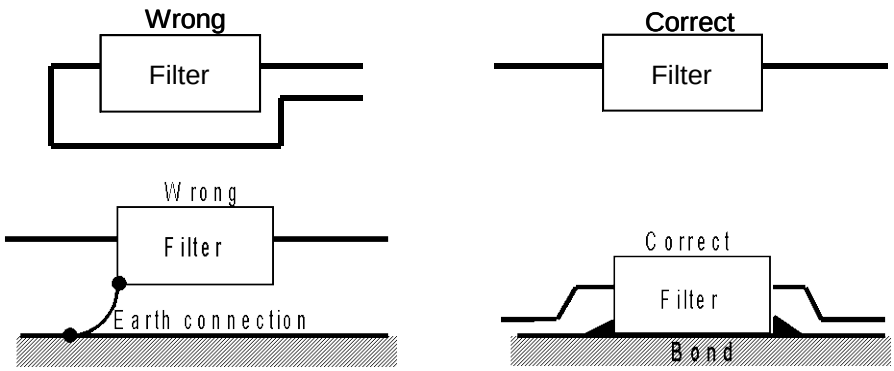


Figure A.6 — Earthing and bonding of filters

When a filter is installed in a cable management system, all the cables should be filtered, otherwise the coupling between the cables could impair the efficiency of the filters (see Figure A.7). In this case it would be better to filter all the cables or use a transient plate.

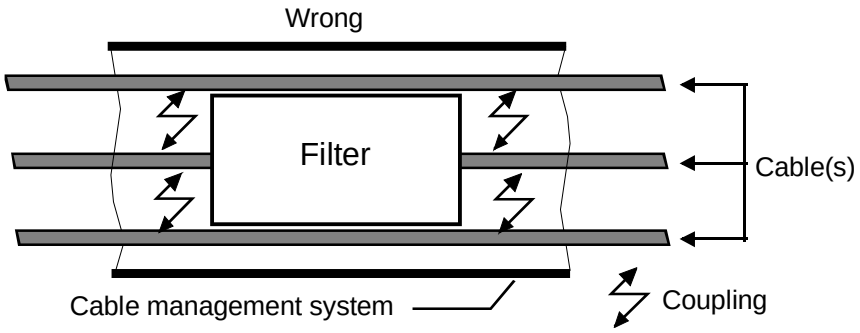


Figure A.7 — Mounting of filters

A.3.1.3.2 Power supply cabling

The use of filters should not interrupt the PE connecting the equipment.

When the filter is located outside the equipment it is preferable that the wires from the filter should be twisted and positioned close to the equipotential structure (see Figure A.8).

When the installation is protected by a residual current device the leakage current of the filter should be lower than the rated residual current of the residual current device (see Figure A.8).

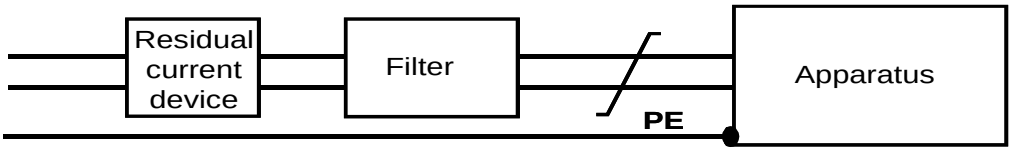


Figure A.8 — Installation of power filter

A.3.1.3.3 Information technology cabling

The following parameters should be maintained to obtain a good filtering to protect the cabling:

a) screening integrity;

b) low mismatch impedance;

c) balance.

A.3.2 Electrical isolation components

A.3.2.1 General

The installation of an electrical isolation component (isolation transformer or optocouplers) are primarily used for the prevention of common mode signals on installed cabling or to interrupt the possible loop formed by the power and information technology cables.

Optocouplers (including optical fibres) can be used to reduce EMI because they ensure a galvanic separation that avoids conducted disturbances and they do not radiate.

A.3.2.2 Design

The choice of the correct electrical information technology isolation component is application dependent.

