British Standards

BSI British Standards
389 Chiswick High Road
London W4 4AL
Tel: 020 8996 9000
Fax: 020 8996 7400
Web: http://bsi-global.com

DIRECT
Tel: **+44 (0) 20 8996 7413**
Fax: **+44 (0) 20 8996 7143**
E-mail: **nicola.harrison@bsi-global.com**

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To the Members of:

Technical Committee TCT/7

SUBJECT: CENELEC VOTE - FINAL DRAFT PREN 50174-3 "INFORMATION TECHNOLOGY - CABLING INSTALLATION. PART 3: INSTALLATION PLANNING AND PRACTICES OUTSIDE BUILDINGS". UK CLOSE DATE 28 MARCH 2003

Please find attached the Formal Vote text for prEN 50174-3 “Information technology - Cabling installation. Part 3: Installation planning and practices outside buildings”

If you have any comments on the draft, please send them to me by **28 March 2003**

NOTE: If the UK is to vote positively on the draft, only minor/editorial comments can be submitted with the vote. If there are major/technical comments, a negative UK vote should be submitted.

If I receive no advice to the contrary by the above date, I shall submit a vote of **YES** with **NO COMMENTS** on behalf of the UK.

Yours sincerely,

Nicola Harrison
Programme Manager
BSI Standards Development
Acting Secretary to TCT/7

FINAL DRAFT
prEN 50174-3

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2003

ICS

English version

Information technology - Cabling installation
Part 3: Installation planning and practices outside buildings

Technologies de l'information - Installation de câblage
Partie 3: Planification et pratiques d'installation à l'extérieur des bâtiments

Informationstechnik - Installation von Kommunikationsverkabelung
Teil 3: Installationsplanung und -praktiken im Freien

This draft European Standard is submitted to CENELEC members for formal vote.
Deadline for CENELEC: 2003-05-23

It has been drawn up by Technical Committee CENELEC TC 215.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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

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

Project: 5164 Ref. No. prEN 50174-3:2003 E

Foreword

This draft European Standard was prepared by Technical Committee CENELEC TC 215 "Electrotechnical aspects of telecommunication equipment" under the framework of the Mandates M/212 on “Communication cables and cabling systems“ and M/239 on “Air traffic management equipment and systems“.

It is submitted to the Formal Vote.

The following dates are proposed:

- latest date by which the existence of the EN has to be announced at national level	(doa)	dor + 6 months
- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

This standard comprises three parts. All three parts support the specification, implementation and operation of information technology cabling using both balanced copper and optical fibre cabling components. These components may be combined to provide cabling solutions either in accordance with the design requirements of series EN 50173 or to meet the requirements of one or more application-specific standards (such as EN 50098-1 or EN 50098-2).

This part, EN 50174-3, contains detailed requirements and guidance relating to the installation planning and practices outside buildings and is intended to be used by the personnel directly involved in the planning and installation of information technology cabling. It shall be used during the different implementation phases when installing information technology cabling, i.e. during the planning phase, the design phase and installation phase.

Annexes designated “informative” are given for information only. In this standard, Annexes A and B are informative.

To support the commenting of this draft standard, continuous line numbering has been provided.

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Introduction

The importance of the information technology cabling infrastructure is similar to that of other fundamental building utilities such as heating, lighting and mains power supplies. As with other utilities, interruptions to service can have 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 installation of information technology cabling. These are

a) design - the selection of cabling components and their configuration,

b) specification - the detailed requirement for the cabling, its accommodation and associated building services addressing specific environment(s) identified within the premises together with the quality assurance requirements to be applied,

c) implementation - the physical 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, implementation and operational aspects. The design issues are covered in series EN 50173 and / or other application standards.

EN 50174-1 is intended to be used by personnel during the specification phase of the installation together with those responsible for the quality planning and operation of the installation. It contains requirements and guidance for the specification and quality assurance of the information technology cabling by defining

- aspects to be addressed during the specification of the cabling,
- quality assurance documentation and procedures,
- requirements for the documentation and administration of cabling,
- recommendations for repair and maintenance.

EN 50174-2 and this part, EN 50174-3, are intended to be used by the personnel directly involved in the implementation phase of the installation. EN 50174-2 is applicable inside buildings and EN 50174-3 is applicable outside buildings.

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

1) planning strategy (road map) and guidance depending on the application and physical environment (climatic, mechanical, electromagnetic, etc.),

2) design and installation rules for metallic and optical fibre cabling depending on the application, electromagnetic environment, physical environment, etc.,

3) requirements on satisfactory operation of the cabling depending on the application, electromagnetic environment, physical environment, etc.,

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

Figure 1 shows the relationships between the standards produced by TC 215 for information technology cabling, namely cabling design standards (EN 50098 series, EN 50173 series), cabling installation standards (EN 50174 series) and equipotential bonding requirements (EN 50310).

Building design phase	**Cabling design phase**	**Planning phase**	**Implementation phase**	**Operation phase**
EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50173 (Series) **or (and)** EN 50098-1 **or (and)** EN 50098-2 **or (and)** Other application standards	EN 50174-1 4: Specification considerations 5: Quality assurance 7: Cabling administration **and** EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling **and** EN 50174-3 **and** **(for equipotential bonding)** EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S)	EN 50174-1 6: Documentation 7: Cabling administration **and** EN 50174-2 4: Safety requirements 5: General installation practices for metallic and optical fibre cabling 6: Additional installation practice for metallic cabling 7: Additional installation practice for optical fibre cabling **and** EN 50174-3 **and** **(for equipotential bonding)** EN 50310 5.2: Common bonding network (CBN) within a building 6.3: AC distribution system and bonding of the protective conductor (TN-S) **and** EN 50346 4: General requirements 5: Test parameters for balanced copper cabling 6: Test parameters for optical fibre cabling	EN 50174-1 5: Quality assurance 7: Cabling administration 8: Repair and maintenance

Figure 1 - Relationship between series EN 50174 and other design standards

1 Scope

This European standard specifies the basic requirements for the planning, implementation and operation of information technology cabling using balanced copper cabling and optical fibre cabling. This standard is applicable to:

a) cabling designed to support particular analogue and digital communications services including voice services;

b) generic cabling systems designed in accordance with series EN 50173 and intended to support a wide range of communications services.

This standard is intended for those involved in the procurement, installation and operation of information technology cabling. Furthermore this standard is addressed to:

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

This standard is applicable to certain hazardous environments but does not exclude additional requirements which are applicable in particular circumstances, e.g. in the presence of electricity supply and electrified railways.

This part of the standard:

c) sets out requirements for satisfactory installation and operation of information technology cabling outside buildings; it is not restricted to campus areas.

d) excludes specific requirements applicable to other cabling systems (e.g. power cabling, coaxial 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.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

EN 41003, *Particular safety requirements for equipment to be connected to telecommunication networks*

EN 50173-1, *Information technology – Generic cabling systems – Part 1: General requirements and office areas*

EN 50174-1, *Information technology – Cabling installation - Part 1: Specification and quality assurance*

EN 50174-2, *Information technology – Cabling installation - Part 2: Installation planning and practices inside buildings*

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

EN 60950-1, *Information technology equipment – Safety – Part 1: General requirements (IEC 60950-1:2001, modified)*

EN 61663-1, *Lightning protection – Telecommunication lines – Part 1: Fibre optic installations (IEC 61663-1:1999 + Corrigendum Oct. 1999)*

EN 61663-2, *Lightning protection – Telecommunication lines – Part 2: Lines using metallic conductors (IEC 61663-2:2001)*

HD 384.4.41 S2, *Electrical installations of buildings – Part 4: Protection for safety - Chapter 41: Protection against electric shock (IEC 60364-4-41:1992, modified)*

HD 384.4.47 S2, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 47: Application of protective measures for safety – Section 470: General – Section 471: Measures of protection against electric shock (IEC 60364-4-47:1981 + A1:1993, modified)*

HD 384.4.482 S1, *Electrical installations of buildings - Part 4: Protection for safety - Chapter 48: Choice of protective measures as a function of external influences - Section 482: Protection against fire where particular risks or danger exist*

ITU-T K.33, *Limits for people safety related to coupling into telecommunications system from a.c. electric power and a.c. electrified railway installations in fault conditions*

ITU-T K.50, *Safe limits of operation voltages and currents for telecommunication systems powered over the network*

ITU-T K.51, *Safety criteria for telecommunication equipment*

ITU-T K.53, *Values of induced voltages on telecommunication installations to establish telecom and a.c. power and railway operators responsibilities*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this European standard the following definitions apply.

3.1.1
bonding network (BN)
set of interconnected conductive structures that provides an “electromagnetic shield” for electronic systems and personnel at frequencies from Direct Current (DC) to low Radio Frequency (RF).

NOTE The term "electromagnetic shield" denotes any structure used to divert, block or impede the passage of electromagnetic energy. In general, a BN does not need to be connected to earth, but all BNs considered in the present document will have an earth connection

[3.1.2 of EN 300 253:2002]

3.1.2
campus
premises containing one or more buildings

[3.1.11 of EN 50173-1:2002]

3.1.3
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.53 for typical fault situations

3.1.4
rural area
area which has a low density of local metallic structures in direct electrical contact with soil

[3.10 of EN 50352]

NOTE In a rural environment the earthing systems of the substations have their own earth electrodes which are not normally connected together.

3.1.5
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

[3.11 of EN 50352]

3.2 Abbreviations

AC	alternating current
BN	bonding network
CBN	common bonding network
CMS	cable management system
DC	direct current
EMC	electromagnetic compatibility
EPR	earth potential rise
ESD	electrostatic discharge
GDT	gas discharge tube
HV	high voltage
LV	low voltage
MOV	metal oxide varistor
PEC	parallel earthing conductor
SPD	surge protective device

TVS transient voltage suppressor

4 Safety requirements

4.1 Prerequisite

This clause only deals with general safety requirements, however, all other clauses in this document contain specific safety requirements.

