UNIVERSITY OF Southampton

Cabling Infrastructure Design Specification for Existing Buildings

Final Version 19

UNIVERSITY OF Southampton

1 Specification for the Design of Cabling Infrastructures in University Environments

Document Reference: CommScope 1

Issue	19
Date	15 September 2024
Author	CommScope/University of Southampton
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Document Control

Revision Control

All documentation will be updated at the discretion of the University of Southampton. Any changes to the documentation will require a new issue to be produced and re-circulated to all parties.

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Issue	Date	Reason	Implemented by
16	06/09/19	1. Cabinet labelling added F and R 2. Bonding of cables for voice 3. Earth module 237 type for voice 4. Tying of cable restraints on voice 5. Floor pedestals to not interfere with apertures 6. Power lead section adding for dressing cables 7. A/C to change to N only 8. Frames from black to white 9. Commandos can be fitted underfloor 10. Added bonding size for floor 11. Added section of how to measure lighting with a grid and front view of cabinets 12. Labelling for earth bonds 13. Bonding of suspended floor added 14. Cabinet earth label 15. EVC cable label 16. Voice cable restraint 17. Voice box label 18. FireTuf cable label 19. Temperature controller added 20. Lighting measurement section added 21. TREND sensor and 2 off Rittal sensors amended 22. FireTuf – earth bonding 23. Fire brushes added to cut apertures in MER and SER rooms 24. Added a contractors link in horizontal designs 25. BS 7671 updated to 18th edition 26. Attenuation criteria for mated plugs and cables added to fibre testing 27. 9.1 line added main contractor must appoint and contract directly the ICT/data contractor	K.Tryner
19	15/09/24	1. Removed LSOH from abbreviations table 2. Added comment about WIFI first standard (Section 4.2.1)	

		3. Added comment about if comms room has to be located adjacent to wet room (Section 4.2.3) 4. Added telecom room sizes to section 4.3.1 5. Added comments for telecom room sizing for existing builds (Section 4.3.1) 6. Updated telecom room layout drawings (Section 4.4) 7. Increased floor clearance of cabinet to touching ceiling grid in section 4.5 8. Removed 6U, 9U and 12U wall mounted cabinets and added a note stating a maximum of 48 active ports for each cabinet in section 4.5.3 9. Updated door entry requirements for existing builds in MER/SERs 10. Added in single door entry drawings and descriptions for SERs in section 4.6 11. Updated lighting requirements for existing builds 12. Updated drawings of telecom lighting layouts. Added a single frame drawing and removed a cabinet from MER A 5 cabinet drawing. Section 4.9 13. Updated drawings of telecom lighting measurement layouts. Added a single frame drawing and removed a cabinet from MER A 5 cabinet drawing. Section 4.9.1 14. Updated the positioning of the internal TREND sensor within cabinet 15. Updated drawing for cooling layouts to show SER 1 cab layout and updated MER A 4 cab layout. 16. Removed temperature sensor from section 4.14 17. Added 1 EZ path to be installed at every major throughway into section 4.17 18. Updated section 4.18. Removed earth bonding screw drawings. Removed MER and SER grounding bar drawings. Added in part numbers for cabinet and telecom room bonding bar. 19. Updated earth bonding bar cable sizes in section 4.18 20. Added a HIK security camera comment into section 4.19. Harmonised with environmental monitoring section	

		21. Updated section 4.22 on telecom room cleaning 22. Updated section 4.23 frame configuration to include single frame table. Also updated the quantities for the other tables 23. Updated section 5.3 to cat 6a F/FTP for external to building fabric 24. Added comment into section 5.4 detailing patch lead lengths 25. Updated section 5.6 Use case outlet quantities table 26. Removed floor boxes and temporary outlets from section 5.7 27. Added comment updating backbox depth to 50mm into section 5.7 28. Changed section 5.7.4 stud walls from flexible to solid conduit 29. Specified in section 5.7.5 dry riser for outlet to be off of the side of the containment 30. Updated section 5.7.12 photo so that AP is positioned externally to the wall 31. Section 5.9 removed cable basket calculations and replaced with a table for loose laid and bundled cable sizes and cable basket capacity 32. Section 5.9.1 a note highlighting 25mm conduit shall be used for 2 cables. 33. Note highlighting cables shall not be stacked higher than the containment (Section 5.11.1) 34. Section 5.12 added in comment about 50mm backbox depth 35. Removed floor box comments in section 5.13. Added in note to allow 25% extra capacity for cat 6a cables. 36. Harmonised section 6.1 with MER/SER terminology 37. Added in new section 6.4 on inter cabinet fibre links 38. Added in new section 6.5 on diverse routing of fibre 39. Updated fibre polarity drawing in section 6.6 40. Mid blow and gas seal photos at buildings and pits added as a requirement to section 6.8 41. Added Karl and Joe Tryners contact details to section 8.3 42. Added new section 8.4 highlighting the use of caplum to record the physical structured cabling infrastructure	

		43. Section 9.1 moved bold comment to the top of section 44. Removed VOIP comments from section 9.2.4 45. Section 10.2 made whole section bold and added comment of CAD drawing being as a requirement for outlet position 46. Removed control of asbestos comments from section 11 47. Changed labelling scheme for fibre patch panels from white on black to black on white 48. Changed labelling scheme for cabinets and earth cable 49. Appendix D updated to include deep clean as requirement at the top of the list 50. Products updated to latest numbers 51. Added fibre network drawing to fibre 52. Edited figure 12 in section 4.5 to read as 0.15m from top of rack to ceiling instead of 15m 53. Risk assessment for omission of RCDs added	

Issue Control

On updating the issue of the tender document or generating an addendum to the tender document all documentation shall be issued to the following:

Issued To	Documentation Issue												
K.Tryner (CommScope)	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0
M.Powell (University of Southampton)	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0
M.Beach (University of Southampton)	1.0	2.0	3.0	4.0	5.0	6.0	7.0			10.0			13.0
K.Tryner (CommScope)	14.0	14.1	14.2	14.4	15.2	15.3	15.4	15.5	15.6	15.7	15.8	16	17
M.Powell (University of Southampton)	14.0	14.1	14.2	14.4	15.2	15.3	15.4	15.5	15.6	15.7	15.8	16	17
K.Tryner (Ethicus)	18	19											
M.Powell (University of Southampton)	18	19											
J Tryner (Ethicus)													

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Table of Contents

Contents

1 Introduction

1.1 Overview

The aim of this document is to provide existing buildings with a cabling infrastructure which has high reliability, is easy to maintain and can support the applications and services of today and the future.

The specification has been written to ensure that a cost-effective solution is provided without compromising any standards or safety issues, and that all single points of failure are designed out by means of route diversity and service duplication.

This document describes the specification for the design of the network infrastructure of both fibre and copper networks for both voice and data services into and out of single and multiple building(s), and all interconnections between buildings.

It is important to note that all telecom rooms are for the sole occupancy of iSolutions and their associated voice and data distribution equipment. It is not permissible for other parties to store or install equipment within these rooms. The university standard model is for no sharing and for sole occupancy however there are limited occasions where sharing is required for multiple service providers within a single building and in which case the shared model for frames will be used. All request for shared hub room spaces must be made to iSolutions for consideration.

All aspects of this document shall be met together with all Appendices. Appendix D shall be completed and signed off before hand over for each MER and SER.

The product set has been standardised on Commscope. This product set has been selected for its high degree of reliability, quality and performance. By standardising on the Commscope product set a standard warranty for voice and data has been set for all buildings within the University of Southampton. To this effect Commscope voice and data products specified within this document shall be selected.

All installation work shall be covered by a Commscope warranty. To ensure that this happens only approved Commscope Premier and Authorised Integrators can be used.

All designs for structured cabling SHALL be undertaken by a RCCD qualified designer in strict compliance with this specification.

1.2 Specification of Criteria

Two levels of criteria are specified, mandatory and highly desirable. The mandatory requirements are described by the word “must” and “shall”; whilst highly desirable are described by the words “should”, “may” or “desirable”. Mandatory requirements shall be adhered to under all circumstances and may not be changed. Highly desirable requirements are the desired ways of design, implementation and documentation that may be changed depending on individual circumstances.

All parties shall adhere to this specification document. Any deviation from this document must be on written approval by iSolutions.

2 Definition of Terms

2.1 Definition of Terms

2.1.1 Buildings

A roofed structure enclosed by walls on all sides containing telecommunications related equipment for the transmission and reception of data, voice, video etc, signals. It may also contains equipment related processing and storage of the signal content.

2.1.2 Backbone cable

A cable that connects any combination of carrier and network devices for the transmission of multiplexed signals.

2.1.3 Channel

ISO/IEC 11801: defines a channel as “The end to end transmission path connecting any two pieces of application specific equipment. Equipment and work area cords are included in the channel, but not the connecting hardware into the application specific equipment.”

2.1.4 Consolidation point

ISO/IEC 11801: defines a consolidation point as “A connection point in the horizontal cabling subsystem between a floor distributor and a telecommunication outlet.”

2.1.5 CP link

ISO/IEC 11801: defines a CP link as “The part of the permanent link between the floor distributor and the consolidation point, including the connecting hardware at each end.”

2.1.6 Cross connect

ISO/IEC 11801: defines a cross connect as “An apparatus enabling the termination of cable elements and their cross-connection, primarily by means of patch cords or jumpers.

2.1.7 Distribution Equipment Room (DER)

A room within a building or building that houses all the core network transmission and processing equipment as well as the campus backbone infrastructure

2.1.8 Entrance room

A room within the building that caters for the entry of cables into the building.

2.1.9 Pit

A box, joint box, manhole or cable chamber.

2.1.10 Pit cover

A covering lid used to seal a pit.

2.1.11 Main Equipment Room (MER)

A room within a building that houses network equipment, horizontal cabling, and building backbone cabling infrastructure.

2.1.12 Satellite Equipment Room (SER)

A room within the building that houses edge network equipment and horizontal cabling.

2.1.13 Solution

An end to end network of active and interconnecting passive devices that are required to transmit and process a stream(s) of client or application specific data.

2.1.14 Telecommunications

A branch of technology concerned with the transmission, emission and reception of signals, that is, information of any nature by cable, radio, optical or other electromagnetic systems. Telecommunications covers all forms of information whether voice, video, data etc.

2.1.15 Telecoms room

Generic term used to describe telecommunications equipment rooms and spaces, including but not limited to entrance rooms, DERs, MERs, SERs, etc

2.2 Abbreviations

AC	Air Conditioning
AP	Access Point
BICSI	Building Industry Consulting Service International
BMS	Building Management System
BS	British Standard
BT	British Telecom
CCTV	Closed Circuit Television
CB	Core Backbone
CP	Consolidation Point
CPR	Construction Products Registration
DDA	Disability Discrimination Act
DECT	Digital Enhanced Cordless Telecommunications
DER	Distribution Equipment Room
EPO	Emergency Power Off
EVC	Emergency Voice Communications
F/FTP	Screened Shielded Twisted Pair
FD	Floor Distributor
GSM	Global System for Mobile Communications
HDPE	High-density Polyethylene
HVAC	Heating Ventilation Air Conditioning
IDC	Insulation Displacement Contact
IP	Internet Protocol
ISO/IEC	International Standards Organisation
LC	Lucent Connector
LJU	Line Jack Unit
MER	Main Equipment Room
OTDR	Optical Time-Domain Reflectometer
PSU	Power Supply Unit
PWS	Public Work Station
RCDD	Registered Communications Distribution Designer
RTU	Remote Terminal Unit
SER	Satellite Equipment Room
SMS	Short Message Service
STS	Static Transfer Switch
TO	Telecommunications Outlet
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VOIP	Voice over IP

3 Cabling Systems

3.1 Overview

The topology of the cabling systems shall be set out and clearly defined in terms of design and product set.

Consult with the University on a project by project basis based on scope of works i.e. ceiling to slab refresh

3.2 Cabling System Structure

The cabling system shall be considered as a series of clearly defined subsystems, interconnected via active equipment that may perform media translation. The fundamental topology of the system derives from the nationally and internationally recognised standards for Generic IT Cabling Systems listed in paragraph 11 of this document. A block diagram of a diverse cabling system showing the various subsystems in relation to a building layout is shown below.

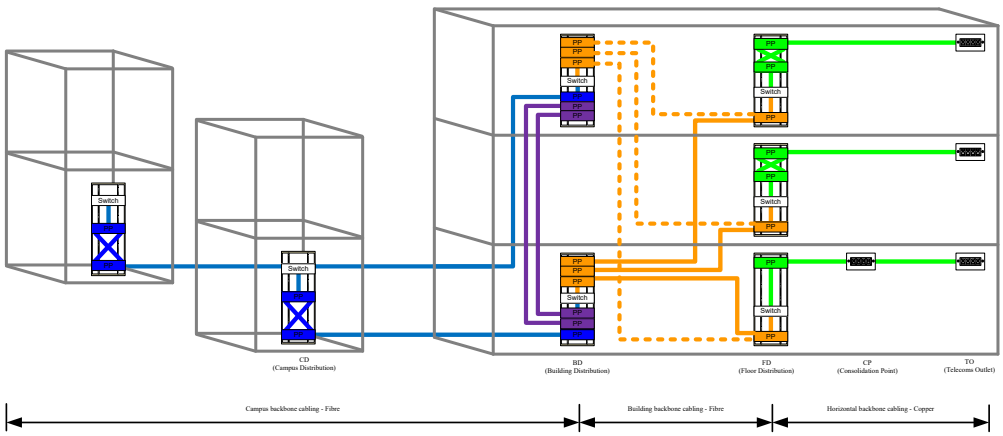


Figure 1 Building System Design with redundancy

There are three hierarchical cabling systems for any one end to end solution. The basic elements are as follows:

- Campus Backbone (Blue)
- Building Backbone (Orange)
- Horizontal Cabling (Green)

3.2.1 Campus backbone cabling subsystem

The campus backbone is the cabling subsystem that provides data and/or telecommunication services between buildings.

The following connections are provided by the campus backbone system:

- Connects Core Buildings on the same campus with fibre cabling infrastructure
- Connects between Core buildings located at remote sites via a service provider network
- Connects from Core buildings to Main Equipment Room (MER) with fibre cabling infrastructure

Further details of the campus backbone cabling sub system are available in section 6 of this document.

3.2.2 Building backbone cabling subsystem

The building backbone is the cabling subsystem that provides data and/or telecommunication services from an SER to the MER. The building backbone subsystem is only necessary in large or multi-storey buildings where distance restrictions limit use of horizontal cabling.

The following connections are provided by the building backbone system:

- Connect MER to SER with fibre cabling infrastructure
- Connect MER to MER with fibre cabling infrastructure

Further details of the building backbone cabling subsystem are available in section 6 of this document.

3.2.3 Horizontal cabling subsystem

The horizontal cabling is the cabling subsystem that provides data and/or telecommunication services from the FD to the user Telecommunication Outlets (TOs).

The following connections are provided by the horizontal cabling system:

- Connects FD to TO with copper or fibre cabling infrastructure

Further details of the horizontal cabling subsystem are available in section 5 of this document.

4 Telecommunications Room

4.1 Overview

This section details the design criteria for all types of telecom room and their association with each other.

Telecom rooms are an integral part of a building's infrastructure. During building design, specific consideration shall be given telecom room:

- Position
- Space
- Layout
- Lighting
- Ventilation
- Power
- Security
- Routing
- False floor
- Ceiling void
- Cable management

4.2 Position

4.2.1 General

The telecoms rooms shall be located such that the maximum distance for horizontal and backbone cabling in the building are not exceeded.

NOTE: WiFi to be used as the first standard for data connection

4.2.2 Telecom Room Position in Respect to TOs and Backbone Cabling

4.2.2.1 Single MER Design for Small Buildings

A telecom room that is linked to the DER via fibre and provides copper connectivity to TOs within a building is known as a Main Equipment Room (MER). A MER shall house a core backbone and FD. The model is only suitable for small buildings in which all TOs can be reached from a single Telecommunications room whilst maintaining the 90m rule.

A single MER shall:

- Have a minimum of two different DER feeds
- Each DER feed shall be capable of servicing the load of the other DER in the event of a trunk failure
- DER trunks shall not share the same building entry
- DER trunks shall not share the same route
- All TO channel lengths shall maintain the 90m rule

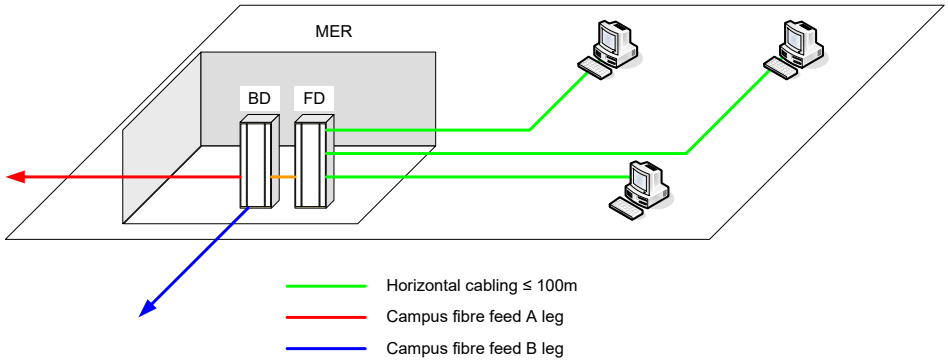


Figure 2 Single MER Design

4.2.2.2 Multiple Data Room Design for Larger Buildings

Where a single telecom room cannot provide all services to a building then multiple telecom rooms shall be used. When using multiple telecom rooms they shall be situated to cater for the 90m horizontal cabling rule. Under this design criterion the telecom room(s) housing the BD and FD would be classified as a MER.

A telecom room that is linked to the MER via fibre and provides copper connectivity to TOs within a building is known as a Satellite Equipment Room (SER). A SER shall house the FD.

There shall be at least one MER with the following characteristics:

- Be separated as far as possible from the SER whilst maintaining the 90m rule to the TOs
- Have a minimum of two different DER feeds
- Each DER feed must be capable of servicing the load of the other DER in the event of a trunk failure
- DER trunks must not share the same building entry
- DER trunks must not share the same route
- All TO channel lengths shall maintain the 90m rule
- Where deemed necessary the MER shall be a four rack room with UPS – guidance shall be sought from iSolutions

The SER(s) shall:

- House an FD
- Be linked to the MER with two resilient fibre feeds
- The resilient fibre feeds shall not share the same route
- All TO channel lengths shall maintain the 90m rule

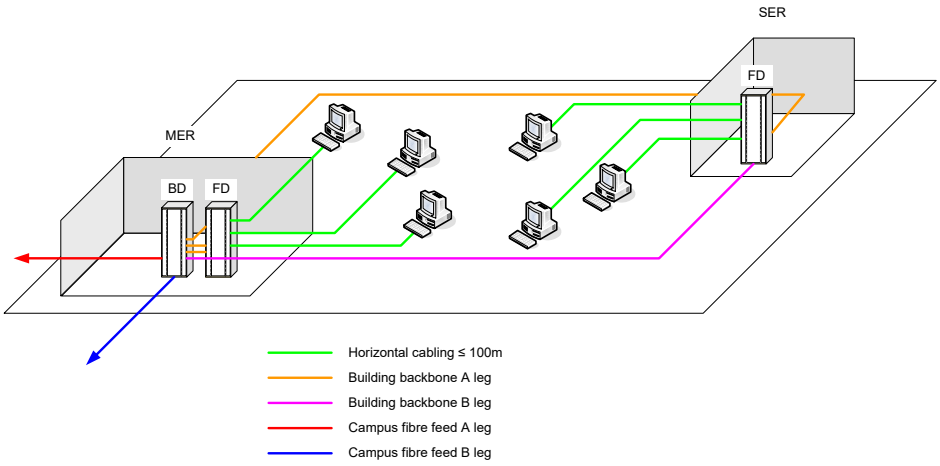


Figure 3 Multiple Data Room Design

4.2.2.3 Multiple MER Data Room Design for most buildings

Multiple MER room design is the standard model of cabling architecture for the university. All new buildings will be provided on this model. Any relaxation of this model will need explicit permission in writing from iSolutions.

The MERs shall:

- Be separated as far as possible from each other
- Be linked together with multiple resilient fibre feeds
- Be separated as far as possible from any SERs whilst maintaining the 90m rule to the TOs
- Have a single DER feed into each MER
- Each DER feed shall be capable of servicing the load of the other DER in the event of a trunk failure
- DER trunks shall not share the same building entry
- DER trunks shall not share the same route
- All TO channel lengths shall maintain the 90m rule
- One of the MERs shall be a four rack room with UPS

The SER(s) shall:

- Be linked to each MER with a single fibre feed
- The resilient fibre feeds shall not share the same route
- All TO channel lengths shall maintain the 90m rule

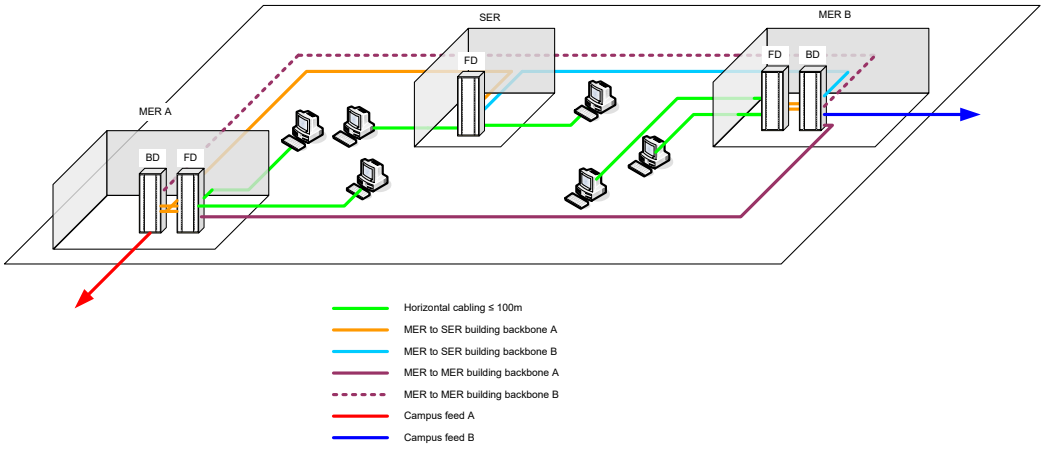


Figure 4 Multiple MER Data Room Design

4.2.2.4 Multiple Floor Data Room Design

Where the building contains multiple floors then a minimum of 1 telecom room shall be provided for every floor. MER A shall be located on the lowest floor and MER B on the highest. 6 below shows a typical scenario.

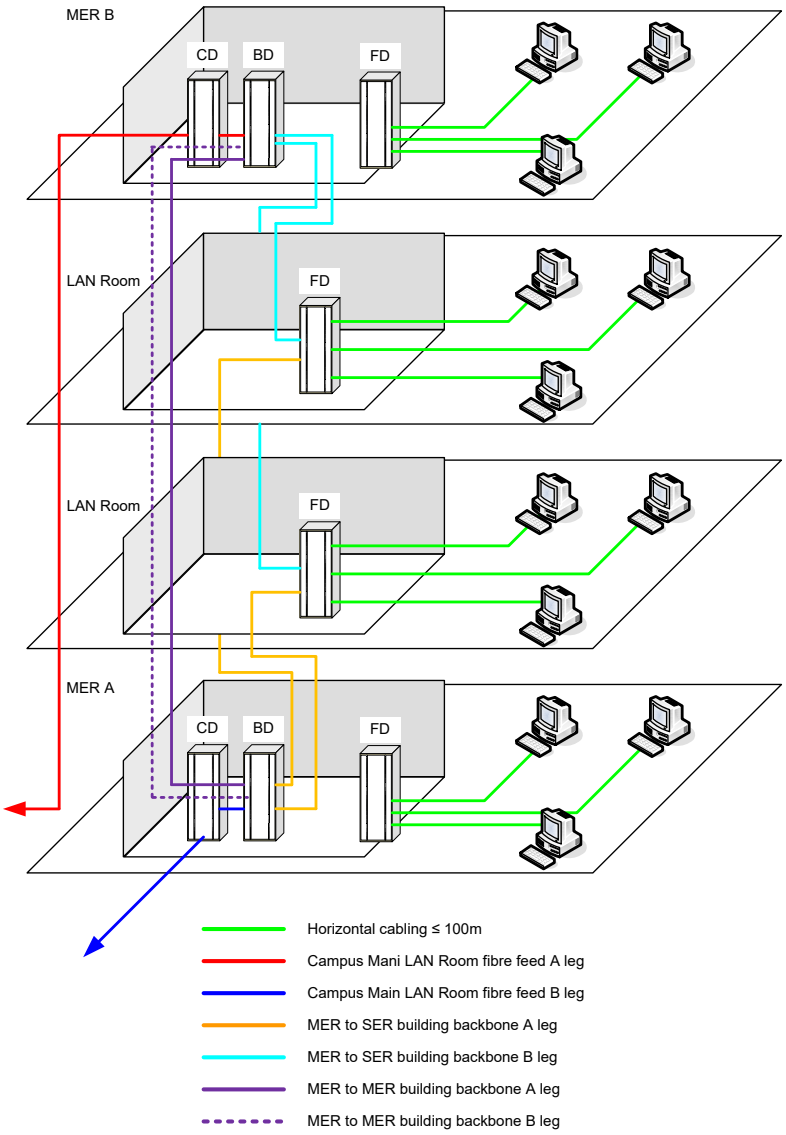


Figure 5 Multiple Floor Data Room Design

4.2.3 Siting Telecom Rooms

The rules for siting telecom rooms are:

- Avoid areas that may limit any future expansion e.g. adjacent to areas containing heavy plant, lifts or other such equipment.
- In areas where flooding is a potential threat all telecom rooms shall be sited one floor above the maximum flood level. Flooding can be defined as land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood.
- In multi-storey buildings that can be serviced by a single MER it should be located central to the building.
- In a multi-storey building that requires one or more MERs and one or more SERs the MERs should be on the lower most floor.
- Where security is a concern the telecom room, where possible, shall not be sited against external walls. Basement floors are desirable followed by floors above the ground floor.
- Shall be located away from high-level sources of EMI.
- Shall be sited with its own access from a major thoroughfare– not acceptable to gain access via smaller rooms i.e. classroom, lecture theatre, private office, etc.
- Shall not be sited within a plant room, or off an office, laboratory or other occupied space.
- Should be positioned adjacent to main ICT risers on each floor
- No wet services or liquid to run through or above telecom rooms.
- Mechanical and electrical services not intended for use within the Telecom shall not run through the telecom room i.e. electrical cables, gas pipes, steam pipes
- HVAC ducting shall not use the telecom room as a route, it shall only terminate within the room
- It is highly desirable to not have MER or SERs adjacent to wet rooms and wet services. Where a MER or SER has to be located adjacent to a wet service/wet room then the following shall be adhered to:
    - Rigudor boarding, or equivalent, shall be used from finished floor level to finished ceiling level
    - Written permission shall be obtained from iSolutions
- Mechanical risers must not be located near telecom rooms.

