University of Oxford IT Services
Infrastructure Specification Project

ISP-03-004:
Distribution cabling - Recommendations: Distributed building services infrastructure

1 INTRODUCTION

1.1 Scope

This document specifies the minimum recommended design features of the generic distribution cabling used to deliver both University of Oxford IT Services and non-user specific telecommunications services for use by multiple disciplines in accordance with BS EN 50173-6 (and the technically equivalent ISO/IEC 11801-6).

The development of solutions providing the powering of remote end-devices over conventional structured cabling has led to a rapid growth in the type of end-devices and associated control equipment covering a wide range of non-user specific services such as:

- University of Oxford IT Services;
  - mobile telephony via distributed antenna systems (DAS);
  - non-fixed IT connections via wireless access points (WAP);
    NOTE this document recommends the design, planning and installation of Type A cabling of BS EN 50173-6 either as an overlay to the cabling of ISP-03-003 or as a stand-alone solution which may also serve fixed IT connections.
- a substantial volume of building management services including:
  - energy management, e.g. lighting, power distribution, incoming utility metering;
  - environmental control, e.g. temperature, humidity;
  - personnel management, e.g. access control, cameras, passive infra-red (PIR) detectors, time and attendance monitoring, electronic signage, audio-visual (AV) projectors

  and
  - personal information and alarms, e.g. paging, patient monitoring, nurse call, infant security.

The vast majority of these end-devices contain IP addressable circuitry and the communications systems adopt the standards developed by IEEE which have defined power levels. However not all such devices conform to these power levels and a degree of caution is required (see 3.2).

This document:

- uses the definitions and abbreviations of clause 1.3 of ISP-00-001;
- assumes that screened cabling is not used.

An overarching objective of this series of documents is to ensure that University of Oxford IT Services, the customer (defined as the college or University, as appropriate) together with those organisations delegated with design and planning responsibilities have discharged the obligations of “the owner of the premises” as specified in BS 6701 and by the other standards referenced normatively from BS 6701; specifically but not exclusively BS 7671, BS EN 50174-1, BS EN 50174-2 and BS EN 50310.

1.2 Applicable external standards

Failure of the customer to install, operate and maintain direct-connect distribution cabling in accordance with the requirements of BS 6701 may result in withdrawal of service support by University of Oxford IT Services. Some critical elements of BS 6701 and its referenced standards are included in this document but customers are strongly advised to be aware of the full requirements of the standard.

2 ELEMENTS OF GENERIC, STRUCTURED, DISTRIBUTION CABLING

As shown in Figure 1, generic cabling in accordance with BS EN 50173-6 comprises:

- building distributor cabinets (see ISP-03-003) containing:
    - equipment;
    - patch cords;
    - equipment cords;
    - panels presenting the campus backbone cables;
    - panels presenting the building backbone cables;
- building backbone cables (see ISP-03-003);
- service distributor cabinets containing:
    - equipment;
    - patch cords;
    - equipment cords;
    - panels presenting the building backbone cables;
    - panels presenting the service distribution cables;
- service distribution cables;
- service concentration points (SCPs);
- SCP cord;
- service outlets (SOs).

It should be noted that Figure 1 shows both Type A and Type B cabling of BS EN 50173-6.

Type A cabling requires the installation of an SO (whether or not an SCP is installed). This allows the cabling between the SO and service distributor cabinet to be subjected to acceptance testing.

Type B cabling allows the connection of application-specific cabling at the SCP (and also the direct connection of equipment without the use of an SO). However, the design of Type B cabling requires that it may be converted to Type A (in performance terms) by the installation of an SCP cord and SO.

This edition of this document assumes the universal use of SCPs and SOs (i.e. Type A cabling).

NOTE: The use of an SCP allows the future implementation of 1-pr generic cabling to a modified SO which may further increase the value of distributed building services cabling concepts.

