



BSI Standards Publication

Information technology – Cabling installation

Part 2: Installation planning and practices inside buildings

National foreword

This British Standard is the UK implementation of EN 50174-2:2018. It supersedes BS EN 50174-2:2009+A2:2014, which is withdrawn.

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

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

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English Version

Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings

Technologies de l'information - Installation de câblages -
Partie 2 : Planification et pratiques d'installation à l'intérieur
des bâtiments

Informationstechnik - Installation von
Kommunikationsverkabelung - Teil 2: Installationsplanung
und Installationspraktiken in Gebäuden

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European foreword

This document (EN 50174-2:2018) has been prepared by Technical Committee CLC/TC 215, "Electrotechnical aspects of telecommunication equipment".

The following dates are fixed:

- latest date by which this document has to be (dop) 2019-05-21
implemented at national level by publication of
an identical national standard or by
endorsement
- latest date by which the national standards (dow) 2021-05-21
conflicting with this document have to be
withdrawn

This document supersedes EN 50174-2:2009, EN 50174-2:2009/A1:2011 and EN 50174-2:2009/A2:2014.

EN 50174 comprises three parts. All three parts support the specification, implementation and operation of information technology cabling. There are specific requirements for cabling systems that are in accordance with the design requirements of the EN 50173 series. However, the three parts also apply to cabling systems of any design including those in accordance with standards such as EN 50700.

This part, EN 50174-2, is concerned with the planning and installation of information technology cabling using metallic cabling and optical fibre cabling inside buildings. It provides guidance as to the responsibilities of those involved and is intended to be referenced in relevant contracts.

It does not cover those aspects of installation associated with the transmission of signals in free space between transmitters, receivers or their associated antenna systems (e.g. wireless, radio, microwave or satellite).

This edition of EN 50174-2:

- a) revises requirements of Clause 4 and Clause 5, respectively, regarding closures, cables, the stacking height of pathway systems, surge protective devices;
- b) introduces a new subclause 4.11 and Annex C on planning and assessment of cabling in support of remote powering objectives;
- c) amends requirements in Clause 6 on segregation;
- d) modifies Clause 7 on electricity distribution systems and lightning protection;
- e) introduces minor changes to Clauses 8, 9, 10, 11;
- f) removes the previous Annex A;
- g) introduces Clause 12 on cabling for distributed services cabling within buildings, Clause 13 on common infrastructures within multi-tenant buildings, Annex B installation conditions and Annex D on equipment accommodation environments.

Introduction

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

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

- a) design;
- b) specification – the detailed requirement for the cabling, including the planning of its accommodation and associated building services addressing specific environments (e.g. electromagnetic) together with the quality assurance requirements to be applied;
- c) installation – in accordance with the requirements of the specification;
- d) operation – the management of connectivity and the maintenance of transmission performance during the life of the cabling.

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

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

- installation specification, quality assurance procedures and documentation;
- documentation and administration;
- operation and maintenance.

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

This European Standard is also relevant to:

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

This part, EN 50174-2, contains requirements and recommendations relating to the installation planning and practices by defining:

- i) planning strategy (road map) and guidance depending on the application, electromagnetic environment, building infrastructure and facilities, etc.;
- ii) planning and installation requirements for metallic and optical fibre information technology cabling depending on the application, electromagnetic environment, building infrastructure and facilities, etc.;
- iii) the practices and procedures to be adopted to ensure that the cabling is installed in accordance with the specification.

In addition, this document describes the methodology for the assessment of spaces, pathways (and pathway systems) and cabling (either installed or planned) in support of remote powering objectives.

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

- 1) this and other parts of the EN 50174 series;
- 2) generic cabling design (EN 50173 series);
- 3) application dependent cabling design (e.g. EN 50700);
- 4) bonding requirements (EN 50310).

