STANDARD SPECIFICATION FOR THE DESIGN AND INSTALLATION OF STRUCTURED, FIBRE OPTIC AND VOICE CABLING SYSTEMS
EPM PM19
JANUARY 2023

If this document is incorporated in another document, it shall be used in its entire and unaltered form.

Following an OJEU tender, the contractors listed below are the only ones approved by the University of Manchester to carry out work on the Structured Cabling Infrastructure.

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Please note that as this is generally a structured cabling specification and the main contact from each of the structured cabling contractors will be required to sign an acceptance form for this and any revised structured cabling specifications.

The signing of the acceptance form will confirm that the specification has been read, accepted and will be followed in full by all operatives working for and on behalf of the University of Manchester, except for circumstances beyond their control.

Each of the named structured cabling contractors will be required to have a minimum of two currently trained operatives for the structured cabling and blown fibre system that they are installing. Manufacturer's installation recommendations and best practices should be followed at all times.
Each of the structured cabling contractors will be required to provide a full manufacturer's backed 25year product and performance warranty for the system installed within each cabled new build or major refurbishment.

Important Notes

To ensure the completed installation meets the user's requirements and adheres to this specification it is essential that consultations with the University's IT Services Division and Telecomms department take place at the beginning of the design process and continues through to completion of the project.

All university staff involved and contractors working on projects are responsible for ensuring that the conditions of this document are fully adhered to.

This document is a specification that has been written for all individuals to follow without ambiguities and shall be used for major refurbishment work, new builds and as a guide to working on existing installations of all sizes. Deviations from any part of this specification are not expected other than where there have been technological advancements or changes in BS/International standards and will only be permitted following the attainment of written permission from the Network Technical Lead (Passive) or his appointed person. Particular attention should be made to this section of the document as unauthorised deviations from the specification will not be accepted or signed off as approved. If derogations are to be approved, they should be requested, logged, and tracked through the project. This will usually be conducted by the Main Contractor or their immediate Sub contractor

- To allow adequate time for the Universities Network team / partner to install active equipment all Communication Rooms shall be signed off by the Network Technical Lead (Passive) or his appointed person at least 2 weeks before any scheduled installation dates.
- From receipt of a Service Request for INSTALL/MOVE/ADD/CHANGE' an implementation plan will be created for sign off and delivery of requirements.
- Any installation of safety-critical and life critical systems which requires network connectivity must be clearly defined and documented prior to any implementation. Before any such systems are connected to the network a suitable network design must be created and validated by the Universities Network team / partner
- Health and Safety issues have been created in previous projects due to insufficiently sized Communication Rooms and/or lack of clearance to work in and around the network cabinets. See section 5 for the minimum level specification for such requirements.
- Insufficient Power and Cooling has previously been an issue resulting in late hand over of projects. Please note that Network equipment is expensive to replace and will not be replaced other than in exceptional situations. Any deviations from the specification will only be allowed with written approval from the Network Technical Lead (Passive) or his appointed person. See section 5 for the minimum level specification for such requirements.
- Wireless is an essential service on campus. Wireless design is the sole responsibility of the IT Services Network Team / Partner. No other designs will be accepted, nor should they be commissioned. Estates Project Managers please note that IT Services Network Team / Partner will procure the wireless equipment on behalf of your project BUT you must plan for IT Services Network Team / Partner to undertake surveys AND reserve the budget to fund the purchase of the aforementioned wireless access points (AP's) and the cabling of these devices. A paper based design will initially be made followed by an onsite survey once the building is close to completion to finalise the locations of wireless devices. Wireless points will not be deployed or enabled on projects that do not follow this specification. See section 15 for details.
- Poor quality labelling has often delayed projects in the final stages of delivery. Please note, all installations MUST be tested and labelled to the level defined within the specification. If clarification is required, please contact the Network Technical Lead (Passive) or his appointed person.
- IT Services Network Team / Partner will design, cost, procure and implement all active network equipment to ensure that all solutions proposed are in line with the IT Strategy. IT Services Network Team / Partner have responsibility for the sign-off of IT solutions and infrastructure (including WIFI, software, applications and so on) and as such are accountable for the design and maintenance.
- IT Services Network Team / Partner will engage with Estates and their consultants appointed as part of the project/design team. This is in line with the Standard Operating Procedure for Acquisition, development, and maintenance of IT systems and/or services.
- Communication Rooms are solely for the purpose of housing the Structured Cabling System and associated active network equipment. No other equipment is permitted. If other servers/BMS equipment etc. are required by the local occupant's alternative space should be designed into the building.
- The position and layout of cabinets MUST be agreed with the Network Technical Lead (Passive) or his appointed person in advance of any Structured Cabling cable termination being performed.

- Installation of active network equipment prior to completion of electrical testing/sign-off has resulted in the loss of equipment and extra cost within projects. Estates Project Managers should consider network installation schedules and the dependencies on a stable power environment as the cost of replacement equipment prior to handover will be borne by the project.
- Access should be given to the IT Services Network Team / Partner during the construction phase so they can check the installation at various stages against the specification.
- The maximum number of room outlets allocated to a single cabinet or rack shall not exceed three hundred and eighty four (384) unless written approval has been obtained from the Network Technical Lead (Passive) or his appointed person.
- Primary Ducts and Sub- Ducts are to be installed as part of the Estates contract by the Main Contractor See section 4 for information.
- One 16A SP&N commando socket c/w isolation switch is to be provided within the Communications room for each cabinet installed and one additional socket for future use.
- It is assumed that UPS will not be required at this stage, but for future UPS provision one dedicated 63A SP&N commando sockets c/w isolation switch shall be fitted above the cabinets
- A review for the delivery of telephony on each refurbishment or new build needs be agreed as part of the design process. The conclusion of the review will determine whether a full VOIP solution or delivery of the TDM capability will be implemented.
- The University is PCI DSS compliant.
  To achieve this compliance, the University restricts the transmission of card payment data to P2PE encrypted data on specific areas of its network and prohibits the transmission of all other card holder data on all other parts of its network.
  The University is not a PCI DSS service provider and will not host PCI DSS connectivity for 3rd parties on its data / telephony network. If connectivity is required for card payment devices, the service should be ordered from a commercial services provider, or if for University business PCI listed and validated P2PE solutions may be used. Any proposed card payment solutions will have to be PCI DSS compliant and vetted by the PCI DSS Operations Board. PCI DSS reference contact will be the Risk Analyst.
- The recent publication of BS6701:2016+A1:2017 "Telecommunications Equipment and Telecommunications Cabling" has now been amended to include the recent Construction Product Regulations (CPR) in relation to the fire performance of communications cabling within buildings. The new BS6701 requires that all fixed telecommunications cabling (Voice, fibre and data cabling) has a minimum fire performance rating of B2ca-S1a,d1,al All installed Cat5e / Cat6A cables will meet or exceed this standard and will be marked with the corresponding CE mark and CPR rating to show conformity to the CPR regulations. See section 18 for cable specification.