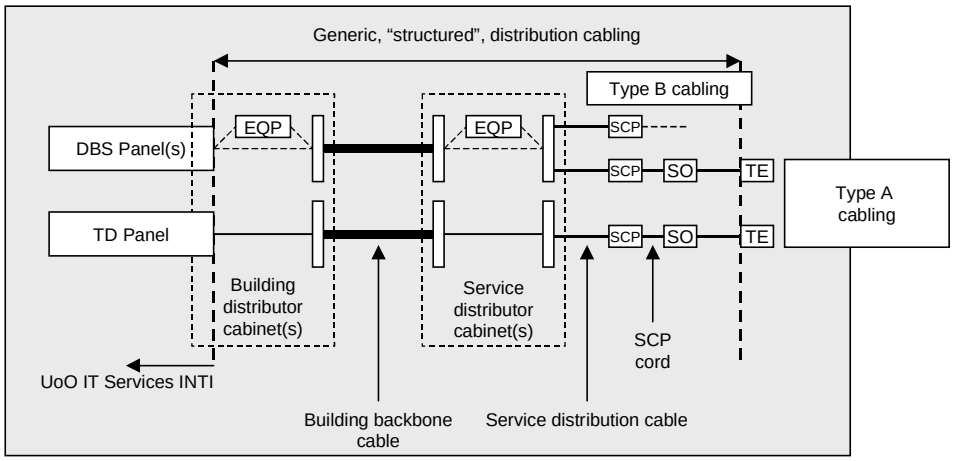


Figure 1 - Schematic of generic "structured" distribution cabling for distributed building services

Cabling in accordance with BS EN 50173-6 may be an overlay with other cabling in accordance with BS EN 50173-2. In such cases, service distributors may be co-located with the floor distributors of ISP-03-003. However, in order to facilitate and

protect the services operated by different disciplines service distributor cabinets may be subject to segregation and security requirements.

Not all the elements will be present in all premises. Premises comprising a single small building will be served by a co-located cabinet that provides the functionality of a service and building distributor (i.e. no building backbone cable will be necessary).

The need for transmission equipment at the building or service distributors depends upon both the application to be delivered to the SO and the cabling technologies applied.

This document assumes that the applications delivered to the customers' cabinets from the EC, i.e. at the INTI, will include 1000BASE-T. However, the delivery of 10GBASE-T to terminal equipment including wireless access points is becoming more common and the selection of cabling performance has been upgraded to reflect this trend (see 3.6).

However, the information technology systems within the premises may include more demanding applications and which may require optical fibre as the transmission medium in the building backbone system.

3 DESIGN SENSITIVITIES

3.1 Future provisioning

The challenge of utilising cabling in accordance with BS EN 50173-6 is four-fold:
(i) the distribution of SCPs (see 3.4);
(ii) the distribution of SOs to be installed both initially and in the future (see 3.5);
(iii) the provision of pathways and spaces to support the installation of future SOs (see 5.2);
(iv) the correct allocation of space to accommodate the service distributor cabinets (see 5.3).

3.2 Remote powering

BS EN 50174-1 defines three possible objectives for remote powering. It is recommended that distributed building service cabling adopts the installation approach defined as "Category RP3" which allows the attachment of the remote powering equipment to any cable at a service distributor to be unrestricted subject to the limit of 500 mA per conductor.

While this represents an extreme condition, this approach avoids the need to administer the connections made provided that that they comply with the maximum current value (which all the IEEE remote powering applications do).

NOTE: The 500 mA value is based upon the maximum capability of the connecting hardware of BS EN 50173-6 at its highest operating temperature.

All the design and planning recommendations of this document are based on this approach.

The challenges of employing this approach are:
(i) the provision of appropriate mains power to the remote powering equipment at the service distributors;
(ii) the design and separation of cable groups and bundles to minimise the heating effects of the remote powering (see 5.2.6);
(iii) the selection of pathways and pathway systems to minimise the heating effect of the remote powering on the cable bundles or groups (see 5.2.4.2).

3.3 Cable sharing

Whilst it may be possible to support specific combinations applications to an SO, the balanced cables specified in BS EN 50173-1 are not designed, or guaranteed, to be capable of simultaneously supporting multiple applications. It is therefore recommended that cabling infrastructure designs are based upon a 4-pair balanced cable carrying a single application to each SO. Failure to take account of this can lead to expensive retrofitting operations.

3.4 Service concentration points (SCPs)

The desirability of SCPs depends upon the stability of SO positioning. If the locations and purpose of all SOs are known from the initial planning stage then SCPs are unnecessary. However, the rapid growth in devices that may be supported by distributed building services cabling suggests that such a definitive plan is unlikely.

In most buildings it is recommended that a grid of SCPs is created in accordance with the recommended implementation of BS EN 50173-6 as follows:

- in "single tenant" residential premises a grid of SCPs should be installed with each SCP serving 9 m^2 (3 m x 3 m);
- in all other premises a grid of SCPs should be installed with each SCP serving 16 m^2 (4 m x 4 m).