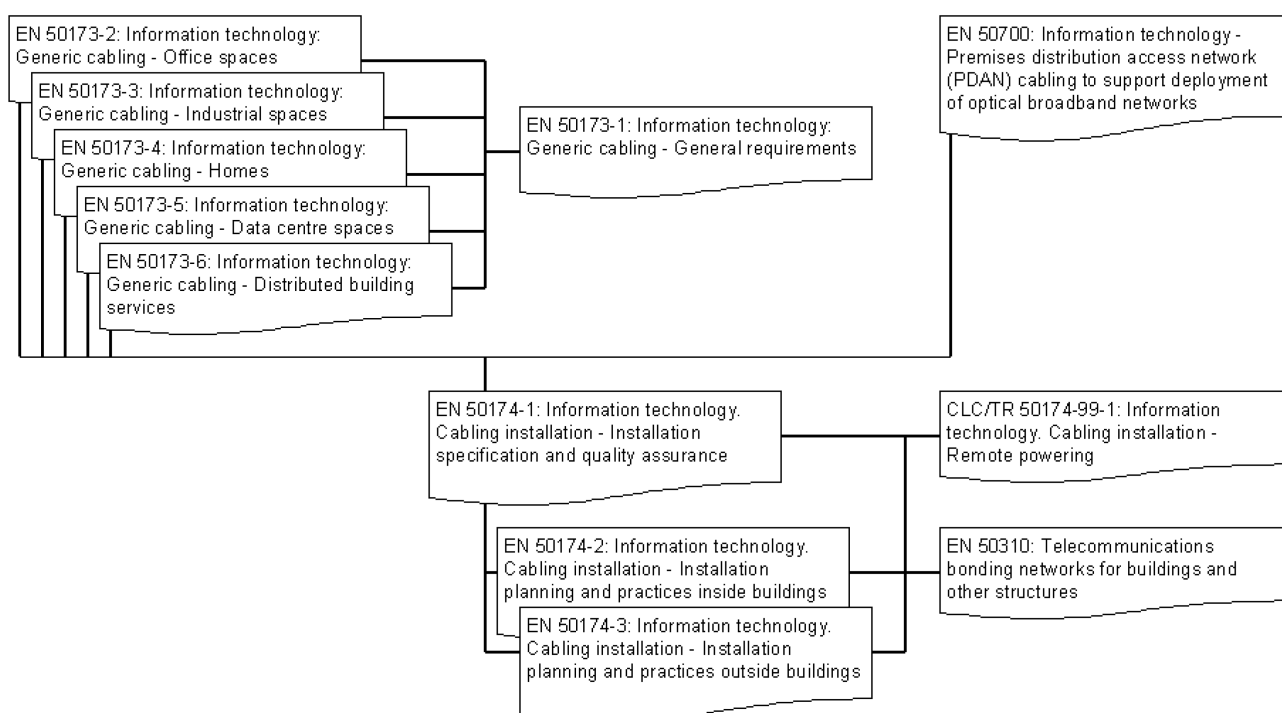


Figure 1 — Schematic relationship between the EN 50174 series and other relevant standards

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

Building design phase	Generic cabling design phase	Specification phase	Installation phase	Operation phase
EN 50310	EN 50173-2	EN 50174-1	EN 50174-2 EN 50174-3 EN 50310	EN 50174-1
	EN 50173-3	Planning phase		
	EN 50173-4 EN 50173-5 EN 50173-6 (these ENs reference general requirements of EN 50173-1)	EN 50174-2 EN 50174-3 EN 50310		

1 Scope and conformance

1.1 Scope

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

- a) planning;
- b) installation practice.

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

NOTE Planning and installation of certain types of application-specific cabling can be supplemented by other standards e.g. EN 50491-6-1 for Home Building Electronics System (HBES) and Building Automation and Control Systems (BACS).

The requirements of Clauses 4, 5 and 6 of this standard are premises-independent unless amended by the requirements of premises-specific clauses.

This European Standard:

- 1) details the considerations for satisfactory installation and operation of information technology cabling;
- 2) describes the methodology for the assessment of spaces, pathways (and pathway systems) and cabling (either installed or planned) in support of remote powering objectives;
- 3) excludes specific requirements applicable to other cabling systems (e.g. power supply cabling); however, it takes account of the effects other cabling systems have on the installation of information technology cabling (and vice versa) and gives general advice;
- 4) excludes those aspects of installation associated with the transmission of signals in free space between transmitters, receivers or their associated antenna systems.

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

1.2 Conformance

For a cabling installation to conform to this European Standard:

- a) the planning of the installation shall meet the requirements of Clause 4;
- b) the installation practices shall meet the requirements of Clause 5;
- c) the additional requirements of the applicable premises-specific clause shall be met;
- d) the bonding system within the premises shall be in accordance with EN 50310;
- e) where a lightning protection system is required, it shall conform to the "integrated lightning protection system" according to EN 62305-4;
- f) other lightning protection systems, including the "isolated lightning protection system" according to EN 62305-3 are allowed provided that specific restrictions are applied both to the implementation of the information technology cabling and the requirements of EN 50310 as agreed between the planners of the lightning protection system and the information technology cabling;
- g) local regulations shall be met.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13501-6, *Fire classification of construction products and building elements – Part 6: Classification using data from reaction to fire tests on electric cables*

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

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

EN 50173-1:2018, *Information technology – Generic cabling systems – Part 1: General requirements*

EN 50173-2, *Information technology – Generic cabling systems – Part 2: Office spaces*

EN 50173-3:2018, *Information technology – Generic cabling systems – Part 3: Industrial spaces*

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

EN 50173-5, *Information technology – Generic cabling systems – Part 5: Data centre spaces*

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

EN 50174-1:2018, *Information technology – Cabling installation – Part 1: Installation specification and quality assurance*

EN 50174-3, *Information technology – Cabling installation – Part 3: Installation planning and practices outside buildings*

EN 50288 (all parts), *Multi-element metallic cables used in analogue and digital communication and control*

EN 50310, *Telecommunications bonding networks for buildings and other structures*

EN 50491 (all parts), *General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)*

EN 50491-6-1:2014, *General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 6-1: HBES installations – Installation and planning*

EN 50600-2-4, *Information technology – Data centre facilities and infrastructures – Part 2-4: Telecommunications cabling infrastructure*

EN 50600-2-5, *Information technology – Data centre facilities and infrastructures – Part 2-5: Security systems*

EN 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements (IEC 60079-0:2004)*

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

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

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

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

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

EN 61000-6, *(all parts), Electromagnetic compatibility (EMC) – Part 6: Generic standards (IEC 61000-6 (all parts))*

EN 61300-3-35, *Fibre optic connecting devices and passive components - Basic test and measurements procedures. Examinations and measurements – Fibre optic connector endface visual and automated inspection*

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

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

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

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

EN 61558-1, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests (IEC 61558-1)*