If there are any clarifications required over this specification, please contact the Network Technical Lead (Passive) or his appointed person.
Deviations from this specification will not be tolerated unless previously agreed in writing by the Network Technical Lead (Passive) or his appointed person.

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1.   Introduction

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

2.   Scope and Compliance

This specification details the requirements for the planning, installation, operation and documentation of Information Technology and Telecommunications cabling using copper and fibre optic cabling and is applicable to all such cabling systems installed for and used by The University of Manchester.

It is intended for use by those involved in the design, procurement, installation and operation of Information Technology and Telecommunications cabling systems within The University of Manchester.

The design and installation of the structured cabling system shall comply with the latest versions of ISO11801, BS EN 50173, BS EN 50174 and BS6701:2016+A1:2017 current at the time of installation and with the recommendation of the system manufacturer. Where there is a conflict between ISO11801, BS EN 50173, BS EN 5017, BS6701:2016+A1:2017 and this specification, written clarification shall be sought from the Network Technical Lead (Passive) or his appointed person on how to proceed.

All electrical work shall be carried out in accordance with The University of Manchester's EPM PM8 - Standard Electrical Specification.

3.   Definitions and Abbreviations

Active equipment
Powered equipment necessary to deliver a service

Blown fibre tube (Single and multicore configurations)

A tube through which the blown fibre cable is blown through

Blown fibre tube link
The section(s) of blown fibre tube between termination points i.e. patchpanels and BFTMPs, or between BFT-MPs.

Blown fibre cable link
The blown fibre cable between fibre optic termination points i.e. patchpanels

Cabinet
A free-standing and self-supporting enclosure to house both passive (cabling) and active (powered) equipment. Cabinets are fitted with lockable doors and side panels, incorporating vertical members on which panels and equipment can be mounted.

Cable route
The path of which new and existing cables follow through tunnels, ducts etc.

Cable containment system
Cable tray, basket tray, trunking and conduit used to contain cables

Cabling system
Combination of cable and termination points to create a structured cabling system.

Cable / Basket Tray
Perforated sheet steel tray or wire basket tray

Communications
Refers to both data network and telephone network systems

Communication room
Dedicated room for the installation of Information Technology and telephone distribution equipment

Data cabling contractor
Contractor that works on the structured cabling system

Standard fibre cable sometimes referred to as conventional
A number of fibre cores enclosed in a protective sheath suitable for both internal and external installation

MDF (Main distribution frame)
Open frame for mounting telecommunication disconnection modules (237A strips)

Identification number
Unique information to distinguishing individual components

Label
Means of marking components with the identification number

Patch panel.
Generic term for the network termination points mounted in a cabinet

APF (Advanced Patching Frame)
A metallic structure without doors or coverings incorporating vertical members on which panels and equipment can be mounted.

Room outlet
Network Termination Point located at the far end of the installed cable

Structured cabling
A building or campus telecommunications cabling infrastructure that consist of a number of standardized smaller elements (hence structured)

Telecommunication
Refers to telephone network system

Primary Ducting
151mm cable duct with smooth inner surface

Sub Duct
A 32mm cable duct that is installed within the primary duct

VOIP
Voice over Internet Protocol technology allows telephone calls to be made over the Structured cabling

4.   Preliminary Information

To ensure the completed installation meets the user's requirements and adheres to this specification it is essential that consultations with the University's IT Services Network Team / Partner and Telecomms department take place at the beginning of the design process and continues through to completion of the project.

All university staff and contractors working on projects are responsible for ensuring that the conditions of this document are fully adhered to. Exceptions to this shall be agreed in writing between the Main Contractor and the Network Technical Lead (Passive) or his appointed person.

All structured cabling installations shall form part of the manufacture backed 25year product and performance warranty. Each cabled new build or installations above 96 structured cabling outlets will require a unique manufacturer's warranty certificate issuing within 4 weeks of completing the structured cabling installation and not the completed project installation date as this is usually later.

To maintain compatibility with existing cabling installations across The University of Manchester only products and systems listed in Section 18 shall be installed.

All components (patch panels, room outlets, etc.) of the cabling system shall meet the requirements of ISO/IEC 11801 / EN50173 and deliver the appropriate class channel e.g. Category 5e (Class D), Category 6A (Class EA)
It is the main contractor's responsibility to ensure that all holes made through walls and ceilings shall be sealed with appropriate fire rated material to maintain the firebreak. If any fire breaks are breached during the installation the Network Technical Lead (Passive) or his appointed person / main contractor shall be informed immediately depending on the type of installation.

No sealing or fixing materials shall be used against any part of the cable containment system which is designed to be removable e.g. trunking covers.

Minimum bend radii must be maintained to ensure that cables are not tight against corners of the cable containment system.