This distribution is independent of whether the distributed building services cabling is an overlay on top of fixed telecommunications cabling in accordance with the recommendations of ISP-03-003 or a stand-alone implementation.

BS EN 50173-6 also recommends the quantity of cables to be fed to the SCP based upon the services to be supported. The recommendations of this document are a simplification of that information.

3.5 Service outlet provision

In individual "single tenant" residential premises this document recommends that each SCP should be considered to support 8 SOs unless it is intended to support the subsequent installation of fixed telecommunications connections (i.e. where the SO becomes, in effect, a telecommunications outlet (TO) of ISP -03-003) in which case each SCP should be designed to support an additional 2 SOs.

3.6 Service distribution cabling

The service distribution cabling should meet the minimum requirements of Class E_A cabling, constructed from Category 6_A components, in line with the minimum requirements of BS EN 50173-6:2018.

3.7 Fire performance

3.7.1 Backbone, service distribution cables and SCP cords

BS 6701:2016 Amendment 1:2017 requires certain cables inside buildings to meet EuroClass C_{ca}-s1b,d2,a2 of BS EN 13501-6. As a result, cables that do not meet the requirements of BS 6701:2016 Amendment 1:2017 shall not be installed inside buildings and other structures without the express authority of the Network Operations Manager.

3.7.2 Other cords

Cables in cords shall comply with the minimum recommended performance requirements of BS EN 60332-1-2 or EuroClass E_{ca} of BS EN 13501-6.

NOTE: Cables designed to be used in cords do not automatically fall within the scope of the Construction Products Regulation and therefore there is no reference to EuroClass in this clause.

4 RECOMMENDED CONNECTIVITY

4.1 Information technology cabling

All 4-pair balanced cabling shall be terminated at panels, SOs and, where relevant, SCPs in accordance with option T568B within ANSI/TIA/EIA-T568-0.D.

4.2 Service distribution cabling containing SCPs

The SCP is recommended to take the form of a 12 or 24-port panel as used in the service distributor. The SCPs should be located in ceiling spaces, sub-floor areas or in wall-mounted cabinets taking into account the requirements and recommendations of B S EN 50174-2 regarding security concerns.

5 ACCOMMODATION OF THE FUNCTIONAL ELEMENTS

5.1 General

This document specifies the pathways and pathway system(s) accommodating:

- service distribution cables;
- SCP cords.

In addition, this document specifies the accommodation of

- service distributor cabinets containing:
    - equipment
    - patch cords and equipment cords
    - panels presenting the building backbone cables;
    - panels presenting the service distribution cables;
- SCPs;
- SOs.

See ISP -03-003 for pathways and pathway system(s) accommodating building backbone cables and the accommodation for building distributor cabinets containing:

- equipment
- patch cords and equipment cords
- panels presenting the campus backbone cables;
- panels presenting the building backbone cables.

5.2 Accommodation for service distribution cables and SCP cords

5.2.1 Pathways at service distributor cabinets

The pathway selected shall provide the segregation between telecommunications cabling and mains power cabling described in 5.2.2 and 5.2.3.

Pathway systems shall enter customers' cabinets from below. This allows cooling equipment (e.g. fan units) to be fitted in the roof of the cabinets and allows unobstructed airflow around the equipment within the cabinet (see 5.3). This is particularly important in view of the growing use of remote powering equipment that can significantly increase the heat generated within cabinets.

5.2.2 General segregation requirements for metallic distribution cables and mains power cabling

The segregation of metallic telecommunications cabling and mains power cabling shall be in accordance with BS 6701 with regard to safety and protection. Segregation in accordance with the requirements of this document will ensure conformance to BS 6701 for mains power cabling of up to 600 VAC.

5.2.3 General segregation requirements for metallic distribution cables and electromagnetic interference sources

5.2.3.1 General

BS EN 50174-2 contains clear requirements regarding segregation of balanced cables and power supply cables. This document applies the requirements of BS EN 50174-2 in total but provides the sub-clauses 5.2.3.2 and 5.2.3.3 as a simple reference to the basic requirements.

5.2.3.2 Segregation of service distribution cables and power supply cabling

The separation requirement "A" is calculated by multiplying the minimum separation distance "S" obtained from Table 1 by the power cabling factor "P" from Table 2.