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

EN 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles (IEC 61784-1)*

EN 61784-2, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for realtime networks based on ISO/IEC 8802-3 (IEC 61784-2)*

EN 61784-3, *Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions (IEC 61784-3)*

EN 61784-3-1, *Industrial communication networks – Profiles – Part 3-1: Functional safety fieldbuses - Additional specifications for CPF 1 (IEC 61784-3-1)*

EN 61784-5, *Industrial communication networks – Profiles (IEC 61784-5 series)*

EN 61918, *Industrial communication networks – Installation of communication networks in industrial premises (IEC 61918)*

EN 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures (IEC 62305-4)*

EN 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements (IEC 62368-1:2014)*

EN 62368-3, *Audio/video, information and communication technology equipment – Safety – Part 3: DC power transfer through information technology communication cabling (IEC 62368-3)*

EN 62949, *Particular safety requirements for equipment to be connected to information and communication networks (IEC 62949)*

HD 60364 *(all parts), Low-voltage electrical installations (IEC 60364 series, modified)*

HD 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions* (IEC 60364-1, modified)

HD 60364-4-41:2017, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock* (IEC 60364-4-41:2005, modified + A1:2017, modified)

HD 60364-4-443, *Electrical installations of buildings – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances – Clause 443: Protection against overvoltages of atmospheric origin or due to switching* (IEC 60364-4-44 (Clause 443), modified)

HD 60364-5 (all parts), *Electrical installation of buildings – Part 5: Selection and erection of electrical equipment* (IEC 60364-5 (all parts), modified)

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50174-1, EN 50310 and the following apply.

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

closed pathway system

cable management system which does not allow installation of cables by laying without tensile load

3.1.2

co-hosting data centre

data centre in which multiple customers are provided with access to network(s), servers and storage equipment on which they operate their own services/applications

Note 1 to entry: Both the information technology equipment and the support infrastructure of the building are provided as a service by the data centre operator.

3.1.3

co-location data centre

data centre in which multiple customers locate their own network(s), servers and storage equipment

Note 1 to entry: The support infrastructure of the building (such as power distribution and environmental control) is provided as a service by the data centre operator.

3.1.4

data centre

structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and

environmental control together with the necessary levels of resilience and security required to provide the desired service availability

Note 1 to entry: A structure can consist of multiple buildings and/or spaces with specific functions to support the primary function.

Note 2 to entry: The boundaries of the structure or space considered the data centre which includes the information and communication technology equipment and supporting environmental controls can be defined within a larger structure or building.

[SOURCE: EN 50600-1:2012, 3.1.9 – modified: added Note 2 to entry; CLC/TR 50600-99-1:2017, 3.1.10]

3.1.5

distribution space

space within a home that corresponds to the installation space IS4 or IS5 of EN 50491-6-1 and that can house a home distributor (secondary home distributor) of EN 50173-4 or a service distributor of EN 50173-6 together with associated equipment

3.1.6

earth electrode

conductive part, which can be embedded in the soil or in a specific conductive medium, e.g. concrete or coke, in electric contact with earth

[SOURCE: IEC 60050-826:2004, 826-13-05; IEC 60050-195:1998, 195-02-01, modified]

3.1.7

earthing conductor

conductor which provides a conductive path, or part of the conductive path, between a given point in a system or in an installation or in equipment and an earth electrode or an earth-electrode network

[SOURCE: IEC 60050-826:2004, 826-13-12; IEC 60050-195:1998, 195-02-03, modified]

3.1.8

enterprise data centre

data centre that is operated by an enterprise which has the sole purpose of the delivery and management of services to its employees and customers

3.1.9

equipment connection space

space within a home that corresponds to the installation space IS6 of EN 50491-6-1 and that can house the outlets (TO, BO) of EN 50173-4 together with attached equipment

3.1.10

extraneous-conductive-part

conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth

[SOURCE: IEC 60050-826:2004, 826-12-11 ; IEC 60050-195:1998, 195-06-11]

3.1.11

hand hole

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

3.1.12

high-voltage

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

3.1.13

home entrance

space at the boundary of a home that can house the interface(s) between the home networks and external networks provided to the home and that demarcate the administration and maintenance of the two networks

3.1.14

junction box

space within a home that corresponds to the installation space IS5 of EN 50491-6-1 and housing a closure, typically in accordance with the EN 60670 series, designed to allow cables to be routed between pathway systems

3.1.15

maintenance hole (telecommunications)

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

3.1.16

metallic information technology cable/cabling

cables (cabling) utilising metallic conductors for signal transmission

3.1.17

multi-tenant building

building which is designed to accommodate more than one tenant each of which has their own tenant entrance facility but share building entrance facilities (BEF) and associated distribution spaces

3.1.18

network operator data centre

data centre that has the primary purpose of the delivery and management of broadband services to the operators' customers

3.1.19

open pathway system

pathway system which allows installation of cables by laying without tensile load

3.1.20

openable pathway system

cable management system which restricts access to installed cables but which can be opened to allow installation of cables by laying without tensile load

3.1.21

parallel earthing conductor

conductor that is parallel to the power supply cable or information technology cable

Note 1 to entry: The term parallel earthing conductor is in common usage but for the purposes of this document it generally acts as a bonding conductor.