As part of a new build or refurbishment all obsolete copper & fibre optic cables must be removed along their entire length and disconnected from both end termination points by one of the approved Framework Contractors.

All cables unfastened to facilitate the removal of obsolete cables shall be refastened ASAP to the cable containment system.

All waste or surplus material shall be removed from site / Communication Rooms. No tools, steps, barriers etc should be stored in Communication Rooms.

New builds shall be diversely linked to the external campus duct network system with a minimum of 2 x 151mm primary cable ducts and 14 Sub Ducts. 1 x 151mm primary duct and 7 x 32mm Sub Ducts are to be installed to each building entry point. There shall be a minimum of 10m separation between building entry points and within buildings.

All external straight through duct chambers which are in and out only with no change in direction shall be a minimum size of 600mm x 600mm all other chambers shall be sized at 600mm x 1200mm. IT / Telecomms cable ducts and chambers shall not be shared with any other services.

Primary Ducts and Sub- Ducts are to be installed as part of the contract by or through the Main Contractor
A Sub Duct is a tube installed within the primary duct through which main telecommunications and blown fibre tubes are installed. Primary ducts should be 151mmID and have a smooth inner surface, Sub Ducts should be 32mmID. 7 x Sub Ducts should be installed within 1 x primary duct.

The Sub Duct normally used by the University is supplied by Emtelle which is a roped HDPE 32/27mm duct, part number MHT582 but an alternative Sub Duct can be used if it is to the same standard & specification. Each of the 7 Sub Ducts should have a different coloured stripe or some form of individual tube identification.

5.   Communications Rooms

To facilitate access by authorised staff and minimise health & safety issues, Communications Rooms / cabinets should be accessible from public areas and not located in risers or plant rooms. The IT services Network Team / Partner may require rapid access to them that could be out of normal working hours. The Communication Rooms / cabinets must either be accessible from public circulation areas, or an unrestricted route must be clearly identified by which the IT Services Network Team / Partner can enter the room without hindrance from departmental security systems.

Communications Room(s) shall be of sufficient size to accommodate the required floor standing cabinets with space for the addition of one extra cabinet. Additional space should be left to the side closest to the communication room door. At design stage the minimum size a communications room should be is 3.2m x 2.9m which allows for one cabinet, one spare and required safe working space around the cabinet.

Basement Level Communication Rooms should be avoided at design stage.

To improve resilience no more than two cabinets should be allowed in a Communications room at the design stage

There shall be no liquid carrying pipes installed within or above a communications room.

There shall be a minimum of 800mm space to the sides of the equipment cabinet(s).

There shall be a minimum of 1000mm space to the front and rear of the equipment cabinet(s).

One wall of the communications room shall be left blank for the installation of telephones wiring frames or Box Connections.
Box Connections shall be mounted on the wall with the bottom edge 1000mm above floor level.

There shall be a minimum of 500mm space to each side of any telephone wiring frame if not mounted against a wall.

There shall be a minimum of 1000mm space to the front of any telephone wiring frame.

As part of the Estates project requirements all Communication Room doors should not have any glass or see through panels and shall be fitted with a lock suited to The University of Manchester's system for Communication Rooms. The suited set and building differ number shall be obtained from the Network Technical Lead (Passive) or his appointed person. This information should be requested, and locks procured as part of the project in time for them to be fitted before Communications Room handover. Three keys should be issued per building irrespective of the number of Comms Rooms.

The communications room shall be linked to the main building fire alarm system.

Emergency Lighting Regulations should be considered within the design of Communication Rooms.

Communication room fire resisting compartmentation should be commensurate with the building fire strategy, fixed horizontal and vertical barriers with designated fire resistance including adequate fire stopping; cavity barriers; fire dampers or seals; doors and vents should all be commensurate with the fire resisting compartmentation of the building fire strategy.
See EPM HS34 – Passive Fire Protection
Liaison with the University Fire Officers is advised at planning stages for early consultation

Lighting levels must comply with BS EN 12464-1 2014 and to an average maintained horizontal illuminance (EM) of 500 lux at floor level and a vertical illuminance of 200 lux on the face of a communications cabinet up to 1m from the floor level.

Floor Finishes
Straight to floor slab:
The floor shall be levelled, using a suitable levelling compound then cleaned prior to fitting the floor covering. The floor covering shall comprise heavy duty Ant-static vinyl, colour selected from the standard RAL range.

Raised floor: (If installed)
Prior to the installation of the raised access floor, the floor slab shall be cleaned and left free from dust and debris in preparation for painting. The floor should then be painted with two coats of epoxy based floor paint, colour red or grey. Water based paints shall not be used.

The raised access floor shall comprise 600 x 600 x 42mm heavy duty square modular panels with a factory bonded Anti-static vinyl finish. New pedestals will be two parts, resin fixed to the concrete substrate and mechanically fixed.

Communication Rooms are solely for the purpose of housing the Structured Cabling System and associated active network equipment. No other equipment or systems should be installed within a Communications Room.

Adequate ventilation or air conditioning shall be provided to maintain the temperature around 24° Centigrade +/- 2°. (A fully equipped cabinet or rack can generate up to 7,500 Btu/h 2.2kw). Humidity levels should be kept between 40 and 60% RH

The final position of the equipment cabinet(s) shall be agreed on site with the Network Technical Lead (Passive) or his appointed person prior to installation.

The power supply for each cabinet shall be served from a dedicated circuit, fed via an isolation switch located between the communication room door and the equipment cabinet(s). Each cabinet requires a dedicated 16A SP&N commando socket. The socket should be fitted directly above the rear and centre of the cabinet or frame and not exceed a height of 2.5m above floor level.
One additional 16A SP&N commando socket and isolation switch located as above is to be provided within the Communications room to accommodate the installation of an additional cabinet. Please note socket faces should point away from the cabinet.

All circuits serving electrical installations within the Communication Rooms shall be derived from a dedicated Distribution Board located within the room.