4.3 Size of Telecom Room

4.3.1 General

The telecom room shall be designed to accommodate all the known and planned requirements for the equipment it shall house. Rooms serving horizontal cabling to a building shall be designed to accommodate all floor areas that are to be used as office areas, or could accommodate office areas.

Calculation of floor space is dependent on the purpose of the telecom room. All calculations shall be based on an interconnect channel design with access layer switches only.

Interconnect with Switches – A design where the telecom room only houses switches and patch panels. The switches patch directly into the distribution patch panel.

The telecom room sizes shall be as follows:

- MER A –4 cabinets
- MER – 2 cabinets
- MER – 1 cabinet
- SER – 2 cabinets

- SER – 1 cabinet

It is important to note that the below telecom room sizes are the absolute maximum allowable on completion of the project e.g. if a telecom room is to have 385 outlets installed by the end of the project the telecom room size shall be as defined by a 720 channel telecom room. However, it is not the maximum number that the telecom room can cater for as an allowance has been made for future expansion. The day 1 room capacity and future capacities are:

- 360 Channels on project completion – 1 to 360 on completion of project
- 720 Channels on project completion – 361 to 720 on completion of project
- 1440 Channels on project completion – 721 to 1440 on completion of project

For all other types of telecom room general rules can be applied. These rules shall only apply as a **minimum** as the room must meet the requirements of the University of Southampton and the telecommunication design for the building.

All telecom rooms shall have:

- ≥1200mm between the wall/equipment/services and each row of cabinets – if equipment or services protrude from a wall the ≥1200mm shall be taken from the furthest protrusion –see figure 14 for example showing a UPS
- ≥1200mm between each row of cabinets
- ≥1200mm at one end of cabinet row and any other equipment/cabinets/ramps
- ≥300mm at the other end of cabinet row and any other equipment/cabinets/ramps
- Headroom from finished floor level to the ceiling slab ≥3500mm
- Unobstructed height above finished floor level ≥2600mm
- Raised floor ≥300mm from floor slab to underside of false floor
- Floor loading ≥8kn/m^2
- Room shall be rectangular or square shaped
- Door to align as near as possible to wall facing the front of the cabinets for single row of cabinets

Door to align with centre of cold aisle for double row of cabinets i.e. front of both row of cabinets.
Where the above requirements cannot be met the telecom room sizing for exiting builds shall be:

- There must be enough clearance in the room to access the front and rear of cabinets
- There must be enough clearance between rows to pass between and fully open cabinet doors
- Floor must be in an acceptable condition as specified by iSolutions

All buildings shall have a two MER design, designed with a central UPS protection to all telecom rooms.

4.4 Telecom Room Layout

The following are examples of requirements.

The layouts do not change between the general office, residential and student learning. For rooms with limited access space, an open frame design may be considered, however this shall be confirmed on a case by case basis with iSolutions before a design is advanced.

4.4.1 Single Cabinet Design for MER and SER

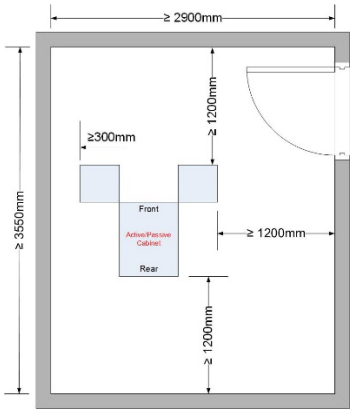


Figure 6 Telecom room layout for 1 Cab SER

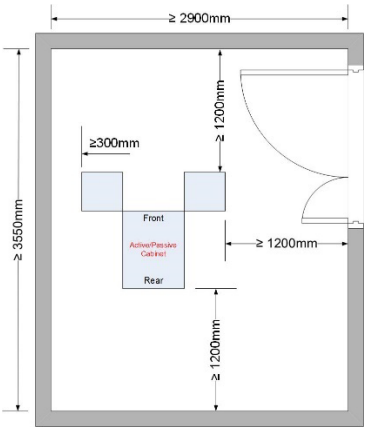


Figure 7 Telecom room layout for 1 cab MER

4.4.1 Double Cabinet Design for MER and SER

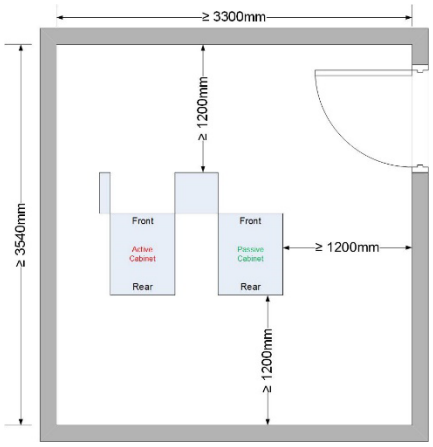


Figure 8 Telecom room layout for 2 Cab SER

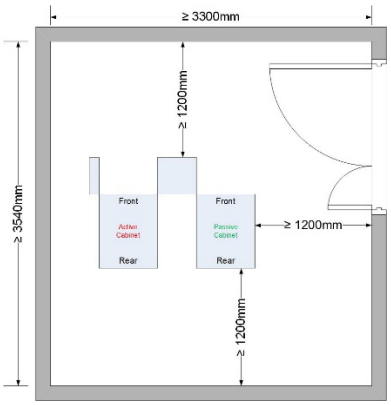


Figure 9 Telecom room layout for 2 cab MER

4.4.2 Four Cabinet Design for MER A

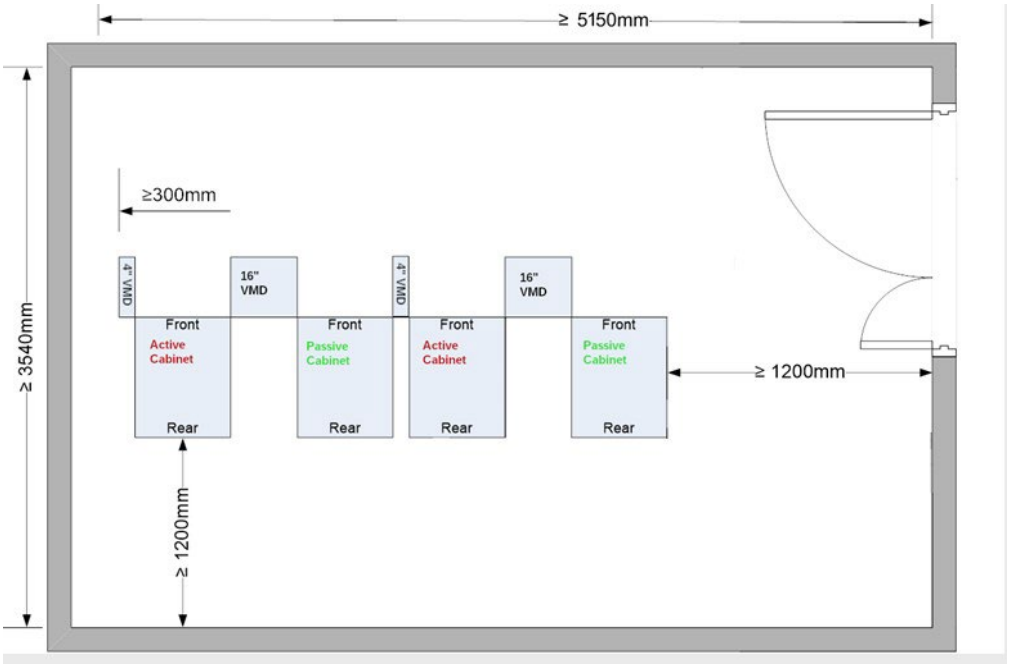


Figure 10 Telecom room layout for 4 cab MER A

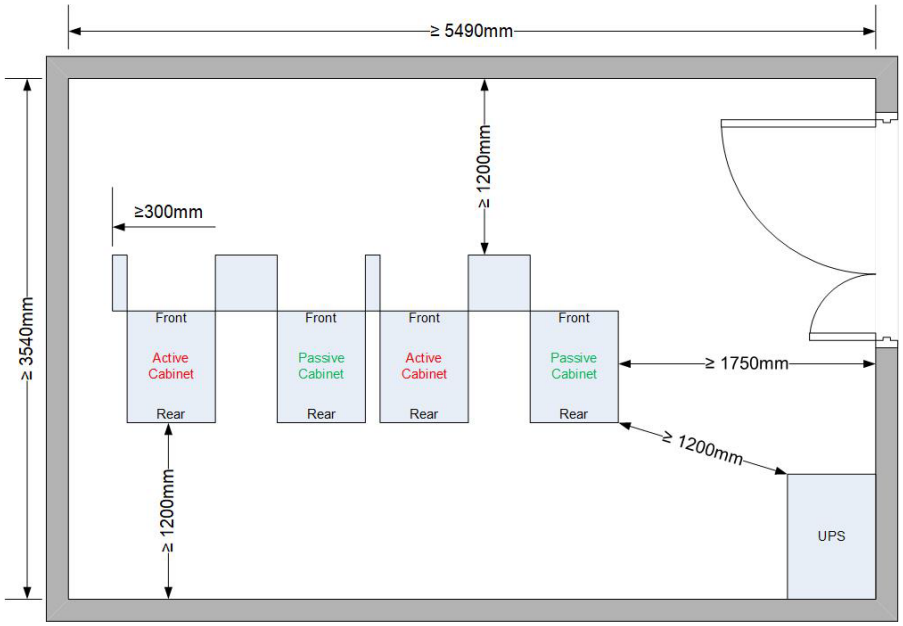


Figure 11 Telecom room layout for 4 cab MER A with UPS

Note – the telecom room layout showing the UPS and four cabinets shall be used for one of the MERs where the building design has two MERs. This design shall also be used where iSolutions deem a single MER building of critical importance.

4.5 Open Space Layouts

Open space layouts are where there is no telecoms room and the cabinets or wall boxes are installed in public access or semi secure areas such as plant rooms, dry risers, storage areas etc. All designs shall be based on an interconnect model with access layer switches only.

All wall mounted boxes and cabinets shall be:

- ≥2000mm above finished floor level
- Flush with finished ceiling level
- ≥300mm on both sides from walls and obstacles for wall boxes
- ≥700mm on both sides from walls and obstacles for wall mounted cabinets
- Shall not be located within plant rooms or doors leading to external areas
- Shall not be swing frame cabinets
- Vented front door and side panels
- Removable side panels

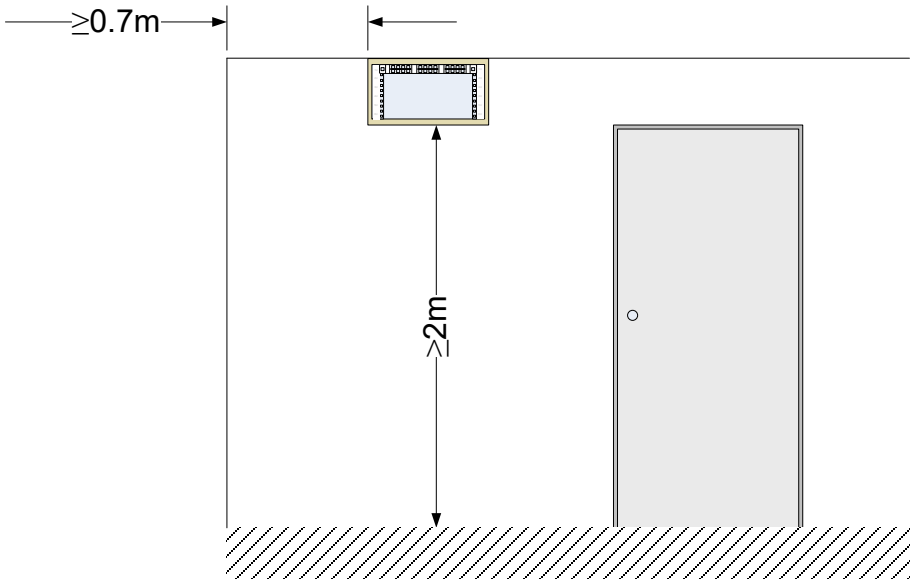


Figure 12 Desirable wall mounted box and cabinet clearances

4.5.1 Single Rooms

Where the requirement for ≥2000mm above finished floor level cannot be met wall mounted cabinets shall not be installed in areas shaded red.

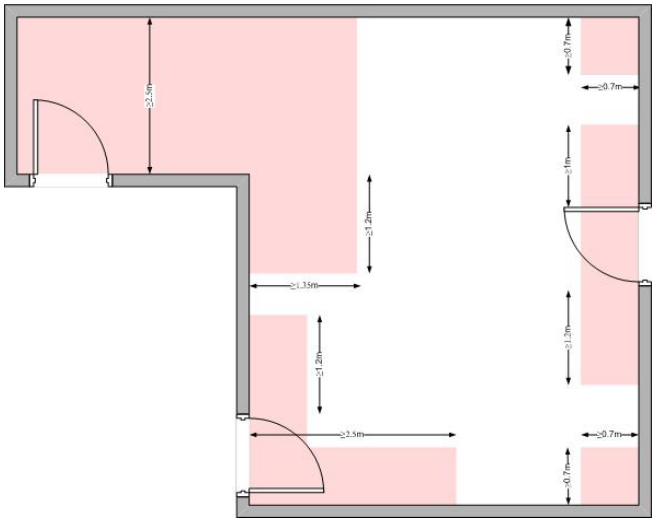


Figure 213 Single room clearances for wall mounted cabinets

4.5.2 Corridors and Throughways

Wall mounted boxes and cabinets shall be installed touching the ceiling grid in all major corridors, throughways and fire exits.

Rooms that act as a throughway, but not designated as one, can have wall mounted cabinets installed below 2m if the minimum width of the throughway is ≥ 2.5m.

In none designated throughways where the requirement for ≥2000mm above finished floor level cannot be met wall mounted cabinets shall not be installed in areas shaded red.

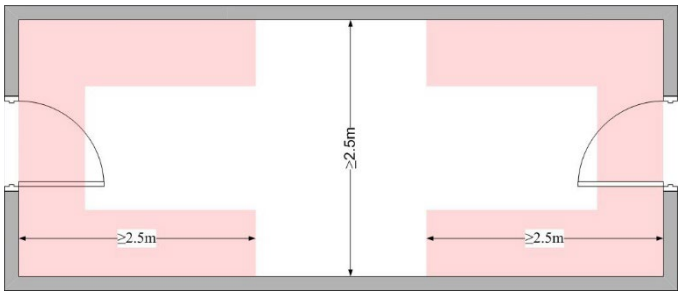


Figure 34 None designated throughway clearances for wall mounted cabinets

4.5.3 Cabinet Sizing

Cabinet depths:

- Height shall be ≥600mm in depth

Unit	Max No of 24 port patch panels
Wall Mounted Box	1
15U Wall Cabinet *	9

NOTE: A maximum of 48 active data ports in each cabinet

4.6 Door Entry

The MERs door entry shall be:

- Double door entry with no centre pillar
- Door height shall be ≥2130mm
- Main door to be ≥900mm in width
- Secondary door to be ≥ 450mm in width
- Both doors to open inwards
- The secondary door (narrowest) to have top and bottom draw bolts into the door frame and slab respectively
- The main door to have a suitable security lock fitted with a MUL-T-Lock M50 107X tumbler lock
- To be ≥ 1350mm width (total opening for both doors)
- The doors shall be a solid construction with no glass panels
- Doors shall be ≥90 minute fire rated
- Fitted with the following signs to the main door entry side
  - Telecom room number and DA code

Where the above requirements cannot be met the door entry for existing builds shall be:

- Door width shall be ≥ cabinet width
- Door height shall be ≥cabinet height
- Door shall have a suitable locking mechanism approved by iSolutions
- Doors shall be ≥90 minute fire rated
- Fitted with the following signs to the main door entry side
  - Telecom room number and DA code

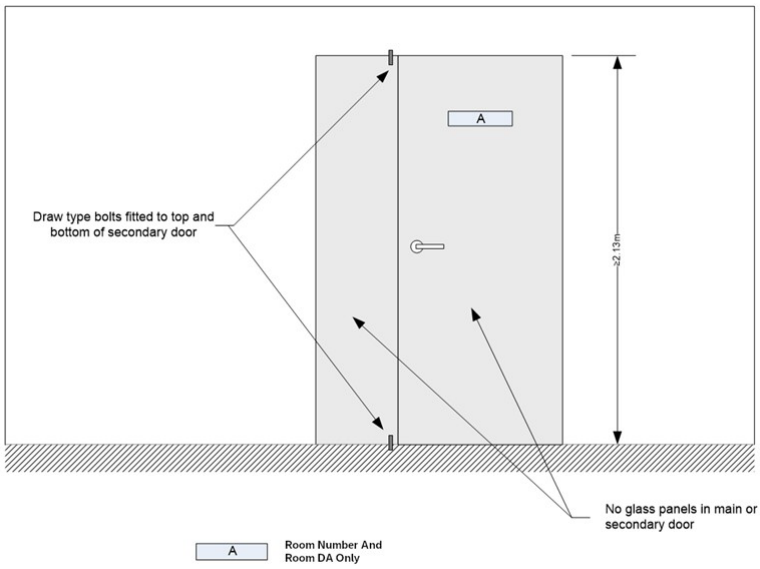


Figure 15 Telecom room door entry details

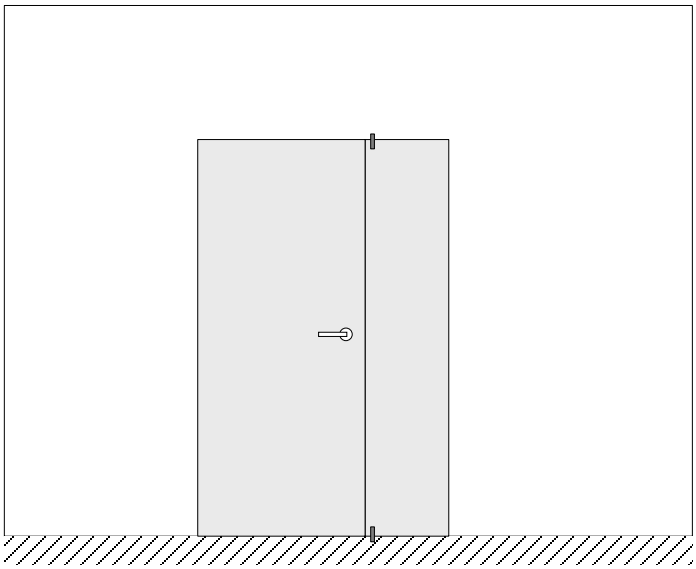


Figure 16 Telecom room door exit details

The SERs door entry shall be:

- Single door entry
- Door height shall be ≥2130mm
- Door to be ≥900mm in width
- Door to open inwards
- Door to have a suitable security lock fitted with a MUL-T-Lock M50 107X tumbler lock
- Door shall be a solid construction with no glass panels
- Door shall be ≥90 minute fire rated
- Fitted with the following signs to the main door entry side

- Telecom room number and DA code

Where the above requirements cannot be met the door entry for existing builds shall be:

- Door width shall be ≥ cabinet width
- Door height shall be ≥cabinet height
- Door shall have a suitable locking mechanism approved by iSolutions
- Doors shall be ≥90 minute fire rated
- Fitted with the following signs to the main door entry side
  - Telecom room number and DA code

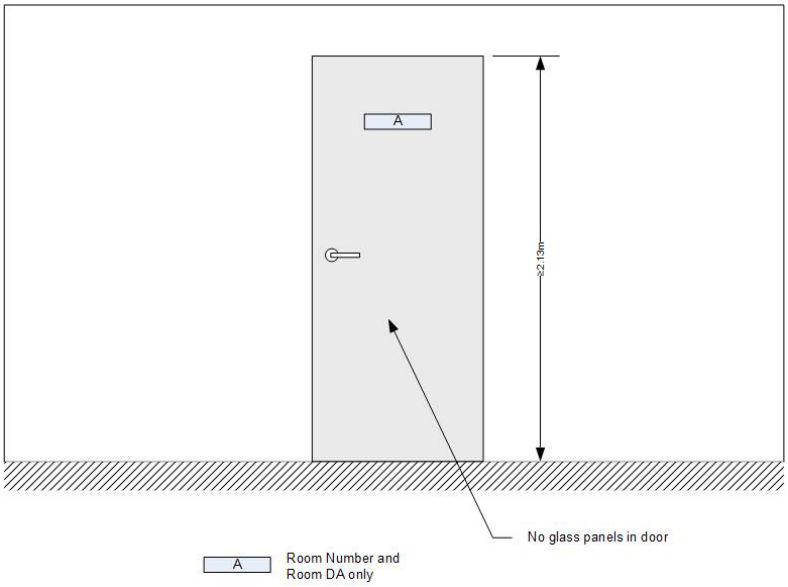


Figure 17 Telecom room single door entry details

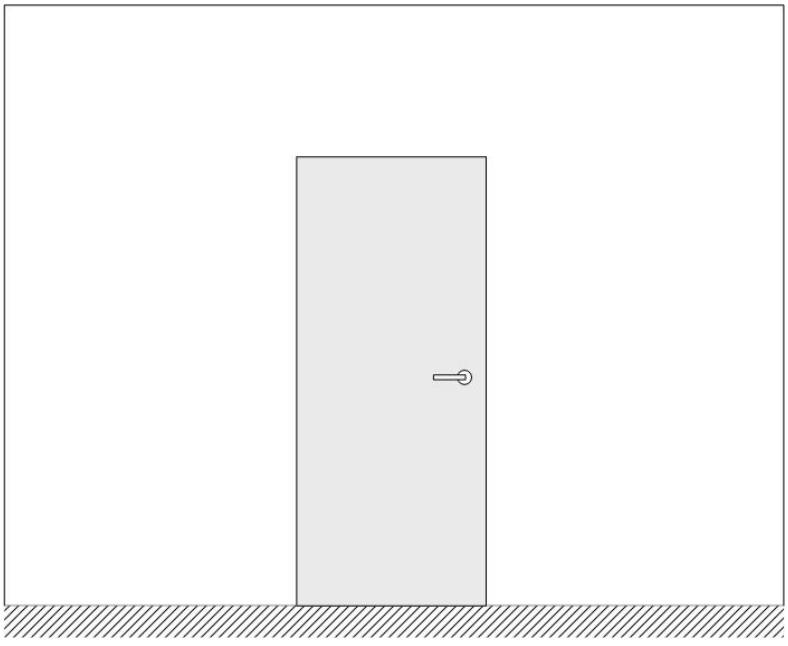


Figure 48 Telecom room single door exit details

4.7 Rack Consolidation for Existing MER and SERs

The following layouts shall be used where the cabinets within a MER or SER are to be removed and the cabling consolidated.

The Contractor will be responsible for the design supply equipment materials and labour including delivery to site, erection installation connection testing and the re-commissioning of the IT systems in the MER or SER where this work package is completed.

The Contractor shall be responsible, but not limited to, the following tasks:

- Remove and dispose of existing rack
- Install Ortronics Mighty Mo 20 open frame
- Supply install of new 32-amp zero U rack mounting PDU's
- Supply and install cable management bars
- Where cabling is installed on 16 port patch panels the cables shall be removed from the panels and re-terminated onto new 1U 24 or 1U 48 port patch panels
- Where space is restricted within the cabinet 48 port 1U patch panels may be used
- Re-terminated cables shall be retested
- Label new patch panels
- Label existing cables
- Update in Caplum
- Removal by agreement with iSolutions of any redundant cabling

4.8 Cabinet Elevations for MER and SERs

The following layouts shall be used where a MER or SER is being refreshed i.e. cabinets removed and cabling consolidated.

The layouts follow the telecom room layouts but detail how the copper and fibre patch panels and switches are laid out.

The general requirements for all cabinets are:

- Fibre Building Distribution (BD) and fibre Campus Distribution (CD) patch panel(s) shall be mounted at the top of the cabinet
- Network switches to be installed in a cabinet to the right of the structured cabling cabinet
- Network switches to be installed from the top down
- A 1U gap to be left between network switches for cooling purposes
- Network switches shall be installed in stacks of ≤ 9
- Room shall be left to enable each stack to reach a maximum of 9 i.e. if there are two stacks of 5 switches then a 8U gap shall be left between each stack of 5 switches

Please note that all cable managers shall be extra deep and capable to accommodating 48 off cat 6a shielded patch cords.