3.1.22

PEN conductor

conductor combining the functions of both a protective earthing conductor and a neutral conductor

[SOURCE: IEC 60050-826:2004, 826-13-25; IEC 60050-195:1998, 195-02-12]

3.1.23

primary building distribution space

space accommodating the main point of distribution of any common cabling infrastructure within multi-tenant buildings

3.1.24**protective (earth) conductor**

conductor provided for purposes of safety, for example protection against electric shock

[SOURCE: IEC 60050-826:2004, 826-13-22; IEC 60050-195:1998, 195-02-09]

3.1.25**secondary building distribution space**

space accommodating optional points of distribution, additional to the main point of distribution, of any common cabling infrastructure within multi-tenant buildings

3.1.26**segregation**

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

3.1.27**semi-detached house**

residence of a single family within a building containing two single-family houses where access to external service provision is shared

3.1.28**single-family house**

residence of a single family within which access to the home entrance space is limited to dweller of the house

3.1.29**surge protective device**

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

Note 1 to entry: The device contains at least one nonlinear component.

3.1.30**tenant entrance facility**

facility that provides all necessary mechanical and electrical services for the entry of telecommunications cables into a tenants space and which can allow for transition from external to internal cable

3.2 Abbreviations

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

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

AC	alternating current
BACS	Building Automation and Control Systems
CATV	cabled distribution television
CSA	cross-sectional area
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ffs	for further study
HBES	Home and Building Electronic System

HE	Home Entrance
N	neutral conductor
PE	protective (earth) conductor
PEC	parallel earthing conductor
PEN	conductor combining the functions of both a protective conductor and a neutral conductor
PHD	Primary Home Distributor
SELV	safety extra-low voltage
SHD	Secondary Home Distributor
SPD	surge protective device
TCL	transverse conversion loss
TNV	telecommunication network voltage
UPS	Uninterruptible Power Supply

4 Requirements for planning installations of information technology cabling

4.1 Safety

4.1.1 Personnel

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

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

4.1.2 Low voltage power supply cabling

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

4.1.3 Optical fibre cabling

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

4.1.4 Transmission and terminal equipment

Telecommunications cabling shall be connected to equipment that incorporates safe signal circuitry complying with ES1 or ES2 requirements of EN 62368-1 and EN 62949.

NOTE Also covered by SELV or TNV requirements of the IEC 60950 series (pending its withdrawal).

Where equipment circuits provide direct current (DC) power transfer over the information technology cabling it shall comply with EN 62368-3.

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

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

4.1.5 Closures

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

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

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

- a) a barrier (either conducting or non-conducting) shall be present between the two cable types which shall meet a minimum of IP20 as specified in EN 60529;
- b) covers on the closure shall allow separate access to the information technology cabling and the power supply cabling and shall be retained such that the use of a tool is necessary to gain access thereby preventing inadvertent connection between the power supply and the information technology cabling;
- c) the entry for the information technology cables shall be separately removable.

4.1.6 Cables

4.1.6.1 Chemical hazard

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

4.1.6.2 Cables containing flammable materials

4.1.6.2.1 General

The “reaction to fire” performance of cables (other than those within cords and jumpers) within buildings and other structures is designated by a EuroClass (see EN 50174-1:2018, Annex G). The minimum EuroClass to be selected can be specified in national or local regulation or standards and can depend upon the type, size or purpose of the building or location within the building.

4.1.6.2.2 Cables within buildings and other structures

Information technology cables installed in the spaces bounded by the external fire barriers of buildings and other structures inside buildings that do not meet the requirements of:

- a) national or local fire regulations;
- b) the requirements of EuroClass E_{ca} of EN 13501-6 or the recommended performance requirements of EN 60332-1-2;

shall be installed within a cable management system that is considered as a fire barrier in accordance with local fire regulations.

4.1.6.2.3 External cables entering buildings

Upon entering buildings, information technology cables that do not meet the requirements of:

- a) national or local fire regulations;
- b) the requirements of EuroClass E_{ca} of EN 13501-6 or the recommended performance requirements of EN 60332-1-2;

shall be either be:

α) terminated in an entrance facility which is outside the external fire barrier of the building;

or

β) terminated inside the building, within 2 m (unless an alternative distance is specified by local regulations) of the point of internal penetration of the external fire barrier or any length exceeding 2 m is installed within a cable management system that is considered as a fire barrier in accordance with local fire regulations.

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

4.1.7 Termination points

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

4.2 Documentation

4.2.1 Requirements

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

4.2.2 Recommendations

The identifier scheme for cabinets, frames and racks should use a grid co-ordinate system based on the access floor grid or, where no access floor exists, a grid created by aisles and cabinets, frames and racks.

4.3 Pathways

4.3.1 Requirements

4.3.1.1 Cable segregation

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

4.3.1.2 Cable separation

Separation of cable bundles within pathways (and pathway systems) shall be adequate to support any remote powering objectives defined in the installation specification of EN 50174-1:2018, 4.11 provides details of appropriate assessments.

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

4.3.1.3 Protection of installed cabling

Cable pathways shall provide protection to the installed cabling except in zones where the cabling can neither be damaged nor have its transmission properties adversely affected (e.g. rising zones, connecting ducts, equipment rooms).

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

NOTE This protrusion aids in preventing poured concrete and other constructions debris from entering the pathway during construction, protects cabling from mechanical damage and protects cabling and fire-stop materials from water and other liquid spills.

4.3.1.4 Access floors

The area of the access floor tile opening shall be at least twice the cross-sectional area of the cables to be installed when the cabinets or frames are at full capacity.

