

# University of Oxford IT Services Infrastructure Specification Project

## ISP-01-001: University of Oxford IT Services Entrance Facilities - Product and design specification

### 1 INTRODUCTION

#### 1.1 Scope

This document specifies the products and associated design criteria used in the provision of the University of Oxford IT Services Entrance Facilities installed in each of the premises served by the University of Oxford IT Services external cabling infrastructure.

#### 1.2 Responsibilities

Figure 1 shows a schematic of the elements used to create the University of Oxford IT Services Entrance Facilities and how they relate to the other cabling-related functional elements within the premises served. Figure 1 uses the definitions and abbreviations of clause 1.3 of ISP-00-001.

While the elements of the University of Oxford IT Services Entrance Facilities are the property of University of Oxford IT Services they are accommodated within the customers' premises served and the ownership of that accommodation lies with the customer.

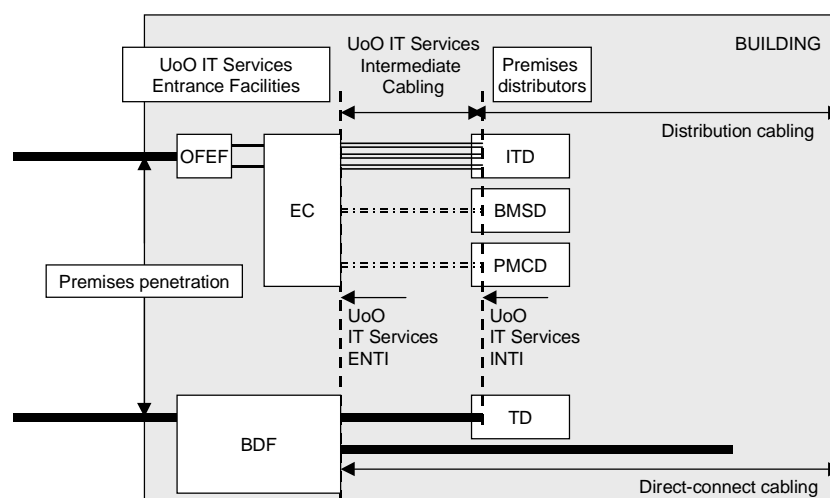


Figure 1 - Schematic of premises infrastructure served by University of Oxford IT Services

### 2 THE ELEMENTS OF UNIVERSITY OF OXFORD IT SERVICES ENTRANCE FACILITIES

The function of the University of Oxford IT Services Entrance Facilities is to ensure the safe delivery of the University of Oxford IT Services external infrastructure into the premises and to provide an external network interface (ENTI) to the incoming balanced and optical fibre cabling.

The University of Oxford IT Services Entrance Facilities comprise:

- incoming balanced cabling to the BDF;
- incoming optical fibre cabling to the OFEF;
- the pathway and pathway system(s) between the premises penetration and the BDF/OFEF;
- the BDF;
- the OFEF (this is not required if the internal/external cable of 4.3.3.1 is used);
- the EC;
- the OFEF-EC link cables;
- the pathway and pathway system(s) accommodating the OFEF-EC link cables.

### 3 DESIGN SENSITIVITIES

#### 3.1 Line-pairs supported by the BDF

The design of the entrance facilities depends upon the number of line-pairs allocated to the customers' premises.

Direct-connect cabling is allocated on a one-pair per line basis and intermediate cabling to a TD panel is allocated as follows:

- 80 %: one-pair per line;
- 20 %: two-pairs per line.

As a result the initial planned number of line-pairs = no. of direct-connect cabling lines + 1,25 x no. of TD lines

The allocated number of lines supported by the BDF shall be 25% above the initial planned quantity. As a result:

- **no. of allocated BDF pairs = 1,25 x (initial no. of direct-connect lines) + (BDF pair allocation of Table 1).**

#### 3.2 Direct-connect lines

The number of direct-connect lines is a decision to be reached by the customer.