Where mains power cables (other than single core cables operating at voltages exceeding AC 600 V) pass through a fire barrier it is possible to reduce the calculated separation requirements of this sub-clause provided that:

- the total distance over which the reduction in the separation occurs is not greater than the thickness of the fire segregation barrier plus 0,5 m on either side;

- the external balanced cables and mains power cables are enclosed in separate metal trunking or conduit;
- national regulations concerning fire barriers are complied with;
- the requirements of BS 7671 are complied with.

Table 1 - Minimum separation distance "S" for external balanced cables

	Containment applied to information technology or mains power cabling		
Separation without electromagnetic barrier	**Open metallic containment [a]**	**Perforated metallic containment [b, c]**	**Solid metallic containment [d]**
300 mm	225 mm	150 mm	0 mm

[a] Screening performance (0 MHz to 100 MHz) equivalent to welded mesh steel basket of mesh size 50 mm × 100 mm (excluding ladders). This screening performance is also achieved with steel tray (trunking without cover) of less than 1,0 mm wall thickness and/or more than 20 % equally distributed perforated area.
[b] Screening performance (0 MHz to 100 MHz) equivalent to steel tray (trunking without cover) of at least 1,0 mm wall thickness and no more than 20 % equally distributed perforated area. This screening performance is also achieved with screened power cables that do not meet the performance defined in footnote d.
[c] The upper surface of installed cables shall be at least 10 mm below the top of the barrier.
[d] Screening performance (0 MHz to 100 MHz) equivalent to a steel conduit of 1,5 mm wall thickness. Separation specified is in addition to that provided by any divider/barrier. The assumption underlying the material performance of the conduit is that the product of the permeability and conductivity is greater than 38 H•S/m2. This performance is not provided by stainless steel, aluminium and non-magnetic materials.

Table 2 - Power cabling factor

Electrical circuit type [a, b, c]	**Quantity of circuits**	**Power cabling factor *P***
20 A 230 V 1-phase	1 to 3	0,2
	4 to 6	0,4
	7 to 9	0,6
	10 to 12	0,8
	13 to 15	1,0
	16 to 30	2
	31 to 45	3
	46 to 60	4
	61 to 75	5
	> 75	6

[a] 3-phase cables shall be treated as 3 off 1-phase cables.
[b] More than 20 A shall be treated as multiples of 20 A.
[c] Lower voltage AC or DC power supply cables shall be treated based upon the their current ratings, i.e. a 100 A 50 V DC cable = 5 of 20 A cables (P = 0,4).

Within the service distribution cabling no segregation is required between information technology cabling and power supply cabling where the power conductors are maintained in close proximity (e. g. within an overall sheath or twisted, taped or bundled together) and form only single phase circuits of no greater than 32 A.

5.2.3.3 Separation of balanced cables and specific electromagnetic interference sources

The separation requirements of Table 3 shall be applied where information technology cabling is installed in proximity to the EMI sources listed.

Table 3 - Separation requirements for specific EMI sources

Source of disturbance	Minimum distance (mm)
Fluorescent lamps	130
Neon lamps	130
Mercury vapour lamps	130
High-intensity discharge lamps	130
Copiers	400

5.2.4 Pathway system selection

5.2.4.1 General

BS EN 50174-1 and BS EN 50174-2 contain clear requirements regarding selection of pathway systems. This document applies the requirements of BS EN 50174-1 and BS EN 50174-2 in total but details the following requirements as a simple reference.

Pathway systems of the types listed below shall comply with the relevant European standards:

- non-flame propagating conduit systems: BS EN 61386-1 and the relevant part 2(see Bibliography);
- non-flame propagating trunking and ducting systems: BS EN 50085-1 and the relevant part 2 (see Bibliography);
- non-flame propagating tray and ladder systems: BS EN 61537.

Unless the express authority of the Network Operations Manager has been obtained then pathway systems shall be of a non-flame propagating type as defined the standards listed above.

The dimensions of the pathway systems shall enable the maximum allocated number of distribution cables to be installed;

- on a phased basis without risk of damage to the cables;
- while maintaining the bend radius of the cables.

The following recommendations apply:

- enclosed shapes provide the best electromagnetic protection to the installed cables by reducing the common mode coupling;
- trays with small slots, for easy attachment of cable, parallel to the axis of the tray provide the best electromagnetic protection to the installed cables;
- tray with slots, for easy attachment of cable, perpendicular to the tray axis should not be used.

5.2.4.2 Pathways serving SCPs

While this document recommends the installation a SCP grid with a given number of potential SOs being supported by each SCP, it may be that not all these cables are installed in the same phase and can have different owners (in terms of the service provided). Pathways between the service distributor cabinets and each SCP shall be adequate to accommodate the total quantity of cables and meet any segregation requirements based on service ownership.