4.8.1 360 Channels – SER

4.8.1.1 Horizontal cables fed from the top

- The switches shall be populated from the bottom of the cabinet – above the fibre patch panel

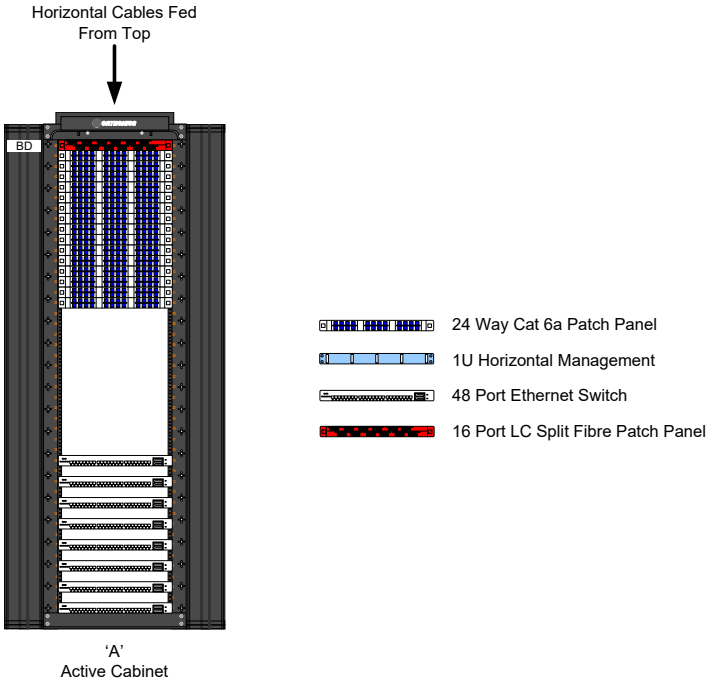


Figure 5 SER cabinet layout for 360 channel top fed

4.8.1.2 Horizontal cables fed from the bottom

- The switches shall be populated from the top of the cabinet – below the fibre patch panel

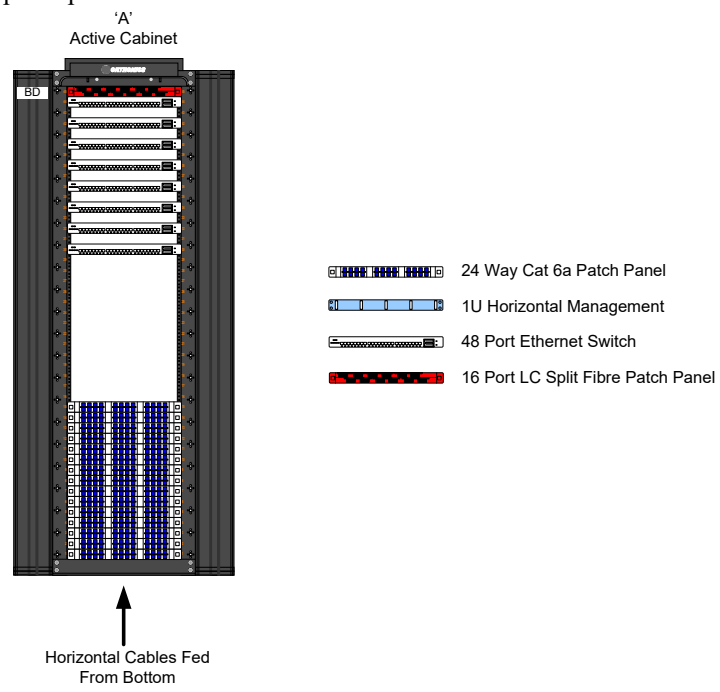


Figure 20 SER cabinet layout for 360 channels bottom fed

4.8.2 360 Channels – MER

4.8.2.1 Horizontal cables fed from the top

- The switches shall be populated from the bottom of the cabinet – above the fibre patch panel

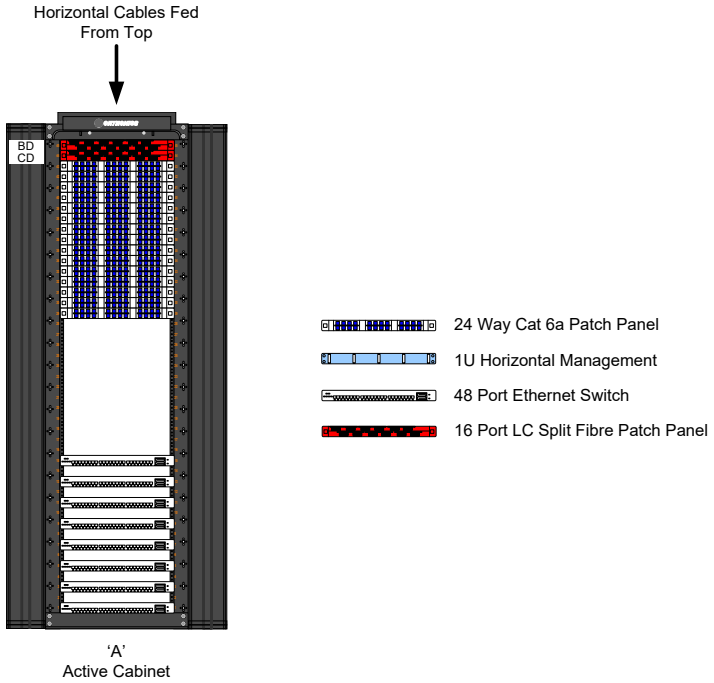


Figure 621 MER cabinet layout for 360 channels top fed

4.8.2.2 Horizontal cables fed from the bottom

- The switches shall be populated from the top of the cabinet – below the fibre patch panel

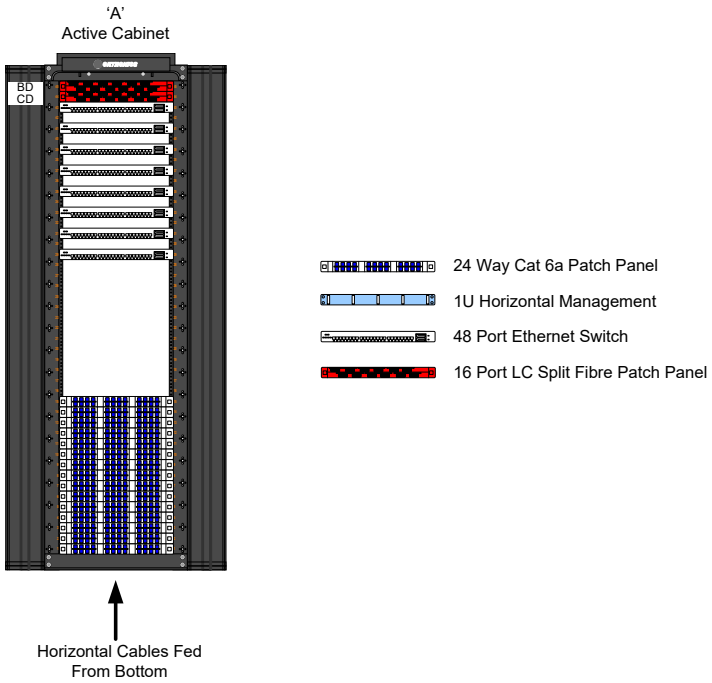


Figure 22 MER cabinet layout for 360 channels bottom fed

4.8.3 720 Channels – SER

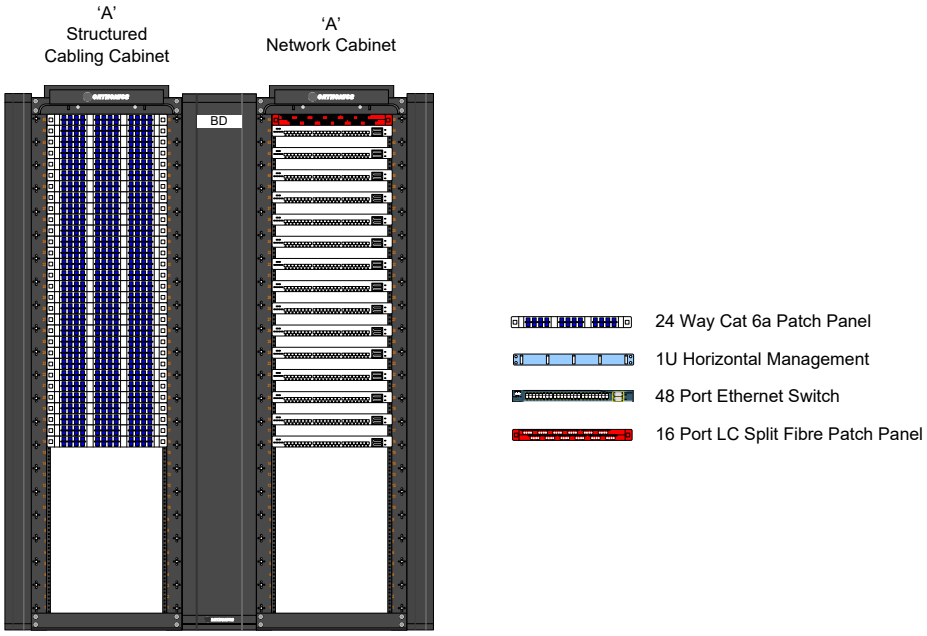


Figure 23 SER cabinet layout for 720 channels

4.8.4 720 Channels – MER

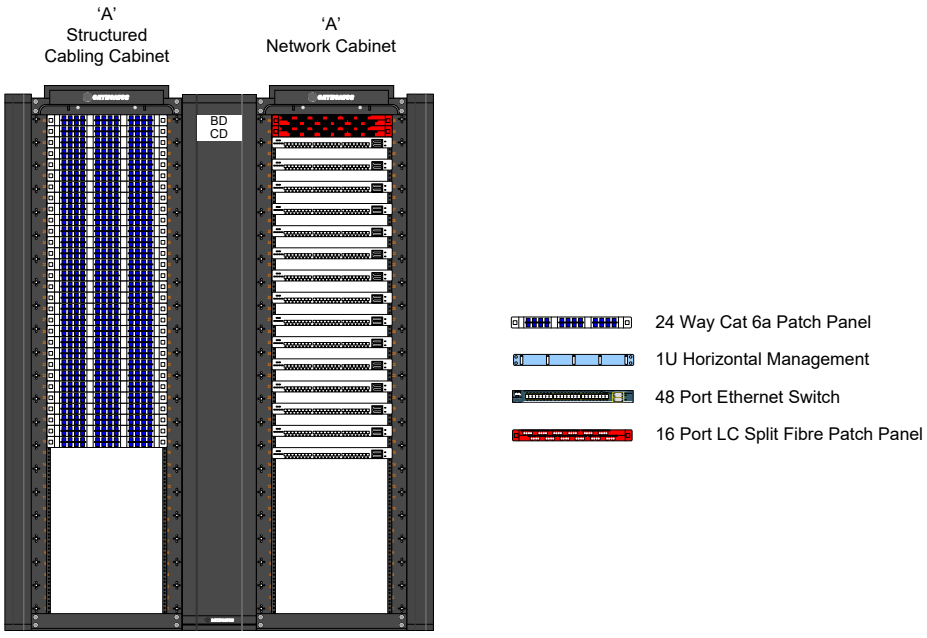


Figure 7 MER cabinet layout for 720 channels

4.8.5 1440 Channels – One MER

Where there is a single MER housing between 721 and 1440 channels the following layout applies.

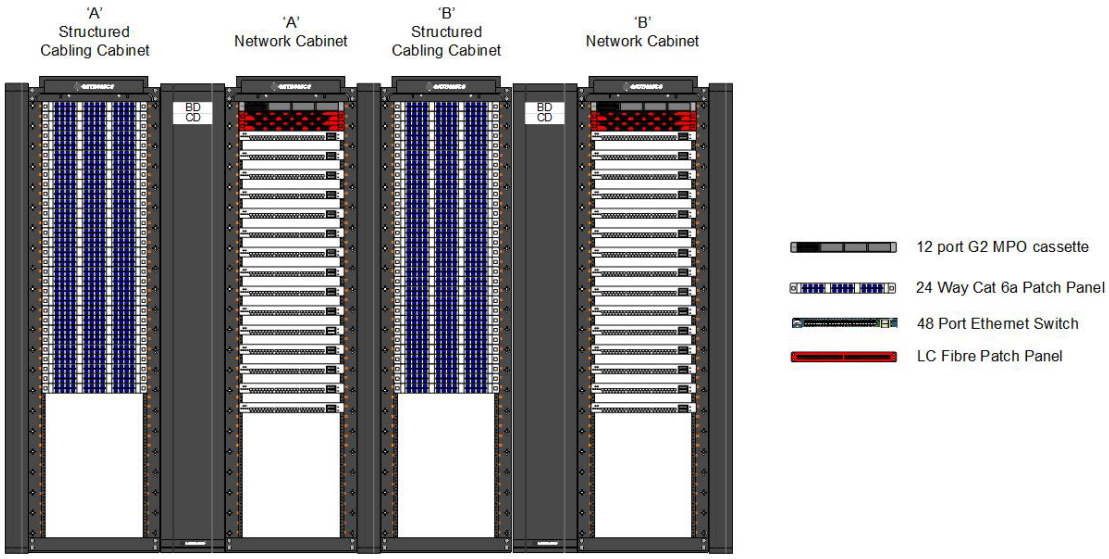


Figure 8 One MER cabinet layout for 1440 channels

4.9 Lighting

All telecom rooms shall have no suspended ceiling installed. Where there is a refresh and the telecom room has a suspended ceiling installed the ceiling shall be removed as part of the refurbishment works.

Lighting shall be measured 1m above the finished floor in the centre of the hot and cold aisles. The luminance shall be a minimum of 500lx in the horizontal and 200lx in the vertical plane. Diffusers shall be used to ensure an even spread of light throughout the length and width of the aisles. Spot lighting shall not be used to illuminate the aisles.

Where the above requirements cannot be met the lighting design for existing builds shall be:

- Light shall be positioned where the front and rear of cabinets are illuminated
- Lighting switched on by a switch or motion sensors shall be deemed acceptable

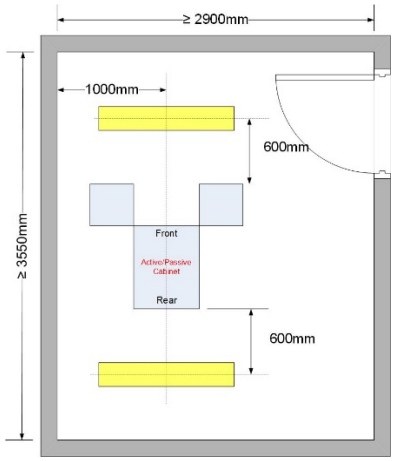


Figure 26 Lighting layout for 1 cab SER

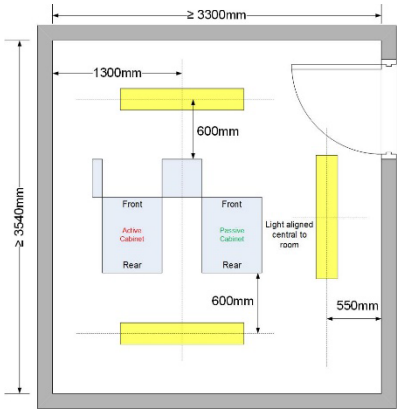


Figure 27 Lighting layout for 2 cab SER

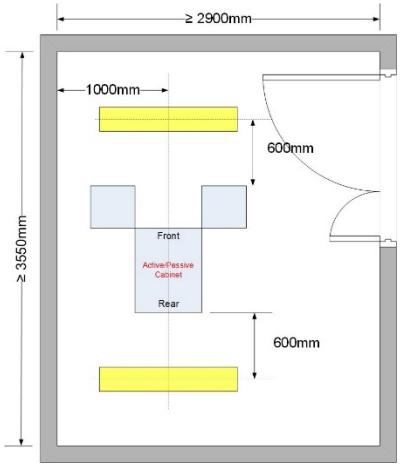


Figure 28 Lighting layout for 1 cab MER

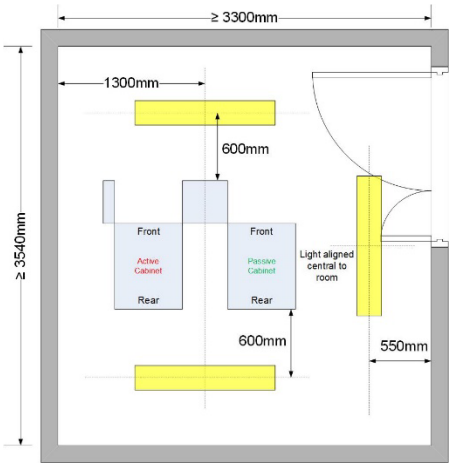


Figure 29 Lighting layout for 2 cab MER

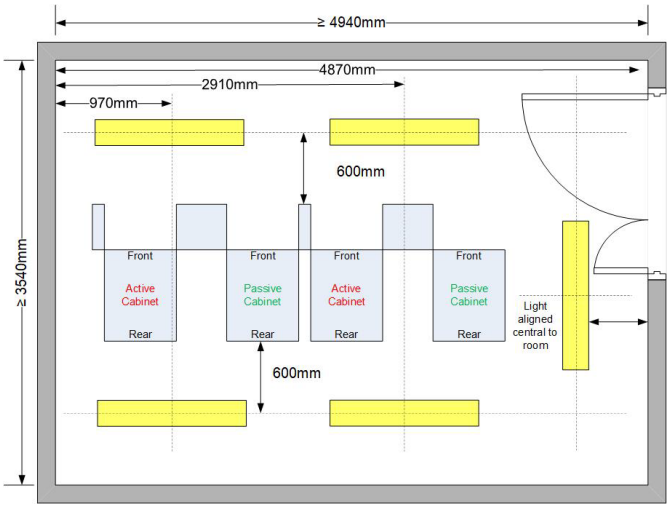


Figure 30 Lighting layout for 4 cab MER A

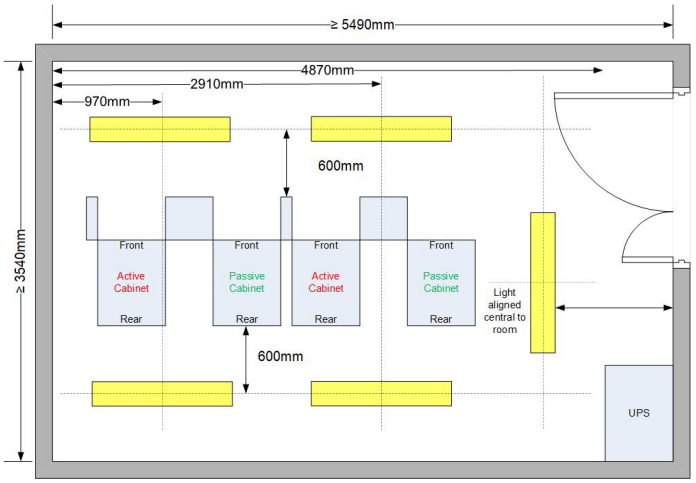


Figure 31 Lighting layout for 4 cab MER A with UPS

Note – the telecom room layout showing the UPS and four cabinets shall be used for MER A where the building design has two MERs. This design shall also be used where iSolutions deem a single MER building of critical importance.

4.9.1 Lighting Measuremens

Lighting shall be measured in the horizontal plane:

- At 1m above the finished floor
- 600mm from the front face of the rack's vertical managers
- 600mm from the rear face of the rack
- In the centre of the aisle to the right and left of the row of racks
- The luminance shall be a minimum of 500lx

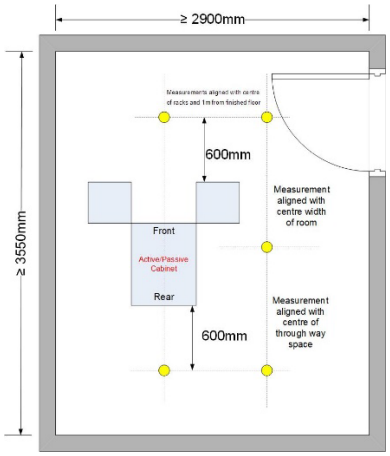


Figure 32 Lighting measurements for 1 cab SER

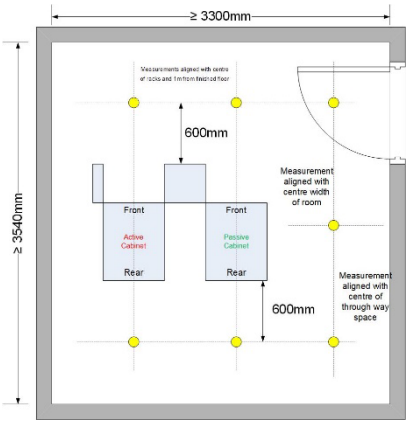


Figure 33 Lighting measurements for 2 cab SER

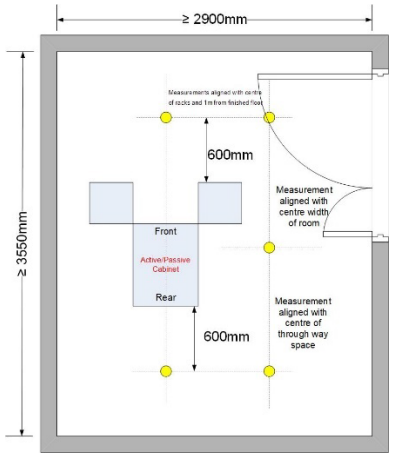


Figure 34 Lighting measurements for 1 cab MER

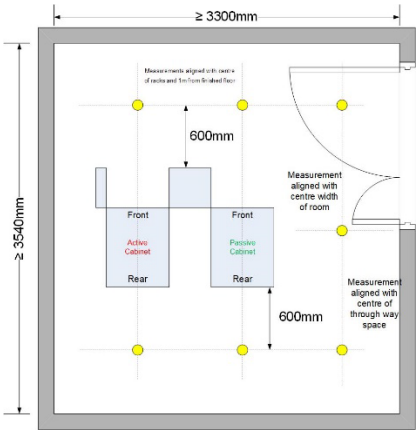


Figure 35 Lighting measurements for 2 cab MER

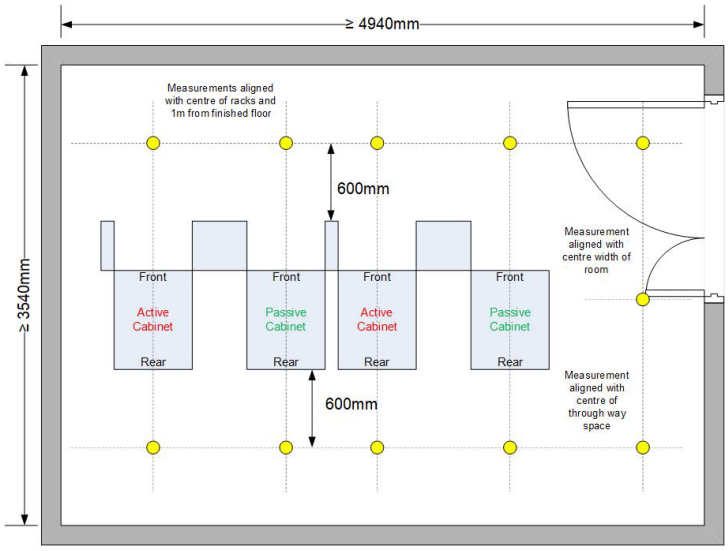


Figure 36 Lighting measurements for 4 cab MER A

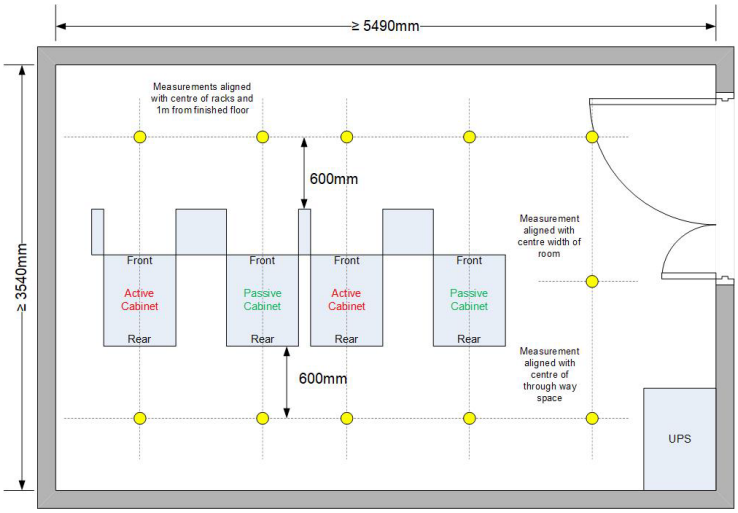


Figure 37 Lighting measurements for 4 cab MER A UPS

Lighting shall be measured in the vertical plane:

- At 5U, 22U and 40U in each rack
- At the front face of the patch panels or network equipment
- At the rear face of the rack
- The luminance shall be a minimum of 200lx

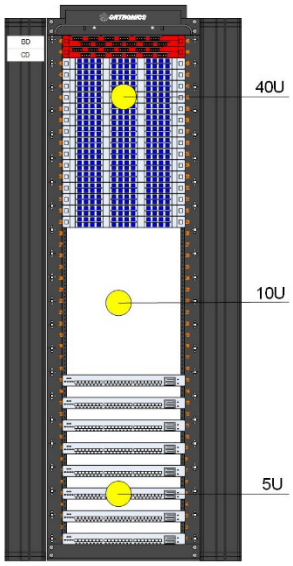


Figure 38 Front view of cabinet lighting test points

4.10 Cooling

The telecom room shall be provided with free cooling ventilation and supplemented with air conditioning. Consideration shall be taken for future power requirements of new equipment. A suitable margin above the flood-wiring scenario shall be taken into account. To allow a safety margin of cooling it shall be designed to accommodate the requirements of flood wiring with all ports active.