NOTE: Any telecommunications equipment, e.g. consoles, that can be damaged or caused to malfunction (including the "blowing" of fuses) shall be directly-connected to the BDF.

#### 3.3 Line-pairs delivered to TD panels

The physical implementation of a TD is a 24-port (RJ45 interface) voice circuit presentation panel as shown in Figure 2 and specified in ISP-02-001. TD panels are housed in cabinets (typically also containing ITD panels) which allows onward patching to the distribution cabling (see ISP-03-001 and ISP-03-003).



Figure 2 - TD panel (24 port, 1U construction)

The number of pairs delivered to TDs is based on multiples of 30 (20 No. 1-pair lines + 4 No. 2-pair lines + 2 No. spare pairs). Table 1 shows the number of TD panels to be provided based on quantity of 24-port distribution cabling panels in a cabinet.

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**Table 1 - TP panel calculator for 24-port distribution cabling panels**

INITIAL PLANNING					ALLOCATION		
Number of 24-port distribution cabling panels	Number of distribution cabling lines	TP panels	Total BDF lines	BDF pairs	TP panels	Total BDF lines	BDF pairs
1	24	1	24	30	1	24	30
2	48	1	24	30	2	48	60
3	72	2	48	60	2	48	60
4	96	2	48	60	3	72	90
5	120	3	72	90	4	96	120
6	144	3	72	90	4	96	120
7	168	4	96	120	5	120	150
8	192	4	96	120	5	120	150
9	216	5	120	150	6	144	180
10	240	5	120	150	7	168	210
11	264	6	144	180	7	168	210
12	288	6	144	180	8	192	240
13	312	7	168	210	9	216	270
14	336	7	168	210	9	216	270
15	360	8	192	240	10	240	300
16	384	8	192	240	10	240	300
17	408	9	216	270	11	264	330
18	432	9	216	270	12	288	360
19	456	10	240	300	12	288	360
20	480	10	240	300	13	312	390
21	504	11	264	330	14	336	420
22	528	11	264	330	14	336	420
23	552	12	288	360	15	360	450
24	576	12	288	360	15	360	450
25	600	13	312	390	16	384	480
26	624	13	312	390	17	408	510
27	648	14	336	420	17	408	510
28	672	14	336	420	18	432	540
29	696	15	360	450	19	456	570
30	720	15	360	450	19	456	570
31	744	16	384	480	20	480	600
32	768	16	384	480	20	480	600
33	792	17	408	510	21	504	630
34	816	17	408	510	22	528	660
35	840	18	432	540	22	528	660
36	864	18	432	540	23	552	690
37	888	19	456	570	24	576	720
38	912	19	456	570	24	576	720
39	936	20	480	600	25	600	750
40	960	20	480	600	25	600	750
41	984	21	504	630	26	624	780
42	1008	21	504	630	27	648	810

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## **4 THE SPECIFICATION OF UNIVERSITY OF OXFORD IT SERVICES ENTRANCE FACILITIES**

### **4.1 External pathway systems**

#### **4.1.1 Specification**

All University of Oxford IT Services external infrastructure cables entering the customers' premises shall do so via PVC conduit (circular duct) in accordance with BS EN 61386--24 and BT specification 54D (90 mm diameter).

If the optical fibre and balanced cables share the duct, one duct shall be installed provided that:

- no more than two optical fibre cables are intended to be installed, and
  - the balanced cables conform to 4.3.1 and the number of allocated BDF pairs does not exceed 1000,
- or
- the balanced cables conform to 4.3.2 and the number of allocated BDF pairs does not exceed 500.

If the optical fibre and balanced cables are presented in separate ducts, one balanced cable duct shall be installed provided that:

- the balanced cables conform to 4.3.1 and the number of allocated BDF pairs does not exceed 1200,
- or
- the balanced cables conform to 4.3.2 and the number of allocated BDF pairs does not exceed 600.