The application of the remote powering objective defined as “Category RP3” has implications both for the planning of pathways serving the SCPs and the installation of cables into those pathways (see 5.2.6).

Table 4 indicates the temperature increases that could be experienced by bundles of typical Category 6_A cables installed in various pathways when subjected to the remote powering approach of Category RP3. The data is a simplification of that in EN 50174-2. However, EN 50174-2 provides additional information for cable bundles and cable groups for a range of cable types and relevant performance parameters.

It is recommended that designers, planners and installers consult the requirements of BS EN 50174-2 to ensure that the appropriate decisions are made.

Table 4 - Temperature changes for Catgeory 6_A cables for various bundle sizes (Category RP3)

No. of cables (*N*)	**6**	**12**	**24**	**48**	**72**	**96**	**144**	**216**
Installation condition	ΔT °C							
Ventilated	2,0	3,0	4,5	7,0	9,5	12,0	16,0	22,0
Open perforated tray	2,5	3,5	5,5	8,5	11,5	14,0	18,5	25,0
Trunking/conduit	3,5	5,0	7,5	12,0	15,0	18,5	24,0	32,0
Insulation	7,5	10,5	15,5	23,0	29,0	34,0	**	**
NOTE ** indicates a temperature in excess of 60 °C (assuming an ambient of 20 °C) which represent unacceptable localized heating.								

It is desirable to minimise the temperature increases to ensure that the overall transmission distance of the data network is not restricted. As a result, it is recommended to:

- select pathways within which ambient temperatures are lowest;
- maximise the routes within either basket or open perforated tray (or equivalent) pathway systems;
- avoid installing cables through insulating materials for lengths greater than 1 m..

Clause 5.2.6 contains recommendations regarding cable installation which potentially increases the dimensions of pathways and cable management systems.

5.2.4.3 Pathways serving SOs

The recommendations of this sub-clause are those of OUT.

While this document recommends the installation a SCP grid with a given number of potential SOs being supported by each SCP, it may be that not all these cables are installed in the same phase and can have different owners (in terms of the service provided). Pathways and pathway systems (or space for them) from SCPs to groups of probable SO locations shall be reserved and preserved.

Where SOs are to be served by trunking, the trunking should have design features that enable the segregation requirements of 5.2.2, 5.2.3 and 5.2.6 to be complied with. The installation of the service distribution cabling and the mains power cabling should observe the relevant design features.

Note: where SOs are served by 3-compartment trunking, segregation requirements of 5.2.2 and 5.2.3 force the service distribution cabling and mains power cabling to be installed in the outer compartments. Only cabling terminations are housed in the central compartment.

Where SOs are served by conduit:

- the conduit should be continuous to the SO from the point at which the cable leaves the main pathway system (e.g. tray).
- the conduit should not serve more than two TOs;
- the conduit shall have a minimum internal diameter of 20 mm (consistent with Size 20 conduits of BS EN 61386 standards);
- no section of conduit shall contain more than two swept 90-degree bends, or equivalent, between pull points;
- no section of conduit shall be longer than 30 m (100 ft) between pull points;
- the inside radius of a bend in conduit shall be at least 75mm.

5.2.5 Pathway system installation

BS EN 50174-2 contains clear requirements regarding installation of pathway systems. This document applies the requirements of BS EN 50174-2 in total but details the following requirements as a simple reference.

Pathway systems shall be installed:

- in accordance with instructions provided by the manufacturer(s)/supplier(s) of the pathway systems;
- to allow installation and removal of the cable without risk of damage to the cable;
- without sharp edges or corners that could damage the cabling installed within or upon them;
- to ensure that water or other contaminant liquids cannot collect.

Where a conducting pathway system is installed, sections shall be bonded to earth in accordance with BS 7671 in order that the pathway system acts as a parallel earthing conductor (PEC).

5.2.6 Cable installation

BS EN 50174-2 contains clear requirements regarding installation of cables. This document applies the requirements of BS EN 50174-2 in total but details the following requirements as a simple reference.

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

a) eliminate cable stress as caused by:
   - tension in suspended cable runs;
   - tightly cinched cable bundles;
b) ensure that minimum bend radii are never less than those specified in the product standard (rollers or other devices shall be used to avoid damage);
c) ensure that the maximum pulling tensions taken from the cable specifications are not exceeded;
d) prevent pressure marks (e.g. through improper fastening or crossovers) on the cable sheath or the cable elements;
e) avoid joints other than those in accordance with the installation specification.