The list below details the parameters that need to be taken into account when choosing isolation components:

a) screened/unscreened cabling;

b) mechanical compliance;

c) disconnectivity;

d) active/passive component;

e) the protection level needed against common mode disturbances;

f) the allowable asymmetrical disturbance at the information technology port to be protected;

g) the unbalanced attenuation required;

h) the compliance to EMI and safety standards if applicable;

i) the insulation needs, e.g. breakdown voltage.

The choice of the correct electrical power isolation component depends upon the following:

1) screened/unscreened cabling;

2) mechanical compliance;

3) disconnectivity;

4) active/passive component;

5) change of the AC power distribution system into a TN-S system if applicable;

6) an equipment will have to be changed from safety protection class I into class II (see EN 60950-1) if applicable. There is no fixed earth connection or touch current problem which forbids the mentioned change;

7) the protection needed against common mode disturbances (opening of loops);

8) the allowable asymmetrical disturbance at the entrance interface (port) of the device to be protected;

9) the power to be transferred;

10) the compliance to EMI and Safety standards if applicable;

11) stray capacitance.

A.3.2.3 Installation

The installation guidelines for electrical isolation components for the protection of information technology cabling from electrical surges developed by a rise of earth potential are covered in Annex B.

Buildings installed with an equipotential earthing system may need to install isolation transformers between the telecommunications cable pairs end-points (terminations) and connecting equipment which have a direct or indirect connection to the equipotential network, to prevent earth loops (see Figures A.9 and A.10). The isolation transformer effectively supplies a ‘barrier’ against an end-to-end current flow (common mode). The isolation transformer will attenuate low frequency AC currents and the degree of attenuation will depend upon its technical characteristics.