4.8.1 Telecom Room Requirements

Each Telecom room shall have:

- Internal temperature sensors
  - One TREND sensor to be plugged into the TREND Network and be positioned to link with environmental monitoring
  - To be mounted within the cabinet
- External temperature sensor
  - Where the telecom room is above the ground floor it shall be mounted >300mm to the telecom room window opening
  - It shall not be mounted directly above a window opening
  - It is preferred to be mounted below a window opening
  - Shall not be mounted within 1m of extractor fan
  - Shall not be mounted above any extractor fan
  - Shall not be directly exposed to solar radiation
  - Shall not be painted
  - Shall not be mounted on external facades that transmit convective heat i.e. metal clad buildings
- TREND controller
  - Inputs for
    - External temperature sensor
    - Internal temperature sensor
    - Output for DX unit – enable and disable function
    - Input from DX unit – fault condition
    - Output for supply fan – enable and disable function
    - Output for extractor fan – enable and disable function
    - Output for air recirculation damper
    - Output for fresh air damper
  - To be mounted on an internal wall within the telecom room
  - To be protected from damage misuse with a lockable wall mounted unit
- DX Unit
  - N+1 for all MERs
  - N for all SERs
  - Where a room has N+1 cooling resilience the DX units shall be fed from the UPS distribution board
  - Each DX unit shall be capable of supplying a minimum of 5kW of cooling for each cabinet housing active equipment
  - 21^0C to 26^0C for telecom rooms with no UPS
  - 16^0C to 21^0C for telecom rooms with a UPS
  - The DX units shall be enabled on an 8k temperature gradient (ΔT) between the buildings external and telecom rooms internal temperature
    - For telecom rooms with no UPS the DX unit is enabled and the extractor fan is disabled when the external temperature is $\leq 18^0$C
    - For telecom rooms with no UPS the DX unit is disabled and the extractor fan is enabled when the external temperature is $>18^0$C
    - For telecom rooms with a UPS the DX unit is enabled and the extractor fan is disabled when the external temperature is $\leq 13^0$C
    - For telecom rooms with a UPS the DX unit is disabled and the extractor fan is enabled when the external temperature is $>13^0$C
  - A digital temperature controller with LCD display to allow a user to set and display fan speed, temperature gradient, temperature setting etc.
  - Lowest most DX unit to be mounted ≥2m from the final floor level
- Free cooling fans
  - An extractor fan with air damping when disabled
  - A supply air fan with fresh air supply damper and air recirculation damper

- Where both fans are on the same external wall, they shall be ≥2m apart
- The cooling system shall be tested and commissioned prior to the installation of active equipment. The active equipment covers, but is not limited to, UPS, network switches etc.
- The cooling system shall be available of a 24 hour 365 day basis
- The telecoms room shall be protected against contaminants and pollutants

Contaminant	2 Concentration
Chlorine	0.01 ppm
Dust	100 µg/m^3/24 h
Hydrocarbons	4 µg/m^3/24 h
Hydrogen Sulphide	0.05 ppm
Nitrogen Oxides	0.1 ppm
Sulphur Dioxide	0.3 ppm

Table 1 - Contaminants List

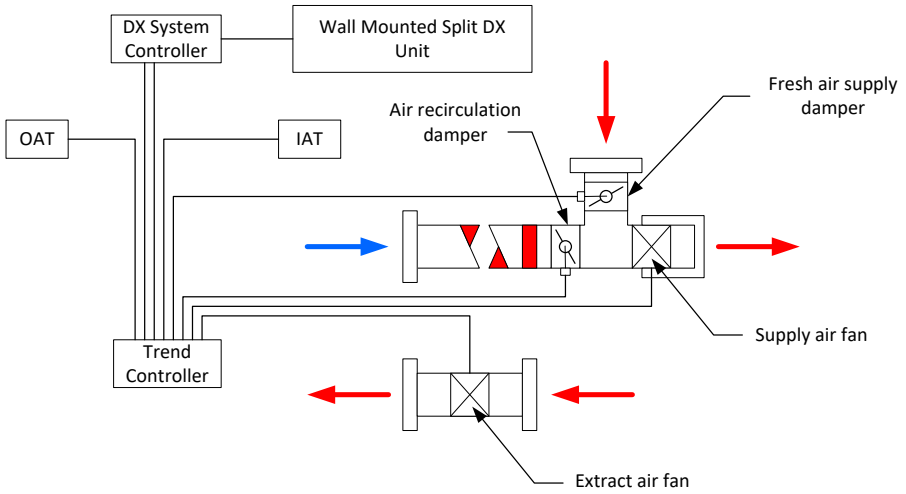


Figure 39 Logical diagram for cooling system

4.8.2 Free Cooling Room Layouts

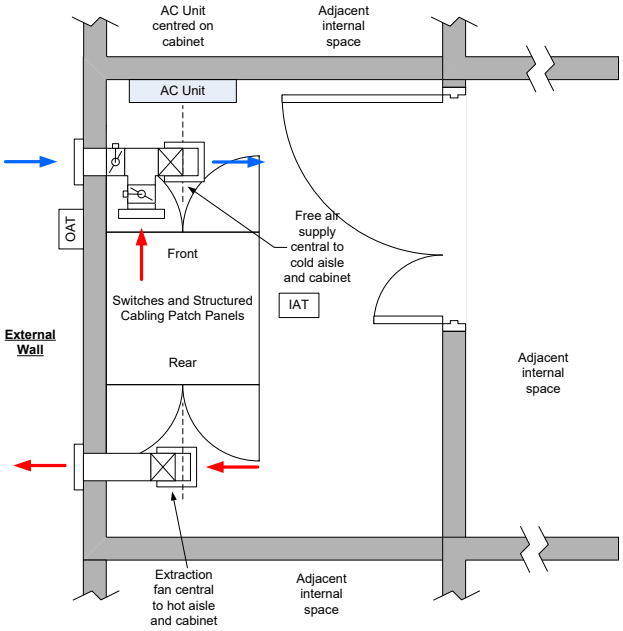


Figure 40 Example layout for a single external wall

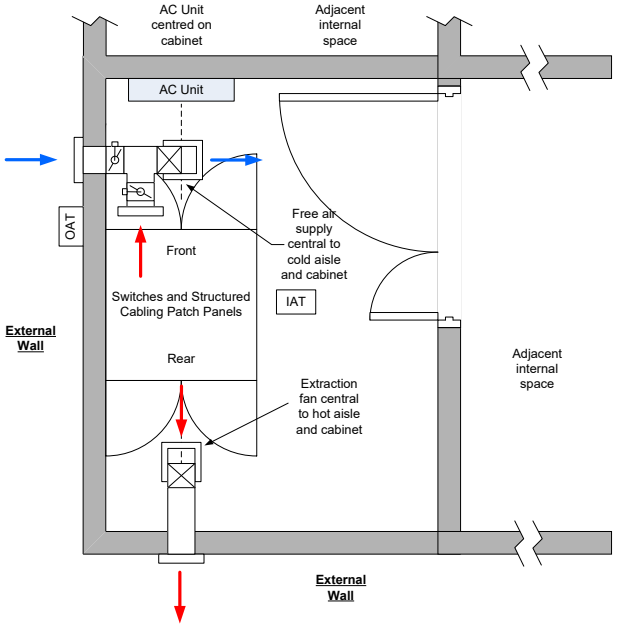


Figure 41 Example layout for a 2 adjoining external walls

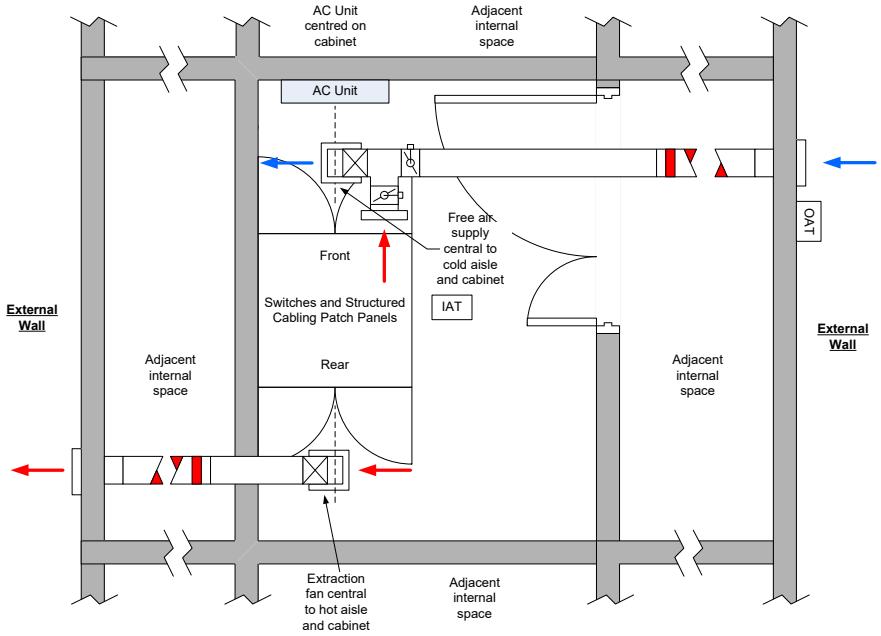


Figure 42 Example layout for 2 adjacent external walls

4.8.3 DX Cooling Room Layouts

All AC units shall point forwards towards the front of the racks.

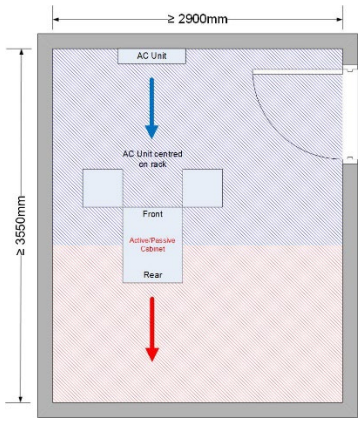


Figure 43 DX layout for 1 cab SER

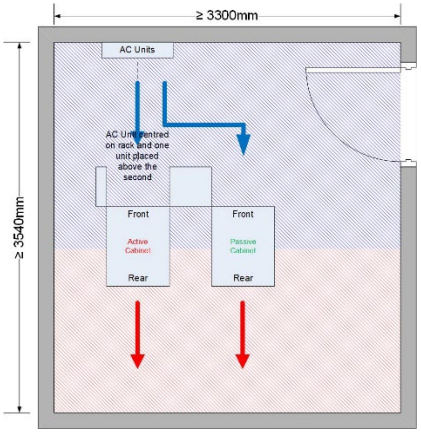


Figure 44 DX layout for 2 cab SER

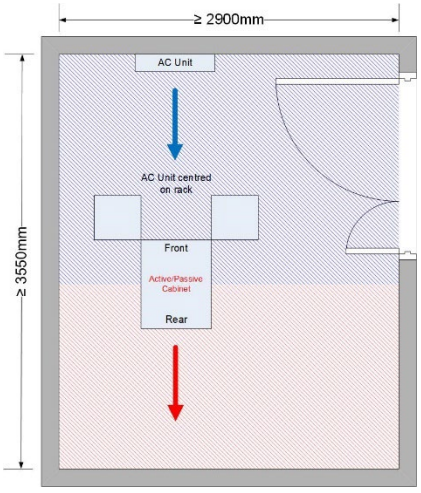


Figure 45 DX layout for 1 cab MER

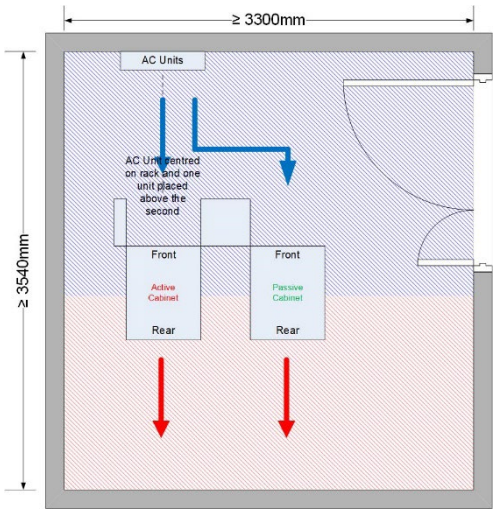


Figure 46 DX layout for 2 cab MER

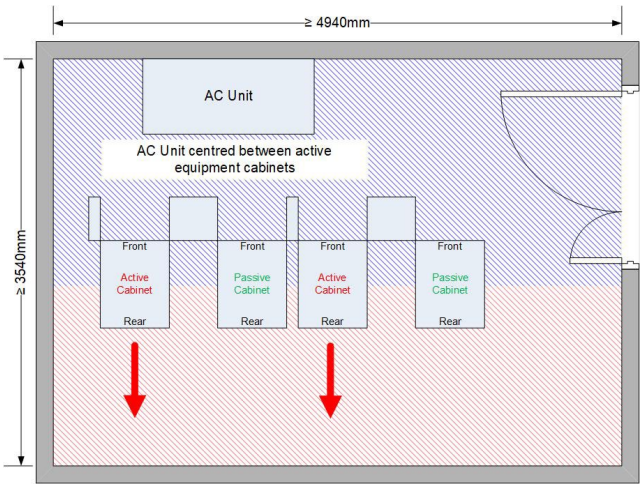


Figure 47 DX layout for 4 cab MER A

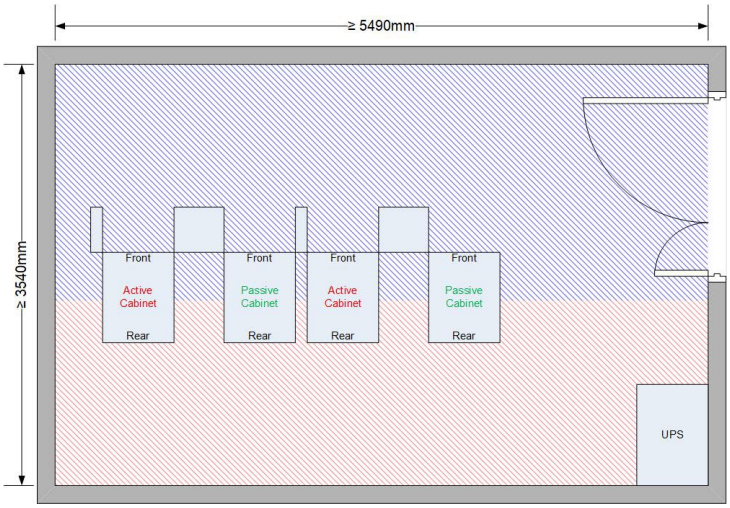


Figure 48 DX layout for 4 cab MER A UPS

4.11 Power

4.11.1 General Requirements for MERs and SERs

- Two commando sockets for each cabinet/rack housing active equipment
  - 240v 32A rating
  - All commando sockets within a single cabinet/frame shall be on the same phase
  - Commando plug termination
  - For high level containment the commando sockets shall be directly above the cabinet/rack – one aligned to the rear left hand side and one to the rear right hand side of the cabinet/rack
  - For low level containment the commando sockets shall be directly underneath the cabinet/rack– one aligned to the rear left hand side and one to the rear right hand side of the cabinet/rack
  - Diverse route to UPS distribution board within the MER or SER and on the same phase
  - Each commando to have its own circuit breaker
  - All commando sockets shall be fed from the UPS distribution board
  - All commando sockets shall be labelled
  - Isolators to be mounted on the commando socket
- Two Raritran PDUs (part no. PX3-1493V 32A) for each cabinet housing active equipment
  - 240v 32A rating
  - 4 way C19
  - 20 way C13
  - 3m cord
  - Un-switched
  - Metered
  - Diverse route to intended commando socket
  - Commando plug termination
  - 2 mounting brackets per PDU (part No. 251-01-0026-00)
  - All PDUs shall be labelled
- Raritan temp/humidity sensor DX2-T1H1
  - Positioned at the front of the frame central to the top rail
  - Plugged into PDU
- All mains leads shall be labelled
- All mains leads shall be Raritran lockable
- Cabinets/frames not housing active equipment shall not have PDUs fitted.
- A 360 channel telecom room shall have a minimum power rating of 5kW, a 720 channel telecom room shall have a power rating of 5kW and a 1440 a power rating of 15kW
- A minimum of 2 off double 13A switched sockets fed from the local distribution board
- All cabinets/frames shall be separately earth bonded using a minimum of 6mm earthing cable back to a grounding bar located within the Telecom room. Bonding shall be in accordance with BS 7671.

4.11.2 UPS

All existing buildings shall be provided with a UPS system located in a central dedicated UPS room or if a singular comms room then in the MER(s). The requirements shall be:

- A Vertiv 3 phase UPS will be supplied and fitted
- The full specification for the UPS shall be sized by the main contractor. The sizing should be based on 10Kw IT load for each MER room and 5Kw IT load for an SER room. One HVAC unit will be supported by the UPS in each room.
- The Main Contractor shall correctly size the UPS for operational capacity and battery autonomy of 20 minutes

- This UPS shall be located in a dedicated UPS room in a plant area and feed a UPS distribution board in each SER, MER A and MER B within the building
- The UPS shall be fitted with an appropriate communications card and shall be connected to the Vertiv Life.Net service
- Loads shall be balanced across the UPS phases
- Each rack shall be fed with single phase power
- The UPS within the MER shall be commissioned, integrated and fully operational prior to the MER hand over
- An external manual bypass facility will be provided to allow the UPS to be taken completely out of circuit to allow maintenance or replacement operations without affecting the output loads
- A commissioned UPS with the communications card reporting to the Life Net service is required as part of practical completion

4.11.1 N Redundancy

Where a building requires an N redundant UPS system it is important that the UPS loading be carefully considered. A centralised UPS solution will be supplied. All network equipment essential for the operation or security of the network shall be connected to the UPS system. The Main Contactor shall provide a UPS design and shall submit this design to iSolutions for approval. A typical UPS layout is shown below.

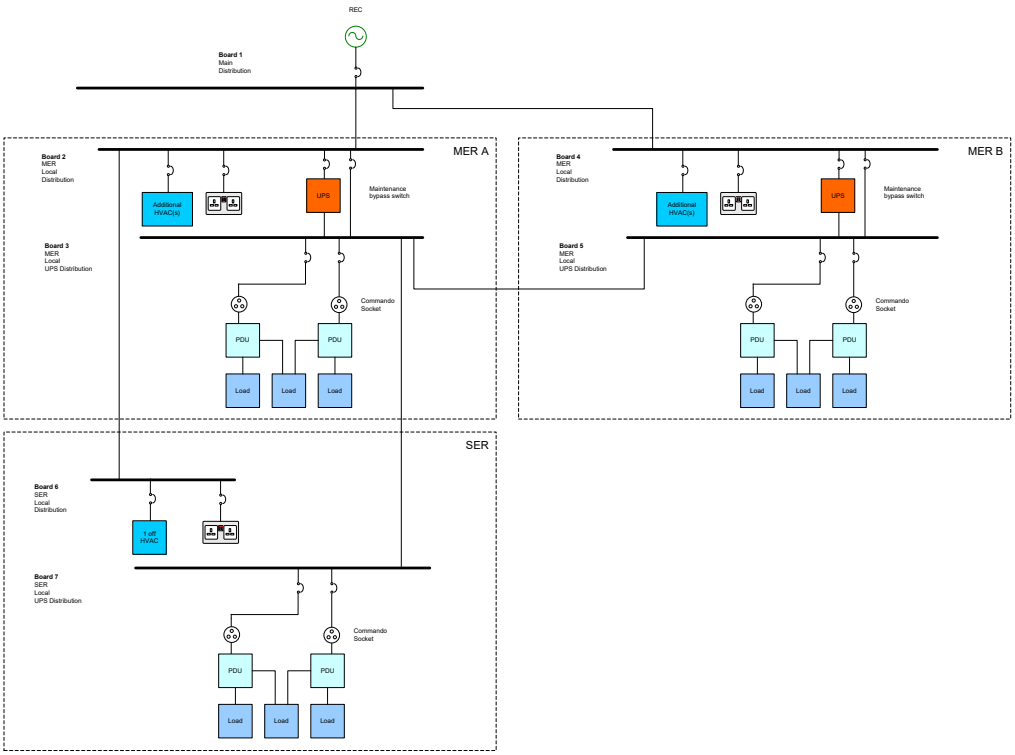


Figure 51 Typical centralised N redundant UPS system

The specification for an N redundant UPS system is:

- 20 minute backup for non-generator backed sites
- Training for a maximum of 6 people on site
- Manufacturer 4 hour fault response service contract will be provided for a five year period
- Ethernet alarm connection
- External maintenance bypass interface

- Emergency Power Off (EPO) – A STS anti-tamper enclosure shall be fitted
- Batteries shall be sealed type – replacement batteries shall also be sealed type. It is not acceptable to fit vented batteries

4.12 Power over Ethernet (PoE)

Any anticipated requirements for PoE shall be discussed with iSolutions in advance.

4.13 Environmental Monitoring

One Raritan DPX2 T1H1 temperatures sensor shall be fitted each active frame, sensor to be mounted on the front centre top rail of the active frame. Sensor will be plugged in to the Raritan frame PDU,s, which are to be networked.

A HIK Vision DS-2CD2343G0-IU will be supplied and connected to a switch port.
The camera will be positioned to look at the entrance door and have an unobstructed view with the door closed or open.

4.14 Floor Finish

4.14.1 Suspended Floor

Where there is a suspended floor the finished floor level shall be:

- Minimum depth of 250mm from the floor finish to the underside of the floor tile
- The surface of the floor tiles shall have a smooth vinyl anti-static proof finish
- The underside shall be clad in a corrosion proof metallic material.
- All apertures cut into a suspended floor shall be sealed with brush seal Gromtec GTAG5-300-UOS or CATAG5-600-UOS.
- The suspended floor support pedestals shall not interfere with the aperture openings
- A floor tile lifting clamp shall be left in each MER and each SER
- The suspended floor shall be bonded to earth in accordance with BS 7671

4.14.1 Solid Floor

Where there is no suspended floor the finished floor level shall be:

- Cracks filled
- Deal with problematic dilatations and mould lines
- Deep clean
- Treat with two coats of blue coloured ESD coating to EN 61340-4-1, EN 61340-4-5 and EN 61340-2-3
- Treat with one clear coat of ESD coating to EN 61340-4-1, EN 61340-4-5 and EN 61340-2-3
- None slip finish

4.15 Acoustic Performance

All walls, doors, ceilings and floors shall have an acoustic performance of not less than R_w, R_w+C_{tr} of 60/50.

All walls shall be sealed and filled prior to handover.

4.16 Cable Penetration

Where cables penetrate a telecom room the following shall apply:

- An aperture shall be cut into the telecom room that is sized to allow the complete penetration of the data cable containment
- The data cable containment shall pass through the penetration with no break/joint
- Data cables shall be installed to the left of the cable basket
- All cable entry points shall be fire stopped to the required rating
- All fire stops shall be in accordance with BS 9999: latest revision.
- Fire stopping must be installed by a LPCB or FIRAS accredited contractor with a minimum of 3 years' experience
- Submit evidence that the Manufacturers products and systems are Third Party accredited by LPCB or FM (Factory Mutual)
- Two off EZ Path 100 x100mm devices shall be installed within the fire stop to the right of the data cabling
- 1 EZ path to be installed within the fire stop for every major throughway

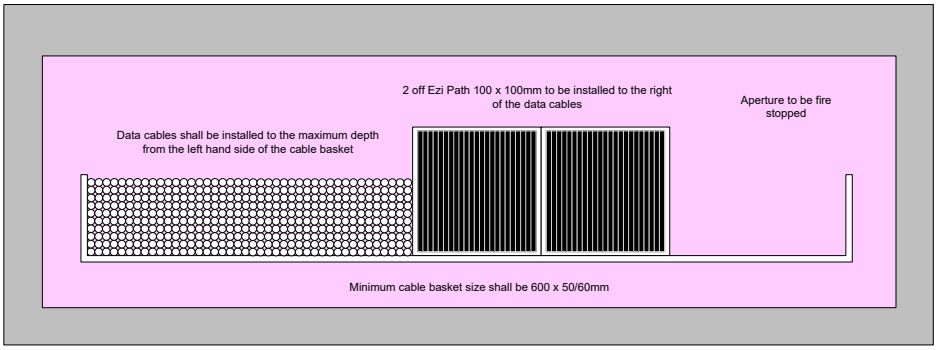


Figure 52 Cable penetration

4.17 Earth Bonding

4.17.1 MER and SER Main Bonding

For Main Equipment Rooms (MER) a copper grounding bar of dimensions ⩾ 100mm (H) x 300mm (L) x 6mm (D) shall be fitted

- Part number: LK243-8SS

For Satellite Equipment Rooms (SER) a copper grounding bar of dimensions ⩾ 50mm (H) x 300mm (L) x 6mm (D) shall be fitted.

- Part number: LK243-8SS

The telecom room copper grounding bar shall be mounted at a height of 300mm above the floor surface. The grounding bar shall be insulated from the support wall or floor to a minimum rating of 2000V

- Part number: LK243-8SS

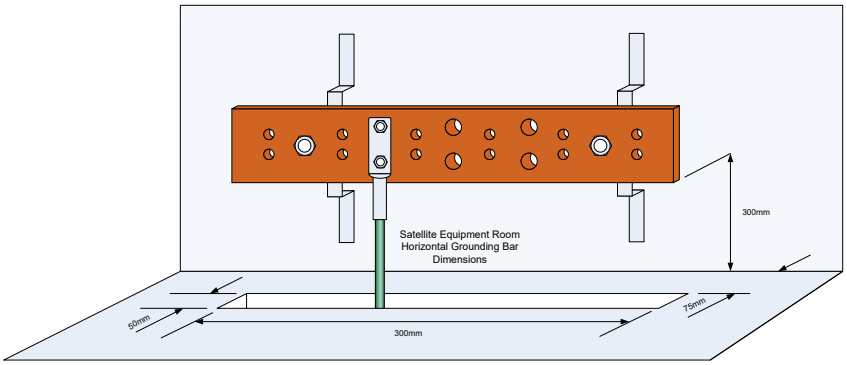


Figure 53 Grounding bar front elevation detail

Where a suspended floor is fitted it shall have an aperture cut within the floor tile to a width of 50mm and length equal to the grounding bar. Where the suspended floor provides air cooling the aperture shall be sealed with a brush seal Gromtec GTAG5-300-UOS or CATAG5-600-UOS.

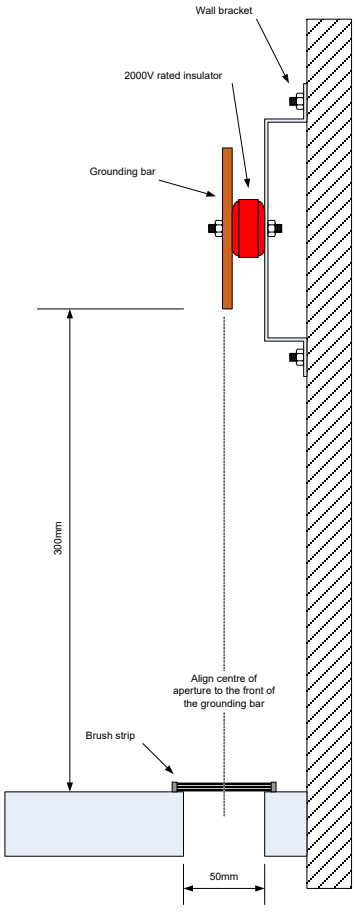


Figure 54 Grounding bar side elevation detail

4.17.2 Cabinet Grounding Bar

The cabinet/rack shall have a suitable sized horizontal or vertical grounding bar fitted. The grounding bar shall be made of copper and drilled with 7mm holes.

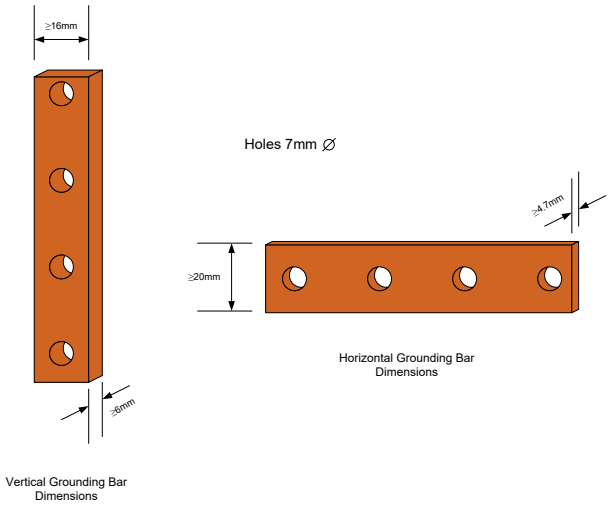


Figure 55 Cabinet grounding bar

Vertical grounding bars shall be fitted to both the rear of the left mounting angle and right mounting angle of the cabinet/rack.

- Part number: OR-GBV72KIT

For wall mounted cabinets a 4 -way horizontal grounding bar will be fitted to the base of the cabinet.