When installing cables into cable tray, the bundles created shall be lower than the sidewalls of the tray.

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

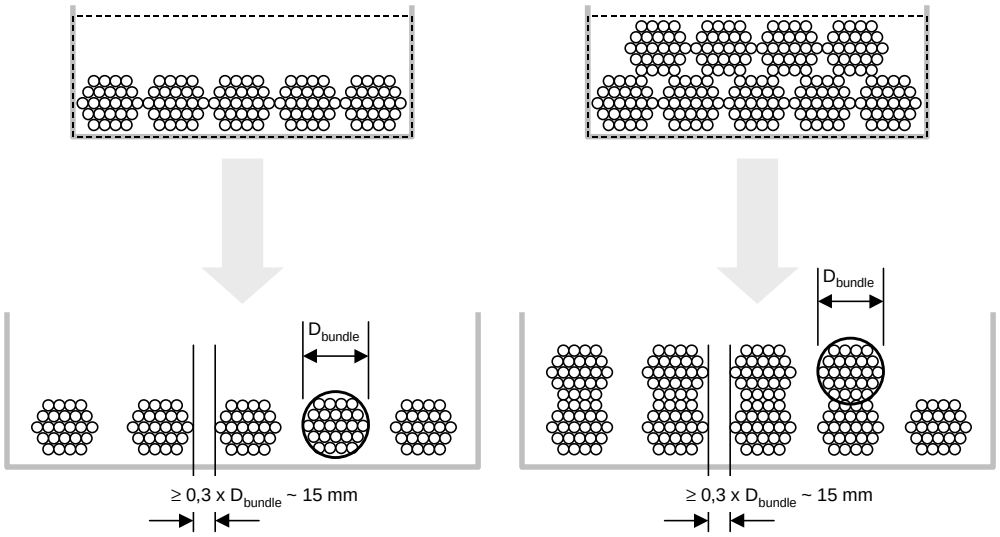
Cable ends shall remain sealed during installation to prevent the ingress of water and other contaminants.

Cables that are not terminated in a cabinet, frame or rack should not be routed within the physical boundaries of that cabinet, frame or rack.

Each SCP should be served by a bundle of cables from the service distributor cabinet. It is also recommended to avoid bundle sizes in excess of $N = 12$ cables (BS EN 50174-2 mandate a maximum of $N = 24$) and to separate these bundles as follows (see **Error! Reference source not found.**):

(i) cable bundles in single rows should be separated by “chimneys” of width ~0,3 x bundle diameter - which results in each cable bundle behaving as if it were isolated from the others;
(ii) cable bundles in multiple rows should be separated by “chimneys” of width ~0,3 x bundle diameter - which results in each cable bundle behaving as if it contained twice the number of cables.

The recommendations (i) and (ii) potentially increase the dimensions of pathways and cable management systems.



a) a single row of bundles

b) multiple rows of bundles

Figure 2 - Separation of cable bundles to minimize heating

5.3 Accommodation for customers' cabinets

BS EN 50174-1 contains clear requirements regarding accommodation of cabinets, frames and racks. This document applies the requirements of BS EN 50174-1 in total but details the following requirements as a simple reference.

The location of cabinets, frames and racks shall:

- allow subsequent measurements, repair, expansion or extension of the installed cabling may be undertaken without risk of injury to personnel;
- be consistent with the space, floor loading and other services required for information technology equipment;
- allow the installation of the necessary cabling together with the delivery and removal of larger items of apparatus;
- provide a minimum clearance of 1,2 m on all faces of the where access is required;
- allow for the installation of additional cabling without major disruption.

Cabinets, frames and racks shall not be installed:

- in toilet facilities and kitchens;
- in emergency escape ways;
- in ceiling or sub-floor spaces;
- within cabinets or closures containing fire hose reels or other fire-extinguishing equipment.

Cabinets (or the closures within them) shall provide the necessary levels of physical and environmental protection for the distribution cabling and equipment installed and shall achieve the necessary protection by their location, design features or a combination of both. Where necessary, atmospheric control shall be provided within the space and/or the cabinets.

The design and dimensions of the cabinets, together with clearances (including those above and below them, as appropriate) shall ensure that:

- it is possible to install the initial quantity of cables in accordance with the minimum bend radii (installation and operating). Where multiple cable types are involved, the largest minimum bend radius shall apply;
- additional cables can be subsequently installed in accordance with the minimum bend radii (installation and operating). Where multiple cable types are involved, the largest minimum bend radius shall apply;
- facilities for the management of cables and cords are provided.