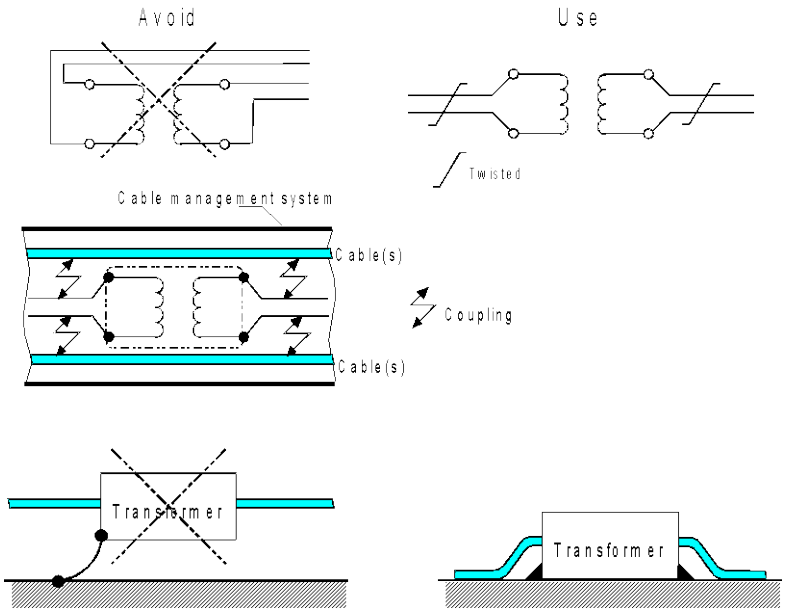


Figure A.9 — Installation guidelines for transformers

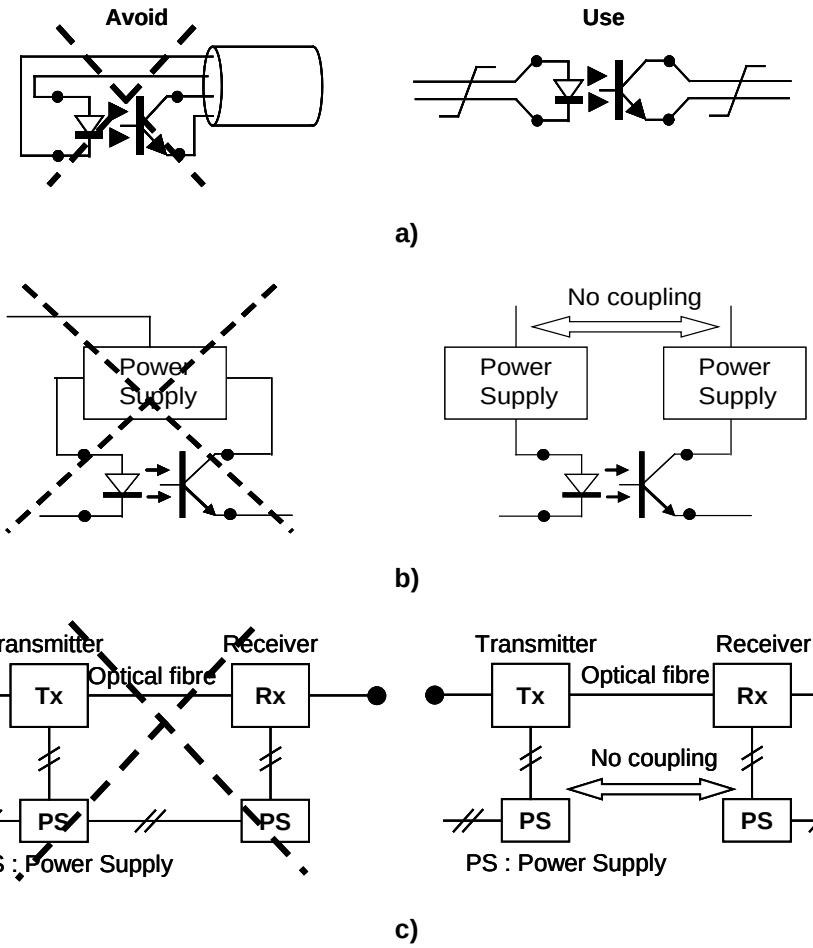


Figure A.10 — Installation guidelines for optocouplers

A.3.3 Surge protective devices

A.3.3.1 General

Voltage and current transients (surges) occur on power and information technology cabling. The origins of these surges can be local or remote, and can be destructive to equipment and be a safety hazard to personnel.

This subclause deals only with the application of surge arresters (surge protective devices) in the mains power cabling and information technology cabling. The adequate protection of equipment does not form part of this subclause, although some equipment influences the protection measures in the cabling part.

Surge arrestors when installed within a telecommunication system will add additional impairments (resistance, capacitance and/or inductance). These additional impairments should be taken into account when designing the information technology network.

A.3.3.2 Design

The choice of the surge protective devices depends on the following considerations:

a) the lightning protection zones – if any – of the site;

b) the amount of energy (voltage, current, duration) to be diverted;

c) the location of surge protective devices (primary or secondary protection);

d) the allowable amount of disturbance (voltage, current, duration) at the interface (port) of the device;

e) protection against surge overvoltages in common and/or differential modes;

f) the type of the transmitted signal or cabling service, e.g. EN 50173-1;

g) the leakage current or stray capacitance values;

h) operational parameters e.g. response time, latching voltage;

i) the compliance to product, EMI and safety standards where applicable.

A.3.3.3 Installation

The surge protective devices fitted at the main distribution frame and all subscriber terminals reduce the risk of damage to information technology cabling but their main function is to protect components having lower dielectric strength than the cables. See Recommendations ITU-T K.20, ITU-T K.21, ITU-T K.44, ITU-T K.45 and the EN 61643 series.

Connections of information technology cabling and earthing systems to surge protective devices should be as short as possible to minimise surge voltage levels between the lines and the equipotential bond point (see Figure A.11).

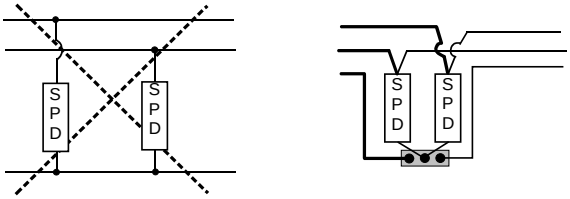


Figure A.11 — Short connections of surge protective devices

Annex B
(informative)

Earth potential rise (EPR)

B.1 General

The EPR for a single phase fault (phase/neutral) is the product of the part of the fault current flowing into the earthing system including earthing of earth wires, cable screens, etc, I_f (A), multiplied by the global resistance of the earthing system.