Note: this design rule allows a 25 % growth in voice line demand in the customers' premises without exceeding the 50 % fill factor normally regarded as the limit with regard to cable damage.

Additional ducts required for onward routing of cables shall also be in accordance with the above specification.

Smaller diameter PVC conduits (circular ducts) accordance with EN 61386-24 and BT specification 56 (49 mm diameter) are intended to house lower quantities of cables and may be used. However, these and any other ducts shall not be selected for installation without the express authority of the Network Operations Manager.

#### **4.1.2 Use of University of Oxford IT Services external pathway systems**

Cables shall only be installed in University of Oxford IT Services pathway systems with the express authority of the Network Operations Manager. These types of cables are specified in 4.3.

Certain other cables shall not be installed in University of Oxford IT Services external pathway systems, independent of their initial application. In particular:

- BS 7671 defines the requirements of coexistence of low voltage power supply cables with other cables for reasons of equipment protection;
- BS EN 50174-3 specifies requirements for the coexistence of all power supply cables with information technology cables for reasons of equipment protection;
- BS EN 50174-3 (by reference to BS EN 50174-2) specifies segregation requirements in relation to electromagnetic interference between power supply cables with information technology cables.

### **4.2 Premises penetration**

The point of penetration of the external cables into the customers' premises shall be provided with a gas seal to prevent ingress of toxic or explosive gases into the premises.

Information technology cables that do not comply with:

- the minimum recommended performance requirements of BS EN 60332-1-2 (which polyethylene sheathed cables, in general, do not);

or

- EuroClass E<sub>ca</sub> of BS EN 13501-6;

shall not be used between the premises penetration and the BDF without the express authority of the Network Operations Manager.

Where authority of the Network Operations Manager is given for the use of cables that do not comply with either of the above requirements, BS EN 50174-x standards requires that the cables shall either be:

- a) terminated in an entrance facility which is outside the external fire barrier of the building;
- or
- b) terminated inside the building, within 2 m of the point of internal penetration of the external fire barrier or any length exceeding 2 m shall be installed within a pathway system which shall be either:
  - a fully enclosed (acting as a fire barrier) steel conduit in accordance with BS EN 61386-1 (and relevant part 2);
  - or
  - a fully enclosed (acting as a fire barrier) steel duct in accordance with EN 50085-1 and the relevant part 2 (EN 50085-2-1 for ceilings and walls, EN 50085-2-2 for underfloor, flush-floor and onfloor).

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

### 4.3 External infrastructure cables

#### 4.3.1 *Balanced cables*

##### 4.3.1.1 *Mechanical and electrical performance*

The cables installed within the external infrastructure shall be in accordance with BT specification CW1308B (see Figure 3) which features the following:

- internal/external grade construction;
- aluminium-polyethylene moisture barrier;
- insulated 0,5 mm diameter conductors in pairs;
- 20 pair, 50 pair or 100 pair (selection and combination based upon the number of allocated BDF pairs).

The physical characteristics are:

- outer sheath colour: black;
- outer sheath diameter: 9,5 mm (20 pair), 13,5 mm (50 pair), 17 mm (100 pair).

A functional earth conductor (1,38 mm diameter) is optional as it not terminated at the BDF

Such cables are available from a wide range of manufacturer/distributors and no specific part numbers are mandated.

##### 4.3.1.2 *Fire performance*

Where the cables are to be installed within buildings without the mitigation specified in 4.2 then the cables shall at least meet EuroClass C<sub>ca</sub>-s1b,d2,a2 of BS EN 13501-6.

#### 4.3.2 *Alternative balanced cables*

##### 4.3.2.1 *Mechanical and electrical performance*

In certain cases it is more appropriate for the cables installed within the external infrastructure to be in accordance with BT specification CW1128 (see Figure 3) which features the following:

- external grade construction;
- polyethylene outer sheath;
- petroleum jelly or equivalent moisture barrier;
- PVC insulated 0,5 mm diameter conductors in pairs;
- 20 pair, 50 pair or 100 pair (selection and combination based upon the number of allocated BDF pairs).