4.3.2 Recommendations

4.3.2.1 General

Consideration should be given to providing protection against failure in one or more parts of the cabling infrastructure by implementing:

- a) multiple areas of distribution with appropriate fire compartmentation with areas served by different power supply distribution units, and be served by different environmental control equipment;
- b) multiple pathways between each area of distribution ensuring that maximum channel lengths are not exceeded.

The location of aisles separating rows of cabinets, frames or racks should be co-ordinated with lighting and fire protection plans:

- c) lighting should be placed above aisles and not above cabinets, frames, racks and overhead pathways;
- d) pathways should not be located where they interfere with the intended operation of fire suppression systems such as water distribution from sprinkler heads.

Pathways should not block airflow to or from environmental control equipment.

Pathways should not restrict access to other building infrastructures that require periodic maintenance e.g. valves, electrical receptacles and smoke detectors. Under-floor pathways should not be located above such equipment unless there is an accessible row of tiles adjacent to these pathways.

Cabling less than 2,7 m above the finished floor should be installed in secure pathway systems (such as duct, trunking or conduit) or apply alternate means to prevent accidental and/or intentional damage to the installed cabling.

Any maintenance holes, hand-holes and drawboxes in unsecured areas should be locked (requiring keys or tools for access) and monitored by a security system using a camera, remote alarm or both.

4.3.2.2 Access floors

Access floor tile openings for cabinets should be placed under the intended location of the cabinets or in locations where the opening will not create a tripping hazard.

Access floor tile openings should:

- a) be no larger than required and should use gaskets, brushes, or other method to minimize loss of under-floor pressure;
- b) have edging or grommets along all cut edges that does not interfere with placement of frames and cabinets;
- c) the edging or grommets should not be placed where cabinets, frames or racks are intended to be in contact with the surface of the access floor.

If the floor opening uses grommets or brushes, the size of the opening should accommodate the support mechanisms for the grommets and brushes.

Access floor tile openings for frames should be placed either under the vertical cable managers between the frames or under the frame (at the opening between the bottom angles). Generally, placing the opening under the vertical cable managers is preferable as it allows equipment to be located at the bottom of the frame.

4.4 Pathway systems

4.4.1 Requirements

4.4.1.1 Loads

The weight of fully loaded pathway systems shall be evaluated and co-ordinated with:

- a) the structural engineer if the pathway systems are to be supported from overhead structures (the structures shall have a minimum hanging capacity of 1,2 kPa);
- b) the access floor system designer if the pathway systems are to be supported by an access floor system.

4.4.1.2 Minimum bend radius

Pathways, entry points to the pathways and the pathway systems selected shall ensure cables are able to be installed and, where appropriate, fixed in accordance with the applicable minimum bend radius (during installation, during operation – static and during operation – dynamic).

This may be achieved by the use of pre-fabricated curved corners, drop-outs, radius limiters or other means as shown in Figure 2.

The techniques employed shall:

- a) be designed to maintain the relevant minimum bend radius of the cable(s) to be installed; where either multiple cable types are involved or cables have multiple bend radius specifications (e.g. cable bundles, so-called shotgun cables or cables with dedicated/catenary wires attached), the largest minimum bend radius shall apply;
- b) not introduce deformation of the cable sheath;
- c) not apply compressive loads exceeding that specified for the cable.

Minimum bend radius is specified by manufacturers' instructions. If instructions do not exist the minimum bend radius shall be the greater of either 50 mm or:

- 1) $4 \times$ the cable diameter for 4-pair balanced cables in accordance with EN 50288 series;
- 2) $8 \times$ the cable diameter for other metallic information technology cables;
- 3) $10 \times$ the cable diameter for optical fibre cables;
- 4) $10 \times$ the cable diameter for coaxial cables.

NOTE 1 Pathway systems that do not allow such an approach can restrict the type and use of cables installed in the pathways and cable management systems selected.

NOTE 2 The above minimum bend radii only apply to cables without constructional components providing atypical mechanical or environmental performance.