Where the earthing system can be represented by an equivalent hemisphere (radius R_e), the voltage decrease V outside the equipotential area is given by Formula (B.1):

$$V = \rho \times I_f / (2\pi \times d) \quad \text{(B.1)}$$

Where

ρ soil resistivity (Ωm);

I_f fault current (A);

d distance (m) between the centre of the area of highest potential of the earthing system and the considered point (see Figure B.1).

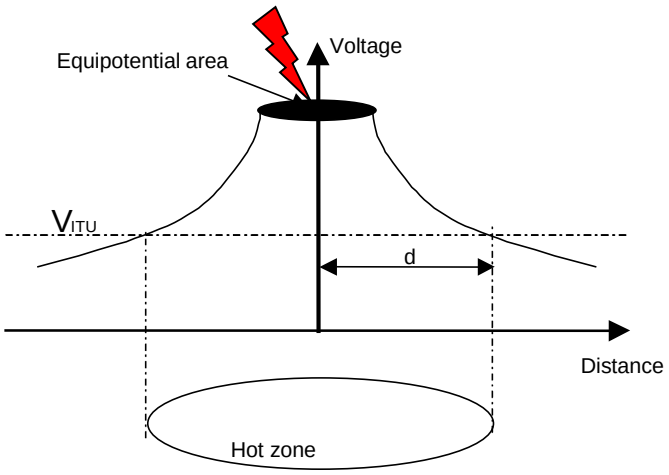


Figure B.1 — Definition of hot zone

B.2 Limit of the hot zone

B.2.1 General

The worst case limit of the hot zone, d(m), measured from the centre of the equipotential zone of the HV installation, can be evaluated with the Formula (B.2):

$$d = \rho \times I_f / (2\pi \times V_{ITU}) \quad \text{(B.2)}$$

Where

ρ soil resistivity (Ωm);

I_f fault current (A) flowing to the earthing system;

V_{ITU} voltage limit (V) given in ITU-T K.68 for a typical situation.

Where the EPR around a hot site is not known or cannot be calculated because of lack of data, recommended minimum distances for the limit of the hot zone are given in B.2.2 and B.2.3.

B.2.2 Example of a hot zone around HV installations less than 25 kV

Where the EPR is not known, the limit of the hot zone can be taken from Table B.1.

Table B.1 — Minimum distance (HV installations less than 25 kV)

Soil resistivity	Power supply system with isolated neutral or arc suppression coil (I_f < 40 A)	Power supply system with directly earthed neutral (I_f > 1 000 A)
< 50 Ωm	5 m	10 m
50 Ωm to 500 Ωm	10 m	20 m
500 Ωm to 5 000 Ωm	20 m	50 m
5 000 Ωm to 10 000 Ωm	20 m	100 m
> 10 000 Ωm	20 m	200 m

B.2.3 Example of a hot zone around HV installations exceeding 25 kV

Where the EPR is not known, the limit of the hot zone can be taken from Table B.2 (ρ in Ωm gives the distances d in m).

Table B.2 — Minimum distance (HV installations exceeding 25 kV)

Time to clear the power fault s	Fault current flowing to earth		
	4 kA	8 kA	12 kA
$t \leq 0,2$	$\rho/2$	ρ	$1,5\rho$
$0,2 < t \leq 0,35$	$2\rho/3$	$4\rho/3$	2ρ
$0,35 < t \leq 0,5$	$5\rho/6$	$5\rho/3$	$2,5\rho$
$0,5 < t \leq 1$	$5\rho/4$	$2,5\rho$	4ρ

Annex C
(informative)

Application of responsibilities

In order to minimise any ambiguity resulting from the use of a standard, it is preferable that a standard both specifies requirements and defines who is responsible for meeting those requirements. For a complex operation such as the planning and installation of information technology cabling it is difficult to specify responsibilities that are applicable in all circumstances particularly where local regulations apply.