5.4 Accommodation for SCPs

5.4.1 General

BS EN 50174-1 and BS EN 50174-2 contain clear requirements regarding location and accommodation of termination points and the closures housing those termination points. This document applies the requirements of BS EN 50174-1 and BS EN 50174-2 in total but details the following requirements as a simple reference.

5.4.2 Location

Closures for SCPs shall provide the necessary levels of physical and climatic protection for the cables and the connecting hardware. The closure or the SCP shall achieve the necessary protection by their location, design features or a combination of both.

The location of SOs shall:

- allow subsequent measurements, repair, expansion or extension of the installed cabling to be undertaken without risk of injury to personnel;
- provide adequate clearances for the closure containing the SCP to be installed without damage to cabling components and in accordance with the minimum bend radii (installation and operating);
- be in accordance with national or local regulations.

5.4.3 Closures

The cable entrance to the closure at the SCP shall:

- maintain the environmental performance of the SCP;
- provide the necessary cable support and prevent kinking at the point of entry;
- provide strain relief for the cable if not already done by separate fixtures;
- be capable of accepting suitable glands.

5.5 Accommodation for SOs

5.5.1 General

SOs may be located in a variety of locations to suit the service they provide.

The terminal equipment may be relatively permanent and the accessibility of the SO is not considered to be a general requirement.

BS EN 50174-1 and BS EN 50174-2 contain clear requirements regarding location and accommodation of termination points and the closures housing those termination points. This document applies the requirements of BS EN 50174-1 and BS EN 50174-2 in total but details the following requirements as a simple reference.

5.5.2 Location

The location of SOs shall:

- allow subsequent measurements, repair, expansion or extension of the installed cabling to be undertaken without risk of injury to personnel;
- take into account the level of security required for the attached information technology equipment (e.g. termination points to which networking equipment such as wireless access points is attached may need to be located to prevent unauthorised access);
- provide adequate clearances for the closure containing the SO to be installed without damage to cabling components and in accordance with the minimum bend radii (installation and operating);
- be in accordance with national or local regulations.

The location of SOs should minimise the length of cords attached from them to the terminal equipment

5.5.3 Closures

Closures for SOs shall provide the necessary levels of physical and climatic protection for the cables and the connecting hardware. The closure or the SO shall achieve the necessary protection by their location, design features or a combination of both.

The cable entrance to the closure at the SO shall:

- maintain the environmental performance of the SO;
- provide the necessary cable support and prevent kinking at the point of entry;
- provide strain relief for the cable if not already done by separate fixtures;
- be capable of accepting suitable glands.

Where the SOs take the place of the TOs of ISP-03-003 then the recommendations for the closures in ISP-03-003 apply.

6 ACCEPTANCE TESTING

No specific test recommendations are included for telecommunications backbone and optical fibre cabling.

For 4-pair balanced cabling, transmission performance tests are able to confirm that the permanent link requirements in accordance with BS EN 50173-1 are met. It is recommended that the test result should be provided as part of the documentation covering the installation. Balanced cabling tests should include the full characterisation traces.

Document IISS-01-001 provides further information on assessment of test results.

7 ADMINISTRATION SYSTEMS

It is a strategic objective and a normative requirement of BS EN 50174-1 to apply an integrated administration system to the cabling infrastructures of, and supported by, University of Oxford IT Services.

Although it is not necessary to define the specific administration tools in this document, the format of documentation containing the details of the fixed infrastructures is critical to future integration.

The data supplied by installers should allow a full and proper completion of the fields applicable to the cabling sub-system.

Table 5 show a common format for service distribution cabling implementations. This type of administration system allows an integrated record keeping system to be implemented as shown in ISP-00-001.