- Part number: AC2590

4.17.3 Earth Grounding Cables for Cabinets and Voice Frames, Cabinet or Wall Box

1. A tri-rated cable shall be bonded to the Telecom room grounding bar to each cabinet or voice frame, cabinet or wall box. It is not acceptable to daisy chain cabinets together.

2. The cable shall be rated to be equal or greater than the largest supply conductor within the cabinet/rack but, it **SHALL** not be less than 16mm^2.

3. The tri-rated cable shall be terminated with compression lugs at each end.

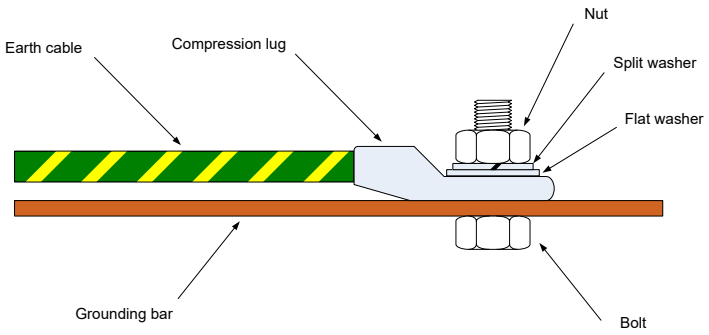


Figure 56 Detail for bonding earth cable with nut and bolt

4. A permanent tag or label printed with ‘Safety Electrical Earth – Do Not Remove’ shall be fitted to either end of the tri-rated cable. The label must be yellow in colour with black upper case text.

Figure 57 Earth cable label

5. A permanent label indicating the destination cabinet shall be fitted to either end of the tri-rated cable.

4.17.4 Earth Grounding Cables for Suspended Floor

1. All earth bonding shall be in accordance with BS-EN50310 latest edition

2. A tri-rated cable shall be bonded to the Telecom room grounding bar to every 6 pedestals in each direction

3. The cable shall be rated to be equal or greater than the largest supply conductor within the cabinet/rack but, it **SHALL** not be less than 6mm^2.

4. The tri-rated cable shall be terminated with compression lugs at each end.

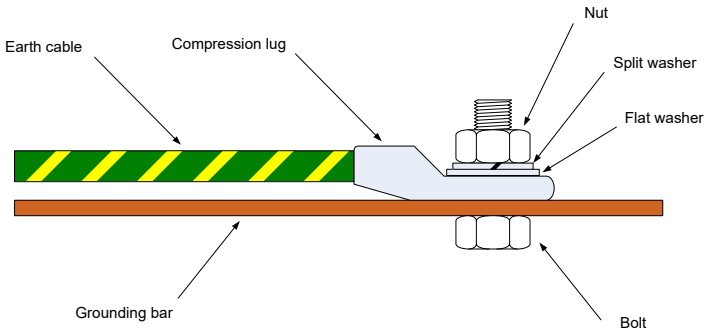


Figure 58 Detail for bonding earth cable with nut and bolt

5. A permanent tag or label printed with ‘Safety Electrical Earth – Do Not Remove’ shall be fitted to either end of the tri-rated cable. The label must be yellow in colour with black upper case text.

Figure 59 Earth cable label

6. A permanent label indicating the suspended floor shall be fitted to either end of the tri-rated cable.

4.17.5 Earth Grounding Cables for Patch Panels and Doors

1. A tri-rated cable shall be bonded to the cabinet grounding bar and each metallic patch panel and isolated cabinet parts i.e. doors, sides etc.

2. The cable **SHALL** not be less than 4mm^2.

3. The tri-rated cable shall be terminated with compression lugs at each end.

4. It is not acceptable to daisy chain or loop patch panels together.

4.17.6 Earth Grounding Cables for PDUs

1. A tri-rated cable shall be bonded to the cabinet grounding bar and each PDU earth lug.

2. The tri-rated cable shall be terminated with compression lugs at each end.

3. The cable cross section **SHALL** not be less than 4mm^2.

4.18 Security

All doors that have direct access to a telecom room shall have a suitable security lock fitted with a MUL-T-Lock M50 107X tumbler lock, which are available from the University of Southampton locksmith. These tumblers are reserved for iSolutions and available from estates and facilities.

All external windows shall be fitted with opaque glass that is obscure to level 5. Security bars shall be fitted to the inside of the windows.

A HIK Vision DS-2CD2343G0-IU will be supplied and connected to a switch port.

The camera will be positioned to look at the entrance door and have an unobstructed view with the door closed or open.

4.19 Fire Detection

Each telecom room shall have a smoke alarm fitted in a central ceiling location. This alarm shall be the same type and manufacture of the building fire detection system. The alarm shall be linked into the building fire detection system.

4.20 Pre Commissioning Patch Panel Protection

Immediately after a patch panel has been installed and terminated the front of the RJ45 ports shall be protected against dust ingress. It is acceptable to use a suitable none marking tape that leaves no adhesive once removed. If the tape has to be removed for testing purposes it shall be renewed immediately after testing completion with new tape.

4.21 Telecom Room Cleaning

The Main Contractor shall clean all MER and SERs on a weekly basis. Cleaning shall cover the removal of all waste material and the vacuum cleaning of the floor and the inside of cabinets. It is not acceptable to brush the floors clean.

A door seal shall be placed on the entrance when working outside of the room directly.

When cleaning the room, the air shall be scrubbed to remove air contamination. Vacuum cleaners must be used to vacuum areas, all surfaces shall be wiped using tack cloths or Anti-static foam and microfibre cloths. Or a mixture of all three procedures. Cleaning liquids are not to be used in these rooms.

Servers and cabinets shall be cleaned with vacuums and tack cloths. Server tops that are accessible shall be cleaned with Anti-static foam and microfibre cloths.

Walls, ceilings and floors shall be cleaned with tack cloths anti-static foam and microfibre cloths or one of each depending on level of contamination.

Server cabinets shall be covered with a light plastic sheet to protect from dust and falling materials but still allowing air to floor through the servers. This shall be removed when work is not being carried out.

The cleaning shall be done from start of contract until hand over.

4.22 Frames

Within the telecommunication rooms and wiring closets, patching frames are required to house the termination of the copper distribution cabling, inter building/campus fibre optic

cable and active I.T. hardware. Where the telecom room or wiring closet are shared with another provider the frames shall be fitted with doors and side panels.

Patching frames shall be:

Ortronics mighty Mo 20, with all necessary accessories and vertical cable manager enclosures for the full capacity of the hub room.

4.22.1 Frame Configuration for a MER and SER (1 Frame)

4.22.1.1 Sole occupancy telecom room for iSolutions

Qty	Part Number	Description 1	Units
1	MM20CMR3-W	MM20 cable mgmt ring,1.75X3",14 PCS, white	Each
1	MM20730-W	MM20, rack, 30" channel,7’ black	Each
2	60400533	Screws, patch panel mounting, #12-24 X 0.625, 50PCS, white	Pack
2	MM20VMD716-W	MM20 vertical cable mgmt cage W/ door 16"	Each
1	OR-GBV72KIT	Vertical ground bar kit, 5/8 x 72""	Each
1	OR-60400010	Grounding kit	Each
16	OR-GL2014	Two hole ground lug	Each

4.22.2 Frame Configuration for a MER and SER (2 Frames)

4.22.2.1 Sole occupancy telecom room for iSolutions

Qty	Part Number	Description 1	Units
1	MM20CMR3-W	MM20 cable mgmt ring,1.75X3",14 PCS, white	Each
2	MM20730-W	MM20, rack, 30" channel,7’ black	Each
3	60400533	Screws, patch panel mounting, #12-24 X 0.625, 50PCS, white	Pack
1	MM20VMD716-W	MM20 vertical cable mgmt cage W/ door 16"	Each
2	OR-GBV72KIT	Vertical ground bar kit, 5/8 x 72""	Each
2	OR-60400010	Grounding kit	Each
16	OR-GL2014	Two hole ground lug	Each

4.22.2.2 Shared occupancy telecom room

Qty	Part Number	Description 1	Units
1	MM20CMR3-W	MM20 cable mgmt ring,1.75X3",14 PCS, white	Each
2	MM20VMS704-W	MM20, vertical cable mgmt cage W/ door 4”	Each
2	MM20730-W	MM20, rack, 30" channel,7’ black	Each
3	60400533	Screws, patch panel mounting, #12-24 X 0.625, 50PCS, white	Pack
1	MM20VMD716-W	MM20 vertical cable mgmt cage W/ door 16"	Each
4	MM20724PD-W	MM20, perforated door, HD 24"W X 7' H, lock, white	Each
2	MM2024DMFHD-W	MM20, DR MNT FR,24" W USE W/ MM20VMD, white	Each
2	MM2024DMRHD-W	MM20,DR MNT RR,24" W USE W/O VERT MGR, white	Each
2	OR-GBV72KIT	Vertical ground bar kit, 5/8 x 72""	Each
2	OR-60400010	Grounding kit	Each
16	OR-GL2014	Two hole ground lug	Each

4.22.3 Frame Configuration for a MER A (4 Frames)

4.22.3.1 Sole occupancy telecom room for iSolutions

Qty	Part Number	Description 1	Units
2	MM20CMR3-W	MM20 cable mgmt ring,1.75X3",14 PCS, white	Each
2	MM20VMS704-W	MM20, vertical cable mgmt cage W/ door 4”	Each
4	MM20730-W	MM20, rack, 30" channel,7’ black	Each
4	60400533	Screws, patch panel mounting, #12-24 X 0.625, 50PCS, white	Pack
2	MM20VMD716-W	MM20 vertical cable mgmt cage W/ door 16"	Each
4	OR-GBV72KIT	Vertical ground bar kit, 5/8 x 72""	Each
4	OR-60400010	Grounding kit	Each
32	OR-GL2014	Two hole ground lug	Each

4.22.3.2 Shared occupancy telecom room for iSolutions

Qty	Part Number	Description 1	Units
2	MM20CMR3-W	MM20 cable mgmt ring,1.75X3",14 PCS, white	Each
2	MM20VMS704-W	MM20, vertical cable mgmt cage W/ door 4”	Each
4	MM20730-W	MM20, rack, 30" channel,7’ black	Each
4	60400533	Screws, patch panel mounting, #12-24 X 0.625, 50PCS, white	Pack
2	MM20VMD716-W	MM20 vertical cable mgmt cage W/ door 16"	Each
8	MM20724PD-W	MM20, perforated door, HD 24"W X 7' H, lock, white	Each
4	MM2024DMFHD-W	MM20, DR MNT FR,24" W USE W/ MM20VMD, white	Each
4	MM2024DMRHD-W	MM20,DR MNT RR,24" W USE W/O VERT MGR, white	Each
4	OR-GBV72KIT	Vertical ground bar kit, 5/8 x 72""	Each
4	OR-60400010	Grounding kit	Each
32	OR-GL2014	Two hole ground lug	Each

5 Horizontal Distribution

5.1 Overview

The horizontal distribution extends from the FD within the telecoms rooms. It is critical that the horizontal distribution design gives consideration to:

- Data communications media choice
- Layouts
- Routing
- False floor
- Ceiling void
- Cable management

5.2 Channel Design Rules

The distances quoted in Table 2 are from the source equipment (i.e. switch) to the terminal equipment (i.e. PC). Allowances shall therefore be made for vertical drops/rises as well as the horizontal runs.

Technology	Distance for application (m)			
	1000 Base T	10G Base T	1000 Base LX	10G Base LX
Cat 6a	100	100	N/A	N/A
OS2 Fibre	N/A	N/A	2000	10000

Table 2 - Maximum distances

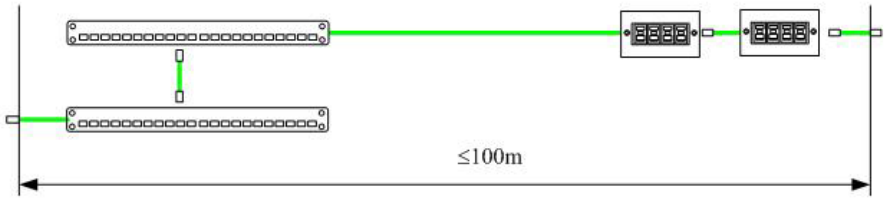


Figure 60 Maximum channel design

The total length of the horizontal cable (solid conductor) shall not exceed 90m and the total length of the patch cordage (stranded cable) shall not exceed 10m. The total combined end-to-end length shall not exceed 100m and shall contain no more than 4 connectors.

5.3 Media Selection

BS 6701:2016+A1:2017 deals with telecommunications cabling and has been revised to accommodate the CPR requirements. Section 5.1.3.1 calls for a minimum classification for telecommunications cables of EuroClass Cca.

The category and type of copper cable to be installed shall be:

- For additions to an existing building floor–same category and type as installed
- For a refurbished floor within an existing building –Cat 6a F/FTP Cca
- For a refurbished building – Cat 6a F/FTP Cca
- For a new building – Cat 6a F/FTP Cca
- Accommodation blocks - Cat 6a F/FTP B2ca
- For a temporary building – Cat 6 UTP Cca
- External to the building fabric – Cat 6a F/FTP
- All WiFi outlets, regardless of building type shall be Cat 6a F/FTP Cca

The grade of copper cabling shall be cat 6a. Any deviation from this document must be on written approval by iSolutions.

Refurbishment work shall be in consolation with iSolutions for guidance on cable category and potential rack consolidation requirements.

5.4 Patch Cord Colours and Category

Patch cord colours shall be white

All patch leads shall be category 6a shielded MiMo

Patch lead shall be supplied as follows:

- 1 quantity 2m – each end user device at the cabinet end
- 1 quantity 2 or 3m – each end user device at the TO end (they must be supplied on a contract basis).
- 2 quantity 1m – each Wifi access point at the TO end
- 1 quantity 1m – each WiFi access point at the cabinet end

Every switch port to be patched and at the far end every device to plug in

5.5 Velcro Straps

It is IMPORTANT to note that all horizontal cables and patch cords shall be secured to containment, patch panels, jacks, Minipods, bundled together etc with Velcro straps. It is not acceptable to use cable ties on any cable type.

5.6 User Case Outlet Quantities

Each User Case will demand different requirements from a structured cabling infrastructure. The main User Cases and associated technologies have been defined below as the minimum requirements for outlet concentrations.

User Case University, college or school	Number of channels per outlet Data and Traditional Voice
Temporary General Office	2 per user – Note 1
Hot Desks	1 per user
Halls of Residence	1 per room
Laboratory	1 per position
Computer room users	1 per position
Learning Space	7 per room
BMS Trend Controller	2 per controller
Automatic Metering	1 per building
RTU Power Control	1 per RTU – Note 2
Emergency Lighting	1 per building
Fire Alarm	1 per building
Door Access	1 per controller – Note 3
IP CCTV	1 per unit
Wireless AP	2 per unit – Note 4
Intruder Alarm Panel	1 per panel – Note 5
Barrier	To be specified by Estates
Drax critical alarm	1 per unit

Table - Outlet Densities per user

Notes

1. 2 ports for every $6m^2$ shall be installed
2. up to 4 controllers per building
3. up to 7 controllers per building
4. A minimum of 2 per 12m radius set on a hexagonal cell design – As per the predictive survey RF design.
5. the controller shall be provided with a standard RJ45 feed from the nearest telecoms room and each lift shall be provided with an EVC circuit run from the data centre. The EVC is to be presented on a 237 module.

IMPORTANT – All BMS outlets, barrier and IP CCTV outlets shall be lockable and all outlets/adapters shall have clear windows.

5.7 Outlet Presentation

5.7.1 Contractors Link

The contractors link is defined as all cabling products and containment that extend the Permanent Link (PL) from the Consolidation Point (CP) to the Telecoms Outlet (TO). The following use cases may use the floor box design:

- General office
  Learning space

Each contractors link shall consist of:

- 1 to 4 qty jacks in a 24 port Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 2 qty Cat 6a F/FTP patch lead – the lead shall be measured to cater for 2 off outlets and cut in half to cater for 2 – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 to 4 qty straight adapter
- 0 to 3 qty blank adapter
- 1 to 4 qty engraved outlet labels and 1 qty floor box label
- 1 qty gland for desk box
- 1 to 4 off cable label for each Cat 6a patch lead run – approved type of cable label at the floor box indicating the outlet number

IMPORTANT – Through coupler adapters SHALL not be used at the desk box. If the desk comes fitted with a through coupler it shall be removed and an RJ45 with IDCs at the rear fitted.

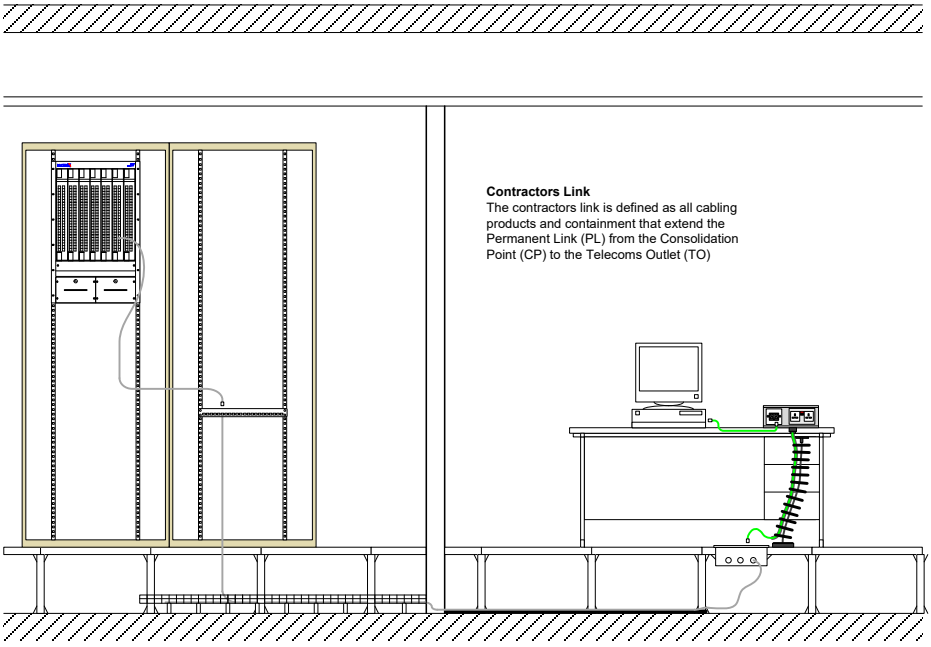


Figure 61 Contractors link

5.7.1 Under Floor Minipod

The following User Cases may use the under floor box design:

- General office
- PWS
- Learning space

Each Minipod outlet shall consist of:

- 1 to 6 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 6 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 qty 3 or 6 way Minipod
- 1 to 6 qty Cat 6a shielded jacks
- 1 to 6 qty angled adapter
- 1 or 5 qty blank adapter
- 1 to 6 qty engraved outlet labels and 1 qty Minipod label
- 1 qty gland for Minipod
- 3m of 32mm copex for cables up to Minipod
- 1 qty Copex anchor – to attach the Copex to the cable basket
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the Minipod and the patch panel

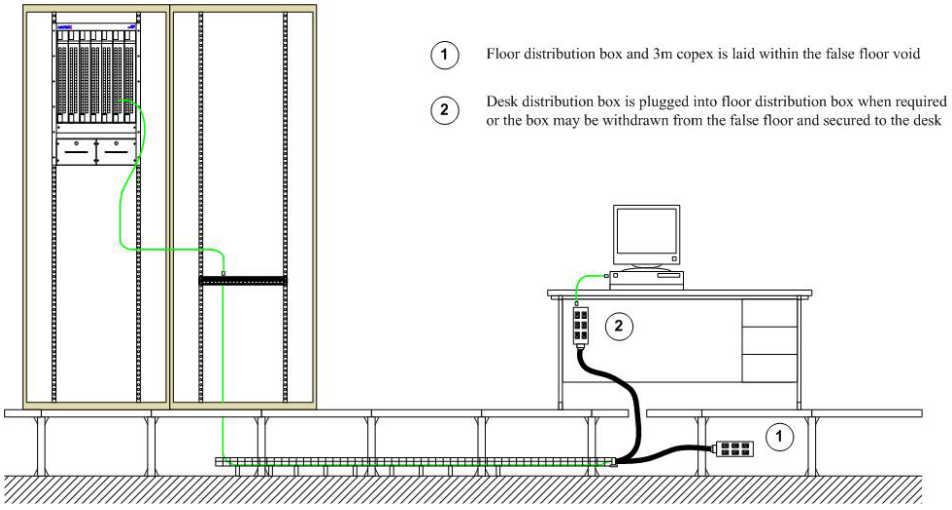


Figure 62 Under floor Minipod

5.7.2 Power pole

The following User Cases may use the power pole design:

- General office
- PWS

Each Outlet shall consist of:

- 1 to 4 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 4 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 qty single or double gang cat 6 faceplate
- 1 to 4 qty angled adapter
- 1 to 2 qty blank adapter
- 1 qty single or double back box 50mm depth PVC
- 1 to 4 qty outlet label
- 1 or 2 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the CP and the TO

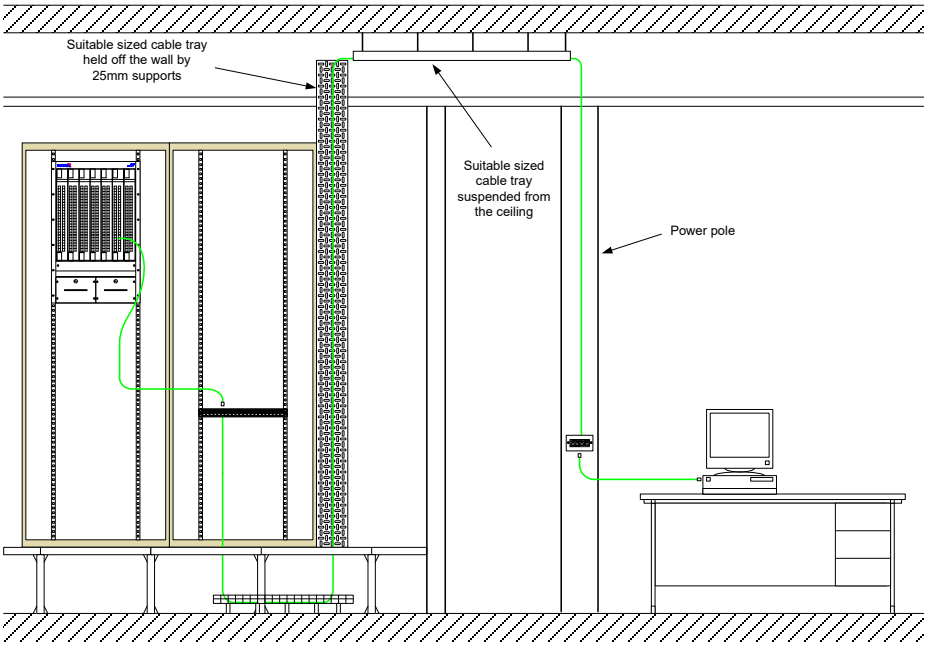


Figure 63 Power pole with consolidation point

5.7.3 Dado trunking

The following User Cases may use the dado trunking design:

- General office
- Halls of residence
- PWS
- Learning space

Each dado trunking outlet shall consist of:

- 1 to 4 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 4 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 qty single or double gang cat 6a faceplate
- 1 to 4 qty angled adapter
- 1 or 2 qty blank adapter
- 1 qty single or double gang back box 50mm depth PVC
- 1 to 4 qty outlet label
- 1 or 2 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the TO and the patch panel

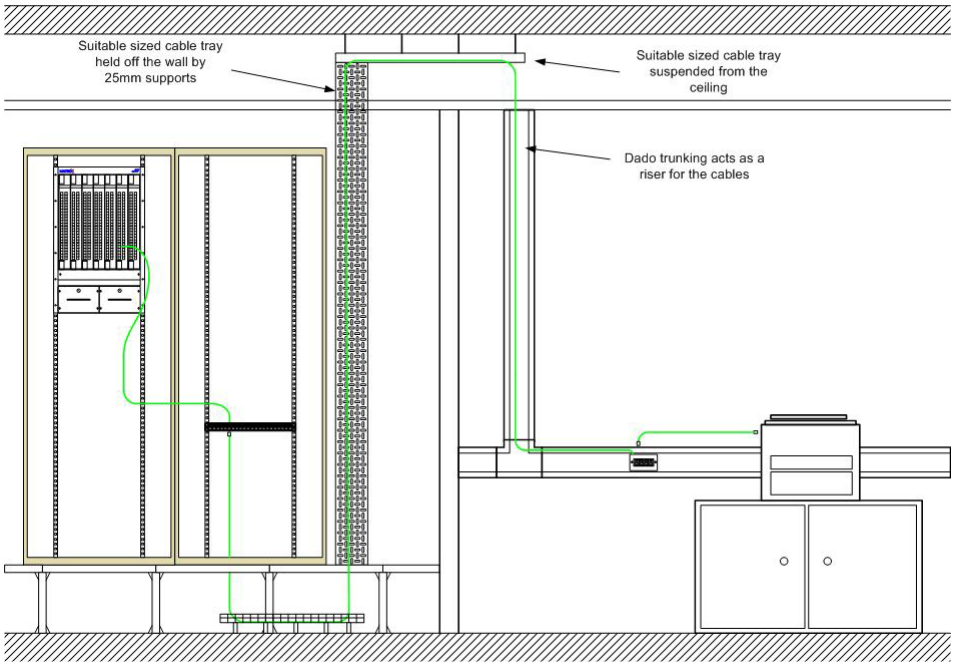


Figure 64 Dado trunking outlets

5.7.4 Stud walls

The following User Cases may use the stud wall design:

- General office
- Halls of residence
- BMS Trend Controller
- Automatic Metering
- Emergency lighting
- Door access
- IP CCTV
- PWS
- RTU power
- DECT phone repeater
- Fire alarm
- Intruder alarm
- Learning Space

Each stud wall outlet shall consist of:

- 1 to 4 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 4 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 qty single or double gang cat 6a faceplate
- 1 to 4 qty angled adapter
- 1 or 3 qty blank adapter
- 1 qty single or double gang back box 50mm depth PVC
- 1 to 4 qty outlet label
- 1 qty 25mm solid conduit – length to be determined by Contractor
- 2 qty 25mm glands
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the TO and the patch panel

It is important to note that RTU power, fire alarm and intruder alarm outlets must be lockable. If the RJ45 interface to the equipment is accessible to multiple parties a lockable Cat 6a patch lead shall be used. The patch lead shall be lockable at one end only as the other end plugs into the lockable outlet.