This European Standard has been structured to ensure that the requirements and responsibilities of the installer (defined in EN 50174-1) of the information technology cabling are specified in Clause 5. However, not all requirements and responsibilities may be applicable to a specific installation e.g. cable management systems may be installed by others. Nevertheless, the installer would be expected to assess, and advise appropriately, the compliance of installation outside their control against the requirements of Clause 5.

The responsibilities for planning are more complex. It is recommended that the responsibilities of the planning and installation of each installation are clearly defined using a template of the form shown in Table C.1.

Table C.1 — Responsibilities template

		Responsibility							
Clause		**I_{IT}**	**O**	**P**	**I_{MP}**	**M**	**N**	**U**	**Other**
4	**Requirements for planning installations of information technology cabling**								
4.1.1	Personnel								
4.1.2	Power supply cabling								
4.1.3	Optical fibre cabling								
4.1.4	Transmission and terminal equipment								
4.1.5	Cells and batteries								
4.1.6	Cable management systems								
4.1.7	Closures								
4.1.8	Cables								
4.1.9	Termination points								
4.2	Documentation								
4.3	Pathways								
4.4	Pathway systems								
4.5	Pathway systems other than for core and access networks								
4.6	Closures								
4.7	Cabling								
4.8	Spaces and structures								
4.9	Spaces and structures other than for core and access networks								
4.10	Administration								
5	**Requirements for the installation of information technology cabling**								
5.1.1	General								
5.1.2	Pathways								
5.1.3	Closures								
5.1.4	Cables								
5.2	Documentation								
5.3	Installation practice								
5.3.1	Storage of cabling components and equipment								
5.3.2	Pathways								
5.3.3	Pathways other than for core and access networks								
5.3.4	Pathway systems								
5.3.5	Pathways systems other than for core and access networks								
5.3.6	Closures								
5.3.7	Cable installation								
5.3.8	Jointing and termination of cables								
5.3.9	Cords and jumpers								
5.3.10	Spaces and structures								
5.3.11	Spaces and structures other than for core and access networks								
5.3.12	Protection against very low frequency fields								
5.3.13	Electrical isolation components								
5.3.14	Surge protective devices								
5.3.15	Protection against lightning								
5.3.16	Protection against electrostatic discharge (ESD)								
5.4	Labelling								
5.5	Testing								
5.6	Contractual acceptance								

Key

I_{IT}	Installer of information technology cabling
I_{MP}	Installer of mains power cabling
M	Manufacturer
N	Network provider
O	Premises owner
P	Designated planner
U	End-user

An example of the completion of such a table is shown in Table C.2.

Table C.2 — Example of completed responsibilities

		Responsibility							
Clause		**I_{IT}**	**O**	**P**	**I_{MP}**	**M**	**N**	**U**	**Other**
4	**Requirements for planning installations of information technology cabling**								
4.1.1	Personnel		■						
4.1.2	Power supply cabling			■		■	■	■	
4.1.3	Optical fibre cabling		■	■					
4.1.4	Transmission and terminal equipment					■			
4.1.5	Cells and batteries		■						
4.1.6	Cable management systems			■	■				
4.1.7	Closures			■	■				
4.1.8	Cables			■					
4.1.9	Termination points		■	■					
4.2	Documentation			■				■	
4.3	Pathways		■	■					
4.4	Pathway systems		■	■	■				
4.5	Pathway systems other than for core and access networks		■	■	■				
4.6	Closures			■					
4.7	Cabling			■	■				
4.8	Spaces and structures		■	■					
4.9	Spaces and structures other than for core and access networks		■	■					
4.10	Administration			■					
5	**Requirements for installers of information technology cabling**								
5.1.1	General	●							
5.1.2	Pathways	■			■				
5.1.3	Closures	●							
5.1.4	Cables	●							
5.2	Documentation	●							
5.3.1	Storage of cabling components and equipment	■			■				
5.3.2	Pathways	●							
5.3.3	Pathways other than for core and access networks	●							
5.3.4	Pathway systems	●							
5.3.5	Pathways systems other than for core and access networks	●							
5.3.6	Closures	●							
5.3.7	Cable installation	●							
5.3.8	Jointing and termination of cables	●							
5.3.9	Cords and jumpers							●	
5.3.10	Spaces and structures	●							
5.3.11	Spaces and structures other than for core and access networks	●							
5.3.12	Protection against very low frequency fields	●							
5.3.13	Electrical isolation components	●							
5.3.14	Surge protective devices	●							
5.3.15	Protection against lightning	●							
5.3.16	Protection against electrostatic discharge (ESD)	●							
5.4	Labelling	●							
5.5	Testing	●							
5.6	Contractual acceptance	■	■						
5.7	Operation							●	