The physical characteristics are:

- outer sheath colour: black;
- outer sheath diameter: 12 mm (20 pair), 16 mm (50 pair), 22 mm (100 pair).

Such cables are available from a wide range of manufacturer/distributors and no specific part numbers are mandated.



CW1308B external/internal balanced cable



CW1128 external balanced cable

**Figure 3 – External balanced cables**

#### **4.3.2.2 Fire performance**

Cables shall comply with:

- the minimum recommended performance requirements of BS EN 60332-1-2;
- or
- EuroClass E<sub>ca</sub> of BS EN 13501-6.

Where the cables are to be installed within buildings without the mitigation specified in 4.2 then the cables shall at least meet EuroClass C<sub>ca</sub>-s1b,d2,a2 of BS EN 13501-6.

#### **4.3.3 Optical fibre cables**

##### **4.3.3.1 External optical fibre cables**

See IISS-01-002, clause 2.1.5 (of Issue 2018-01).

#### **4.4 OFEF-EC link cables**

##### **4.4.1 SMF optical fibre cables**

See IISS-01-002, clause 2.1.5 (of Issue 2018-01).

#### **4.5 Building Distribution Frame (BDF)**

The BDF presents to the pairs of the incoming external balanced cables for onward distribution either:

- via direct-connect cabling either direct to Line Jack Units or via local distribution panels;
- via the intermediate balanced cables (see ISP-02-001) to the TD panels (ISP-02-002).

A number of possible BDF constructions are possible as shown in Table 2 and Figure 4. These are the default options as they provide secure accommodation for the connections within the BDF.

A frame as shown in Table 3 may be used in the following circumstances:

- space constraints prevent the use of the closed BDF constructions of Table 2;
- the number of lines exceeds those of Table 2.

Under no circumstances shall cables that are not terminated in a BDF be routed within the physical boundaries of a BDF (enclosed or open).

**Table 2 - Enclosed BDF Constructions**

Number of allocated BDF pairs	BT Specification	Dimensions (H x W x D)	Austin Taylor Part No.
20	251A box (Note 1)	210 x 160 x 90	9BC1932302
50	301A box	320 x 210 x 90	9BC1932502
100	304A box	320 x 420 x 120	9BC1932602
170	510 cabinet	1000 x 300 x 140	9BOX223091
340	520 cabinet	1000 x 500 x 140	9BOX223101
510	530 cabinet	1000 x 750 x 140	9BOX223111
NOTE 1: direct-connect cabling only			

**Table 3 - Open BDF Constructions**

Number of allocated BDF pairs	BT Specification	Dimensions (H x W x D)	Austin Taylor Part No.
690	108A	2006x570x150	9FRA223001



BT specification 251A (top) and 301A (bottom)

BT specification 520 cabinet

BT specification 108 frame

**Figure 4 - BDF constructions**

#### 4.6 Optical Fibre Entrance Facility (OFEF)

The OFEF is a lockable cabinet as follows:

- Rittal Part No. 1555.500;
- 300 x 300 x 120 mm.

The OFEF cabinet shall be drilled and fitted with blind grommets to suit:

- 3 No. external optical fibre cables (see 4.3.3);
- 3 No. OFEF-EC optical fibre cables (see 4.4);

Under no circumstances shall cables that are not terminated in an OFEF be routed within an OFEF.

This allows the standard implementation of two external optical fibre cables being jointed to four OFEC-EC cables.

Alternatively, one external optical fibre cables being jointed to two OFEC-EC cables with a further external optical fibre cables being jointed to up to two other external optical fibre cables.

The optical fibre management system in the cabinet shall be capable of supporting 48 No. optical fibre fusion splice protection sleeves.