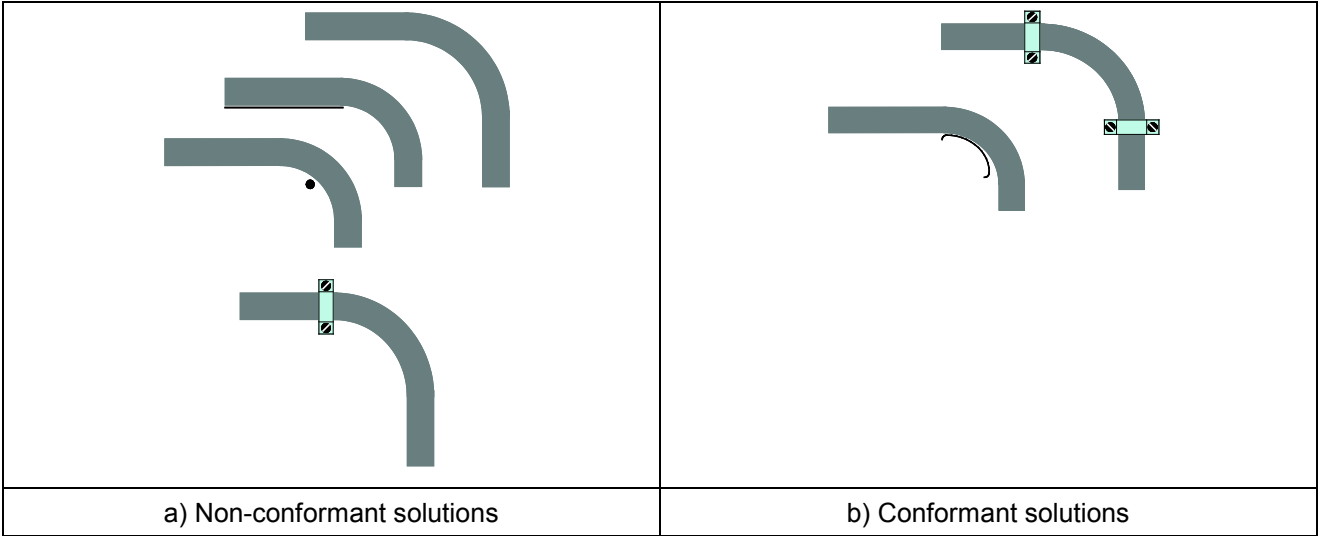


Figure 2 — Examples of non-conformant and conformant bend limiting techniques

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

4.4.1.3 Stacking height

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

- 1) for pathway systems that provide continuous support (e.g. trays), the stacking height shall not exceed 150 mm;
- 2) for pathway systems that provide non-continuous support (e.g. basket, ladder or hooks):
 - the maximum distance allowed between supporting elements of the pathway system is 1 500 mm;
 - the maximum stacking height shall be calculated according to Formula (1) (the integer values shown in Table 2 are calculated using the formula and are for information only).

$$h = \frac{150}{1 + 0,002 \times l} \tag{1}$$

where

- h is the maximum stacking height (mm);
- l is the distance between points of support (mm).

Table 2 — Stacking height for typical distances l

l mm	h mm
0	150
100	125
150	115
250	100
500	75
750	60
1 000	50
1 500	37,5
NOTE The requirement for h is based on cables with a crush resistance of at least 5 000 N/m.	

4.4.2 Recommendations

4.4.2.1 Loads

Planning of overhead pathway systems for information technology cabling should be co-ordinated with architects, mechanical engineers and electrical engineers that are designing lighting, plumbing, air ducts, power supply and fire protection systems.

Overhead pathway systems may be stacked to provide additional capacity.

Overhead pathway systems should be suspended from overhead structures where increased operational flexibility is required to:

- a) support the use of cabinets, frames and racks of various heights;
- b) add and/or remove cabinets, frames and racks.

If pathway systems are to be suspended from overhead structures, the structures should have a minimum hanging capacity of 2,4 kPa. If applied, this capacity shall be communicated to, and coordinated with, the structural engineer.

Overhead pathway systems may be attached to the tops of cabinets, frames and racks where the cabinets, frames or racks are of uniform height and are capable of supporting the additional loads of the cable management systems and the installed cables.

Overhead pathway systems should not be placed directly below fire extinguishing systems.

Access floor systems, also known as raised floor systems, should be used for cabinets, frames or racks that are to be cabled from below.

The routing of underfloor pathway systems should be co-ordinated with other underfloor infrastructures during the planning stages of the building.

Information technology cabling under an access floor should be installed in pathway systems that do not block airflow, where the under floor space form part of a ventilation or cooling system.

4.4.2.2 Fill

The size and quantity of all pathway systems should take into account the volume of cables to be contained at maximum planned utilisation. Particular attention is required for adequate capacity of pathways at intersections.

Separate pathway systems should be installed to segregate cabling that is permanently installed from that which is less permanent such as equipment cords and patch cords.

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

Within pathway systems the useable cross-sectional area shall take the following into account:

- a) for open or openable pathway systems and cable management systems (e.g. tray or basket), cables are not installed above the sidewalls;

NOTE Electromagnetic screening performance of the selected cable management system might require modified criteria (see Clause 6).

- b) bends in the pathway systems can restrict the useable cross-sectional area dependent upon the specified bend radii of the cable to be installed;
- c) requirements for separation of cables and cable bundles to reduce the thermal impact of remote powering (see 4.11) can reduce the useable cross-sectional area;
- d) for non-enclosed pathway systems to which cables are to be attached or supported by (e.g. messenger/catenary wires or designated routes) the cross-sectional area is the minimum available area surrounding the pathway system.

During initial planning:

- e) pathway systems should be considered full when the cross-sectional area of the cables is 40 % of the cross-sectional area of the pathway system so as to leave adequate space for future cabling;
- f) open or openable pathway systems should provide adequate capacity to allow subsequent installation of additional telecommunications cables whilst maintaining minimum bend radii (see 4.4.1.2) and segregation from power supply cabling (see Clause 6).

During subsequent planning, open or openable pathway systems (cable tray, wire mesh cable tray, cable ladder, trunking) should be considered full when the cross-sectional area of cables is 50 % of the cross sectional area of the pathway system.

4.5 Cable management systems

4.5.1 General

4.5.1.1 Requirements

The selection of cable management systems shall take into account the requirements and recommendations of 4.4.