Provisions shall be taken to make all concerned persons present in the campus aware of

a) the locations and boundaries of hazardous areas outside buildings,

b) the procedures to be adopted when working in or in proximity to these hazardous areas,

c) fire precautions.

It is assumed that mains power cabling is installed in accordance with the requirements of relevant international or regional standards, national or local regulations.

All the installed cable shall comply with the relevant product safety requirements.

The requirements of EN 50174-2:2000, Clause 4, shall apply.

4.2 Protection against electric shock

4.2.1 Active equipment requirements

Only equipment that incorporates safe signal circuitry complying with EN 60950-1, EN 41003, ITU-T K.50 and ITU-T K.51 shall be connected to information technology cabling.

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.

4.2.2 Cabling components

Conductors with hazardous voltages shall not be accessible at any entry and distribution points. The coexistence of power and information technology cables requires proper insulation for the information technology cabling components (e. g. connecting hardware, cable, terminals) or other protection measures to achieve adequate protection from indirect contact. The requirements of HD 384.4.41 S2, HD 384.4.47 S2 and HD 384.4.482 S1 or relevant national or local regulations shall apply.

Connection of the main earthing terminal (MET) (as close as possible to the building entrance point), or of a local earth with a low resistance (if outside the premises) to the following is necessary:

a) metallic cable screen(s) at both ends; if high unbalance currents are expected, due to different earthing potential, precautions should be taken to limit such currents;

b) conductive parts of the entry, distribution and termination points, including metallic cabinets, covers and other metallic parts of the cable management system;

c) protection devices installed on line conductors of information technology cables, i.e. at exposed sites.

The above earthing shall be realised by low impedance bonding.

The electrical continuity of the metallic screen shall be maintained.

Stays and struts used on poles used for information technology cabling should be suitably insulated when required e.g. when passing power cables, and also when using a metallic catenary wire to ensure the safety of the public from hazardous voltages reaching accessible portions of the stay wire.

Connecting hardware selected for information technology cabling shall not be interchangeable with the sockets or plugs used for mains power distribution.

Further requirements are set out in EN 50174-2:2000, Clause 4, 6.7, 6.8 and Annex A.

4.3 Protection from voltages due to the proximity of high voltage systems

This standard gives installation rules for the following situations:

a) proximity of information technology and power cables / overhead lines;

b) proximity of information technology cables and power earthing systems;

c) proximity of information technology and power earthing systems.

See 5.9 and Annex A.

4.4 Fire and chemical hazard

The choice of cables shall be made according to the national regulation relating to the Construction Product Directive (see also EN 50174-2:2000, Clause 4).

4.5 Explosive and asphyxiating gases

The requirements of EN 50174-2:2000, 4.4, shall apply.

4.6 Optical fibre hazard

The requirements of EN 50174-2:2000, 4.5, shall apply.

4.7 Mechanical hazard

The hazard is mainly related to the mechanical stability of aerial cables. For proper installation national regulations shall be followed in placing the poles and evaluating the maximum permitted span length. For further details see Clause 5.

4.8 Separation requirements for metallic cabling

Cable and installation requirements for crossing of underground cables and overhead clearances are set out in 5.9 as well as in EN 50174-2:2000, 6.5, (segregation of services) where safety and EMC aspects are taken into account.

4.9 Closures

Closures providing facilities for the termination and (or) distribution of both information technology cables and mains power cables shall be designed to provide separate covers for the two cabling types. Alternatively, a single overall cover is allowed provided that the mains power cabling remains protected to prevent electric shock after removal of the cover. This applies for example to a closure containing separate termination points for information technology and mains power cabling, but not for termination points where the power supply is provided within the information technology cabling termination point.

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

a) if the closure is metallic, it shall be earthed in accordance with the relevant wiring regulations for protective earth;

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 mains power cabling and shall be retained such that the use of a tool is necessary to gain access thereby preventing inadvertent connection between the mains power and the information technology cabling;

d) the entry for the information technology cables and the mains power cables shall be separate and the separation of the cables shall conform to the requirements of Clause 5.

5 General installation practices for metallic and optical fibre cabling

5.1 General

The installation practices take into account safety hazards and interference with other outside plant. General EMC requirements and guidance are given in Clause 6.

Metallic and optical fibre cabling in outside plant can be installed underground or overhead according to the different possible situations. Generally, but particularly for underground installation, the cable management system should allow for the installation of additional cables in the future without risk of damage.

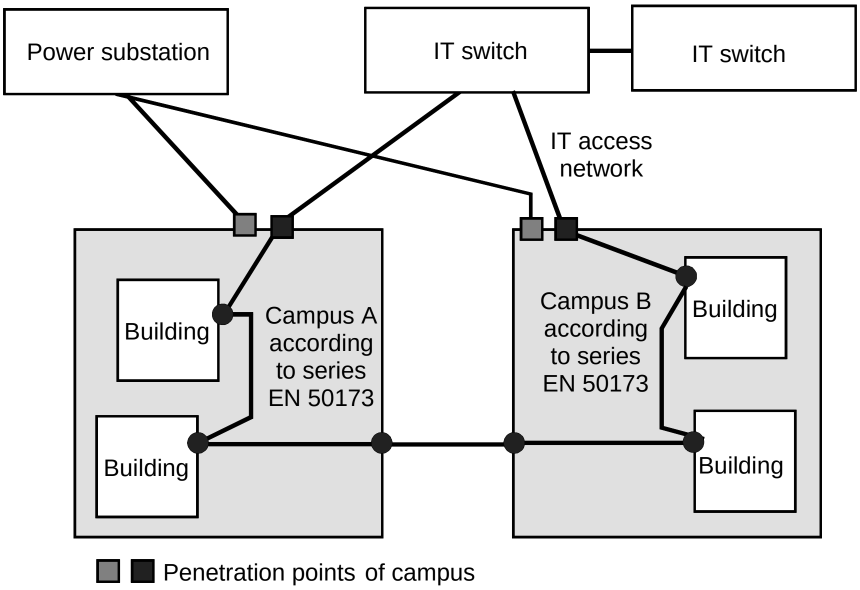
Additional installation guidelines for optical fibre cabling are given in Clause 7.

The requirements within this standard do not cover:

a) any additional requirements for the information technology cables installed in hazardous or stressful environments e. g. electricity supply and electric railway locations (see Clause 8);

b) coaxial cabling and components used within cable distribution systems for television and audio signals (according to EN 50083 series).

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



NOTE Neither the connection performance nor the media between the entry point and the building entrances are defined in EN 50173-1. Cabling denoted by dotted lines is not within the scope of this standard.

Figure 2 - Examples of areas covered by this document

5.2 General precautions

All cables and cabling components shall be checked on delivery to ensure that no mechanical damage has occurred during transportation.

Documentation supplied shall be checked for compliance with the procurement specification and retained.

The components shall be stored in a suitable place until required. Consideration shall be given to security and environmental conditions.

The components shall not be unpacked until required for installation.

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. Precautions shall be taken during installation to prevent the ingress of water and other contaminants.

5.3 Pre-installation practices

5.3.1 General

The installer shall establish that the routes defined in the installation specification are accessible and available according to the installation programme. The installer shall advise the client of all proposed variations (see 4.8.1 of EN 50174-1:2000).

The installer shall verify that the physical compatibility and the environmental conditions within the routes and the installation methods to be used are suitable for the design of cable and components to be installed.

Where underground installations are envisaged, the installer shall use the best digging methods to minimise any disruption or inconvenience (e.g. traffic, dust, reduced access to buildings and shops, etc.) to the population.

The installer shall identify the proposed locations at which cable drums, reels or boxes are to be positioned during the installation programme and should establish the accessibility and availability of those locations.

The installer shall identify proposed locations of cabinets and maintenance holes and should establish their accessibility and availability according to the installation programme.

The cabinets and maintenance holes 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 (see EN 50174-1:2000, 4.6).

Should a gas hazard be detected the installer shall inform the site contact nominated by the client and appropriate action shall be agreed and undertaken.

The installer shall ensure that all necessary guards, protective structures and warning signs are used to protect the cable, the installation personnel and third parties. Relevant national regulation for safe working practices shall be complied with.

5.3.2 Mechanical and environmental (rodents)

Where there is a history of rodent damage special measures may need to be taken.

5.4 Preparation of cable routes

5.4.1 General

The requirements of EN 50174-2:2000, 5.4, shall apply.

When designing and maintaining information technology cable routes, the regulations related to the prevention of dangerous voltages and any potential disturbances caused by power cables and other heavy current cables shall be taken into consideration (see also 4.1).

5.4.2 Underground cables

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

There are several techniques for installing cabling into ducts or pipes. If draw ropes are used they should be installed prior to the installation of the cable as required. Under no circumstances shall draw ropes be installed concurrently with the cable. Existing draw ropes should be checked for satisfactory function.

Cables that are to be laid directly in the ground shall be of suitable mechanical construction for this purpose. Soil conditions should be carefully considered when a cable is buried directly in the ground. However, if subsoil conditions are known to be corrosive, the cable may require additional protection and the cable suppliers should be consulted. Marking tape shall be laid above any directly buried cable (see EN 12613).

Laying marking tape above the cable management system is always recommended.

When cables with metallic components are buried in rural areas with high risk of lightning strikes, extra protection is strongly recommended (see 6.8). The need for lightning protection shall be considered according to series EN 61663.

5.4.3 Aerial cables

The route of the cable shall be designed and built in such a way that damage or unsafe situations caused by overloading the construction are avoided. At the crossing of two or more routes, different cables shall not touch each other in any circumstances.

Special consideration shall be given to overhead routes that run parallel to or cross railways, tramways, trolley bus cables, cable railways, cable ways, ski and chair lifts, motor ways, roads and navigable rivers and waterways, etc.