Key

I_{IT}	Installer of information technology cabling
I_{MP}	Installer of mains power cabling
M	Manufacturer
N	Network provider
O	Premises owner
P	Designated planner
U	End-user
●	Sole responsibility
■	responsible together with others (shall)

Annex D
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC national member.

This European Standard does not fall under any Directive of the EU.

In the relevant CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Clause	Deviation
4.3.7.1.2, Table 5	In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electricity Supply Lines SR 734.31 from 1st of July 2012.***
	NOTE The regulation can be found at the following URL: http://www.admin.ch/ch/d/sr/7/734.31.de.pdf
	The purpose of this Ordinance is to avoid hazards that may arise from electricity supply lines, as well as from close proximity, parallel routing and intersection of electricity supply lines with one another, with other installations and with buildings.
	Article 100 forbids the aerial crossings of electrified railways.
	Article 119 forbids the aerial crossings of motorways.
	Per Article 14, the minimal clearance distance for walkable or drivable areas is 5 m.
	Per Article 14, the minimal clearance distance for not walkable or not drivable areas is 4 m.
	Per Article 14, the minimal clearance distance for non-navigable waterways is 4 m.
6.2.1.1.1	In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electricity Supply Lines SR 734.31 from 1st of July 2012.***
	NOTE The regulation can be found at the following URL: http://www.admin.ch/ch/d/sr/7/734.31.de.pdf
	The purpose of this Ordinance is to avoid hazards that may arise from electricity supply lines, as well as from close proximity, parallel routing and intersection of electricity supply lines with one another, with other installations and with buildings.
	As per Article 94, paragraph 2, no minimal separation distance is required if the insulation is sufficient.
6.2.1.2.1	In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electricity Supply Lines SR 734.31 from 1st of July 2012.***
	NOTE The regulation can be found at the following URL: http://www.admin.ch/ch/d/sr/7/734.31.de.pdf
	The purpose of this Ordinance is to avoid hazards that may arise from electricity supply lines, as well as from close proximity, parallel routing and intersection of electricity supply lines with one another, with other installations and with buildings.

As per Article 96, a minimal separation distance of 0,3 m has to be maintained. If either the information technology cables or the power supply cables (or both) are installed in non-conducting conduit or duct or separated by a non-conducting barrier, no minimum separation between information technology cables and power supply cables are required.

6.2.1.3.2, Table 8 and Table 9

In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electrical Weak Current Installations SR 734.1 from 1st of July 2012.***

NOTE The regulation can be found at the following URL:http://www.admin.ch/ch/f/rs/7/734.1.fr.pdf

This ordinance applies to the erection, operating and maintenance of weak current electrical installations.

As per Article 8a, if no protective measures are taken, the following separation distances shall be maintained:

- For low voltage installation, a minimum separation distance of 30 cm shall be maintained
- For high voltage installations with isolated neutral, a minimum separation distance of 30 cm shall be maintained.
- For high voltage installations with arc suppression coil, a minimum separation distance of 10 m shall be maintained.
- For high voltage installations with directly earthed neutral, a minimum separation distance of 20 m shall be maintained.

The separation distance is independent from soil resistivity.