All electrical installations are to comply with the requirements of EPM PM8 – Standard Electrical Specification.
It is assumed that UPS will not be required at this stage, but for future UPS provision one dedicated 32A SP&N commando socket and isolation switch shall be fitted above the cabinet (positions to be agreed at the time of installation)

All isolation switches shall be clearly labelled with the cabinet reference number.
1 Dual Data Socket and 3 Dual power sockets with high integrity earthing shall be installed within each Communications Room for convenience use only so positions are not critical.

6.   Equipment Cabinets / Racks

Equipment cabinets shall be floor standing and contain 19" rack mounting rails to the front & rear.
A minimum of one full height 300mm x 54mm Basket tray shall be installed to both internal sides of the equipment cabinet. A larger size may be required based on the number of cables to be installed.
Equipment cabinets shall be of a type listed in section 18.

Cage nuts (6mm) shall be supplied and inserted by the structured cabling contractor for the full height of the rack to facilitate the installation of data switches.

Where multiple cabinets are installed in one location they shall be positioned side by side (with any intermediate side panels removed) and bolted together using the manufacturer's baying kit.

Equipment cabinets shall be fitted with double vented front and rear wardrobe style doors, and solid side panels.

The Front and rear doors of the equipment cabinets should be provided with an electronic remote controllable locking device which will have the capability of operating, utilising the Universities incumbent MiFare swipe cards. Equipment side panels should also be lockable but only require the standard locks that already come with the cabinet.
Cabinet Locks shall be of type listed in section 18. Please note the locking device does not come with a power lead so 1 x 1m C13 to C14 Powered lead will need to be procured and provided in addition to the locking device

Equipment cabinets shall be 42u high, 800mm wide and 875mm deep.

The front vertical mounting strips shall be set back to give a minimum clearance of 150mm between the front mounting strip and the inside face of the front door.

A typical layout of patch panels and equipment within a cabinet is shown on page 11.

All equipment cabinets shall be individually earth bonded. This will normally be by means of a separate 10mm earth cable wired back to the closest main earth bar.
Approval shall be required from the Network Technical Lead (Passive) or his appointed person on the position of cabinets before any components are installed or cables terminated within the cabinet. The layout shown must be followed.
Due to the size and weight of active equipment and several associated Health & Safety issues wall mount cabinets are not allowed. Under certain circumstances smaller floor standing cabinets could be considered if agreed in writing with the Network Technical Lead (Passive) or his appointed person.

The maximum number of room outlets allocated to a single cabinet or rack shall not exceed three hundred and eighty four (384)

Power distribution units are required and must be installed to the left hand side mounting rails when looking at the cabinet from the back.
Power distribution units shall be of type listed in section 18.

TYPICAL CABINET / RACK layout

'U'	FRONT	
1	Space for fibre terminations	
2	Cable Management	
3	Cab Lock Controller (rear)	
4	Distribution Switch	
5	Distribution Switch	
6	Space	
7	24 Room Outlets	24
8	48 Port Data Switch	
9	24 Room Outlets	48
10	Voice Link 1	
11	24 Room Outlets	72
12	48 Port Data Switch	
13	24 Room Outlets	96
14	Voice Link 2	
15	24 Room Outlets	120
16	48 Port Data Switch	
17	24 Room Outlets	144
18	Voice Link 3	
19	24 Room Outlets	168
20	48 Port Data Switch	
21	24 Room Outlets	192
22	Voice Link 4	
23	24 Room Outlets	216
24	48 Port Data Switch	
25	24 Room Outlets	240
26	Voice Link 5	
27	24 Room Outlets	264
28	48 Port Data Switch	
29	24 Room Outlets	288
30	Voice Link 6	
31	24 Room Outlets	312
32	48 Port Data Switch	
33	24 Room Outlets	336
34	Voice Link 7	
35	24 Room Outlets	360
36	48 Port Data Switch	
37	24 Room Outlets	384
38	Voice Link 8	
39	Space	
40	Space	
41	Space	
42	Space	

7.   Patch Panels and Patching

The 24 port room outlet patch panels shall be mounted as detailed in the section 6 Rack layout
Patch panels shall use RJ45 connectors meeting the requirements of ISO/IEC 11801
Cat6A Cable terminations shall enter the patchpanel from both sides (12 per side) and will be terminated to the
T568B standard. Cat6A patchcords shall enter the front of the patchpanel from both sides (12 per side). Ports 1
through to 12 should be patched to the closest switch and the next available switch port on the left hand side of

the switch e.g. ports 1 -12 or 25 – 36. Ports 13 through to 24 should be patched to the closest switch and the next available switch port on the right hand side of the switch e.g. ports 13 - 24 or 37 – 48.
Patching will be carried out by the Universities Network team / partner at the time of the switch installation.

All patch leads provided shall be of the same manufacturer as the cabling system installed.

All patch leads shall be colour coded as follows:
Grey/Beige   standard lead used for data circuits
Green   standard lead used for voice circuits

Patch panels and Patchcords shall be of a type listed in section 18.

8.   Room Outlets

Cables shall be terminated to the T568B standard.

Room outlets shall be mounted at a height of 1 metre above the floor level, unless a different height has been specified within a design. If installing individual Cat5e / Cat6A outlets to an existing infrastructure then they should be mounted at the same height as the existing.

When outlets are presented in floor boxes or grommet boxes with a minimum of 38mm compartments side entry modules should be used. No outlets are to be presented within a floor void unless agreed with the Network Technical Lead (Passive) or his appointed person. Consolidation points and or Zone cabling shall not be used unless the solution has been agreed and approved with the Network Technical Lead (Passive) or his appointed person.

Room outlet faceplates fitted in dado trunking shall be removable without removing trunking covers.

Room outlet labels shall be machine printed and fixed behind the plastic window of the faceplate.

Room outlets shall be of a type listed in section 18.