The stresses on the cables and poles depend on the span length and the sag. The climatic conditions that can have a major effect on tensions in poles, aerial cables and sag are heat, cold, wind and snow / ice load on cables and poles. Reference shall be made to the national regulations for routes affected by such conditions and the appropriate construction methods utilised.

The information technology cable route should be as straight as possible and shall be installed to respect the minimum clearances above ground given in Table 1:

Table 1 – Minimum installed clearances above ground for aerial cables

Location	Clearance
Motorway, main roads	6 m
Non electric railway	6 m
Minor road crossings, areas accessible to vehicular traffic, field path, campus entrance	5,5 m
Minimum clearance no traffic crossing	4 m
Specific environment, Gardens	3 m

NOTE Aerial crossing of motorway, non electric and electrified railways is not recommended.

Where pole sharing is allowed, see 5.11.

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

5.5 Cabling practices

Proper installation practices shall be observed for cabling to ensure performance of the cabling system over its life cycle.

Performance specifications for cable and connecting hardware assume the use of proper installation practices and cable management techniques according to manufacturers' guidelines. If recommended cable handling practices and installation methods are not observed, it is possible that specified transmission capabilities of cabling components cannot be achieved.

During cable installation, appropriate techniques shall be followed:

a) the cabling components shall be installed in environmental conditions compliant with any relevant standards;

b) bend radii shall never be less than the minima specified by the manufacturer/supplier;

c) cables shall not be exposed to temperatures exceeding their specified limits after installation, this includes localised effects such as those from hot air blowers or gas burners;

d) no forces shall be allowed that cause damage (e.g. through improper fastening or crossovers) to the cable sheath or the cable elements;

e) jointing chambers should be positioned at all joints, places where there are severe changes of direction and cabinets;

f) leaving enough spare cable along the route (e.g. at jointing chambers or poles) to facilitate future maintenance is recommended;

g) covers of jointing chambers shall be sized according to the maximum foreseeable load;

h) all cabling management systems at the entrance into a building shall be sealed to prevent the ingress of dust, water, animals, gas, etc.;

i) if more additional cables are installed in a duct or sub-duct then great care shall be taken to prevent damage to existing cables, when removing or installing cables.

5.6 Cable management systems

5.6.1 Aerial supporting structures (overhead)

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. The most economical layout will generally be obtained with a span of 50 m. If special supporting structures are used, greater span lengths may be obtained. The deviation from the straight line between poles should not be more than 20 % without using stays or struts.

Supporting structures shall be suitably treated to prevent decay.

Supporting structures should be checked periodically so that degradation and damage can be detected and corrected if required.

Where necessary stays or struts can be attached to the pole at the resultant load points of the cables or at road crossings. To ensure the safety of the public from hazardous voltages reaching accessible portions of the stays or struts, they shall be suitably insulated when required (e.g. when passing power cables), and also when using a metallic catenary wire. Catenary wires shall not be spliced in the field.

5.6.2 Underground

Except for particular cases (e.g. bridges, thrust boring) underground cable management systems (e.g. pipes, ducts) should be made from suitable non conductive material. All underground cable management systems should be made of a non-porous material. Sections shall be jointed to inhibit ingress of gases, water and foreign materials.

5.6.3 Attachments

Attachment of suspension wires or catenary cables to buildings should be 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.

Attachment of suspension wires or catenary cables to buildings should be avoided in earthquake zones.

5.6.4 Earthing of cables and cabling management systems

Metallic parts (e. g. screens, suspension or catenary wires) and metallic cable management systems should be connected to earth at both ends and at every earthed cabinet. They are also bonded together with the metallic part of any cabinet even if not directly earthed. In case of TN-S systems the requirements of EN 50310 shall apply.

Earth connections could also be necessary at intermediate points where there is a possibility of induced voltage from power lines or in regions particularly exposed to lightning strikes. See also 5.9.4.

Where earth potential rise (EPR) is expected, see 5.10.2 and Annex A.

5.6.5 Cabinets

See 5.8.

5.7 Labelling

Cables, jointing chambers and cabinets shall be labelled with a unique identifier to enable tracing in both directions. Labels shall be chosen allowing for the environments in which they will be used in order to ensure adequate lifetimes. See also EN 50174-1.

Warning signs and labels shall be fitted in accordance with the installation specification.

5.8 Installation of closures

Outside plant cabinets shall be installed in a position according to the installation plan and shall

a) minimise the impact on the surrounding environment,

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

c) permit easy access for repair and maintenance.

It is recommended that:

- outside cabinets are installed next to walls to ensure better protection;
- accessible outside cabinets are provided with a lock to prevent unauthorised access.

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. Where possible, electrical equipment connected to the main electricity network should be installed clearly separated from cabling, patch panel and other passive components.

The cable entrance to a cabinet or a jointing chamber shall

1) maintain the environmental and functional conditions,

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.

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

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

Only connecting hardware specifically designed for outside use and particular environments shall be used.

Manufacturer's installation instructions for the connector and cable shall be strictly followed. If special tools are required for termination, then only those recommended by the manufacturer shall be used.

The connecting hardware used for copper cabling shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of termination (by not changing the original twist), see EN 50173-1.

5.9 Segregation of services

5.9.1 General

Information technology cables outside buildings shall be installed taking into account safety rules and minimising interference to and from all other existing services (e.g. power, communication and traction systems etc.). Generally interference can be avoided by respecting minimum distances between systems and, where necessary in particular cases, adopting appropriate countermeasures and particular installation methods. In order to achieve better performance and to reduce costs, all possible interference shall be considered during the planning phase of an installation.

5.9.2 Aerial cables

5.9.2.1 Interaction of overhead information technology cables with overhead power cables

Work on the crossing of overhead power cables and information technology cables shall not be carried out before an approach has been made to the owner of the existing cables and agreement to the crossing obtained.

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

In order to avoid possible contact between aerial information technology cables and overhead power plants through mechanical faults (e.g. fallen wires or poles), a good installation practice is to fix the minimum horizontal separation between information technology and power plants greater than the height of the higher cables. However, if particular rules for construction of both power and information technology aerial cables are applied, it is possible to reduce the clearances.

Maintenance of the minimum separation distances shall be ensured by also considering variable climatic conditions (sun, rain, wind, ice etc.). This requirement can be satisfied by using particular construction methods or taking suitable clearance margins into account during planning and also by appropriate cable design.

If at least one of the power or information technology conductors is insulated and the information technology poles are wooden or insulated, the minimum clearance between aerial information technology and overhead power cabling both using poles as support shall be as specified in Table 2..

Table 2 - Minimum clearances between aerial information technology and overhead power cabling crossing or when running in parallel

	Overhead power lines > AC 1 000 V		Overhead power lines < AC 1 000 V		
	Power cables / conductors	Power poles	Power cables	Power wires	Power poles
Information technology cables	[1,5+(0,015 × U)] [a] m	1,0 m	0,5 m	1,0 m	0,5 m
Information technology poles	[3+(0,015 × U)] [a] m	1,0 m	0,5 m	1,0 m	0,5 m

[a] U is the voltage of power line expressed in kV

If both cables are not insulated the minimum clearance shall be 1 m. In the case of pole sharing, see 5.11.

Where the requirements of safety and electrical interference demand different limits for either spacing or physical separation, the more stringent requirements shall take precedence.

Aerial information technology cables which are routed to buildings and which intersect there with low voltage power cables shall be separated. If both power and information technology cables are fixed on the external walls of the building and are insulated the minimum separation shall be 0,2 m otherwise the minimum clearance shall be 1 m.

5.9.2.2 Interaction of overhead information technology cables with roads and railways

In order to minimise the interference zone, aerial crossing of roads and railways should be planned with a crossing angle near to 90°.

The use of stays or struts to reinforce the stability of two poles adjacent to the road or railway is recommended.

Aerial crossing of electrified railways is not recommended.

5.9.3 Underground cables

5.9.3.1 Interaction of underground information technology cables with underground power cables and underground parts of an earthing system

For crossings between underground information technology cables and underground power cables both cables should be insulated and the minimum separation shall be 0,3 m. The upper cable shall be the information technology cable and shall have adequate protection extending at least 0,5 m each side of the crossing.

If the separation at the crossing is less than 0,3 m then both cables shall be fitted into a protection pipe for a linear extension either side of the crossing for at least 0,5 m. If at least one of either the information technology cable or power cable is installed into a cable management system that assures adequate mechanical protection the minimum separation can be reduced to 0,1 m.

If, in the case of parallel routing, the distance between information technology and power cables running in parallel is less than 0,3 m then at least one of either information technology cable or power cable shall have adequate mechanical protection (see Figure 3).

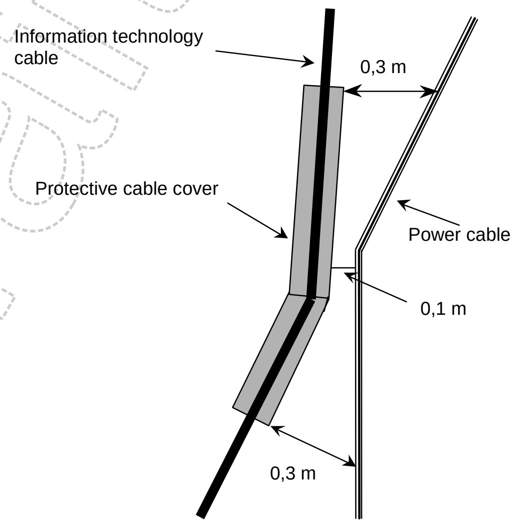


Figure 3 - Example showing the protection of underground information technology cables when located next to power cables

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. 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.

For rural environments, the distances shall not be less than those given in Table 3. This table assumes information technology cable having a dielectric strength of at least 1,5 kV at 50 Hz.