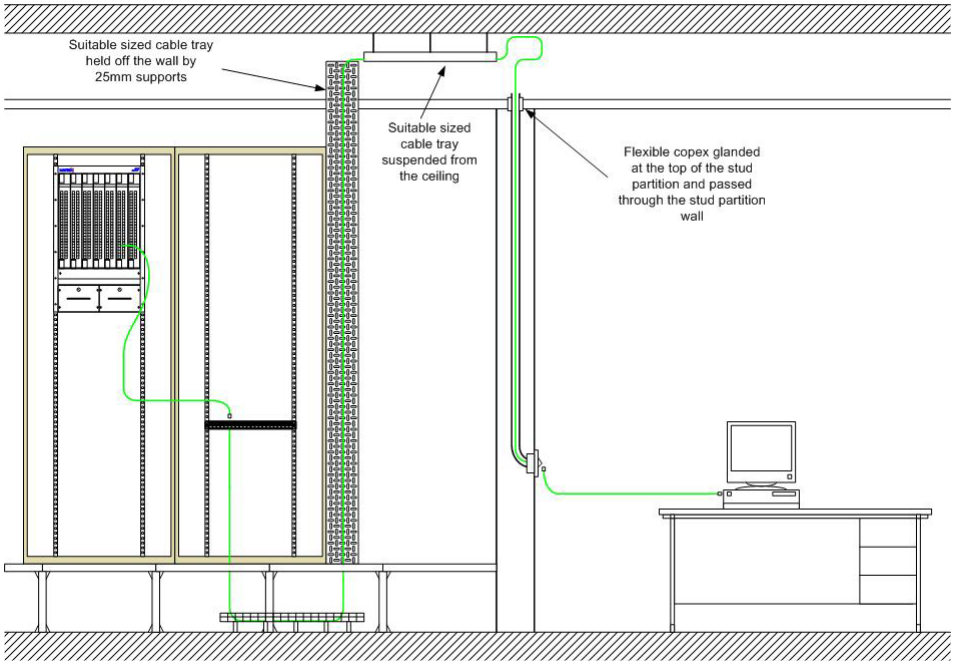


Figure 65 Stud partition outlets

5.7.5 Dry Riser

The following User Cases may use the dry riser design:

- RTU power
- Door access

Each dry riser outlet shall consist of:

- 1 qty jack in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 qty Cat 6a shielded jack
- 1 qty single gang cat 6a faceplate
- 1 qty angled adapter
- 1 blank adapter
- 1 qty single gang back box 50mm depth PVC
- 1 qty outlet label
- 1 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the TO and the patch panel

The outlet shall be mounted to the side of the containment

If the RJ45 interface to the equipment is accessible to multiple parties a lockable Cat 6a patch lead shall be used. The patch lead shall be lockable at one end only as the other end plugs into the lockable outlet.

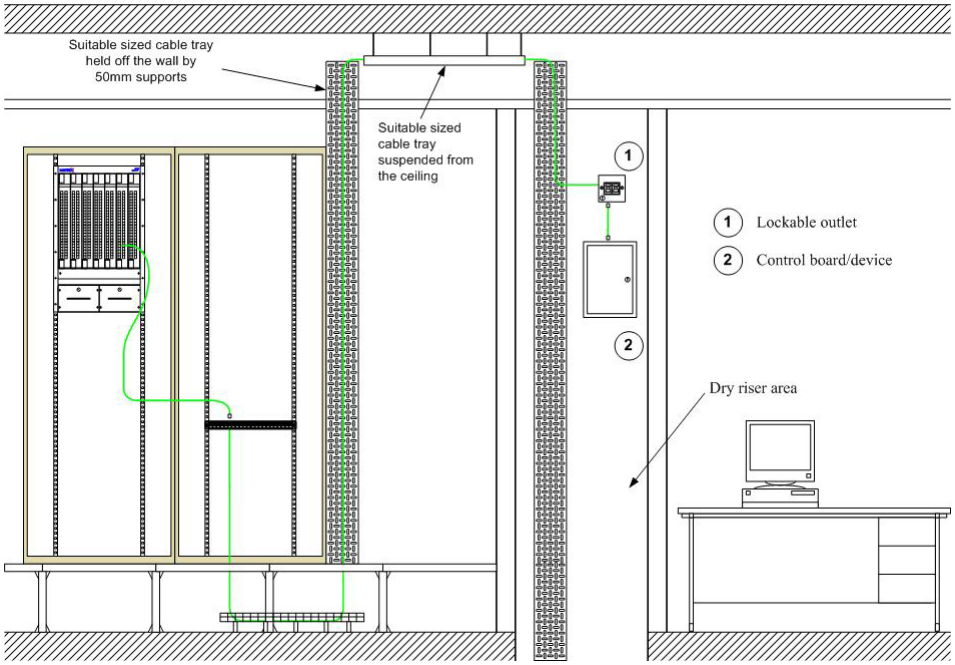


Figure 66 Dry Riser Outlets

5.7.6 Suspended Ceiling

The following User Cases may use the suspended ceiling design:

- IP CCTV
- Wireless AP
- DECT phone repeater

All horizontal cabling within new buildings shall provide an overlay of cat 6a cabling. There shall be a minimum of two cat 6a outlets for every 100m^2 of floor space. This requirement is additional to the calculation of required outlets for high level installation.

Each outlet shall consist of:

- 2 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 2 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 2 qty Cat 6a shielded jacks
- 1 qty 2m loop of cable from the containment run. The two cables for the AP shall be strapped together with Velcro straps every 300mm
- 1 qty single gang Cat 6a faceplate
- 2 qty straight adapter
- 1 qty single gang back box 50mm depth PVC
- 2 qty outlet label
- 1 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the CP and the patch panel either on solid conduit or on containent

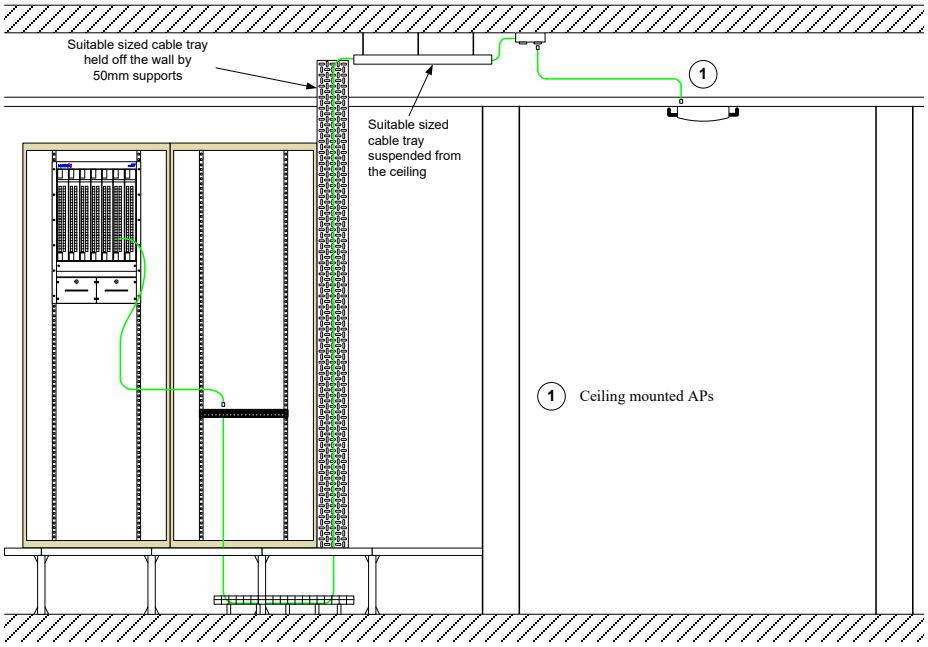


Figure 67 Suspended ceiling outlets

5.7.7 Ceiling Mounted – No Suspended Ceiling

The following User Cases may use the ceiling mounted design:

- IP CCTV
- Wireless AP
- DECT phone repeater

Each outlet shall consist of:

- 1 qty mounting bracket. The bracket shall be long enough to suspend the AP below all M&E services
- 1 qty 24 port 24 or 48 port 1U Cat 6a shielded patch panel mounted in the data room frame/cabinet
- 1 qty printed label – patch panel
- 1 qty cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 qty cat 6a shielded jacks
- 1 qty single gang lockable faceplate
- 1 qty straight adapter
- 1 qty blank adapter
- 1 qty single gang back box 50mm depth PVC
- 1 qty outlet label
- 1 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each cat 6a cable run – approved type of cable label at the TO and the patch panel

The outlet must be within 100mm of the AP mounting bracket.

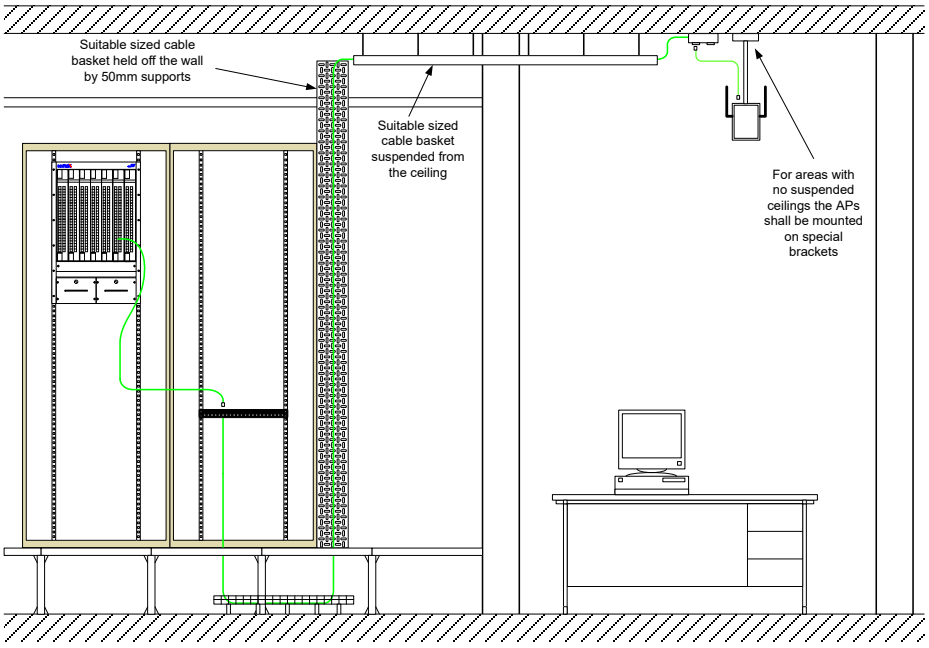


Figure 68 Ceiling mounted with no suspended ceiling outlets

5.7.9 Surface Mounted

The following User Cases may use the surface mounted design:

- Halls of Residence
- BMS Trend Controller
- Automatic Metering
- RTU power
- Emergency lighting
- Door access
- IP CCTV
- Wireless AP
- DECT phone repeater
- Fire alarm
- Lift controller
- Lift telephony
- Door access

Each surface mounted outlet shall consist of:

- 1 to 4 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 4 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 qty single or double gang lockable Cat 6a faceplate
- 1 to 4 qty angled adapter
- 1 to 2 qty blank adapter
- 1 qty single or double gang back box 50mm depth PVC
- 2 to 4 qty outlet label
- 1 qty gland for outlet

- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the TO and the patch panel

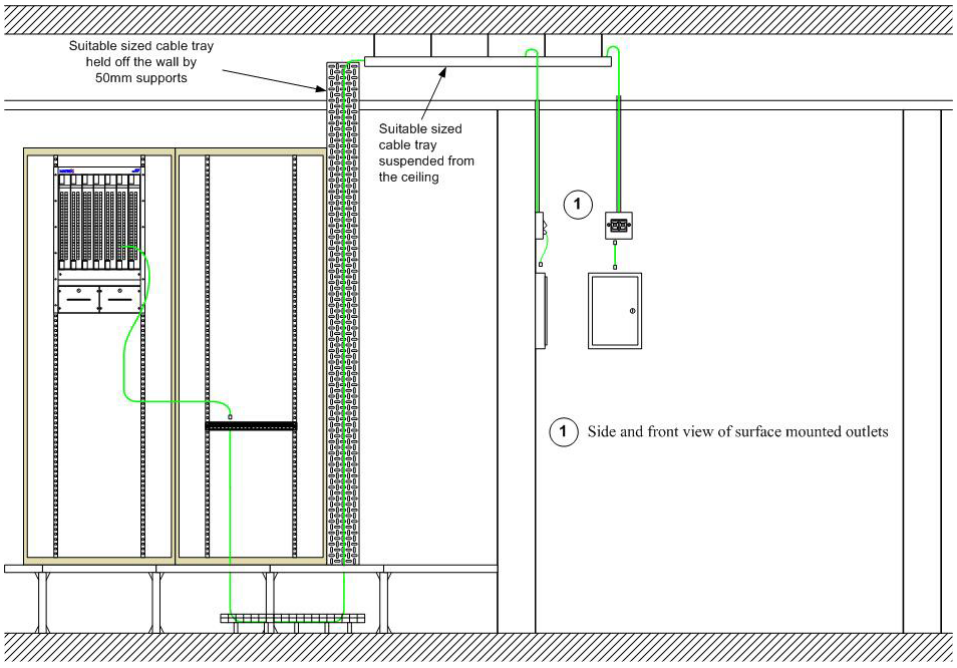


Figure 69 Surface mounted outlets

5.7.10 Temporary Outlets

The following User Cases may use the temporary outlet design:

- Temporary General Office

For temporary desk locations the preferred option is to use Consolidation Points (CP) in the ceiling which drop down to trunking or mini trunking outlets. Each CP shall be sized according to the requirements of the temporary desks and may consist of single, double, quad outlets as well as 3, 4 or 6 port minipods.

The cable from the Consolidation Point (CP) to the TO shall be of a solid conductor construction i.e. horizontal cable and not patch cordage.

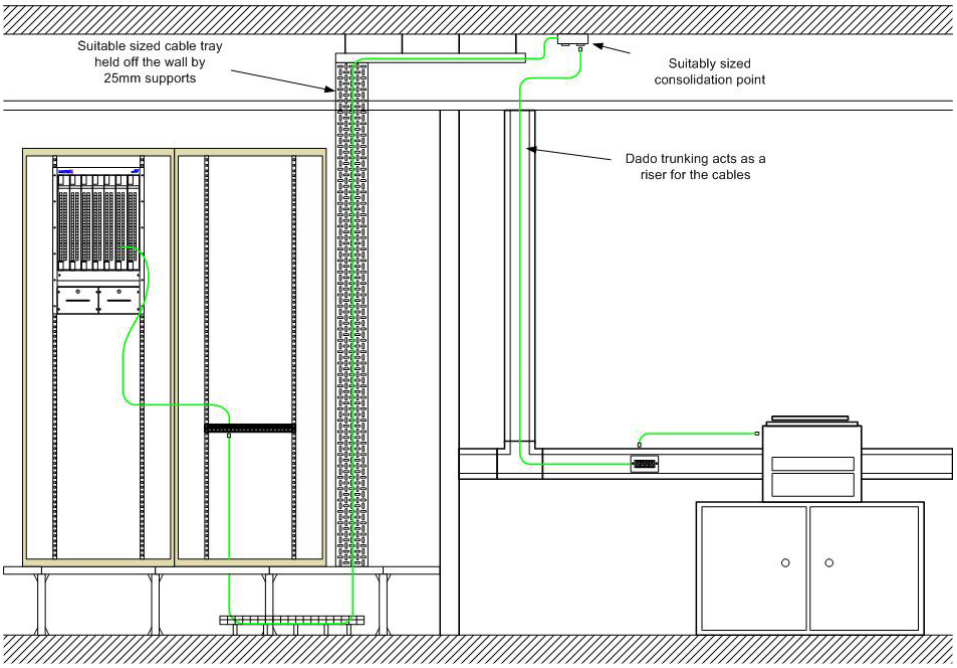


Figure 70 Temporary outlet with consolidation point

5.7.11 External

The following User Cases may use the external design:

- Wireless point to point

Each external outlet shall consist of:

- 1 qty jack in a 24 or 48 port 1U cat 6 UTP patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 qty cat 6 external rated UTP cable runs – length to be determined by Contractor
- 1 qty cat 6 UTP jack
- 1 qty external IP 67/65 rated wall box
- 1 qty straight adapter
- 1 qty blank adapter
- 1 qty outlet label
- 1 qty gland for outlet
- Velcro type ties – suitable quantity for installation (every 300mm within the communications room and every 600mm outside of the communications room. Additional Velcro type ties shall be used as necessary)
- Cable label for each cat 6 cable run – approved type of cable label at the TO and the patch panel

All external copper cable runs shall be protected with a lightning surge protection device rated at 1G Base Tx. The device shall be located within 2 metres of the building entrance and be suitably bonded to earth.

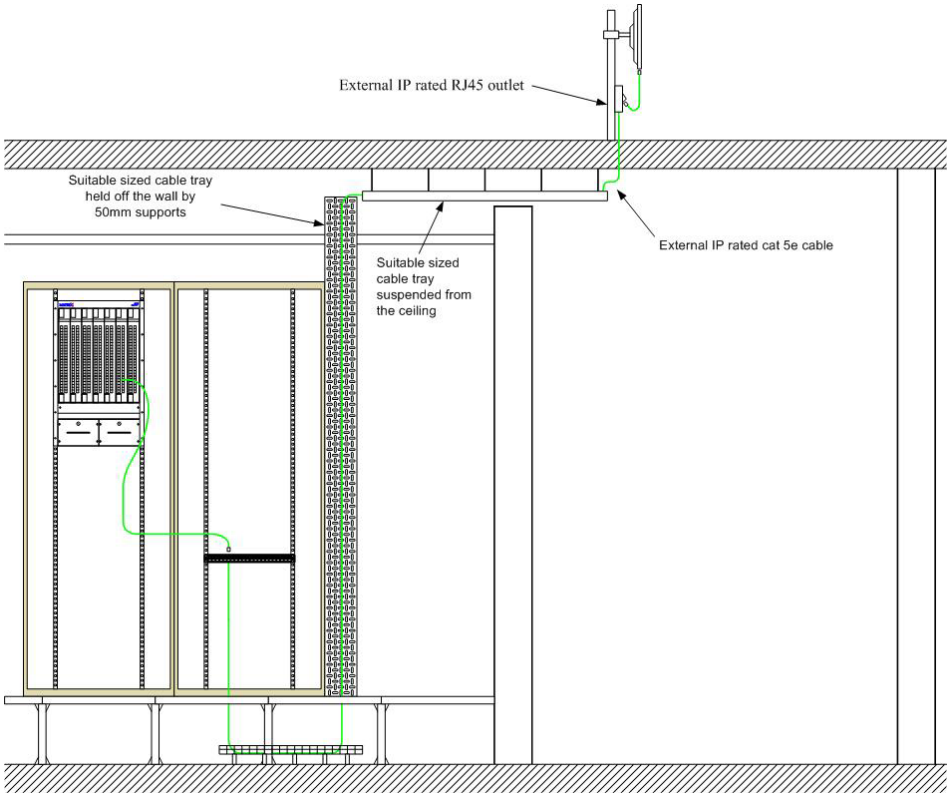


Figure 71 External mounted outlets

5.7.12 External APs

The following User Cases may use the external design:

- Wireless APs

Each external outlet shall consist of:

- 1 to 4 qty jacks in a 24 or 48 port 1U Cat 6a shielded patch panel mounted in the telecom room frame/cabinet
- 1 qty printed label – patch panel
- 1 to 4 qty Cat 6a Cca F/FTP cable runs – length to be determined by Contractor
- 1 to 4 qty Cat 6a shielded jacks
- 1 qty single or double gang Cat 6a faceplate
- 1 to 4 qty angled adapter
- 1 to 2 qty blank adapter
- 1 qty single or double gang back box 50mm depth PVC
- 2 to 4 qty outlet label
- 1 qty gland for outlet
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs Additional Velcro type ties shall be used as necessary)
- Cable label for each Cat 6a cable run – approved type of cable label at the TO and the patch panel

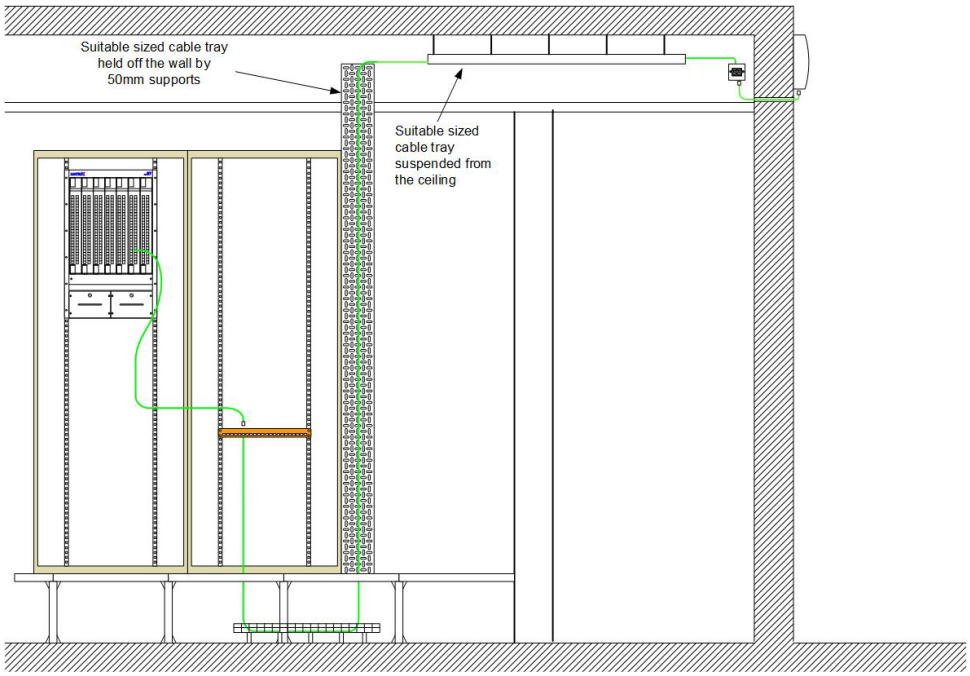


Figure 72 External mounted wireless APs

5.7.13 Remote external APs with Powered Fibre Cable

The following User Cases may use the external design:

- Wireless APs that are remote from buildings or buildings with no telecom rooms.
- IP CCTV cameras that are remote from buildings or buildings with no telecom rooms

Each external outlet shall consist of:

- 1 or 2 qty duplex LC OS2 connector in a 48 core OS2 LC patch panel mounted in the telecom room frame/cabinet
- 2 or 4 qty OS2 LC pigtails
- 1 qty printed label – patch panel
- 1 qty CommScope 12 awg 2 or 4 core OS2 hybrid powered fibre cable run – length to be determined by Contractor
- 1 qty 1 or 2 port CommScope PoE extender
- 1 qty printed label – PoE extender
- 1 qty duplex patch cord cut in half – this is to be spliced onto the powered fibre cable at the CommScope PoE extender for connection into the SFP
- 1 qty SPF 1G port single mode transceiver module
- 1 qty port in a 19" rack mounted -48V dc power supply – CommScope Power Express Class 2 with alarm module
- 1 to 4 qty Power Express distribution module – max 8 devices
- 1 to 3 qty Power Express blank slot panel
- 1 qty port in a 19" rack mounted -rectifier – CommScope SPS rectifier distribution shelf
- 1 qty rectifier controller display
- 1 to 3 qty SPS power rectifier module – 1600W per module
- 0 to 2 qty rectifier blank slot panel
- 2 qty 2 or 4 AWG bus bar power conductors plus lugs at each end – to connect the Power Express Class 2 shelf with the SPS power rectifier distribution shelf
- Velcro type ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs
- Cable label for each powered fibre cable run – approved type of cable label at the TO and the patch panel

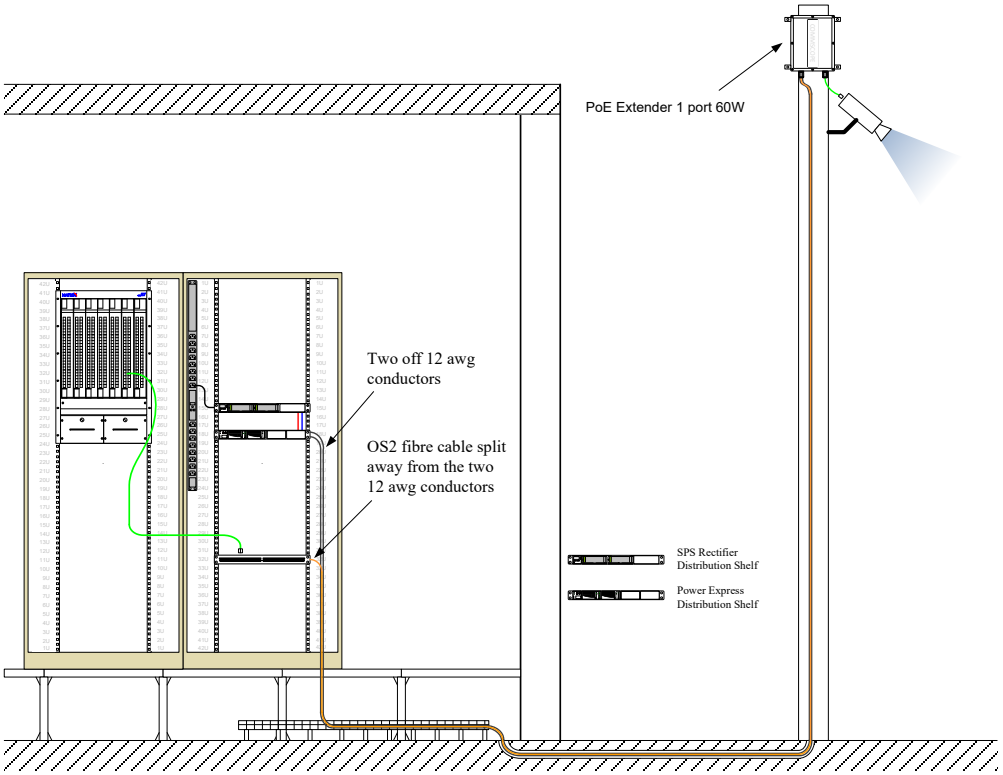


Figure 73 Powered fibre cable

5.8 Barrier Systems for Vehicles

Barrier systems will require some form of data/voice communication but due to the uncertain nature of these requirements barrier systems shall be specified on a case by case basis. The Contractor shall seek approval in writing from the University for the specification of the barrier system, communications and position.

5.9 Cable Management

All cabling within the telecom rooms shall be bundled together in no more than 24 cables. This shall include horizontal, vertical and cabinet containment. All cabling outside of the telecom room shall be loose laid.