9.   Cable Containment System

Primary Ducts and Sub- Ducts are to be installed as part of the contract by the Main Contractor
A Sub Duct is a tube installed within the primary duct through which main telecommunications and blown fibre tubes are installed. Primary ducts should be 151mmID with a smooth inner surface, Sub Ducts should be 32mmID. 7 x Sub Ducts are typically installed within 1 x primary duct.

The Sub Duct normally used by the University is supplied by Emtelle which is a roped HDPE 32/27mm duct, part number MHT582 but an alternative Sub Duct can be used if it is the to the same standard & specification. Each of the 7 Sub Ducts should have a different coloured stripe or some form of cable identification.

All containment feeding cabinets installed within a Comms Room should be 600mm x 54mm basket tray and there should be one basket tray installed for each cabinet until it exits the Comms Room. All containment installed outside of the Comms Room shall have a usable space that allows for 50% extra to the initial quantity of cables installed unless an alternative containment has been specified by the Network Technical Lead (Passive) or his appointed person. This means that no more than 66% of the containment should be used on day one leaving 34% spare capacity for future use.

If a two tier containment system is to be installed the top tier is to be filled first allowing the cables to pass through to the cabinet without obstructing or reducing the usable space on tier below.

Voice and data cabling systems may share the same containment. No other cabling systems are to be installed onto the side or within the primary voice and data containment e.g. fire, BMS AV etc.

Cable dividers shall not be used on basket trays.

Where primary cable routes pass through a wall (or any other obstacle) the hole shall be lined with the same type and size of containment as used on each side.

Metal cable containment should be used in areas out of sight, risers, false ceilings, plant rooms etc.
All metal containment shall be earth bonded to meet current IET regulations.

Horizontal sections of containment should be installed with the cable filling surface uppermost and shall be fully accessible.

Vertical sections of containment shall be installed with the cable filling surface facing outwards and shall be fully accessible.

All containment shall be fully accessible and not installed behind permanently fixed structures including solid ceilings. If this is unavoidable, then the correct amount and size of access hatches must be installed for faults and new installations without compromising standards or safety.

White PVC single or multiple compartment trunking or conduit shall be used where the containment will be visible.

Provision shall be made to ensure conformance to the minimum bending radius of cables to be installed.

Vertical sections of trunking 50mm x 50mm or larger should be avoided where possible.

Where trunking 50mm x 50mm or larger has a vertical drop greater than two metres cables shall be secured at regular intervals using the appropriate fixings.

Where the contractor considers the installation of cable containment to be extremely difficult or impossible, advice shall be sought from the Network Technical Lead (Passive) or his appointed person.

10.   Cat5e / Cat6A Cabling Requirements

All Category 5e cables shall be UTP Low Smoke Zero Halogen (LSOH) sheathed

All Category 6A cables shall be U/FTP Low Smoke Zero Halogen (LSOH) B2ca-Sla,d1,a1

Each connection between patch panel and room outlet shall use a single 4-pair twisted pair cable meeting the requirements of ISO/IEC 11801.

The length of cable from patch panel to room outlet shall not exceed 90m.

There shall be no junctions, splices or other connections in the cable between the patch panel and the room outlet.

There shall be no twists or kinks along the length of the cable.

All 4 pairs shall be terminated at each end of the cable.

Each end of the horizontal cable shall be labelled with machine printed labels (before and after termination)

The correct twists in each 4pair cable shall be maintained up to the point of termination as per the manufacturer's guidelines

The cable sheath shall not be stripped back more than the manufacturer's guidelines.
The manufacturer's recommended fixings shall be used to secure the cables at the termination points and as installed.

All structured cabling should enter the cabinets at high level unless installed within a floor void.
All cables, or bunches of cables installed on the horizontal shall be loose layed but tied directly to the containment at 300mm intervals or less at any bend or change in direction. Only Velcro cables ties are to be used on Cat6A installations except for cables fixed to vertical cable management and cables not supported along their entire length. These must be secured using Velcro cable ties and additional fire resistant cable ties at 1m intervals. This also includes fire escapes routes, corridors and staircases. External routes should also use the fire resistant cable ties in addition to any standard cable fixings.

Where cables are fixed to the containment the looms should not exceed 48 and 24 within a cabinet.

11.   Blown Fibre Cabling

For all new builds and major refurbishments, two fully diverse blown fibre tube cable routes (including SM fibre) shall be provided from two different core nodes into the building with a minimum of 10m separation both internal and external to the building.

In situations of a single Main Communications Room (MCR) the diverse blown fibre tubes (including fibre) shall be provided from two different core nodes with a minimum of 10m separation until it enters the MCR.

In situations of 2 Main Communications Rooms (MCR's) diverse blown fibre tubes (including fibre) shall be provided from two different core nodes with a minimum of 10m separation into each MCR location. The two MCR's shall then be linked together with 1 x 12core blown fibre tube and 2 x 12core SM OS2 blown fibre cables.

In situations of more than 2 Communication Rooms, 2 Communication Rooms will be designated as Main Communications Rooms (to be agreed with the Network Technical Lead (Passive) or his appointed person) and diverse blown fibre tubes (including fibre) shall be provided from two different core nodes with a minimum of 10m separation into each MCR location. The two MCR's shall then be linked together with 1 x 12core blown fibre tube and 2 x 12core SM OS2 blown fibre cables. Any additional Comms Rooms over and above the 2 MCR's shall be classed as secondary Comms Rooms

All secondary Communication Rooms (SCR's) will then have a 12 core SM OS2 fibre link back to both MCR's.

An example of two different core nodes are the Stopford Building and Kilburn. Core nodes will need to be confirmed at design stage by the Network Technical Lead (Passive) or his appointed person.

All blown fibre optic cabling shall be of the blown fibre system specified in section 18.

All installations shall be in accordance with the manufacturer's recommendations.