Table 3 – Minimum distance between buried insulated information technology cables and earthed electrodes of power systems in rural environment

Soil resistivity (Ωm)	LV 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)
< 50		2 m	4 m
50 to 500		4 m	8 m
500 to 5 000	2 m	8 m	20 m
5 000 to 10 000		8 m	40 m
> 10 000		8 m	80 m

[a] This distance is considered sufficient to avoid damage on information technology cables due to lightning on LV power systems.

The installer shall contact the owner of the HV installation concerning the risks and the size of the hot zone.

For HV power systems exceeding 25 kV, calculations shall be performed in order to fulfil the limits of ITU-T Recommendations K.33 and K.53.

In urban zones, due to the density of buildings and buried metallic conductors, only mechanical protection is required and the minimum distances for those circumstances apply.

Where it is necessary to run cables closer together than the distances given in Table 3, cables containing metallic parts shall be fitted in an insulated outer sheath. The outer sheath should extend sufficiently to ensure compliance with the limits.

5.9.3.2 Interaction of underground information technology cables with roads and railways

At crossings with roadways and railways, underground cables shall be laid inside protective cable pipes or conduits.

Jointing chambers should be located at sides of crossings to facilitate future cabling and maintenance.

The values in Table 4 are provided as a guide to the minimum clearances between the ground surface and the upper part of the underground plant.

Table 4 - Minimum depth of information technology cabling below the ground surface

Location	Depth
Railway	1,0 m
Pavement (also grassed area)	0,5 m
Urban and rural roads	0,6 m
Motorway	0,8 m

Cable pipes or ducts under roads and railways should be laid in co-operation with the relevant authorities, who will specify access and safety requirements together with requirements for depth of cover and back filling.

5.9.3.3 Interaction of underground information technology cables with other underground services

Table 5 summarises some protective measures/clearances that should be observed when other underground services are found.

Table 5 - Minimum clearances and protective measures at crossings between information technology cables and various underground services

Other services	Clearances at crossing m	Protection measures	Notes
Inflammable gas or liquid ducts	1,5 m (operating pressure > 500 kPa) 0,5 m (operating pressure ≤ 500 kPa)		If the minimum spacing is less than the indicated values then the gas or liquid duct should be covered with a protective pipe or duct extending 1,0 m each side of crossing. For parallel paths, an intermediate layer should be provided.
Water pipes sewers and ducts	0,3 m except district heating 1,0 m	The installation should be mechanically protected with a pipe or duct. The protection should extend at least 0,5 m each side of the crossing.	If the minimum spacing is less than the indicated values then both installations should be protected with a pipe or duct or an intermediate layer should be provided.

5.9.4 Power distributions systems and electrified traction lines (equipment of power stations)

Where there is inductive coupling, each case should be treated individually and protection is needed every time that the result of calculations or measurements show that the induced voltage exceeds the values in ITU-T K.53.

When the distances given in Figure 4 are exceeded, it is not necessary to carry out any investigations or calculations. This is applicable for high voltage overhead lines exceeding 100 kV operating with direct-earthed systems.

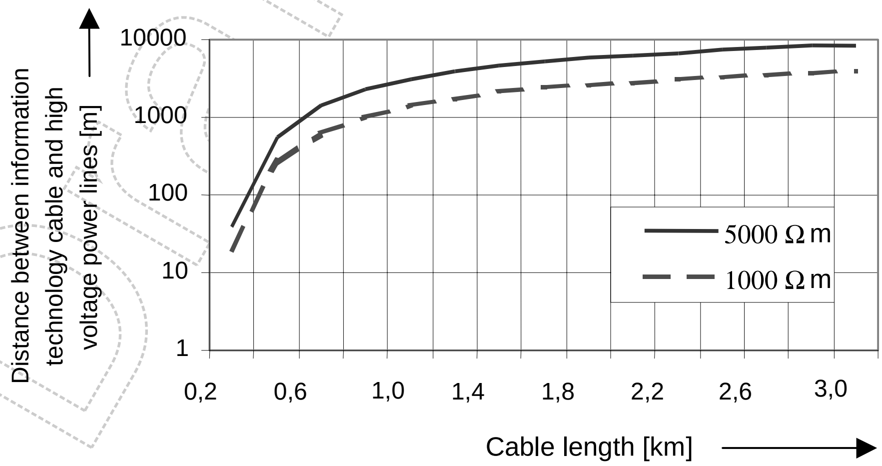


Figure 4 - Distance between information technology cable and high voltage power lines

The curves assume an inducing current of 10 kA. In cases of higher inducing currents the distances are also higher.

As a rule of thumb and considering the limit values, it is normally possible to avoid any calculations in the following cases:

a) normal operating condition for power cables (not valid for electrified traction cables) below 30 kV;

b) fault condition for power cables operating with a voltage below 25 kV and with a parallelism below 5 km.

When, from the calculated results, it is necessary to reduce the induced voltage it is possible to apply one or more mitigation methods until the induced voltage is reduced to an acceptable value.

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 duct which is earthed at both ends.

5.9.5 Interference between information technology earthing systems and power earthing systems

In rural environments, the minimum separation between information technology earthing systems and earthed electrodes of LV and HV (under 25 kV) power systems shall be as given in Table 6.

Table 6 - Minimum distance between information technology earthing systems and earthed electrodes of power systems in rural environment

Soil resistivity Ωm	LV neutral earthing electrode (TT system)	LV neutral earthing electrode (TN system and IT system) [a]	HV earthing system (with isolated neutral or arc suppression coil)	HV earthing system (directly earthed neutral)
< 50	2 m		5 m	10 m
50 to 500	4 m		10 m	20 m
500 to 5 000	8 m	2 m	20 m	50 m
5 000 to 10 000	16 m		20 m	100 m
> 10 000	16 m		20 m	200 m

[a] This distance is considered sufficient to avoid damage on information technology cables due to lightning on LV power systems.

For HV power systems exceeding 25 kV, calculations shall be performed in order to fulfil the limits of ITU-T K.53.

In urban zones, due to the density of buildings and underground metallic conductors, mechanical protection is required and the minimum distances for those circumstances apply.

5.9.6 Building entrance facilities for power and information technology cabling

To minimise induction loops and to assist the earthing and bonding arrangements the following applies:

a) metal pipes (e.g. for water, gas, heating) and cables should enter the building at the same place;

b) metal sheets, screens, metal pipes and connections of these parts shall be bonded and connected to the main equipotential bonding of the building with low impedance conductors;

c) common routes for power and signal cable shall have adequate separation (by distance or screening)

For further information see also EN 50310.

Incoming cabling management systems shall:

1) 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);

2) be sealed to prevent the ingress of dust, water, animals, gas etc.

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 5.

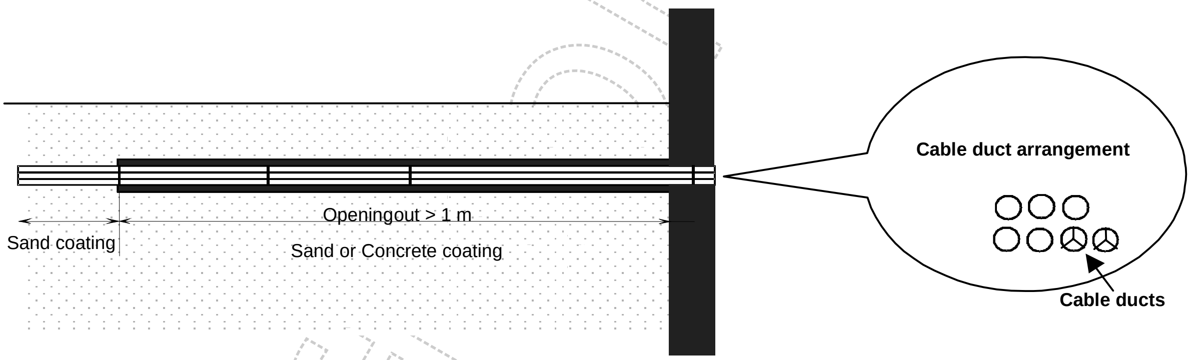


Figure 5 – Example of an underground cable duct entrance for information technology cables into a building

The ducts shall be sealed at or near to the entrance point inside the building.

Requirements for segregation of services are given in 5.9.3.

5.9.7 Interface between internal and external cabling

External information technology cables that enter a building should be terminated on a frame, block or socket/box dependent on the number and types of cables entering. This termination point can be considered as the interface between the external and internal cabling systems. The termination point of the information technology cables should be as close as possible to the service entry point for the building. Where cables without fire retardancy (euroclass F according to Construction Product Directive) are used, the length within the building shall be as short as possible according to national regulations.

The use of a dedicated termination point is also recommended as it allows an appropriate point for isolation, testing and measurement into and out of the building. It also provides a suitable point to install any surge protective devices.

Connection of all external metallic parts of the cables (as a minimum the screen) and metallic ducts at the same equipotential plane except in particular cases (e.g. hot zone, see Annex A and 5.10.3) is strongly recommended. This equipotential plane is connected to the main earthing terminal directly or through the bonding network (see also EN 50174-2:2000, 6.7, for information).

5.9.8 Special precautions for entering a hot zone

This clause applies only for information technology cabling with metallic parts (e.g. twisted pair cables, optical fibre cables with metallic parts, etc.).

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

When connecting information technology cabling inside a hot zone with information technology cabling outside 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.

The following three steps shall be taken:

1) installation of a specific enclosure outside the hot zone as a physical interface with the external information technology cabling. This enclosure shall be used only for the connection of the information technology cabling entering the hot zones;

2) installation of galvanic insulation device at one or several locations inside the hot zone for each metallic information technology conductor. This device shall have relevant transmission characteristics to guarantee the quality of the link;

3) installation between the specific enclosure 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 ducts (see Figure 6).