The selection of cable management systems shall consider:

- a) the strength of the electromagnetic fields along the pathway (proximity of electromagnetic conducted and radiated disturbing sources);
- b) the authorized level of conducted and radiated emissions;
- c) the type of cabling, e.g. coaxial, Category of balanced cable (if a cable management system is selected to support a specific cable technology, it might not be suitable for installations of other cabling technologies in the future);
- d) the telecommunications bonding in the building;
- e) the type of closures to be housed, if appropriate;

- f) the immunity of the equipment connected to the information technology cabling system (if a cable management system is selected to support the interconnection of equipment having a specific level of electromagnetic immunity, it might not be suitable for other equipment);
- g) other environment constraints (chemical, mechanical, climatic, fire, etc.);
- h) the MICE environmental classification of EN 50173-1;
- i) any future information technology cabling system extension.

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

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

- 1) conduit systems: EN 61386-1 and the relevant Part 2;
- 2) cable trunking systems and cable ducting systems: EN 50085-1 and the relevant Part 2;
- 3) power track systems: series EN 61534;
- 4) cable tray systems and cable ladder systems: EN 61537.

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

- the cabling products to be contained;
- the electromagnetic performance of the cable management system;
- the segregation requirements of Clause 6.

Where metallic or composite cable management systems are planned to be used specifically to provide electromagnetic screening for the information technology cables to be contained within them the requirements and recommendations of 5.3.3.3 shall be included in the planning of the installation. Any covers used shall provide the required electromagnetic screening performance.

Where non-metallic cable management systems are planned to be used and if the equipment to be connected to the cabling (by unscreened cables) is not affected by low frequency disturbances then a metallic conductor (cable or barrier) may be installed within the cable management system to improve the electromagnetic protection provided to the cabling by reducing the common mode loop area. Where used, the metallic conductor shall be:

- i) designed to withstand large common mode and power fault currents;
- ii) bonded to the local protective earthing system at both ends using a low impedance conducting element (e.g. a large metal wall of the apparatus cabinet).

4.5.1.2 Recommendations

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

- a) through a screening effect on the circuits within the cable management system;
- b) by improving the cohabitation between circuits contained in the cable management system;
- c) by reducing perturbations transferred from current flowing through the cable management system onto circuits contained in the cable management system.

For the purposes of electromagnetic screening within trays as shown in Figure 3:

- 1) the inner corners provide the greatest effect;
- 2) for a given internal cross-sectional area, high sidewalls provide greater useable capacity.

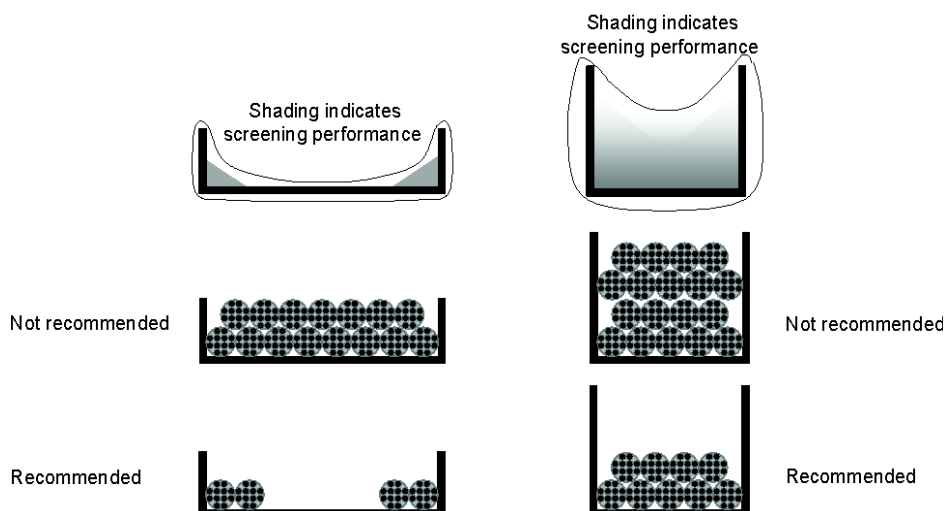


Figure 3 — Cable arrangement in a metallic section

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

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

4.5.2 Overhead cable management systems

4.5.2.1 Requirements

Cables (and bundles of cables) shall not be laid on the framework grids of false ceilings unless the cable directly serves devices attached to ceiling tiles.

4.5.2.2 Recommendations

Overhead cable pathways can alleviate the need for access floors that do not employ floor-standing systems that are cabled from below. Overhead cable management systems may be stacked to provide additional capacity.

Cable management systems should be suspended from overhead structures where increased operational flexibility is required to

- a) support the use of cabinets, frames and racks of various heights;
- b) add or remove cabinets, frames and racks.

Cable management systems may be attached to the tops of cabinets, frames and racks where they are of uniform height.

4.5.3 Under-floor cable management systems

4.5.3.1 Requirements

There shall be adequate clearance between the top of open cable management systems (e.g. tray, basket) and the access floor tiles to allow the cables to enter/exit the pathway systems without risk of damage and in accordance with the applicable minimum bend radius (installation, operating-static and operating-dynamic).

Where cable management systems are vertically stacked and run in parallel to provide additional capacity:

- access to lower layers shall be provided by either using narrower cable management systems for upper layers (as shown in Figure 4) or by providing an accessible row of adjacent tiles (as shown in Figure 5);
- in Figure 4 and Figure 5, X shall be at least 200 mm to provide adequate access to lower layers for addition and removal of cables.