The location of all Blown Fibre Tube Management points (BFTMPs) and gas seal units shall be agreed with the Network Technical Lead (Passive) or his appointed person.

All junctions in the Blown Fibre tube system shall be labelled with a unique identifier that will be agreed with the Network Technical Lead (Passive) or his appointed person prior to completion of installation. The contractor shall obtain written confirmation of labels required from the Network Technical Lead (Passive) or his appointed person.

12 core blown fibre tubes shall be installed for all internal / external installations unless a different size has been agreed with the Network & Planning Officer or his appointed person. The external sheath shall be suitable for the environment in which it is to be installed.

Ducting rated for Internal and External use shall be used for inter building links if suited to the environment in which it is to be installed.

External grade ducting shall be terminated with gasblock connectors within 1.5 metres of the building entry.

All internal / external joints shall be carried out using the appropriate closures for the environment it is to be installed in to.

12 Core BFT tubes should be brought into the rear of the cab and stripped back to 100mm from the top exposing the internal cores. The spare internal cores of the tube should then be tied down to floor level and capped for future use.

The ducting installation shall be tested as detailed in Section 13 prior to any fibres being blown.
On completion of the testing unused tubes shall be sealed with the appropriate endcaps.

When the installation of a blown fibre tube is not possible and conventional multicore fibre optic cable is being considered at the design stage approval must be sought from the Network Technical Lead (Passive) or his appointed person.

All fibre optic links shall be 9/125 OS2 fibre.

All fibre cores installed shall be terminated within the patchpanel using fusion spliced LC pigtails

The Duplex LC couplers fitted to patch panels shall be colour coded as per the following.

Singlemode   Blue
Multimode   Beige

The fibre optic patch panel shall be mounted at the top of the equipment cabinet or rack as detailed in section 6

The fibre optic patch panel shall face the front of the cabinet or rack.

The fibre optic cable / tube shall enter the cabinet in the same manner as the structured cabling.

The fibre optic cable / tube shall enter the patch panel through a cable gland in the rear of the patch panel.

No connection shall be made to any fibre optic links until the test results have been accepted by the Network Technical Lead (Passive) or his appointed person

12.   Telephone Cabling

A review for the delivery of telephony on each refurbishment or new build needs to be agreed as part of the design process. The conclusion of the review will determine whether a full VOIP solution or delivery of the TDM capability will be implemented.

External cables that run direct to the communications room and or internal multicore CW1308 cables installed between a BDF and communication room shall be terminated on the Left Hand side (Vert. 1) of a Box Connection 520 or Frame 108 located in the Communication room or at the top if only a single 108 Frame is installed. The termination location of all multicore cables shall be agreed with the Telecoms office (0161 275 2235) at the design stage, who will advise on capacity to buildings prior to installation.
No joints shall be made in any cable without written authorisation from the Telecoms Office.

Telephone cables shall be terminated as directed by the Telecoms Manager.

All telephone cables shall be of a type detailed in section 18.
Terminations on frames and in box connections shall be done using 237A disconnection modules (237A strips) and will be identified with designation strips 51A.

All box connections shall be fitted with cable management rings.
Within the Communication Rooms the internal 25 pair CW1308 cables shall be installed on the Right Hand side (Vert. 2) of the Box Connection 520 or Frame 108 or towards the bottom if only a single 108 Frame is installed and onto 24 port voice patch panels mounted within the cabinet.
The last port on each 24 port patch panel to be 4 wired circuit and labelled as such

Each 25 pair cable shall be terminated on 3 (Three) 237A strips and will be identified with designation strips 51A.
Eight 25 pair cables shall be installed in every cabinet or rack installed as part of a major project / refurbishment.

All new box connections and frames shall be earth bonded to meet current IET regulations
Integral earths within multicore cables shall be connected to the earth terminals with the box 520 / frames and left coiled at the patchpanels within the communications cabinet.

Location of voice patch panels within the equipment cabinet are detailed in section 6

All CW1308 telephone socket numbers are to be provided by the Telecoms Office. Where CW1308 cable is used from a DP to a telephone socket the DP shall be labelled with designation strips 51A, indicating the socket reference number. This number is to be provided by the Telecomms Manager.

On completion or phased completion PABX convertors and patchleads for voice connectivity are to be provided as detailed in section 17.

On completion or phased completion all data outlet patchcords are to be provided as detailed in section 17

All cable pairs to be tested for continuity e.g. pair 1 appears as pair 1 pair 2 appears as pair 2, etc.

All voice labelling requirements will be given at the time of installation by the Telecomms department. It is the structured cabling installer's responsibility to request this information at the time of termination and to allow for all materials and labour required to install them.

Each voice panel within the data cabinet shall be labelled with a 9mm white label stating Voice Panel
(1 – 8)

All cable pairs to be tested for continuity e.g. pair 1 appears as pair 1, pair 2 appears as pair 2, etc.

Any installation of safety-critical and life-critical systems which requires network connectivity must be clearly defined and documented prior to any implementation. Before any such systems are connected to the network, a suitable network design must be created and validated by the University Network team.

13.   Copper and Fibre Testing Requirements

Cat5e & Cat6A Structured Cabling installations:
The installation shall be fully tested to confirm that it meets the requirements of ISO/IEC 11801 (Class D/ Category 5e and Class EA Category 6A).

A permanent link test will be carried out on each installed link using a Fluke DSX or equivalent tester that meets the latest requirements of ISO 11801 and the standard Molex Warranty requirements.

A complete set of test results shall be provided including a copy of the Fluke linkware (or equivalent) used to view the results (PDF test results acceptable). These shall be issued as part of the Operations & Maintenance manuals and also issued directly to the Network Technical Lead (Passive) or his appointed person. All work shall be fully tested by the installer and then up to 5% may be witness tested by the Network Technical Lead (Passive) or his appointed person. Visual inspections will be carried out during and on completion of the installation. Please notify the Network Technical Lead (Passive) or his appointed person when testing is complete to give the opportunity for witness testing

Blown fibre installations

All tubes within a blown fibre cable shall be pressurised to 10bar and monitored for any pressure loss over a 2 minute period. All tubes within a blown fibre cable shall be tested for a minimum airflow of 30 litres per minute with an inlet pressure of 10bar.