The capacity of cables must cater for requirements that will be implemented from day one and all known requirements that will follow in the future plus a 25% additional capacity for unknown future expansion.

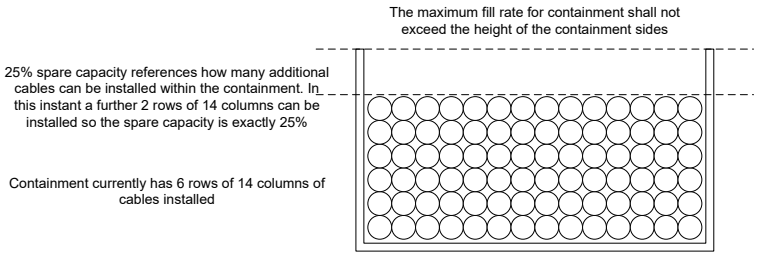


Figure 74 Example of 25% spare capacity

Cable management is split between cable basket loose laid and bundled (all cabling within the telecom room shall be bundled) and trunking loose laid. This is primarily to cater for the differing requirements for capacity and future expansion requirements.

5.9.1 Trunking Loose Laid

Trunking for the use of telecommunication services should be dedicated to telecommunication services only. Where multi-compartment trunking is used the telecom services compartment shall not be shared with other services. When using triple compartment dado trunking, all communication cabling shall only use the top and bottom sections of trunking.

When calculating the capacity of trunking it shall have at least 25% future capacity. Allow 7.1mm for the overall diameter of a category 6a cable.

For standard trunking sizes the below table details the maximum cable capacity. These are calculated for category 6a cables and should be applied for category 6 cables i.e. if 4 category 6 cables are to be installed in mini trunking it shall be sized to cater for 4 category 6a cables. When using mini trunking there is no consideration for future capacity i.e. it is allowable to 100% fill during the initial installation. The only exception to this rule is if there is a known future requirement for further cables to be installed in which case the trunking size shall be selected to cater for the future requirements.

The minimum size of mini trunking shall be 40 x 25mm.

Size	Trade Ref.	No. Cat 6a Cables
40 x 25	YT4	4

Table 5 Standard Trunking Capacity

NOTE: If YT4 cannot be used, a 25mm conduit shall be installed for a maximum of 2 cables. It shall be noted that 25mm conduit is the minimum size

5.9.2 Cable Basket

Cable basket for the use of telecommunication services shall be dedicated to telecommunication services only. The cable basket shall not be shared with other services. Where it is not possible to have separate containment systems for power and data cables the single containment system shall provide the correct power separation distance by using two parallel rows of metallic fillets. The two rows of fillets shall be spaced according to section 4.16 above.

When calculating the capacity of cable basket, it shall have at least 25% future capacity. All cable baskets shall be calculated to cater for category 6a cable. The maximum depth of cables on a cable basket is 100mm. Allow 7.1mm for the overall diameter of a category 6a cable.

Cables in the following areas shall be in bundles of no more than 24 and tied together with Velcro straps on every bend.

- Horizontal containment within telecom rooms
- Vertical containment within telecom rooms
- Vertical risers outside of telecom rooms
- From entering cabinets to the rear of the patch panel
- All areas that are visible to the naked eye outside of telecom rooms (relaxed to 400mm)

All cables outside the telecom rooms shall be loose laid. All cables inside the telecom rooms shall be bundled.

5.9.2.1 Cable basket Bundled

The following table details the maximum number of cat 6a F/FTP copper cables that can be bundled onto a cable basket accounting for 25% spare capacity

Tray Width (mm):	Tray Height (mm):	No. of Cables
50	60	28
100	60	57
150	60	85
200	60	111
300	60	170
400	100	379
500	100	474
600	100	568

5.9.2.2 Cable basket Loose Laid

The following table details the maximum number of cat 6a F/FTP copper cables that can be loose laid onto a cable basket accounting for 25% spare capacity

Tray Width (mm):	Tray Height (mm):	No. of Cables
50	60	45
100	60	89
150	60	134
200	60	179
300	60	268
400	100	595
500	100	744
600	100	893

5.10 Cable Capacity

Planning of cable capacity shall be co-ordinated with all parties involved in the planning, design and implementation of the IT network. The capacity of cables shall cater for requirements that will be implemented from day one and all known requirements that will follow in the future plus a 25% additional capacity for unknown future expansion.

5.11 Horizontal Cable Basket and Trunking

5.11.1 General Rules for Containment

The general rules for all high and low level horizontal data and telecom containment are:

- Shall not be installed above the height of the basket. If the side of the containment exceeds 150mm in height the cable height shall not exceed 150mm in depth. If this cannot be achieved, then special dispensation shall be sought from NWI. If NWI agree that the cable depth can be increased above 150mm then 8mm fire retardant (LPS1207) flooring sheets shall be installed in the bottom of the cable basket
    i. *EN 50174-2 – Requirements – Section 4.4.1.3 – 'The maximum stacking height in pathway systems is specified by manufacturers' instructions. If instructions do not exist, the following shall apply:*
    - *1) for pathway systems that provide continuous support (e.g. trays), the stacking height shall not exceed 150 mm'*
- All cables to be installed in bundles of 24 cables. This shall only apply within the telecom rooms.
    i. *EN 50174-2 – Requirements – Section 5.3.5.3.1 – 'Bundles of cables shall not contain more than 24 cables'*
- The cables shall be tram lined and shall not cross over. This shall only apply within the telecom rooms.
- All cable bundles of 24 shall be tied with Velcros at 300mm centres

i. *Requirements for bundled cables only*

- Shall not be shared with other services i.e. mains, fire detection, BMS etc. shall be on its own cable basket and the copper shall be on its own cable basket for its entire length

  i. *EN 50174-2 – Requirements – Section 6 – Details all requirements for separation distances and none sharing of services*

  'Power supply cables and cables of other "trades" shall not be installed within the same bundle or in the same compartment of a pathway or pathway system, as information technology cables unless physical separation is maintained.'

- Copper and fibre data cables/tubing shall not share the same containment i.e. the fibre cabling shall be on its own cable basket and the copper shall be on its own cable basket for its entire length

- Trunking may share services, but it shall be multi compartment and the data/telecom cables shall not share services within their compartment

  i. *EN 50174-2 – Requirements – Section 6 – Details all requirements for separation distances and none sharing of services*

  'Power supply cables and cables of other "trades" shall not be installed within the same bundle or in the same compartment of a pathway or pathway system, as information technology cables unless physical separation is maintained.'

- Shall not be used as a support for other systems i.e. strapping cables to outside of the containment, structural support for lighting pendants etc.

  i. *EN 50174-1 – Requirements – Section 4.3.2.1 – 'Elements of other supply systems such as water, heating, HVAC or sprinklers shall not be used as pathways or support for pathway systems due to the potential environmental impact on the cabling components and the risk that cable support will disappear following changes made to the supporting system.*

- Data/telecom cables shall not be supported by any other Mechanical and Electrical fittings/supports. It is not acceptable to strap cables to HVAC ducting, BMS, cables, ceiling tile supports etc.

  EN 50174-1 – Requirements – Section 4.3.2.1 – 'Elements of other supply systems such as water, heating, HVAC or sprinklers shall not be used as pathways or support for pathway systems due to the potential environmental impact on the cabling components and the risk that cable support will disappear following changes made to the supporting system.
  NOTE An exception to this is where the telecommunications cabling directly serves a device of the supply system (e.g. water meter).

  The grids of suspended ceilings shall not be used as support for pathway systems but may be used as pathways for individual cables serving devices within the suspended ceiling.'

- Cables shall not be stacked above the height of the cable basket side walls i.e. if the cable basket has side walls of 100mm then the cable depth shall not exceed 100mm

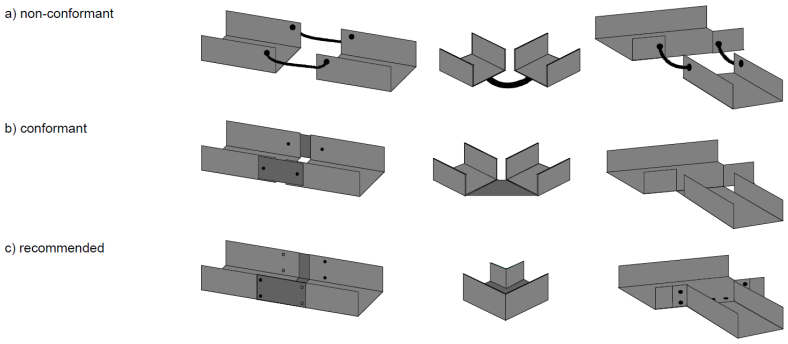
  i. *General requirements*

- All cable baskets and metal trunking shall be earth bonded to BS 7671

  i. *EN 50174-1 – Requirements – Section 5.3.3.2 – 'Where an electrically conductive cable management system is installed, sections shall be bonded to earth in accordance with 5.1.1.1 in order that the cable management system acts as a PEC described in 7.1.3.4.'*

ii. *EN 50174-1 – Requirements – Section 5.3.3.3.1 – 'The following requirements apply to metallic or composite cable management systems that are required specifically to provide electromagnetic screening for the information technology cables to be contained within them (see 4.4.1): a) if the cable management system is constructed from multiple sections: – the sections shall be interconnected to ensure continuity; – bonds shall have performance in accordance with EN 50310 (illustrated in Figures 6 b) and 6 c)); b) cable management systems shall be functionally bonded in accordance with EN 50310;'*

- There shall be no discontinuation between sections of cable basket or trunking unless complaint with BS 7671 i.e. earth bond 4mm^2 connecting containment systems
  - *EN 50174-2 – Requirements – Section 5.3.3.3.1.*



- All cable baskets and trunking shall be jointed together with the manufacturer's fixings

i. *General requirements*

- All sections of containment, bends, joints, clamps, bonding etc. shall be from a single Manufacturer. It is not acceptable to mix and match containment products from different Manufacturers

  i. *General requirements*

- Cable containment shall have manufactured bends – it is not acceptable to change direction by butting together two sections with no manufactured bend

  i. *General requirements. Not applicable for cable basket*

- Cable basket external and internal bends shall be ≥ 200mm radius

  i. *This is to cater for blown fibre*

- Cable basket right angle bends shall be ≥ 200mm radius

i. *This is to cater for blown fibre*

- Cables entering a riser at low level shall immediately enter a wall mounted cable basket riser
  - Vertical cable basket supported by 41mm Unistrut bars

    i. *EN 50174-1 – Requirements – Section 4.3.2.1 - Pathways constructed using tray-work shall be located to:*
    – provide a minimum clearance of 25 mm from the fixing surface;

    – provide the greatest working space possible subject to a minimum of 150 mm above the tray to enable access during installation;

  - Vertical Unistrut bars to be spaced at 1000mm centres

  - Lowest Unistrut bar to be within 50mm of the cable basket end
  - Highest Unistrut bar to be within 50mm of radius to horizontal cable basket
  - There shall be a cable basket with a radius of ≥200mm between the vertical and horizontal cable basket

- Where cables penetrate walls or fire barriers the containment shall penetrate completely through

  i. *EN 50174-2 – Requirements – Section 5.3.3.3.1. – 'Figure 7 shows cable management systems crossing a wall at which a fire barrier is to be installed following cable installation. Unless specifically allowed by local regulations, the fire-stop materials or fire-stopping techniques, the cable management system shall be interrupted (with the smallest gap consistent with the construction of the fire barrier and allowing for the thermal expansion of the cable management system) and the two metallic sections shall be bonded. The bonds shall have performance in accordance with EN 50310;'*
  ii. *Existing requirement*

- Fire barriers shall be sealed to the fire rating of the penetrated barrier

  i. *EN 50174-2 – Requirements – Section 10.3.3.1.1 – 'Any openings created within the building fabric by the planning of the selected pathways and pathway systems shall: 1) not cause damage to adjacent properties without prior permission; 2) be treated to maintain the mechanical strength, fire protection, thermal insulation and sound insulation of the premises;'*
  ii. *Existing requirement*

- Where cable baskets cross power cables they shall be bridged at 90^0.

  i. *EN 50174-2 – Requirements – Section 6.2.1 – 'The minimum separation requirement applies in three dimensions. However, where Information technology cables and power supply cables are required to cross and required minimum separation cannot be maintained then the angle of their crossing shall be maintained at 90 degrees on either side of the crossing for a distance no less than the applicable minimum separation requirement.'*

- **Where there are multiple tiers of cable baskets the most accessible position shall be reserved for data cable basket i.e. for suspended floors the data cabling basket shall be the top most and for suspended ceilings it shall be the bottom most**

- The cable basket shall be labelled at ≤1800mm centres with a Traffolyte engraved label of dimensions ≥150 (length) x 50 (height) x 1.6mm (depth). The label shall be tied on at both ends of the label. The label shall be yellow with black lettering. The text shall read 'IT COPPER Data Cabling ONLY' or 'IT FIBRE Data Cabling ONLY'.

  i. *EN 50174-1 – Requirements – Section 4.5.2 – 'An administration system shall be specified to enable effective operation, maintenance and repair of the cabling infrastructure. All information produced for or by the administration system shall be dated. Change control shall be exercised and records shall be retained for a specified minimum period.*

- Tight/unnecessary bends in trunking/basket shall be avoided.

  i. *EN 50174-2 – Requirements – Section 4.4.1.2 – 'Minimum bend radius is specified by manufacturers' instructions. If instructions do not exist, the minimum bend radius shall be the greater of either 50 mm or:*
  1) 4 x the cable diameter for 4-pair balanced cables;

  2) 8 x the cable diameter for other metallic cables;

  3) 10 x the cable diameter for optical fibre cables;

4) 10 x the cable diameter for coaxial cables,'

- Minimum cable bend radius to be adhered to at all times

  i. *EN 50174-2 – Requirements – Section 4.4.1.2 – 'Minimum bend radius is specified by manufacturers' instructions. If instructions do not exist, the minimum bend radius shall be the greater of either 50 mm or:*

  1) 4 x the cable diameter for 4-pair balanced cables;

  2) 8 x the cable diameter for other metallic cables;

  3) 10 x the cable diameter for optical fibre cables;

  4) 10 x the cable diameter for coaxial cables,'

  ii. *Where cables are dressed loose laid or are dressed into position and then bundled with cable straps the above requirements (i) shall apply to the dia of a single cable. Where cables are bundled together with cable straps and then dressed into position the above requirements (i) shall apply to the dia of the overall bundle.*

- Draw wires to be installed in all empty conduits ≥50mm ID.
- Changes in cable containment i.e. basket to riser ladder, basket to conduit or copex etc. shall be within 200mm of each other
- Changes in cable containment from vertical to horizontal and vice versa shall be within 200mm of each other
- The Unistrut bar shall be fully de-burred with end caps installed as required

  EN 50174-1 – Requirements – Section 4.3.2.1 – 'The pathway systems shall:
  – have smooth surfaces and be free of burrs, sharp edges or projections that can damage the cables;
  – be free of pressure points that may degrade the transmission performance of the installed system.'

- Cable baskets shall not be installed upside down or flat against a wall. The only exception is vertical risers.

  i. *BS 7671:2018 (IET Wiring Regulations Eighteenth Edition), which was published in January 2018 and comes into effect on 1 January 2019, will include a requirement that wiring systems all locations. The requirement is included in a new regulation (Regulation 521.10.202), which is reproduced below.*

  ***521.10.202** Wiring systems shall be supported such that they will not be liable to premature collapse in the event of a fire.*

  ***NOTE 1:** Wiring systems hanging across access or egress routes may hinder evacuation and firefighting activities.*

  ***NOTE 2:** Cables installed in or on steel cable containment systems are deemed to meet the requirements of this regulation.*

  ***NOTE 3:** This regulation precludes, for example, the use of non-metallic cable clips or cable ties as the sole means of support where cables are clipped direct to exposed surfaces or suspended under cable tray, and the use of non-metallic cable trunking as the sole means of support of the cables therein.*

NOTE 4: *Suitably spaced steel or copper clips, saddles or ties are examples that will meet the requirements of this regulation.*

- Cable baskets can be mounted with the base of the basket against walls but only where they form a riser i.e. vertically
- Cable baskets mounted on walls in a horizontal aspect shall be mounted on wall brackets that keeps the base of the basket at 90^0 to the wall

i. *BS 7671:2018 (IET Wiring Regulations Eighteenth Edition), which was published in January 2018 and comes into effect on 1 January 2019, will include a requirement that wiring systems all locations. The requirement is included in a new regulation (Regulation 521.10.202), which is reproduced below.*

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NOTE 4: *Suitably spaced steel or copper clips, saddles or ties are examples that will meet the requirements of this regulation.*

- Plastic trunking shall not be mounted on walls or ceilings within escape routes.

i. *BS 7671:2018 (IET Wiring Regulations Eighteenth Edition), which was published in January 2018 and comes into effect on 1 January 2019, will include a requirement that wiring systems all locations. The requirement is included in a new regulation (Regulation 521.10.202), which is reproduced below.*

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NOTE 4: *Suitably spaced steel or copper clips, saddles or ties are examples that will meet the requirements of this regulation.*

5.11.2 Suspended Floor Containment

All cables within suspended flooring shall:

- All raised flooring shall have a minimum height of 200mm
  - *EN 50174-2 – Requirements – Section 4.5.3.1 – 'Minimum height between floor tile and underside of access floor tile shall be a minimum of 50mm clearance'*
- The minimum height from the top of a cable bundle to the underside of the false floor shall not be less than 50mm.
  - *EN 50174-2 – Requirements – Section 4.5.3.1 – 'Minimum height between floor tile and underside of access floor tile shall be a minimum of 50mm clearance'*
- Cable basket supported by 41mm Unistrut bars
  - *EN 50174-1 – Requirements – Section 4.3.1.1 – Pathways constructed using tray-work shall be located to:*

    – provide a minimum clearance of 25 mm from the fixing surface;

    – provide the greatest working space possible subject to a minimum of 150 mm above the tray to enable access during installation;

    – meet the applicable cable minimum bend radius requirement;

    – prevent damage to the installed cabling.
- Where cables are installed within suspended floors the containment shall be accessible along the entirety of its length

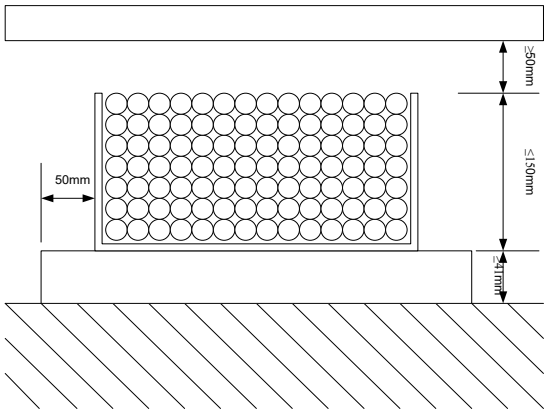
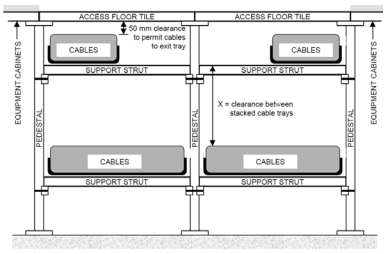


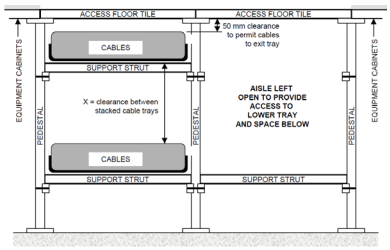
Figure 75 Suspended floor cable basket

- The containment run shall be in excess of 300mm from other containment and services on at least one side

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

  a) access to lower layers shall be provided by either using narrower cable management systems for upper layers (as shown in figure below) or by providing an accessible row of adjacent tiles (as shown in figure below);





5.11.3 Suspended Ceiling Containment

All cables within suspended ceiling shall:

- All cables to be installed at high level on suspended cable basket – cable tray is not acceptable
  i. *Cable tray cannot accommodate high depths of cable stacking*
- High level cable basket to be suspended at a height of ≥200mm below all points of the ceiling slab where reasonably practical
  i. *EN 50174-1 – Requirements – Section 4.3.1.1 – Pathways constructed using tray-work shall be located to:*
  – provide a minimum clearance of 25 mm from the fixing surface;
  – provide the greatest working space possible subject to a minimum of 150 mm above the tray to enable access during installation;
  – meet the applicable cable minimum bend radius requirement;
  – prevent damage to the installed cabling.
- High level cable basket to be suspended at a height of ≥75mm above all points of the suspended ceiling
  i. *A requirement of TIA 569*
- Basket to be supported by trapezes. It is important to note that once the cable basket enters a telecom room the threaded rods shall be A2 stainless steel
- Threaded rods to be secured to the ceiling slab and shall be capable of holding the maximum number of cables plus a safety margin of 100%
- Lighting and sprinkler systems shall not be impeded by basket work

i. *EN 50174-2 – Requirements – Section 4.3.2.1 – 'The location of aisles separating rows of cabinets, frames or racks should be co-ordinated with lighting and fire protection plans:*
c) lighting should be placed above aisles and not above cabinets, frames, racks and overhead pathways;

d) pathways should not be located where they interfere with the intended operation of fire suppression systems such as water distribution from sprinkler heads.

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

- Cable basket shall be installed such that cables can be placed into the basket, not clipped to the underside.

i. *BS 7671:2018 (IET Wiring Regulations Eighteenth Edition), which was published in January 2018 and comes into effect on 1 January 2019, will include a requirement that wiring systems all locations. The requirement is included in a new regulation (Regulation 521.10.202), which is reproduced below.*

***521.10.202** Wiring systems shall be supported such that they will not be liable to premature collapse in the event of a fire.*

***NOTE 1:** Wiring systems hanging across access or egress routes may hinder evacuation and firefighting activities.*

***NOTE 2:** Cables installed in or on steel cable containment systems are deemed to meet the requirements of this regulation.*

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***NOTE 4:** Suitably spaced steel or copper clips, saddles or ties are examples that will meet the requirements of this regulation.*

- At a minimum of every 6000mm along the length of the containment run a person shall be able to gain access to the containment
- At every change in direction of the containment run a person shall be able to gain access to the containment
- At every change in height of the containment run a person shall be able to gain access to the containment
- Cable basket access hatches shall have a square aperture of 550 x 550mm.
- Cable basket shall be used along its entirety for bundle sizes of 5 or more cables. Where the cable basket meets trunking or copex vertical drops they shall be within 200mm of each other
- Cable bundles of 4 or less cables should be installed in cable basket but may be installed in rigid or flexible copex. If copex is used, it shall be:
    - 32mm in diameter

- Finish within 150mm on the trunking/copex vertical drop
- Be glanded to the cable basket at the exit point
- Be glanded to the outlet with proprietary mini trunking clip or copex gland
- Total copex run shall be ≤4000mm
- There shall be a ceiling fixing within 150mm either side of a change in direction
- All ceiling fixing SHALL be metallic and shall be at ≤1500mm centres. This includes the copex saddle and the screws/bolts/pins

i. *EN 50174-2 – Requirements – Section 4.4.1.3. – 'for pathway systems that provide non-continuous support (e.g. basket, ladder or hooks):*

− the maximum distance allowed between supporting elements of the pathway system is 1500 mm;

ii. *BS 7671:2018 (IET Wiring Regulations Eighteenth Edition), which was published in January 2018 and comes into effect on 1 January 2019, will include a requirement that wiring systems all locations. The requirement is included in a new regulation (Regulation 521.10.202), which is reproduced below.*

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NOTE 4: *Suitably spaced steel or copper clips, saddles or ties are examples that will meet the requirements of this regulation.*

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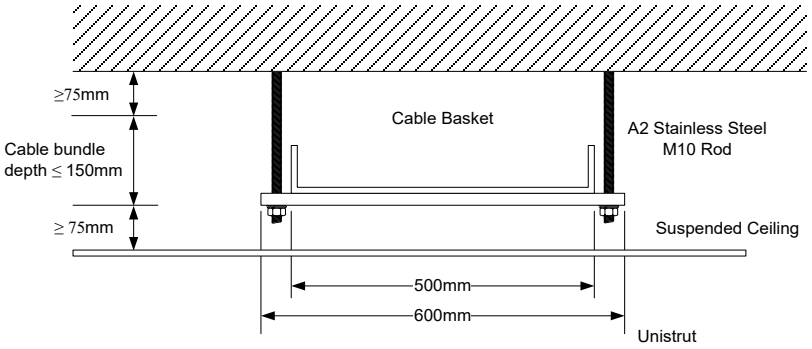


Figure 76 Suspended ceiling cable basket

The Unistrut trapeze must be spaced at a maximum of 1.5m centres.

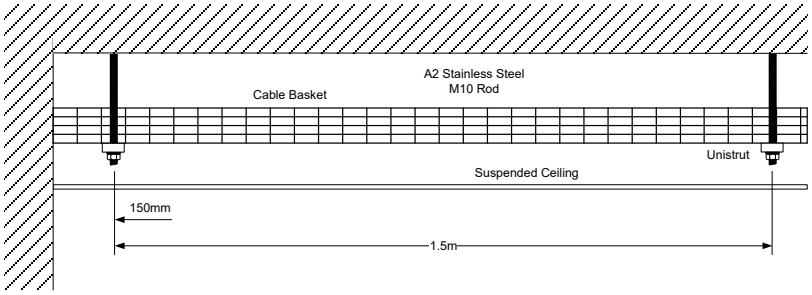


Figure 77 Suspended ceiling cable basket side elevation

5.12 Trunking

A system of perimeter dado trunking, to be installed by the electrical installer, will be used to distribute cabling to service positions. This trunking system to be specifically **MK Prestige 2COM**.

Dado trunking shall:

- Dado level trunking system linking to the horizontal basket distribution shall only be accomplished by a vertical section of trunking from the dado section to the suspended ceiling/floor void
- Each room shall have its own vertical section of trunking
- Not be fed by conduit drops
- Not be fed through the walls from adjoining rooms
- Not be used in ceiling voids
- Not be screwed to ceiling slab
- Not be used in escape routes
- All back boxes to be a minimum depth of 50mm

5.13 Screed Trunking

Screed trunking shall:

- **Separate compartment dedicated to data cables only**
- Where connected to vertical risers the manufactures vertical bend shall be used
- Accessible junction box shall be used at all changes in direction
- Shall be constructed from a minimum of 18swg galvanised steel
- Shall be bonded to earth in accordance with BS 7671
- Finished screed surface shall be ≥25mm above the top of the trunking
- Design to accommodate capacity for 25% extra cat 6a.