The screen of the information technology cable, if any, shall be insulated at both ends. The following applies:

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

- aerial information technology cable should not be used in hot zones;

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

- where additional protection against lightning is necessary, surge protective devices shall be installed in the closure and earthed.

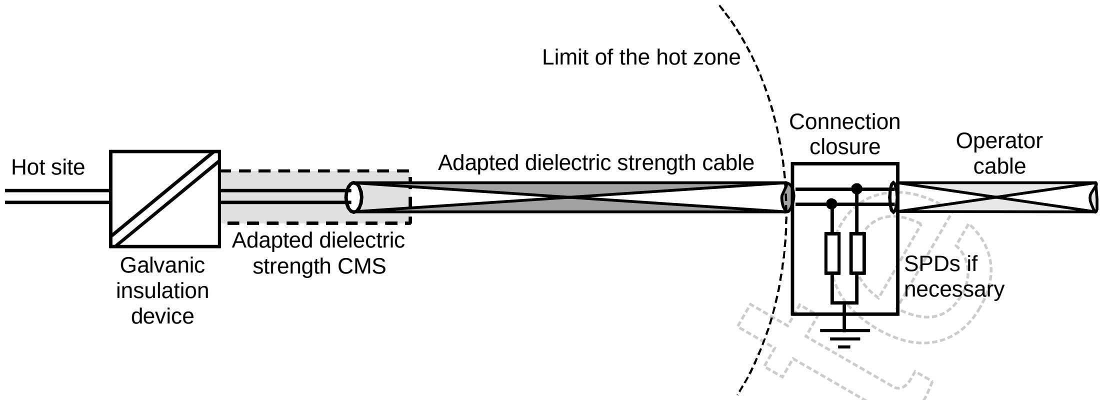


Figure 6 - Example of the use of a galvanic isolation device

Annex B gives examples of installation practices.

5.10 Information technology cabling interconnections between buildings

5.10.1 Buildings with the same earthing system

The requirements of EN 50174-2 shall apply.

5.10.2 Buildings with different or separate earthing systems

See EN 50310 for information.

For the purposes of this clause it has been assumed that for hazards caused by an EPR corrective actions have been implemented.

As a general guide, buildings in close proximity may have cable screens directly connected to earth. This is only possible where any circulating currents, due to potential differences between buildings, will not disturb or damage services.

If direct connection of the cable screen to the earth system provides an unacceptably high current see the HD 384 series for information.

Special requirements may need to be adopted for some particular environments (e.g. chemical industries where an earth free installation may be required). For this particular case, each installation needs a detailed study to fulfil all the safety and local regulations.

In the case of cable sharing (hybrid cables) to carry high voltage applications, very detailed labelling is needed for safety reasons.

The maximum distance for which two buildings can be connected is strictly related to the application and the type of cables. More information is given in EN 50173-1.

For fire and chemical hazard the requirements of EN 50174-2:2000, Clause 4, shall apply.

5.11 Pole sharing

5.11.1 General precautions

This clause deals with the use of low voltage distribution poles for lighting and for information technology services.

Poles used for HV mains power (> 1 000 V) as well as those supporting both HV and LV lines are not covered by this part of EN 50174.

An agreement shall be reached with the owner of the poles for joint use. Poles may be shared by more than one information technology system with the agreement of the owner.

Special care shall be taken with regard to safety and electromagnetic interference in cases where there are antennas on poles.

5.11.2 Hazards requirements

Personnel working on shared poles shall be made aware of safety rules or local regulations relating to the access of LV works.

See 5.4.3.

The information technology cable shall be insulated.

5.11.3 Pre-installation

It is necessary to verify that joint use of poles is allowed and to give special consideration to

a) the voltage in the mains power system,

b) the mechanical capacities of poles,

c) the requirements described in this 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 mains power system;

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

3) the reservation of the expected zone for a light fitting.

When installing a new earthing system for information technology cabling, the location of an existing earthing systems or any metallic parts should be checked to avoid galvanic coupling, see 6.10.

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

- mains power cabling,
- lighting,
- information technology cabling.

The use of mains poles for information technology cabling implies the installation of cables, support, stays or struts and closures (connection, protection, amplification, radio, etc.).

Except for stays or struts, all equipment shall present a voltage insulation of at least 4 kV 50 Hz for one minute.

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

Information technology cabling shall always be fixed below LV power cabling (including cables for mains networks, conductors and devices for lighting as well as their feeder cables).

Locations of any equipment or cables should allow the use of any approved access.

Closures and accessories shall be installed below the information technology cables.

In addition, the dimensions and locations of closures and accessories shall be agreed between the owner of the pole and the installer of the information technology cabling.

5.11.4 Distances

5.11.4.1 Height above the ground of information technology cabling

See 5.4.3.

5.11.4.2 Distances between systems

Two cases are considered.

5.11.4.2.1 Without existing or foreseen lighting

The information technology cabling shall be supported such that the minimum vertical distance at the pole between mains power and information technology cabling, is at least:

a) 1 m in cases where mains power conductors have no insulation (see Figure 7);

b) 0,50 m in cases of mains power in cables (insulated) (see Figure 7).

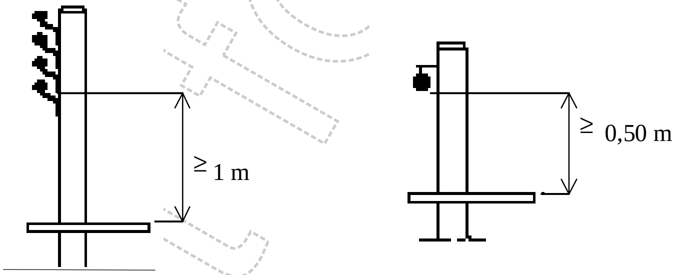


Figure 7 - Separation distances at the pole

Due to the sag, the minimum distance at any point along the line between information technology cables and the power cables (insulated) shall be at least 0,3 m.

5.11.4.2.2 Presence of a lighting system

If the pole has a lighting device, information technology cabling and equipment shall be installed at least 0,20 m below this device and away from its feeder cable (see Figure 8).

In addition, the information technology cabling shall be supported such that the minimum distance, at the pole, between mains and information technology cabling, is at least:

a) 1 m in cases where mains conductors have no insulation(see Figure 8);

b) 0,5 m for cables (insulated) (see Figure 8).

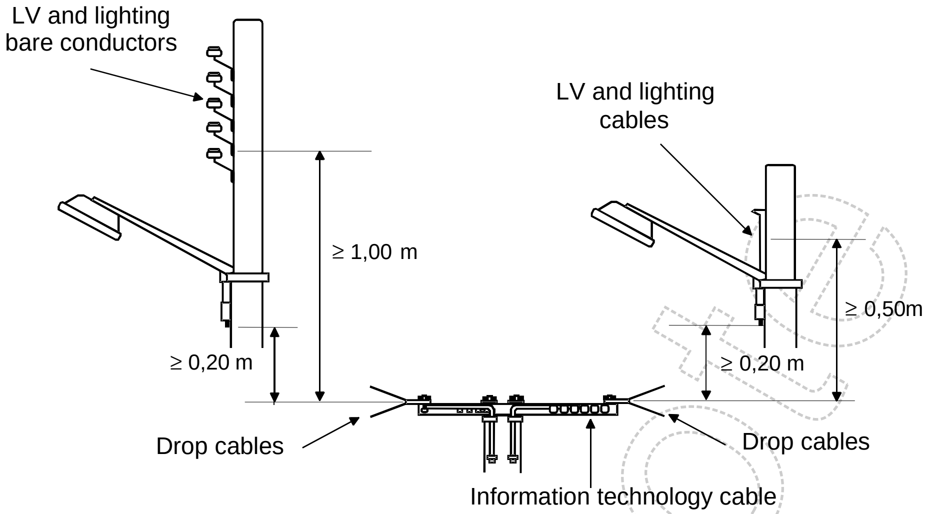


Figure 8 - Separation distance at the poles with lighting devices

5.11.4.3 Installation rules

On the same pole, the following shall be implemented:

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.

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 series IEC 61024, series IEC 61312 and IEC/TR 61662.

To reduce the risk of damage, the metallic element of cables shall be electrically continuous along the length of cable and metallic elements should be earthed at least at both ends of cable. The most common protection methods are

- use of all dielectric optical cables,
- use of shield conductor(s),
- use of surge protective devices.

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

6 Additional installation practice for metallic cabling

6.1 EMC-Considerations

The requirements of EN 50174-2 shall apply.

6.2 Balanced transmission

The requirements of EN 50174-2 shall apply.

6.3 Screening

The requirements of EN 50174-2 shall apply.

6.4 Mains and high voltage power distribution systems (above 1 000 V)

The protective measures for resistive, inductive or capacitive coupling to the power distribution system, can be made in the power distribution system, the information technology system or both as described in 5.9. If any measures have been made in the information technology cabling to prevent overvoltages exceeding the limit values, installers and service personnel need to have knowledge about these protected lines. This information should be a part of the documentation of the network. In addition accessible parts of the network should be marked with warnings. When work on the cable or associated plant is necessary it should be made safe either by earthing or isolation dependent on the protective measures inherent to the system. This is done to ensure the safety of personnel. Applicable national safety regulations shall be followed.

6.5 Protection against very low frequency fields

For detailed information see EN 50174-2:2000, 6.9.

6.6 Electrical isolation components

For more detailed information see EN 50174-2:2000, 6.10.

6.7 Surge protective devices

6.7.1 General

For detailed information see EN 50174-2:2000, 6.11.1.

6.7.2 Design guidelines

6.7.2.1 General

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 3);

c) the type of transmitted signals (AC, DC, data, high frequency, etc.) - the link requirements specified according to EN 50173 series shall not be altered beyond the limits set.

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.

See also ITU-T K.12 and ITU-T K.28 for information.