All fibre testing must be conducted using an Optical Loss Test Set (OLTS) in two directions and at both applicable wavelengths for the fibre under test. The results must be within the permitted losses specified in EIA-TIA568. If the OLTS does not provide a length of the fibre under test an OTDR trace must be performed in one direction only to provide the length. These results shall be issued as part of the Operations & Maintenance manuals and also issued directly to the Network Technical Lead (Passive) or his appointed person on completion of the testing. All work shall be fully tested by the installer and then up to 5% may be witness tested by the Network Technical Lead (Passive) or his appointed person. Visual inspections will be carried out during and on completion of the installation. Please notify the Network Technical Lead (Passive) or his appointed person when testing is complete to give the opportunity for witness testing

14.   Numbering and Labelling.

Labels shall be provided at both ends of the Cat5e or Cat6A horizontal cable and the outlet. It shall be given a unique identifier as follows:

aa   Comms Room and Cabinet Number 1-1
bb   Row Number in cabinet e.g. 11 for 11u
cc   Outlet Number in patchpanel e.g. 15 for port 15

Therefore, an example label would be 1-1/11/15

All printed labels shall be inserted in the space provided within the faceplate. Room outlet labels shall be machine printed and fixed behind the plastic window of the faceplate.

Every cabinet shall be labelled with a unique number in the form of Building ref aaa, and cabinet number aa (aa denotes the number of racks in the building)

All fibre optic backbone cables shall be labelled at the patchpanel with the source, destination and core size.

All the above labels shall be machine printed black lettering on a white background

The unique label information to be used on the following labels shall be provided by the UoM

Blown fibre tubes, conventional fibre optic backbone cables and voice backbone cables shall be labelled on view at the entry and exit of any duct (chamber) or tunnel.

Backbone cable labels shall consist of lettered rings mounted on a plastic carrier. Letters shall be black on a yellow background. The carrier shall be secured to the backbone cable using plastic ties.

All backbone cables shall be labelled at the following points:

On view at termination points

On view at the entry and exit of any duct or tunnel

On view at every joint or junction

BFTMP and gas seal enclosure labels shall also be black lettering on a White background

15. Wireless

On behalf of the University, IT Services Network Team / Partner completed a project to provide pervasive wireless network coverage across the campus and residential sites. Any new and refurbished installations should be carried out to the same or higher specification, to prevent any reduction in coverage, and to improve coverage where possible or required.

Estates Project Managers shall provide IT SERVICES NETWORK TEAM / PARTNER with accurate, scale floor plans as soon as available in both .DWG and .PDF formats. This will allow a desk top survey to be prepared. These plans or other accompanying information shall provide details of construction materials used and ceiling heights to provide accurate inputs to the modelling software.

The Estates Project Manager should provide information on expected occupancy/client numbers in areas requiring coverage. This is to ensure the density of coverage is adequate. This is particularly important with regards to communal/teaching spaces.

IT SERVICES NETWORK TEAM / PARTNER shall be the sole arbiter and provider of the wireless network design and no other wireless design authorities shall be permitted.

Prior to finalisation of Wireless Access Points (AP's) a site visit and walk around MUST be allowed and arranged by the Estates Project Manager. This should take place a minimum of 4 weeks prior to handover and ideally immediately once internal walls are in place and doors fitted. This will allow the design to be finalized.

The cost of active equipment and all associated cabling shall be borne by the project.

When carrying out refurbishments that require the removal / relocation of APs a Wi-Fi re-survey must be conducted to allow for changes to building layout/use and or wireless requirements. All APs and mounting brackets removed during refurbishment should be removed correctly without damage and should then be returned to IT SERVICES NETWORK TEAM / PARTNER. Obsolete, end-of-life APs should not be re-installed under any circumstances. When refurbishing an area that requires additional data sockets or additional APs and has existing APs with only one outlet then a second outlet should be installed to the AP.

Final locations for APs, brackets, and data outlets should always be accessible and visible, e.g. below false ceilings. This will normally be between 2.5m and 3.0m above floor height but no more than 3.0m. No equipment, other than a set of short step ladders should be required to access the devices and data socket once in place. A dual data socket should be provided for each AP installed and located no more than 300mm apart.

The data outlets should be visible from a floor standing position and clearly labelled. It is the responsibility of structured cabling contractor to request and collect the AP's, brackets and patchcords from the Network office or other collection point giving 1 weeks' notice. It is also the structured cabling contractor's responsibility to install them to the required locations and complete all necessary paperwork as detailed below. This should be done as part of the project.

Final locations should always be accessible and visible e.g. below false ceilings. Typical AP antenna design is highly optimised for ceiling mounting, unless otherwise instructed APs shall be ceiling mounted using the appropriate mounting bracket. Wall mounting may result in significantly different and/or degraded performance. Wireless APs must not be installed above any obstructions including traywork or ducting and not within 300mm of a wall or ceiling except that which they are being mounted to. In the case of exposed services, the AP should be mounted at a level below these in order that the antennas are unobstructed. Upon completion

of the installation the labels should be removed from the access point and stuck onto an "as fitted" drawing and handed over to the IT SERVICES NETWORK TEAM / PARTNER department. The "as fitted" drawing should also be annotated with the outlet number it has been patched into. Both outlet numbers should be recorded, and specifically which ones is plugged into ETH0 on the AP

16.   Operation & Maintenance Documentation requirements for Structured Cabling

The O&M manual or documentation handed over to the client at the end of a new project or major refurbishment is a record of what has been provided with information about the products, the locations they have been installed and the testing records. In addition to the normal distribution of O&M manuals a copy of all required information is to be delivered directly to the Network Technical Lead (Passive) or his appointed person electronically within 4 weeks of completion including the 25 year product and performance warranty.

