

# Imperial College London

**Information & Communications Technology  
Network Infrastructure Group**

**Network Infrastructure Standards**  
**January 2018**

**Appendix H – Fibre installation (vertical and backbone)**

Version 1.5

## **Appendix H – Fibre installation (vertical and backbone)**

### **1. Introduction**

This Section details the required standards for Fibre Optic cabling.

### **2. Standards**

The College has an established policy to install Brand-Rex fibre optic products (both micro-duct and tight buffered cable) and has generally standardised on OS1 fibre type. Due to legacy issues other types may have to be used (only if agreed with ICT).

It is a mandatory requirement that all fibre (tubes and cabling) supplied and installed is selected from the Brand-Rex “Optical Systems” range of products.

Before any blo-lite product is considered ICT needs to be informed and the reasons for installing this product explained. This is a solution to be used between areas where access is difficult or due to H&S reasons. It is preferred the use of micro-blo (or blown cable).

The optical Fibre installation shall conform to all applicable optical fibre standards.

### **3. Cable Routes**

All cable routes should be agreed with ICT’s representative prior to commencement of the installation of such routes.

All cables shall be either:

- Enclosed in trunking;
- Pulled in duct;
- Securely fastened to tray;

All containment shall be clearly marked at 5 meter intervals and at all concealment points with the following label:

“ICT DATA CABLES”

#### **3.1 Containment**

Steel wire cable Tray (a “basket” system) will be used.

#### **SCOPE**

Cablofil Steel Wire Cable Tray conforming to the material and performance of this specification.

#### **GENERAL**

Cable basket shall be manufactured from steel wires, welded together and bent into final shape prior to surface treatment.

Surface Treatments:

- i). Electro zinc plated to EN 12329
- ii). Hot Dipped Galvanised to EN ISO 1461
- iii). Stainless Steel to EN 10088-2 - AISI 316L and EN10088-2 AISI 304L

Steel Wire Cable Tray Widths & Depths

- i). Cable Tray dimensions are all internal.
- ii). Depths of 30mm, 54mm, 80mm, 105mm & 150mm.
- iii). Widths of 50mm, 100mm, 150mm, 200mm, 300mm, 400mm 450mm, 500mm & 600mm for depths of 30mm & 54mm.
- iv). Widths of 100mm, 150mm, 200mm, 300mm 400mm & 500mm for Depths of 105mm & 150mm
- v) All trays are of 3000mm Nominal long

## SPECIFICATION

Trays will be manufactured with a longitudinal 'T-welded' safety edge along the top wire of the sidewall (excluding 30x50)

Trays will be constructed with a 50mm x 100mm mesh configuration.

All tray fittings (e.g. changes in direction, level and size) shall be constructed on site, to the manufacturer's instructions, using side action bolt croppers and fastened using 25mm and 30mm counter clamps with M6 bolts and nuts, all surface treated as the tray.

Trays will be coupled together using the recommended fixing methods as stated in the catalogue

Trays shall be supported at a maximum span of 2.5m by trapeze, wall, floor or channel mounting methods and will not exceed maximum loads as specified by the manufacturer.

All welds will be manufactured to an average minimum tensile strength of 500Kg per weld.

## TESTS, CERTIFICATION AND CONFORMITY

Loading and deflection characteristics of the tray should be tested and the results published in accordance with the European Standard CEI 61537.

Suitability for the support of Cat6a data cabling should be demonstrated by way of

independent test verification.

Fire test certification published in accordance with the DIN4102-12 standard to achieve E30 to E90 for temperatures up to 1000oc

Electrical continuity across a coupling should be demonstrated by means of a published test method and result as specified in IEC61537

<https://www.legrand.co.uk/products/cable-management/cablofil/>

[http://www.cablofil.co.uk/sites/default/files/Cablofil\\_low\\_res\\_0.pdf](http://www.cablofil.co.uk/sites/default/files/Cablofil_low_res_0.pdf)

#### 4. Cable Joints

All cables should be complete between termination points; no cable joints will be permitted unless with specific authorization of the ICT department in writing.