6.7.2.2 Protection of information technology cabling

Situations where protection may be required are as follows:

a) in areas with high lightning probability;

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

c) where not enough adequate protective measures have been provided in the outside information technology network.

Typical examples of protection for information technology cabling are given in Annex B.

6.7.3 Installation rules

Suppliers' installation instructions shall be complied with.

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.

Where surge protective devices are used to reduce high voltages appearing in information technology lines 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. See Annex B.

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. The protective devices fitted at the Main Distribution Frame and all subscribers terminals reduce the risk of damage to lines but their main function is to protect components having lower dielectric strength than the cables. See ITU-T K.20 and ITU-T K.21 for information.

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

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

In cases where the users power cabling is susceptible to surges, an isolation transformer may be installed which will reduce the peak value of the surge.

6.8 Protection against lightning

Lightning-induced voltage surges are often described as a 'secondary effect' of lightning; there are three recognised means by which these surges are induced in mains or information technology cables. For resistive, inductive and capacitive coupling see, for instance, IEC 61024-1, IEC 61312 (series), IEC 61662 (series), and EN 61663 (series), as appropriate.

6.9 Protection against electrostatic discharge (ESD)

For information see EN 50174-2.

6.10 Corrosion

The requirements of 6.14 of EN 50174-2:2000 shall apply.

Any surfaces associated with earthing, information technology cable terminating onto surge protective devices or systems which are in electrical contact and installed in an outside environment shall be protected from corrosion.

There are two techniques to achieve cathodic protection:

a) by the use of a reactive consumable anode made of metal such as magnesium, aluminium, zinc or zinc alloy;

b) or by connecting the metal to be protected to the negative pole of a low voltage DC generator and the positive pole to an anode made of steel, graphite, lead or titanium platinum. The goal is to cancel the corrosion current by a counter current.

For further information see also EN 60068-2 series dealing with corrosion tests, 5.14 of EN 50174-2:2000, ITU-T L.7 and ITU-T L.8.

Electrolytic and chemical danger may result, for instance, from marshy humus and chalky ground, from deposits of rubble and sewage and from soft water containing dissolved carbon dioxide.When they are to be laid in such environments, cables shall be equipped with an external, plastic sheath. Any protective tubes for cables shall be made from plastic material.

Cathodic protection shall be used for cables with an external plastic enclosure over the metal shell, since it has to be assumed that:

1) the plastic enclosure may be penetrated, for example, by atmospheric discharges or as a result of mechanical damage,

2) the metal sheath below may be corroded (pitting) at the exposed point.

If cables, which act as earth electrodes, are to be laid in aggressive ground then attention shall be paid to the provision of good protection against corrosion, e.g. by the use of an armouring made from heavily galvanised round steel wire.

Intersections between underground information technology cable lines and cathodically protected installations, which generate stray currents, shall be taken into consideration.

When laying information technology cables in the same trench as pipelines which will be cathodically protected, the information technology cable shall be included in the cathodic protection.

NOTE It may be advisable to include in the cathodic protection those information technology cables which do not act as earth electrodes, but which do have a conductive metal sheath beneath a plastic cover.

If the clearance between the information technology cable and the pipeline does not exceed 0,3 m, the information technology cable shall be fitted with an insulating outer sheath. No additional mechanical protection shall be provided due to the shadowing effect of the information technology cable on the cathodic protection. The clearance between the information technology cable and the pipeline shall be no less than twice the diameter of the information technology cable. Cables with aluminium sheathing which is subject to anodic and cathodic corrosion are unsuitable for use in areas which are cathodically protected or which carry stray currents.

6.11 Protection against radar emission and broadcast emitters

See EN 50174-2:2000, A.6.1 for information.

7 Additional installation practices for optical fibre cabling

7.1 General

This clause specifies additional requirements for an optical fibre cabling system (e.g., cable, connectors, splices, connecting and protective hardware). It supplements the requirements given in Clauses 4 and 5. It provides guidance to assist the user and installer with regard to the general aspects of the installation of optical fibre cables covered by the EN 60794 series of specifications. Additional information is available in Annex C of EN 60794-1-1:2002. Cables can contain multimode fibres, single mode fibres or a combination of these fibre types. For cables with different types of optical fibres, some means of segregating the fibres by type shall be employed. Additionally, it is recommended that spare capacity be included to support present and future applications.

Optical fibre cabling provides a high performance communications pathway whose characteristics can be degraded by incorrect installation.

Optical fibre cables generally have a strain limit rather lower than metallic conductor cables and in some circumstances, special care and arrangements may be needed to ensure successful installation.

It is important to pay particular attention to the cable manufacturer's recommendations and stated physical limitations, and not to exceed the given cable tensile load rating for a particular cable. Damage caused by overloading during installation may not be immediately apparent but can lead to failure later in its service life.

Recommended optical fibre test schedules are contained in Annex A of EN 50346:2002.

7.2 Pre-installation procedures

The optical fibre cable should be tested for compliance with its specification, in particular insertion loss, prior to installation. Installed (laid) optical fibre cable acceptance tests should be undertaken to avoid contractual disputes.

7.3 Optical fibre cable practices

Optical fibre cables are available in several designs with many jacketing options (see series EN 60794 for information). In many cases, a non-armoured cable is referred to as a duct cable. An all-dielectric cable has no metallic or conductive components such as a metallic central member, metallic strength member(s), armour or copper wires.

7.4 Final assembly of closures

Labels according to series EN 60825 should be applied adjacent to all accessible optical interfaces (see EN 50174-1 for information).

7.5 Termination practices

7.5.1 General

This subclause details the recommended practices that should be adopted by the installer during the jointing and termination of the installed optical fibre cable.

7.5.2 Splicing methods

Typical splicing methods include fusion and mechanical and are intended for use in a variety of environments such as in jointing chambers, overhead or in open trenches. Splicing may be used to join individual fibres or fibre ribbons.

7.5.3 Fusion splicing

Fusion splicing is a method of fusing two fibres together with an electric arc. Since the fibres are basically welded together, it is possible to get an environmentally stable optical fibre connection. For this reason, fusion splicing is recommended for optical fibre connections in the outside plant.

Fusion spliced joints are achieved by welding the core and cladding regions of the two optical fibre ends. The fusion splice should be protected by a suitable sleeve or splint.

The fusion splice is generally retained within the protective sleeve by either friction or adhesive bonds to the optical fibre. In some cases it is necessary to provide further strain relief for the completed joint.

7.5.4 Mechanical splicing

Mechanical spliced joints are achieved by the alignment of the two optical fibre ends within a protective sleeve. A typical mechanical splice incorporates a gripping mechanism to prevent fibre separation and a means for fibre alignment. Depending on the design, the mechanical splices may be reusable. Because the mechanical splices depend on a physical contact between two cleaved fibre ends, these splices may be more sensitive to large variations in temperature. Manufacturers' recommended instructions for protection and retention of the optical fibres should be observed.

7.6 Jointing/termination of optical fibres

7.6.1 General

The use of either fusion splicing or mechanical jointing techniques provides a permanent stable, low attenuation connection of optical fibres.

The performance of a splice is dependent upon the environmental conditions (e.g. humidity) as well as the capability of the technique, the workmanship applied to achieve the splice and the subsequent workmanship applied to protect the splice to ensure satisfactory operational lifetime.

Termination can be achieved by direct application of connectors to the installed optical fibre, e.g. gluing techniques, or splicing of a pre-manufactured pigtail to the optical fibre of the installed optical fibre cable or mechanical connection of a pre-manufactured pigtail to the optical fibre of the installed optical fibre cable.

Labelling of optical fibre installations should be such that the polarisation of duplex optical fibre connections is known and consistent throughout the installation.

During the direct application of connectors to the installed optical fibre, the recommended installation procedures shall be followed.

Optical fibre connectors are more susceptible than splices to temperature induced losses at extreme temperatures and are usually limited to temperature controlled environments.

Connectors applied to optical fibres should be subjected to visual inspection as defined in EN 50346.

7.6.2 Mechanical protection

Each fusion or mechanical splice shall be protected in a splice tray or similar protective device that will mount inside a closure or an enclosure. The tray shall be used to store and organise the fibres and splices, protect the fibres, and ensure the fibres comply with the minimum bend radius. Stripped optical fibre should be protected with a heat shrink cap or silicone adhesive to prevent exposure to moisture.

7.7 Optical fibre management

7.7.1 General

All splice joints and their strain relief mechanisms should be fixed within the optical fibre management system of the closure.

Splices shall be supported where there is risk of damage that could limit operational lifetime.

7.7.2 Fibre storage and organising housings

Fibre storage and organising housings typically involve fibre and fibre splice storage, as well as fibre distribution and fibre cross connection.

The following should be considered when selecting fibre storage and housings:

a) always follow the specific installation specification of the manufacturer for the minimum bend radii of the cable,

b) cable entry ports providing strain relief,

c) provisions for electrically bonding/grounding cables,

d) storage for excess fibre slack.

Splicing is used where higher performance connections are desired (lower insertion loss and lower back reflection). The enclosures house and organise groups of spliced fibres.

Splice module housings are used when directly splicing to the incoming fibres. Typically, these enclosures house and organise groups of fibres and accommodate splice trays, but have no patch panel capability.

7.7.3 Optical fibre splice closure

7.7.3.1 General

An optical fibre splice closure, and the associated hardware, are intended to restore the mechanical and environmental integrity of an optical fibre cable following a splicing operation. Splice closures are used to provide environmental protection for exposed cable cores (sheath removed) and exposed fibres. They are used to protect through splices (continuation of a run), branch splices or to splice "drop" fibres to nodes.

In addition, a splice closure provides the necessary facilities for organising and storing optical fibre and splices. Optical fibre closures shall be able to be re-entered and water resistant.