8 OTHER DOCUMENTS IN THIS SERIES

IISS-00-001: Infrastructure Installation Specification Strategy: Overview
IISS-00-002: Infrastructure Installation Specification Strategy: Distributed building services
IISS-01-001: Assessment of balanced cabling test results
IISS-01-002: Installation and acceptance testing of singlemode optical fibre cabling

ISP-00-001: Infrastructure Specification Project: Overview
ISP-00-002: Access to University of Oxford IT Services facilities (later)
ISP-01-001: University of Oxford IT Services Entrance Facilities - Product and design specification
ISP-01-002: University of Oxford IT Services Entrance Facilities - Accommodation requirements
ISP-02-001: University of Oxford IT Services Intermediate cabling (INTI-ENTI) - Product and design specification
ISP-02-002: University of Oxford IT Services Intermediate cabling (INTI-ENTI) - Accommodation requirements
ISP-03-001: Distribution cabling - Recommendations: Overview
ISP-03-002: Direct-connect cabling - Recommendations: Telecommunications infrastructure
ISP-03-003: Distribution cabling - Recommendations: IT infrastructure

519 **Table 5 - Example of field listing for 4-pair balanced service distribution cabling infrastructures**

	Service distribution cabling	
Building	1	Walker Annex
Floor		2
Closet		
Cabinet		M-2-1
Closure Type		Distribution Panel
Distribution Panel ID		DP-2-18
Port Type		RJ45
RJ45 Port ID		RJ45-12
Service Distribution Cable	2	Cable-Cat.6A-4
Cable-Cat.6A-4		H4323
Building	3	Walker Annex
Floor		2
Closet		
Cabinet		
Closure Type		SCP
SCP ID		SCP-28
Port Type		RJ45
RJ45 Port		RJ45-12
Service Distribution Cable	4	SCP Cord
SCP Cord		6578
Building	5	Walker Annex
Floor		2
Closure Type		TO-2
TO-2		WA-2-01
Port Type		RJ45
RJ45 Port		RJ45-02

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NORMATIVE REFERENCES

The following documents are required to be applied in a normative manner (i.e. mandated) by the users of this document.

BS 6701:2016 + Amendment 1:2017	Telecommunications equipment and telecommunications cabling - Specification for installation, operation and maintenance
BS 7671:2018	Requirements for electrical installations: IEE Wiring Regulations: 18th edition
BS EN 13501-6	Fire classification of construction products and building elements. Classification using data from reaction to fire tests on electric cables
BS EN 50174-1:2018	Information technology - Cabling installation - Part 1: Installation specification and quality assurance
BS EN 50174-2:2018	Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings
BS EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions. Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame

BIBLIOGRAPHY

The following documents are considered useful reference sources for the users of this document.

ANSI/TIA-568-0.D	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568-2.D	Balanced Twisted-Pair Telecommunications Cabling and Components Standards
BS EN 50085-1:2005 + Amendment 1:2013	Cable trunking systems and cable ducting systems for electrical installations. General requirements
BS EN 50085-2-1:2006 + Amendment 1:2011	Cable trunking systems and cable ducting systems for electrical installations. Cable trunking systems and cable ducting systems intended for mounting on walls and ceilings
BS EN 50085-2-2:2008	Cable trunking systems and cable ducting systems for electrical installations. Particular requirements for cable trunking systems and cable ducting systems intended for mounting underfloor, flushfloor, or onfloor
BS EN 50085-2-3:2010	Cable trunking and cable ducting systems for electrical installations. Particular requirements for slotted cable trunking systems intended for installation in cabinets
BS EN 50085-2-4:2009	Cable trunking systems and cable ducting systems for electrical installations. Particular requirements for service poles and service posts
BS EN 50173-1:2018	Information technology - Generic cabling systems - General requirements
BS EN 50173-2:2018	Information technology - Generic cabling systems - Office premises
BS EN 50173-6:2018	Information technology - Generic cabling systems - Distributed building services
BS EN 50310:2016	Information technology - Telecommunications bonding networks for buildings and other structures
BS EN 61386-1:2008	Conduit systems for cable management. General requirements
BS EN 61386-21:2004 + A11:2010	Conduit systems for cable management. Particular requirements. Rigid conduit systems
BS EN 61386-22:2004 + A11:2010	Conduit systems for cable management. Particular requirements. Pliable conduit systems. pliable conduit systems
BS EN 61386-23:2004 + A11:2010	Conduit systems for cable management. Particular requirements. Flexible conduit systems
BS EN 61386-24:2010	Conduit systems for cable management. Particular requirements. Conduit systems buried underground
BS EN 61537:2007	Cable management. Cable tray systems and cable ladder systems
IEEE P802.3bt	IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Data Terminal Equipment (DTE) Power Via Media Dependent Interface (MDI): Amendment 2: Power over Ethernet over 4 Pairs
IISS-01-001	Assessment of balanced cabling test results
ISO/IEC 11801-6:2017	Information technology - Generic cabling for customer premises - Distributed building services