6.3.1.2.1, Table 11

In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electricity Supply Lines SR 734.31 from 1st of July 2012.***

NOTE The regulation can be found at the following URL:
http://www.admin.ch/ch/d/sr/7/734.31.de.pdf

The purpose of this Ordinance is to avoid hazards that may arise from electricity supply lines, as well as from close proximity, parallel routing and intersection of electricity supply lines with one another, with other installations and with buildings.

Articles 81 and 89 as well as Appendix 17 mention that the following minimum separation distances between parallel lines shall be maintained:

- Between Information technology overhead wires and Overhead power supply < AC 1 000 V r.m.s. or DC 1 500 V, the minimum distance is 2 m
- Between Information technology cables and Overhead power supply < AC 1 000 V r.m.s. or DC 1 500 V (Power supply cables (insulated) or Power supply cables (uninsulated)), the minimum distance is 1,5 m
- Between Information technology cables and Overhead power supply > AC 1 000 V r.m.s. or DC 1 500 V (Power supply poles), the minimum distance is 2 m
- Between Information technology poles and Overhead power supply > AC 1 000 V r.m.s. or

DC 1 500 V (Power supply poles), the minimum distance is 10m if the parallel length is smaller than 300 m and 20 m otherwise.

6.3.1.4.1 In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***Ordinance on Electricity Supply Lines SR 734.31 from 1st of July 2012.***

NOTE The regulation can be found at the following URL:
http://www.admin.ch/ch/d/sr/7/734.31.de.pdf

The purpose of this Ordinance is to avoid hazards that may arise from electricity supply lines, as well as from close proximity, parallel routing and intersection of electricity supply lines with one another, with other installations and with buildings.

Articles 81 and 89 as well as Appendix 17 mention that the minimum separation distance is 1,5 m.

7.5.4.2 In Switzerland, the following requirements are applicable, instead of the requirements of the clauses of this EN as per ***SN EN 50122-1:2011, Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock.***

The national defined values are 3 m for high voltage and 2 m for low voltage.

Bibliography

EN 50098 (all parts), *Customer premises cabling for Information Technology*

EN 50121 (all parts), *Railway applications — Electromagnetic compatibility*

CLC/TR 50173-99-2:2012, *Information technology — Implementation of BCT applications using cabling in accordance with EN 50173-4*

EN 50174-2:2009 + A1:2011+AC:2011, *Information technology — Cabling installation — Part 2: Installation planning and practices inside buildings*

EN 50288 (all parts), *Multi-element metallic cables used in analogue and digital communication and control*

EN 50341-1, *Overhead electrical lines exceeding AC 45 kV — Part 1: General requirements – Common specifications*

EN 50406 (all parts), *End user multi-pair cables used in high bit rate telecommunication networks*

EN 50407 (all parts), *Multi-pair cables used in high bit rate digital access telecommunication networks*

EN 50700, *Information technology — Premises distribution access network (PDAN) cabling to support deployment of optical broadband networks*

EN 61140, *Protection against electric shock — Common aspects for installation and equipment (IEC 61140)*

EN 61663-1 [3)], *Lightning protection — Telecommunication lines — Part 1: Fibre optic installations (IEC 61663-1)*

EN 61663-2 [3)], *Lightning protection — Telecommunication lines — Part 2: Lines using metallic conductors (IEC 61663-2)*

EN 62305 (all parts), *Protection against lightning (IEC 62305 series)*

HD 637 S1, *Power installations exceeding 1 kV a.c.*

IEC/TR 61000-5-3, *Electromagnetic compatibility (EMC) — Part 5-3: Installation and mitigation guidelines — HEMP protection concepts*

ITU-T K.8, *Separation in the soil between telecommunication cables and earthing system of power facilities*

ITU-T K.12, *Characteristics of gas discharge tubes for the protection of telecommunications installations*

ITU-T K.20, *Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents*

ITU-T K.21, *Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents*

ITU-T K.28, *Characteristics of semi-conductor arrester assemblies for the protection of telecommunications installations*

ITU-T K.44, *Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents — Basic Recommendation*

3) Standard withdrawn without replacement in IEC and CENELEC.

ITU-T K.45, *Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents*

ITU-T L.88, *Management of poles carrying overhead telecommunication lines*

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