The expected operating environment for an optical fibre splice closure is between –40 °C and 70 °C. Within this temperature range, it is necessary for the closure not to experience any functional degradation that could affect its performance. In addition there are several extreme environmental and mechanical conditions to which a closure may be subjected in certain deployment configurations. These include flood water or chemical exposure, immersion in ice, and exposure to steam.

Outdoor closures may be installed in cabinets, jointing chambers, on poles and suspended from catenary wires. They shall be designed by calculating the number of splices, the amount and the density of the optical fibre and whether the cables are installed at one end or both ends of the splice closure. Optical fibre closures shall be capable of bonding and grounding cable screens and closures as required by applicable codes.

In the case of sealed closures, pressurisation tests shall be carried out. See EN 60794-1-2:1999, method F8, for information.

7.7.3.2 Installation requirements

Optical fibre splice closures shall be accessible to maintenance personnel and maintenance vehicles. A closure should be located away from high traffic or conditions that could cause damage to the closure or injury to personnel.

Cables with metallic or conductive components shall be bonded and earthed.

8 Additional installation practices for specific sites and services

8.1 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).

8.2 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 of EN 50174-2:2000.

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

8.3 Nuclear areas

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

The three main electromagnetic couplings are:

1) galvanic coupling due to return current by the soil (stray current) and particular attention should be given to corrosion effects, and EPR areas;
2) inductive coupling due to alternating currents (see also 4.3 and 6.8.3);
3) radiated coupling due to high voltage sources (electrostatic influence) and due to antennas for communication and surveillance services.

They produce

a) low frequency electric and magnetic fields in a wide zone,
b) low frequency harmonics (up to 9 kHz),
c) transients, flashover discharges (e.g. heavy current faults, switching voltage surges),
d) high frequency electric fields in a wide zone,
e) corona effect (due to very high voltage).

For mitigation techniques see EN 50174-2:2000, 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 A.

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

8.4 Explosive areas

Refer to explosive atmospheres standards EN 50014, EN 50019, EN 50020 and series EN 60079/IEC 60079.

8.5 Chemical manufacture /areas /plants

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 (refer for information to 6.10 and EN 50174-2:2000, 6.14).

In such environments, use of non-metallic cable management systems is often recommended. In this case refer for information to EN 50174-2:2000, 6.5 and 6.6.3.2. For closures, refer to EN 50174-2:2000, 5.8, for information.

The selection of cables, connectors, CMS and accessories shall be based upon the requirements of the relevant European product standards (national regulations are mandatory).

NOTE In this context controlled earth free installations are very common.

8.6 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 EN 50174-2:2000, 6.7.3.2, 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 EN 50174-2:2000, 6.7.3.2, for information). This, however, shall not apply in the case of direct current railway installations because of electrolytic corrosion. See 6.10.

8.7 Waterways, including rivers, canals, streams (natural or ducted / channelled etc.)

When information technology cables are to be in or under water, the regulations of the relevant authorities shall be complied with.

Only cables that are specifically designed or protected, by means of a protective cover can 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. The points where the information technology cables come ashore shall be marked.

Where underground information technology cable lines cross beneath waterways and other navigable waters the depth of the cable line and any necessary measures for the protection of the cable line and for the protection of shipping shall be agreed upon with the authorities responsible for waterways and shipping.

In the case of non-navigable waterways and channels, the landowners (e.g. local authorities) and where appropriate also the water authorities are responsible.

In the case of 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 lowest wires or aerial cables at maximum sag and the surface of the water at the highest navigable water level. Any measures, which should be implemented for the protection of shipping, should be ascertained from the authorities responsible for waterways and shipping. In the case of non-navigable waterways a minimum clearance of 5 m above the surface of the water will, as a general rule, be sufficient when the water is at its normal level.

In the case of 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.

8.8 Over-ground and underground railways

8.8.1 General

A railway is a complex installation with moving sources of electric and electromagnetic disturbances; the implementation of the EMC standards within information technology installations alone is not a guarantee of satisfactory performance. All cases shall be considered with respect to a formal plan to the management of EMC. This plan should be established early in the project.

8.8.2 Electric and electromagnetic environment

Refer for information to relevant railway applications standards (EN 50121 series).

Different sources of electromagnetic interference are produced in the vicinity of railway installations.

Electromagnetic coupling occurs in three main ways:

1) 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;
2) electrostatic influence due to high voltage sources;
3) induction phenomenon due to alternating currents (see also 4.3 and 6.8.3).

Direct current sources (600 V up to 3 000 V) and alternating current sources (16 2/3 Hz at 15 kV, 50 Hz at 25 kV or 2 x 25 kV) are used. They produce

a) low frequency electric and magnetic fields in a wide zone,
b) low frequency harmonics (up to 9 kHz),
c) transients, flashover discharge (e.g. short circuit catenary / rail, pantograph / catenary disconnection),
d) radio frequency (9 kHz to 400 GHz) fields from trains,
e) corona effect.

For mitigation techniques see EN 50174-2:2000, Annex A.

DC railway and traction systems using the earth as a part of the current return path may have earth leakage. Users of information technology cables and equipment adjacent or near to DC traction systems experiencing earth leaking problems shall seek expert advice.

8.8.3 Installation guidelines

8.8.3.1 Intersections of above-ground information technology cables with railway installations

The tracks shall be crossed at right angles.

The information technology cable shall not obstruct the visibility of signals and road crossings.

The functioning of technical equipment of railway installations shall not be impaired.

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.

In the case of standard gauge railways on which vehicles with a width of 3 150 mm run, the following clearances shall apply (excluding information technology systems for signalling and controlling of the rolling stock):

a) 6 m above the upper surface of the rails;

b) 3 m from the centre line of the track and horizontal to the track;

c) 1,2 m below the upper surface of the rails.

These areas shall not be occupied by any part of the information technology cable (e.g. even by anchors and stays). See Figure 9.

The minimum 6 m clearance shall be adhered to at maximum sag and under conditions of ice wind loading.

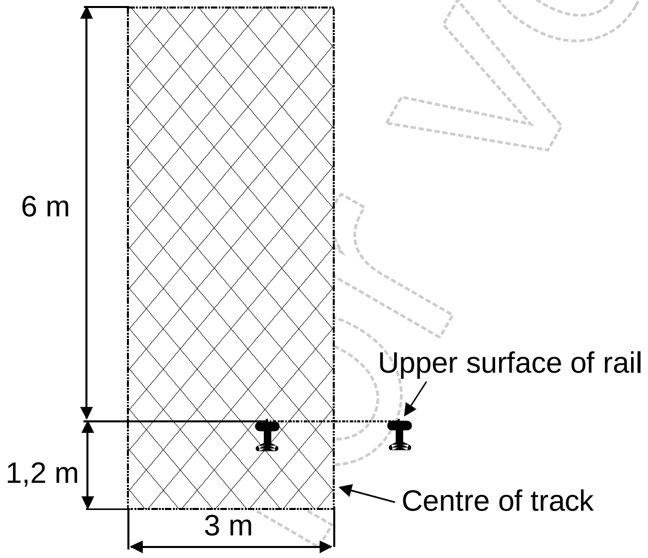


Figure 9 - Clearance not including components of information technology cabling for standard gauge railways

8.8.3.2 Close proximity to railways

Avoiding aerial crossing of railways is strongly recommended.

Information technology cables shall be provided with a high degree of resistance to fracture.

As a means of preventing danger resulting from a falling contact wire, in addition to the space specified in 8.8.3.1, 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 contact wire and extends horizontally by 4 m to either side of the centre line of the track (see Figure 10).

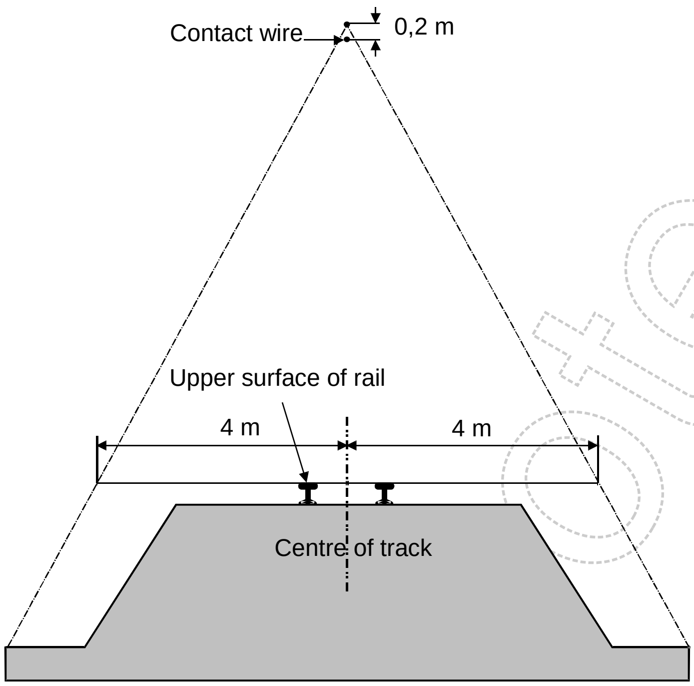


Figure 10 - Clearance not included components of information technology cabling for protection against falling contact wires

The vertical clearance between the aerial information technology cable and the earth contact wire shall be a minimum of 2 m.

Railways with alternating contact wire (type of pantograph) voltages above 1 kV or with direct contact wire voltages above 1,5 kV shall not be crossed by information technology cables. Exceptions to this requirement are information technology cables that have been laid alongside a power line, which crosses the contact wire.

The information technology equipment shall be protected against overvoltages caused by the contact line voltage being exceeded, e.g. by means of an overvoltage arrester or a protective transformer.

Information technology cables shall be positioned at a horizontal distance of at least 4 m from the centre line of the track where the alternating contact wire voltage exceeds 1 kV or where the direct contact wire voltage exceeds 1,5 kV.