#### 5. Cable Protection

Holes drilled through walls or floor for the routing of cables shall be suitably sleeved to prevent damage to installed cables.

#### 6. Fire Protection

Where cables, trunking, tray-work and conduit, pass through floors or walls, suitable fire sealing shall be provided in accordance with IEE 17th Edition Wiring Regulations (BS7671: 1992).

In main cable routes EZ-Path cableways **will/shall/must** be installed. These will include entry points to CWCs, risers and major thoroughfares and fire breaks.

#### 7. Labelling

All termination points shall be clearly labelled.

The cable will be labelled with a securely fixed 'traffolyte' type engraved label or with wraparound cable markers, before the fibre panel, showing:

ICT  
<Fibre ID> <CWC1 ID> to <CWC2 ID>  
<Installer company name> - <date>

Where <Fibre ID> is an ICL internal ID that will be provided to the installer by ICT. For this to occur the following information needs to be provided:

- <CWC1 ID>,
- <CWC2 ID>,
- Number of cores,
- number of cores terminated,
- connector type,

- cable type.
- Any important comments on the installation, if any.

If cables are running in inside of a building add:

*<Riser ID / description>  
This information is to be passed on to ICT rather than placed on the cable.*

The fibre panel will be labelled with:

*<Fibre type> <number of cores> <Fibre ID><CWC ID1><CWC ID2> <X>*

*Where CWC ID1 and CWC ID2 are the two linked CWCs and CWC ID1 is always the one with the smallest ID value.*

X is the panel identifier. Starting with “A” and continuing to “B” and so forth.

Fibre ID. Please contact Imperial College ICT to obtain the ID number

**e.g.:** To connect CWC42 and CWC1 with OS1 24 cores would be – OS1 24 CWC1 CWC42 A. An additional connection would be - OS1 24 CWC1 CWC42 B

As a safety measure a Laser/LED information sticker will be placed on the back of the fibre trays (right hand side) and also on the front (right hand side).

Individual connectors should be labelled in accordance with circuit numbers.

## 8. Cables

All cables shall be clearly labelled at 5 metre intervals and at all points of entry and exit for concealment, indicating:

ICT  
*<Fibre ID> <CWC1 ID> to <CWC2 ID>  
<Installer company name> - <date>*

If cables are running in inside of a building add:

*<Riser ID / description> - This information is to be passed on to ICT rather than placed on the cable.*

These labels will be of the same type as mentioned in the previous item.

## 9. Fibre Optic Cable Construction

The cable should be:

- Of a tight buffer or loose tube construction suitable for installation in risers.
- Capable of withstanding temperatures in the range -10° to 50°C without degradation in performance;
- Suitable for installation in underground ducts (occasionally flooded) and for

routing on tray work within buildings. The outer sheath shall meet fire regulations for installation within buildings.

The cable shall have a construction as below:

Standard	Core Diameter	Cladding Diameter
OM1*	62.5 micron	125 micron
OM2 *	50 micron	125 micron
OM3 *	50 micron (Broadband)	125 micron
OS1	9 micron	125 micron
OS2**	9 micron	125 micron

\* - These are old standards that will be used only where necessary for local compatibility. They should only be a last resource and if used should be installed in parallel with single mode fibre.

\*\* - OS2 is currently being considered. For adoption by the College Brand Rex will be checking its seamless interoperability with OS1.

Fibres shall be individually colour coded to aid identification.

## 10. Fibre Optic Termination Points

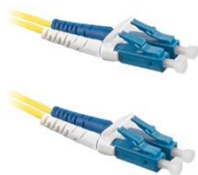
All optical fibre cables should be terminated within termination panels mounted within a CWC's equipment Cabinet, in accordance with the proposed cabinet layout.

Panels will be mounted in the cabinet such that the connectors are flush with the mounting rails of the cabinet. The front of the patch panel should not be recessed.