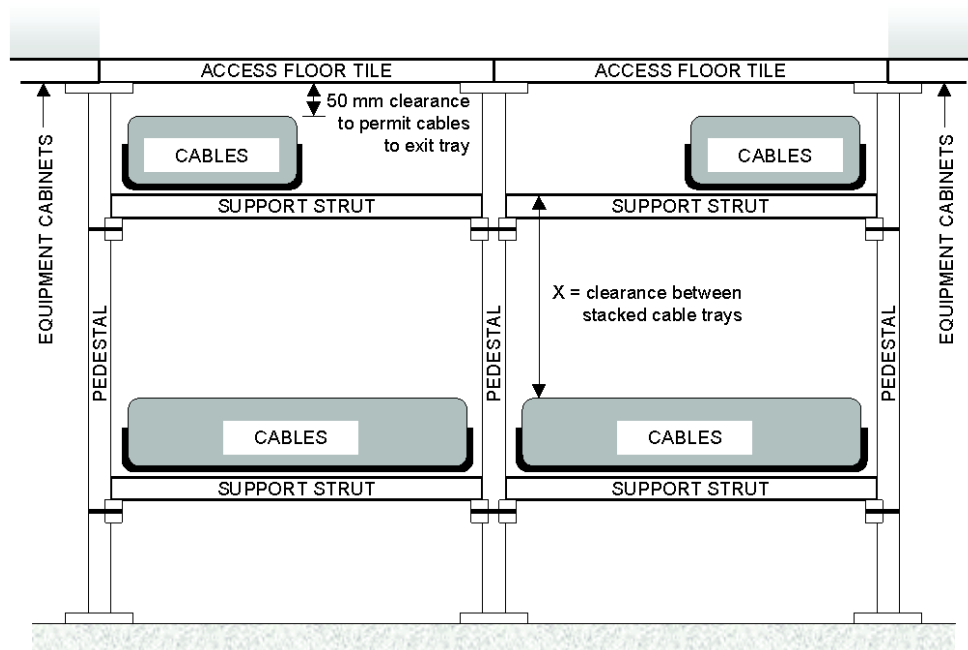


Figure 4 — Example of layered cable trays with smaller width upper trays

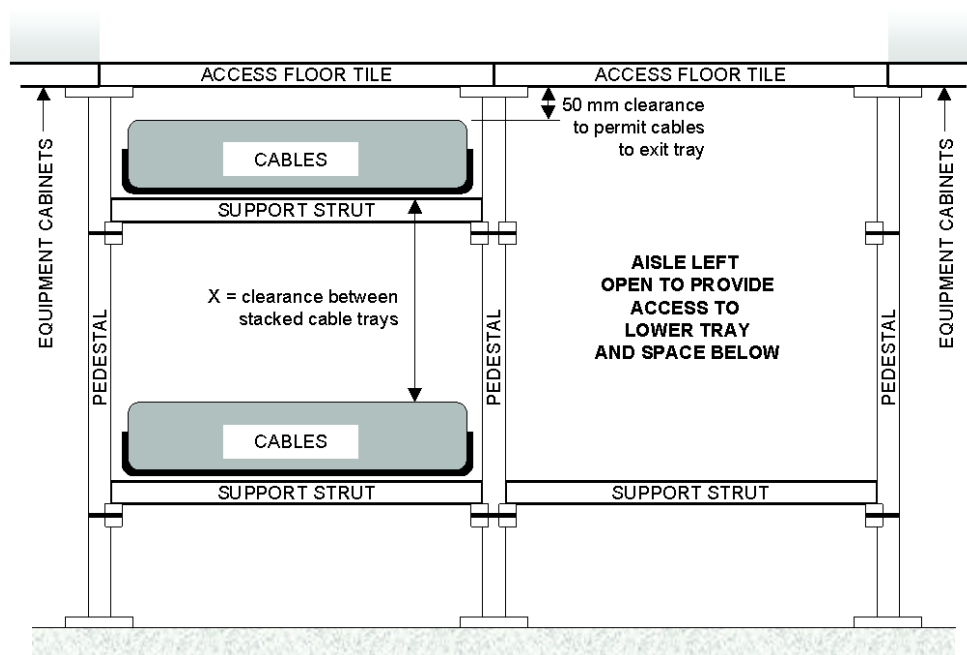


Figure 5 — Example of accessible row of floor tiles to provide access to lower tray

4.5.3.2 Recommendations

In Figure 4 and Figure 5, X should be at least 300 mm to provide adequate access to lower layers for addition and removal of cables.

4.5.4 Conduit

4.5.4.1 Requirements

Conduits shall not:

- contain more than two bends of up to 90° max. between pulling points (e.g. outlets, telecommunications rooms, or pull boxes);
- be subject to cumulative changes in direction of more than 180° between pulling points.

Bends within conduit shall be accessible and able to act as pulling points unless:

- no additional cables are to be installed within the conduit, following the initial installation of cable;
- cables are to be removed before any additional installation takes place.

The inside radius of a bend in conduit shall be at least 6 times the internal conduit diameter.

Bends in the conduit shall not contain any kinks or other discontinuities that might have a detrimental effect on the cable sheath during cable pulling operations.

4.5.4.2 Recommendations

Where conduits are installed without bends, the maximum distance between pulling points should be 50 m unless appropriately specified cables and/or installation techniques are to be used.

Conduits should be considered as “full” when the cross-sectional area of the planned/installed cables reaches 40 % of the conduit cross-sectional area.