In the case of crossings of railways, underground cables shall be laid inside protective ducts or conduits which 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.

In the case of electric railways, ducts or conduits shall be made of an insulating material.

8.8.3.3 Exceptions

Exempted from the above are information technology cables which lead to signalling and points installations which are used for the operation of the railway. These installations shall be planned and carried out by experts approved by the railway authorities.

Annex A
(informative)

Earth potential rise (EPR)

A.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 Re), the voltage decrease V outside the equipotential area is given by equation A.1:

$$V = \rho \times I_f / 2\pi \times d \quad \text{(A.1)}$$

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 A.1).

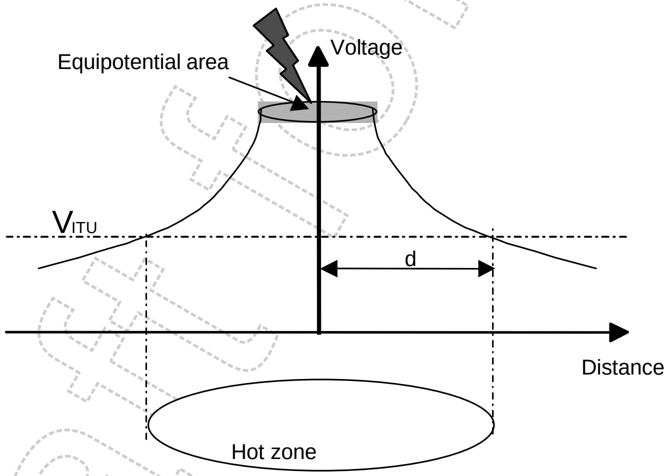


Figure A.1 - Definition of hot zone

A.2 Limit of the hot zone

A.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 equation A.2 :

$$d = \rho \times I_f / 2\pi \times V_{ITU} \quad \text{(A.2)}$$

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.53 for a typical situation

For a more precise calculation of the limit of the hot zone see ITU-T K.33.

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 A.2.2 and A.2.3.

A.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 A.1 (see Table A.1 of EN 50352).

Table A.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 ($I_f > 1000$ 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

A.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 A.2 (ρ in Ωm gives the distances d in m).

Table A.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
$t \le 0,2$	ρ/2	ρ	1,5ρ
$0,2 < t \le 0,35$	2ρ/3	4ρ/3	2ρ
$0,35 < t \le 0,5$	5ρ/6	5ρ/3	2,5ρ
$0,5 < t \le 1$	5ρ/4	2,5ρ	4ρ

Annex B
(informative)

Typical examples of protection for information technology cabling

B.1 At the point of taking over interface (port) between inside and outside building information technology cabling.

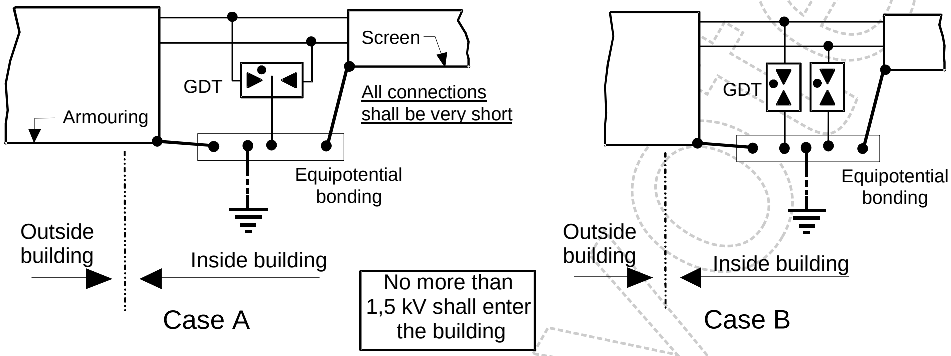
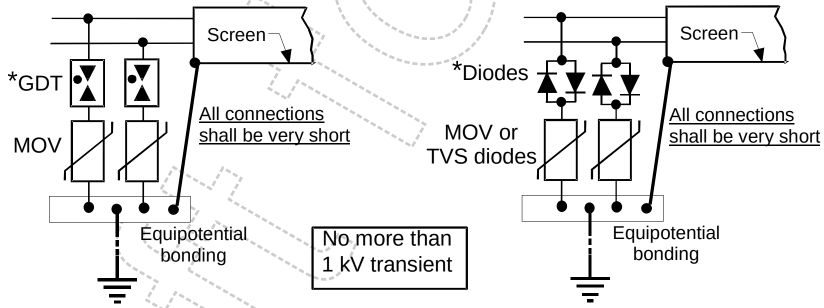


Figure B.1 - Example of connection between inside and outside building

The use of a 3-electrode arrester (case A) is a better choice, because the unbalanced breakdown is minimised.

B.2 At the distributor



* These devices are necessary to reduce the parallel capacity of the MOV's. Diodes shall have low stray capacitance.

Figure B.2 - Example at main frame distributor

B.3 At other locations

B.3.1 Example 1: In non-equipotential zones

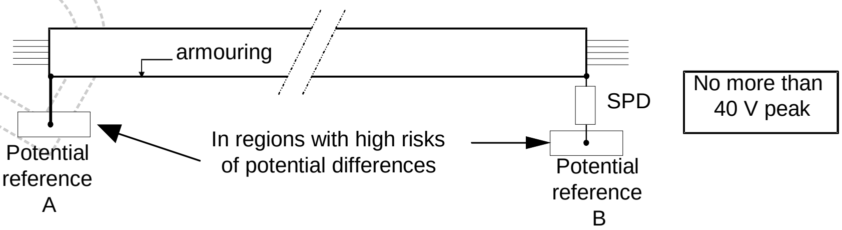


Figure B.3 - Example of non-equipotential zones

NOTE SPD devices should be, according to case, GDT, GDT + MOV, diodes + MOV.

B.3.2 Example 2: ERP hot zone

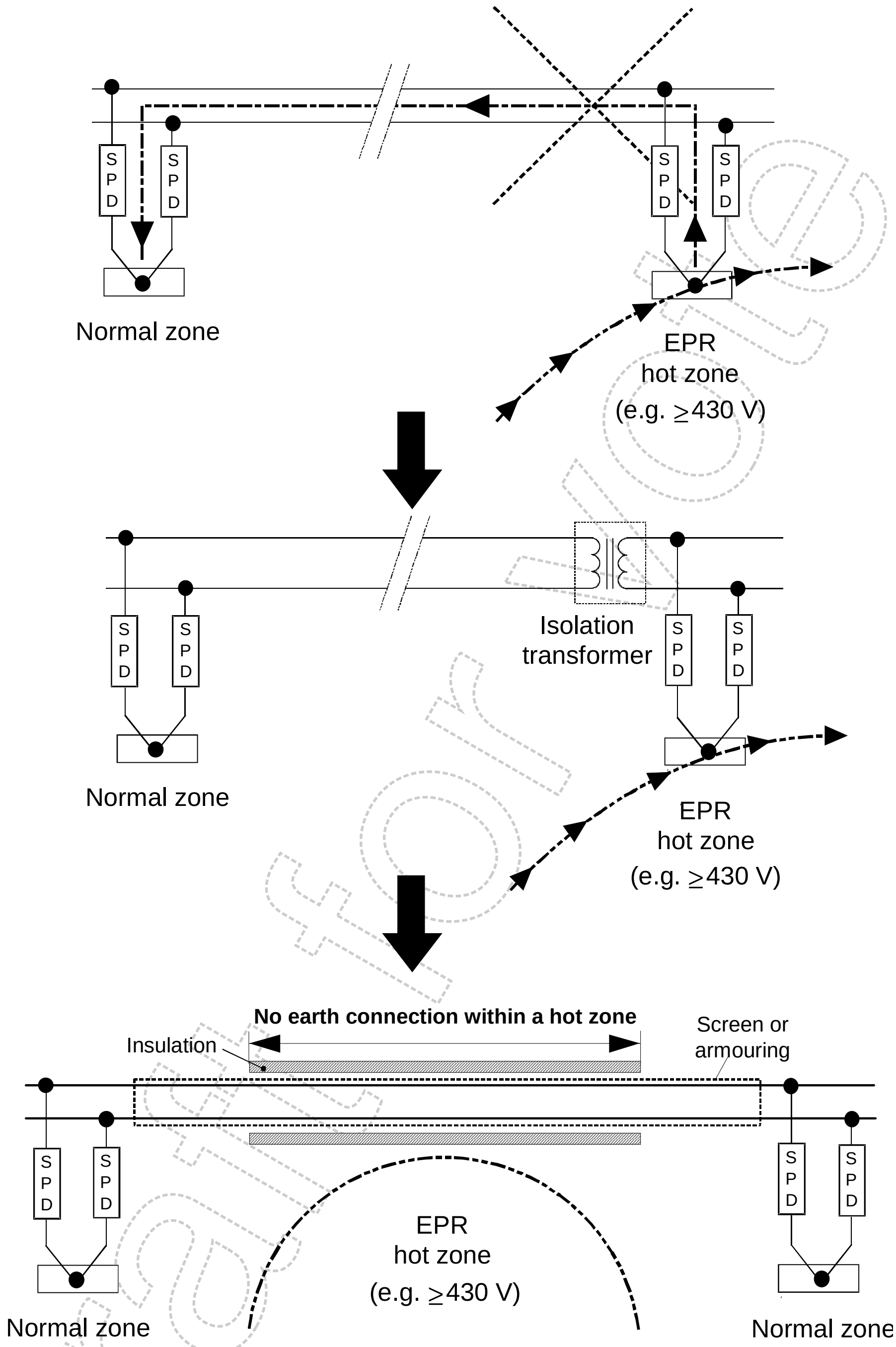


Figure B.4 - Example of a hot zone

NOTE SPD devices should be, according to case, GDT, GDT + MOV, diodes + MOV.

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