The identifier for the OFEF shall be provided by University of Oxford IT Services. The label to applied to the OFEF shall be agreed with OUT.

Entry to OFEFs is prohibited without the express authority of the Network Operations Manager.

#### **4.7 EC**

##### **4.7.1 General**

The EC is a lockable 19 inch cabinet as per Rittal part number 7712009:

- 12U internal construction;
- 2 part;
- depth: 572 mm.

The EC cabinet shall be drilled and fitted with blind grommets to suit 2 No. OFEF-EC optical fibre cables (see 4.4).

Cable entries are also provided for the balanced intermediate cables and mains power cable.

Under no circumstances shall cables that are not terminated in an OFEF be routed within an OFEF.

The cabinet provides accommodation for:

- 1U height active equipment switch;
- 2U height UPS;
- 1 No. optical fibre termination panel (see 4.7.2);
- 1 No. balanced intermediate cable termination panel containing 24-ports (see ISP-02-002);
- optical fibre equipment cords;
- optical cords connecting the active equipment to the optical fibre termination panel;
- balanced cords connecting the active equipment to the balanced cabling termination panel.

The identifier for the OFEF shall be provided by University of Oxford IT Services. The label to be applied to the OFEF shall be agreed with University of Oxford IT Services.

Entry to ECs is prohibited without the express authority of the Network Operations Manager.

##### **4.7.2 Optical fibre termination panel**

See IISS-01-002, clause 2.4.4 (of Issue 2019-01).

##### **4.7.3 Optical fibre pigtails**

See IISS-01-002, clause 2.2 (of Issue 2019-01).

##### **4.7.4 Optical fibre equipment cords**

###### **4.7.4.1 Fire performance**

Cables within the cords shall comply with the minimum recommended performance requirements of BS EN 60332-1-2; or EuroClass E<sub>ca</sub> 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.

#### 4.7.4.2 **Singlemode**

Singlemode optical fibre cords terminated:

- at one end with connectors conforming to BS EN 61754-20:2012, Interface 20-5 (duplex LC).;
- at one end with connectors compatible with the active equipment.

Length: 0,5 m or 1,0 m long.

Colour of outer sheath: yellow

The termination end faces shall have been inspected in accordance with the requirements of ISO/IEC 14763-3. The terminations shall have been tested in accordance with:

- IEC 61300-3-6 (return loss): limit 45 dB minimum;
- IEC 61300-3-4 (insertion loss): limit 0.75 dB maximum.

#### 4.7.5 **Balanced equipment cords**

Category 5 cords in accordance with BS EN 50173-1 (these are equivalent to Category 5e cords of ANSI/TIA-568- 2.D).

Length: 0,5 m or 1,0 m long.

Colour of outer sheath: Red

### 4.8 **External Network Test Interface**

#### 4.8.1 **Balanced cables**

The balanced cable external network interface is presented on the BDF. This allows the continuity and pair mapping of the external cabling infrastructure to be tested.

#### 4.8.2 **Optical fibre cables**

The optical fibre external network interface is presented at the optical fibre termination panel (see 4.7.2) within the EC.

See IISS-01-002 for testing procedures.

## 5 **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: Overview

ISP-00-002: Access to University of Oxford IT Services facilities (later)

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

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

## NORMATIVE REFERENCES

The following documents shall 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 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 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 50173-1:2018	Information technology - Generic cabling systems - General requirements
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
IEC 61300-3-4	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-4: Examinations and measurements - Attenuation
IEC 61300-3-6	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 3-6: Examinations and measurements - Return loss
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
IISS-01-002	Installation and acceptance testing of singlemode optical fibre cabling

## BIBLIOGRAPHY

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

ANSI/TIA-568-2.D	Balanced Twisted-Pair Telecommunications Cabling and Components Standards
BS 8492:2016 + Amendment 1:2017	Telecommunications equipment and telecommunications cabling. Code of practice for fire performance and protection