Important Note
A duplication of all information shall be provided by the Structured Cabling Contractor directly to the Network Technical Lead (Passive) or his appointed person to allow for the acceptance of the cabling system and the installation of all active components.

The information to be provided by the structured Cabling contractor will consist of the following.

Required Information
A statement of the system installed detailing, Manufacturer, Category / Class, number of Cabinets installed, numbers of room outlets installed, number of network points installed for Wireless, number of voice switch link cables installed, quantities size and type of patchcords provided and a schematic showing installed backbone cabling and numbers

As fitted drawings showing the Site Name and location within the site
The data cabling contractors job reference number
Location of the installed Network Termination Points (as fitted)
Unique reference numbers of the Network Termination Points (as fitted)
Location of Comms Rooms to be shown on as fitted drawings
Unique reference number of Cabinets
Cabinet layouts should be provided by diagram of clear photograph
Containment drawings
Schematic of installed backbone cabling
Installed horizontal cabling test reports to be provided as a PDF, summary only.
Installed fibre optic cabling test reports
Locations of installed blown fibre tube cable joints
Metre marks taken from the start and the end of the installed blown fibre tubes
Unique reference numbers of installed blown fibre tubes
Excel spreadsheet showing the room numbers and the detail of outlets within the rooms
Excel spread sheet detailing voice continuity testing
Excel spreadsheet detailing Access point reference number information and outlet number
The unique project manufacturer's 25year product and performance warranty

Important note
The requirements in Section 16 are for new builds and major refurbishments only. As fitted drawings, excel spreadsheet and test results must be provided for all installations of 25outlets and over in a single building. On smaller jobs if no drawing is provided to work from then a sketch of installed outlets will be acceptable. Manufacturer's warranties are required on all installations of 97 outlets or over in a single building.

Any installations of 24 outlets and under do not require as fitted information or test results providing but should be tested and provide a pass test result.

17.   The Structured Cabling Contractor shall provide.

All mechanical and electrical works will be carried by the main contractor or approved electrical contractor to the construction issued drawings or latest revision drawings if applicable. For clarification all primary and secondary containment including backboxes will form part of the main / electrical contractor's package.

Additional equipment to be provided by the Data cabling contractor as part of a project:

1u Horizontal cable management panels as shown on the cabinet layout in section 6

The following patchcord requirements are for the cabinet only. No outlet position patchcords are required as part of this specification.

8 No. 1m & 4 No. 2m Molex Cat5e patch leads (grey) for every Cat5e RJ45 patch panel installed
Patchcords to be left plugged into the patchpanel ports.

8 No. 1m & 4 No. 2m Molex Cat6A patch leads (grey) for every Cat6A patch panel installed
Patchcords should be left in the Primary Comms Room 1

12 No. 0.25 Cat5e patch leads (green) for every RJ45 patch panel (CW1308) installed.

12 No. telephone converters for every RJ45 patch panel (CW1308) installed.

6 No. 1m and 6 No 2m Excel 9/125 OS2 LC-LC Duplex fibre optic patch leads to be provided for every 12core 9/125 OS2 link cable installed.

One 300mm (approx.) Molex Cat6 Patchcord for each AP installed

18.   Component Specifications
Structured cabling systems shall be Molex
Cat5e (Class D) Parts to be used:
Standard Cat5e Molex products

Cat6A (Class Ea) parts to be used:
Molex

CAA-00413-VL	MOLEX C6A U/FTP LSOH CLASS B2ca-S1a,d1,al violet 500M
PID-00282	1U 24P ANGLED PORT APERTURE LINEAR PATCH PANEL UNLOADED
KSJ-00079	SHIELDED KEYSTONE C6A 1XRJ45 360DEG
KSJ-00062-02	DATAGATE WHITE JACK C6A FTP 568A/B
KSJ-00073-02	SIDE ENTRY DataGate Jack C6A FTP White
MEU-00074-02	Euromod II Adaptor Pack 20 LJ6CE
17-0111-02	E/Mod 1 Gang F/Plate Labelled
17-0112-02	E/Mod 2 Gang F/Plate Labelled
17-0413-02	E/Mod Half Blank White
17-0412-02	E/Mod Quarter Blank White
MMS-00021-02	MOD-SNAP 111 Adaptor PACK of 10 LJ6C
PCD-07000-0E (E = Grey).	1m Patchcord Grey

All equipment cabinets shall be of the following:
USystems cabinet spec: D3P0000956
42U Side Panel Kit: D3SP4208L
42U 300w Cable tray kit: D3CTK42U300W
Temperature and humidity sensors
Power distribution Units: EATON**: Part No:** EMIB04 **Description:** ePDUG3:Mtr I:IEC16A O:C13(20)C19(4)

Cabinet Locking Systems
Advanced DataCentre Systems: iAccess Controller Part no: ADS001
1 x 1m C13 to C14 Powered lead will need to be provided in addition to the locking system.

Blown Fibre systems shall be of the following
Emtelle: Blown Fibre Cable
Excel: Pigtails and patchcords.
Excel: Duplex Patchpanels (Black)

Conventional Fibre systems shall be of the following:
Excel: Fibre, pigtails and patchcords.
Excel: Duplex Patchpanels (Black)

Voice panels shall be of the following:
PID-00162 Molex 50P 3Pr 1U Voice Panel

Telephone material shall be of the following:
All internal cables to be CW1308
All internal / external cables to be CW1308B
Alternative external cables may be specified to suite the environment
Ultima box connection 520 with earthing facility
Ultima 51A Designation Strips Part number – 774836
Ultima 237A Disconnection modules Part number - 774834

LJU – RJ45 PABX adapters should be of the following: Excel tailed adapter part number 100-628