Terminations should be agreed with ICT in advance, but will in general be:

Standard	Termination
OM1	STII
OM3	MTRJ
OS1	LC

Please see the LC Splice Module, the LC fibre leads and fibre connector housing, as per our Ordering appendix.



Please note the new

## 11. Fibre Optical Cable - Patching and Splicing in Termination Boxes

All fibre cores shall be terminated and tested.

After testing the contractor should make sure that all dust caps are in place.

To facilitate re-termination or splicing of fibres, sufficient slack cabling should be left to enable at least two re-terminations to be achieved.

The cable will be left with enough slack as to allow the cabinet to be moved in an emergency or unforeseen event. Please see CAT 5 cabling specifications in respect to this (Appendix F - UTP cabling)

## 12. Fibre Optic Patch Cords

Duplex patch cords should be used.

## 13. Warranty

The Fibre Optic distribution scheme should be included within the Applications and Performance Warranty'.

## 14. Fibre Optic Testing

All fibres should be tested individually with an OTDR (Optical Time Domain Reflectometer).

In addition, the attenuation of each cable should be measured at both **850NM + 1300NM** using a light source/power meter.

The test results shall be tabulated in a neat and legible form and signed by the installation Contractor's representative as a record of the installation. This should be a 100% test. Testing should be carried out from each end of every fibre, as a minimum, comprise:

Standard	Wavelength	Maximum Attenuation	Modal Bandwidth (OFL)	Modal Bandwidth (LL)	Propagation Delay
OM1	850nm 1300nm	√ √	√ √		√ √
OM2	850nm 1300nm	√ √	√ √		√ √
OM3	850nm 1300nm	√ √	√ √	√	√ √
OS1	1310nm 1550nm	√ √			√ √

Test settings should also be recorded for each test so that results can be faithfully repeated.

The results form will record:

- The unique identifier of the fibre optic cable and fibre number
- The name of the person conducting the test
- The type and manufacture of the cable being tested
- The date of the test
- The results to be recorded on the form shall be:
- All settings of the test equipment so that the test may be exactly recreated if necessary
- The end of the cable from which the test is carried out
- The measured cable length
- The attenuation at 850nm, 1300nm and 1550nm (dB) as appropriate
- The Bandwidth at 850nm, 1300nm and 1550nm (MHz/ km) as appropriate
- A copy of the OTDR trace

## **15. Completion Documentation**

The Contractor should, on completion of their works and prior to acceptance by ICT, submit digital copies of all records and schematics for this part of the installation.

Schematics will detail all cable runs and termination points. The installed cable capacity, cable identification reference, length and type of cable shall be identified. Records will show clearly all cable terminations and cross connections together with cable capacity and installed length.

The following documentation is required:

- Fibre Optic cabling schematics;
- Fibre Optic cable records;
- As fitted drawings;
- Fibre Optic cabling test results;
- Cabinet Layouts;
- All relevant operating and maintenance manuals;
- All documentation and drawings will be required in machine readable format, ie. CD-ROM disk. Full details of CAD formats will be provided. All drawings shall be “as fitted” and shall take account of all changes and variations.

## **16. Drawings**

Please refer to Support Services Engineering Team CAD Strategy.

## **17. Telco fibre services**

As part of the critical services to Imperial we may need to have external services installed to enable the connection of a building or campus to the outside world and/or to the rest of Imperial’s network.



These links are done, in most cases, via the installation of fibre cables to the campus and/or building.

Considering the risk to College, especially for the Maintenance teams and Projects that may need to change building fabric where these services would traditionally be installed (risers and cable routes throughout the building) the College will be installing “intake rooms” into the buildings. These will be small secure spaces that will have an ODF (Optical Distribution Frame) installed where the Telco will provide their services to and where their delivery point will be.

The link between that ODF or Intake Room to the main comms room for the building or campus will be done with Imperial College own fibre.

For the design of the space and specification of the ODF please check “Appendix E - Ordering”.