5.14 Resilience

When designing the floor areas it is important to consider the resilience to the outlets. To keep the concept of resilience simple there shall be two levels. Level 1 shall be lowest level and level 2 the highest. Level 1 is reserved for a 336-channel design and level 2 for a 672-channel design.

5.14.1 336 Channels – Level 1

Each switch shall be powered from a different PDU within the back of the cabinet to provide further resilience.

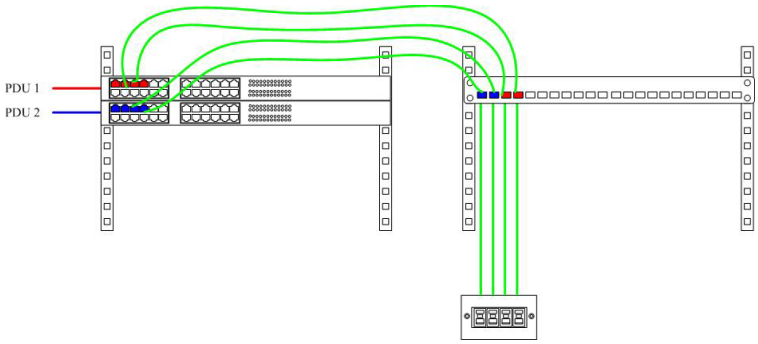


Figure 78 Level 1 resilience

Worst-case outage from power failure on any one spur is 50%. Catastrophic power failure to the telecoms room means a 100% outage or at best will be limited to the UPS(s) power rating(s).

5.14.2 672 Channels - Level 2

There are two active cabinets and two structured cabling cabinets. Each active cabinet may only be patched into its adjacent structured cabling cabinet. This effectively splits the row of 4 cabinets into 2, namely and A route and a B route.

The A route patching field shall be fed from two separate PDUs and the B route patching field from a further two separate PDUs.

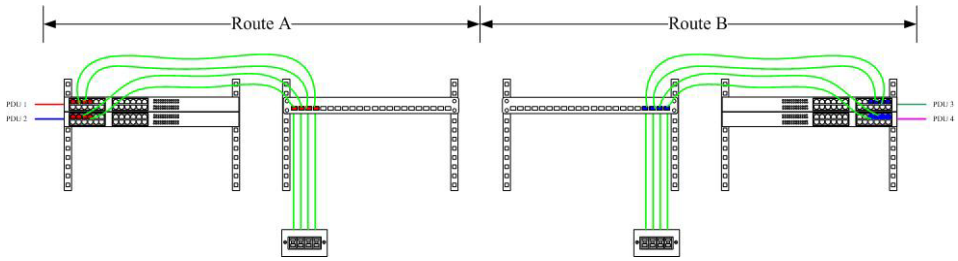


Figure 799 Level 2 resilience

Worst-case outage from power failure on any one spur is 25%.

Catastrophic power failure to the telecoms room means a 100% outage or at best will be limited to the UPS(s) power rating(s).

5.15 Copper Testing

All horizontal permanent copper links shall be tested prior to patching of network switches.

Copper test results are presented before go live and after telecom room sign off/handover to allow go live to take place with a go live change.

For each test, a testing unit shall be used to produce a measured result and determine whether the result is within the specified limits of EN 50173. The unit shall be configured to store enhanced plot data within the overall test record.

An overall PASS / FAIL shall be provided for each test, and a measured result for all the pairs shall be provided. For each test, the worst-case value or margin to a limit and the frequency shall be reported.

The method of test equipment utilisation shall be strictly in accordance with CommScope's testing instructions. The latest instructions shall be sought from CommScope before testing commences.

Test results shall be issued to iSolutions as part of the sign off process for hub rooms, along with as fitted drawings indicating data outlet positions and outlet numbering.

6 Backbone Distribution

6.1 Overview

The backbone distribution is split into two areas, namely the Core backbone and the MER backbone. The Core backbone links buildings together whilst the MER backbone links telecom rooms within buildings.

The Core Backbone distribution extends from the Core building to any subsequent Cores in other buildings on the same campus; and from the Cores to the MERs within all remaining buildings on that same campus.

It is critical that the backbone distribution is designed correctly and consideration given to:

- Data communications media choice
- Layouts
- Routing
- False floor
- Ceiling void
- Cable management

The below network topology diagram shows the current layouts and status of the campus fibre backbone.

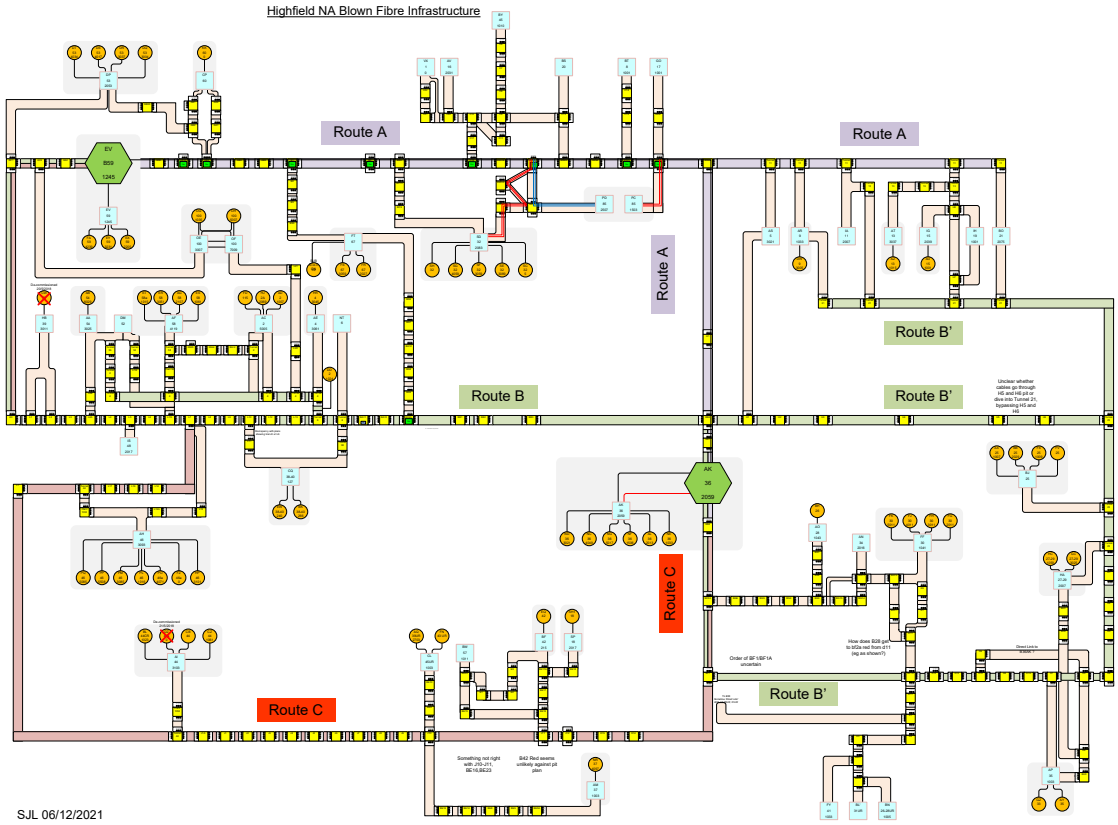


Figure 80 Campus fibre backbone

6.2 Media Choice

6.2.1 OS2 / Blown Fibre

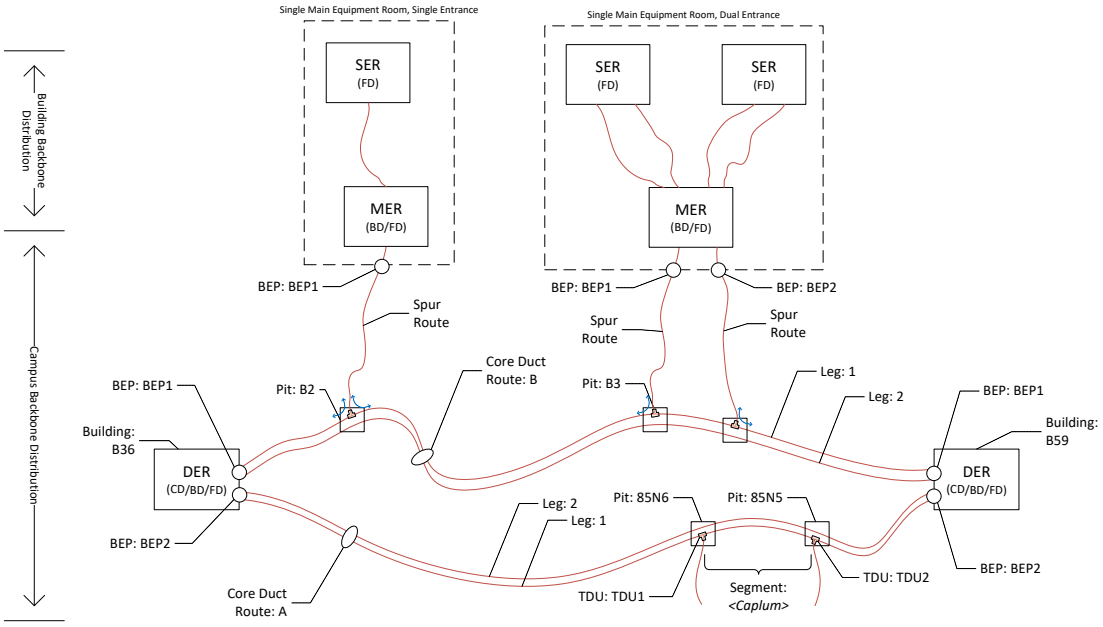
All new campus backbone fibre links shall be blown fibre OS2, regardless of whether the building has traditional fibre that is not being refreshed.

For new buildings or buildings that will be refurbished/refreshed, then the Building Backbone fibre cable shall be blown fibre OS2.

For existing buildings that have traditional fibre already installed and where there is an additional requirement for new Building Backbone links, then the fibre cable shall be blown fibre OS2.

All fibre cores shall be terminated on LC duplex UPC pigtails by fusion splicing. It is not acceptable to use mechanical splicing techniques.

The figure below provides an overview of a typical blown fibre deployment (only the Single MER and Multiple Data Room models are shown). Advice should be sought from iSolutions on how to integrate with the existing blown fibre deployment on each campus.



6.2.2 OS2 / Traditional Fibre

For temporary campus backbone or temporary building backbone links, traditional tight buffered cable may be used. The grade of the fibre cable will be dependent on the type of service required.

All fibre cores shall be terminated on LC duplex UPC pigtails by fusion splicing. It is not acceptable to use mechanical splicing techniques.

6.3 MER and Building Incoming Fibre Design

There are three recognised incoming fibre design for MERs in a building:

- Single MER, Dual Entrance
- Single MER, Single Entrance
- Dual MER, Dual Entrance – to be specified for all New buildings

Dual entrance fibre designs shall be achieved for all new buildings and any refurbishments of existing buildings. If this is not possible, use of the single entrance design must be confirmed as acceptable from iSolutions.

6.3.1 Single Main Equipment Room, Dual Entrance

The MER shall have:

- A blown fibre ring to feed the building. The size and number of tube and tube units to be specified by iSolutions
- Have a minimum of one 12 core OS2 fibre cable for each DER trunk i.e. one 12 core for the A leg and one for the B leg
- A 4 way external blown fibre tube unit from the main blown fibre ducting to the building entry gas seal unit. This applies to both DER trunks
- A gas seal unit at the building entry
- A 4 way LSOH blown fibre tube unit from the gas seal unit to the MER. This applies to both DER trunks
- Each DER trunk shall not share the same building entry
- Each DER trunk shall not share the same external ducting route
- Each DER trunk shall not share the same internal containment route
- A split fibre patch panel with 24 off LC connectors A leg to be terminated into the top drawer and the B leg into the bottom. One to be fitted at each end of each DER trunk.

The SER shall have:

- A minimum of two 8 core OS2 fibre MER trunks – one from each MER
- A minimum of two off 4 way blown fibre tubes – one from each MER
- Each SER trunk shall not share the same route
- Each SER trunk shall come from a different MER
- A plastic fibre patch panel with 8 off LC connectors. One to be fitted at each end of each MER trunk.
- A split fibre patch panel with 16 off LC connectors A leg to be terminated into the top drawer and the B leg into the bottom. One to be fitted at the SER.

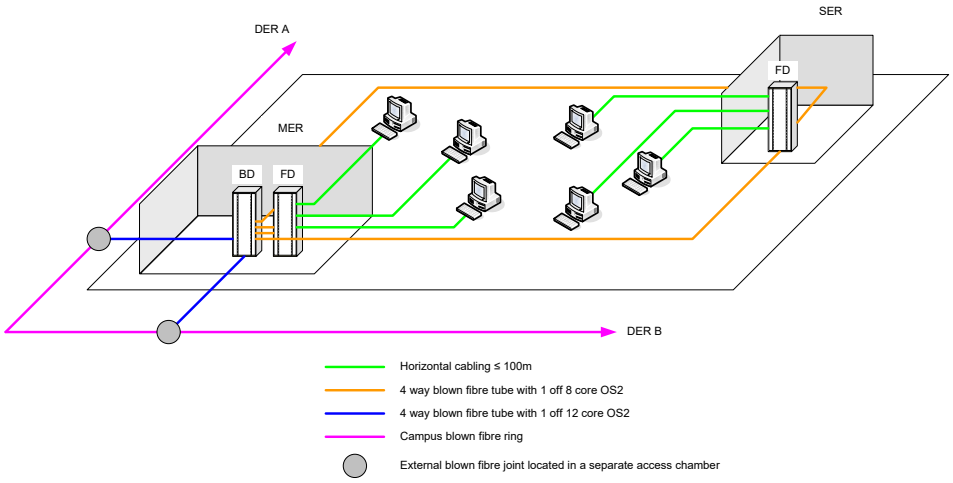


Figure 81 Single MER blown fibre, Dual Entrance

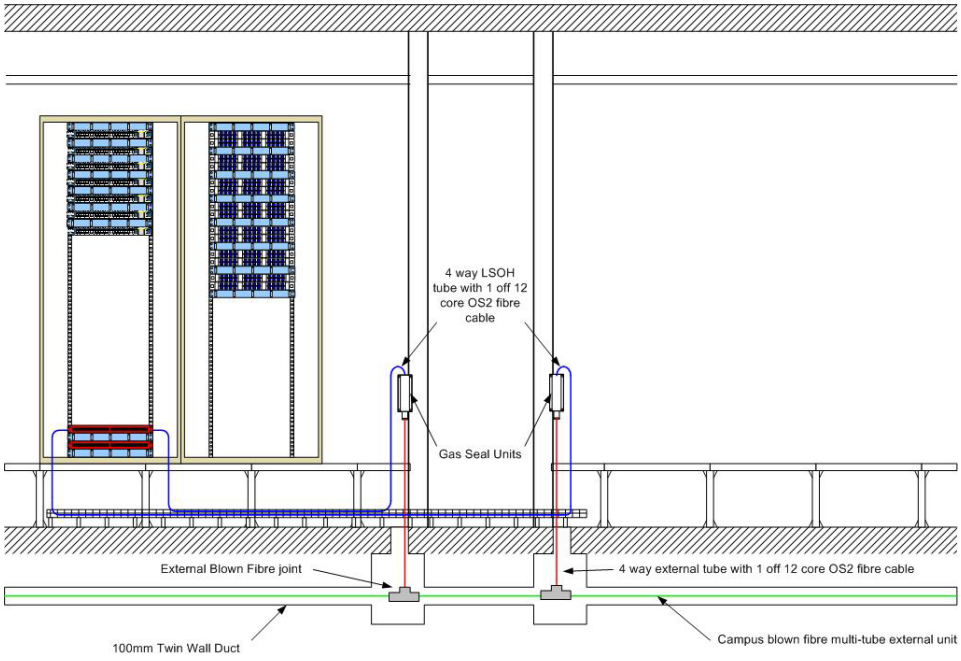


Figure 82 Campus distribution for a single MER, Dual entrance

6.3.2 Single Main Equipment Room, Single Entrance

The MER shall have:

- A blown fibre ring to feed the building. The size and number of tube and tube units to be specified by iSolutions
- A minimum of one 12 core OS2 fibre cable for each DER trunk i.e. one 12 core for the A leg and one for the B leg
- A 7 way external blown fibre tube unit from the main blown fibre ducting to the building entry gas seal unit
- A gas seal unit at the building entry
- A 4 way LSOH blown fibre tube unit from the gas seal unit to the MER. This applies to both DER trunks i.e. one 4 way for the A leg and one for the B leg.
- Each DER trunk may share the same building entry
- Each DER trunk shall not share the same external ducting route
- Each DER trunk shall not share the same internal containment route
- A split fibre patch panel with 24 off LC connectors A leg to be terminated into the top drawer and the B leg into the bottom. One to be fitted at each end of a trunk.

The SER shall have:

- A minimum of two 8 core OS2 fibre MER trunks – one from each MER
- A minimum of two off 4 way blown fibre tubes – one from each MER
- Each SER trunk shall not share the same route
- Each SER trunk shall come from a different MER
- A plastic fibre patch panel with 8 off LC connectors. One to be fitted at each end of each MER trunk.
- A split fibre patch panel with 16 off LC connectors A leg to be terminated into the top drawer and the B leg into the bottom. One to be fitted at the SER.

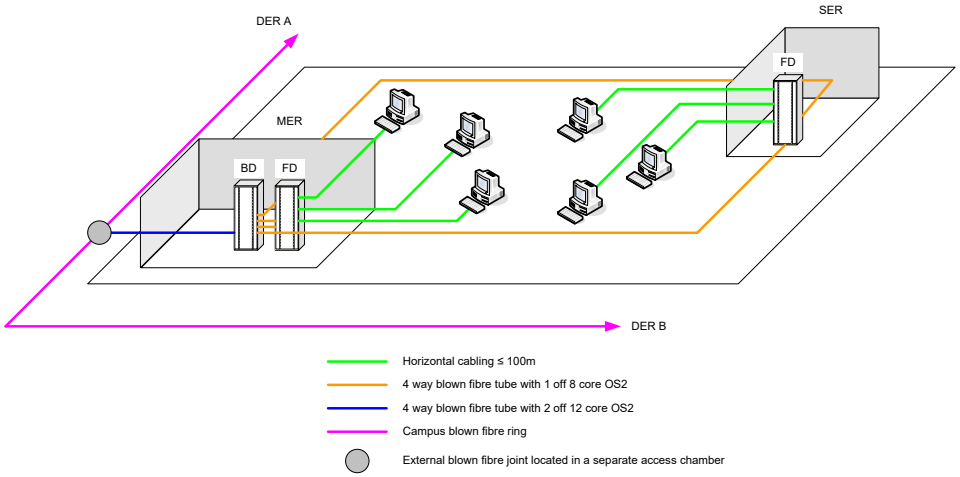


Figure 83 Single MER blown fibre, Single entrance

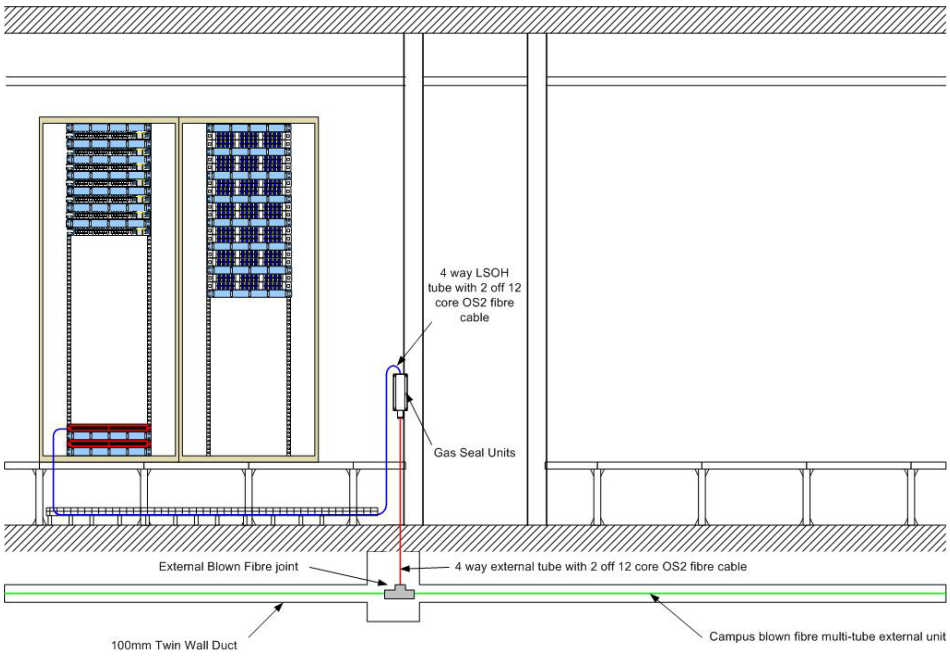


Figure 84 Campus distribution for a single MER, Single entrance

6.3.3 Dual Main Equipment Rooms, Dual Entrance

Dual entrance fibre designs shall be achieved for all new buildings and any refurbishments of existing buildings. If this is not possible, use of the single entrance design must be confirmed as acceptable from iSolutions.

Each MER shall have:

- A blown fibre ring to feed the building. The size and number of tube and tube units to be specified by iSolutions
- A minimum of one 12 core OS2 fibre DER trunk - to each MER
- A 4 way external blown fibre tube unit from the main blown fibre ducting to the building entry gas seal unit – to each MER
- A gas seal unit at the building entry – to each MER
- A 4 way LSOH blown fibre tube unit from the gas seal unit to each MER.
- Each DER trunk shall not share the same building entry
- Each DER trunk shall not share the same external ducting route
- Each DER trunk shall not share the same internal containment route
- Each DER trunk shall feed a different MER
- A plastic fibre patch panel with 12 off LC connectors. One to be fitted at each end of each DER trunk
- The MERs shall be meshed together with 2 off 4 way LSOH blown fibre tube units. The tube units shall be diverse routed
- The MERs shall be meshed with 2 off 12 core OS2 blown fibre cables – one in each of the 4 way blown fibre tube units
- A split fibre patch panel with 16 off LC connectors One to be fitted at each end of the MER meshed fibre backbone. The patch panels shall share the A and B leg

The SER shall have:

- A minimum of two 8 core OS2 fibre MER trunks – one from each MER
- A minimum of two off 4 way blown fibre tubes – one from each MER
- Each SER trunk shall not share the same route
- Each SER trunk shall come from a different MER
- A plastic fibre patch panel with 8 off LC connectors. One to be fitted at each end of each MER trunk.
- A split fibre patch panel with 16 off LC connectors A leg to be terminated into the top drawer and the B leg into the bottom. One to be fitted at the SER.

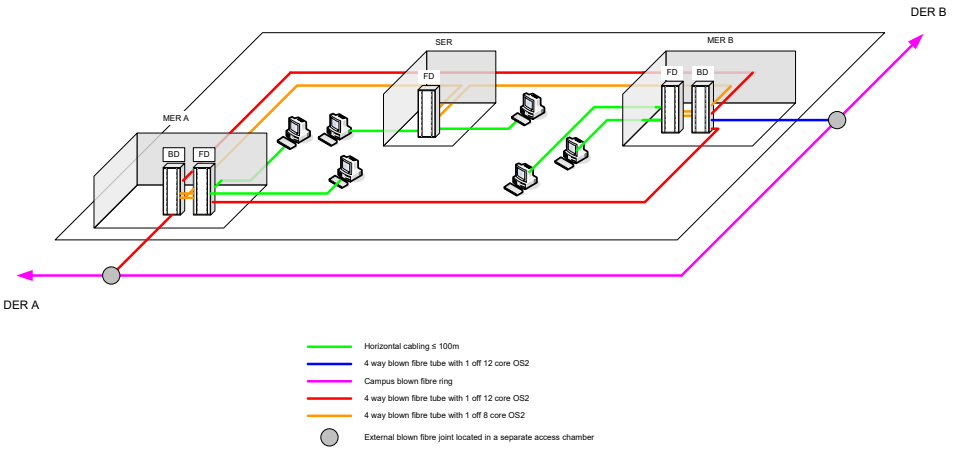


Figure 85 Double MER blown fibre

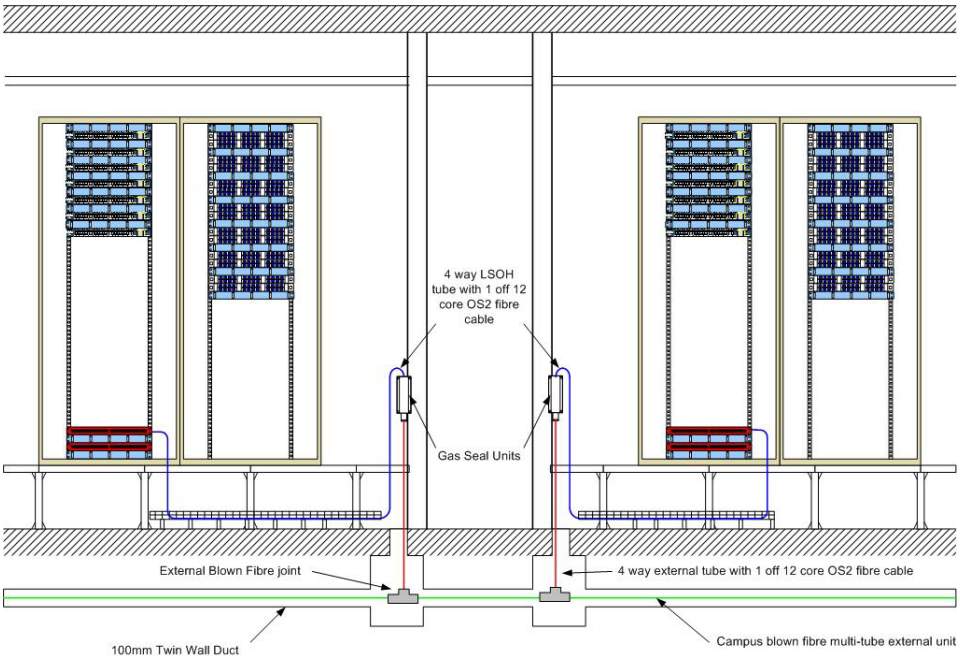


Figure 86 Campus distribution for a double MER

6.4 OS2 Inter Cabinet links

6.4.1 Overview

Between the MER A Network cabinets A and B a 12 port G2 MPO cassette shall be installed

6.4.2 Inter Cabinet Links

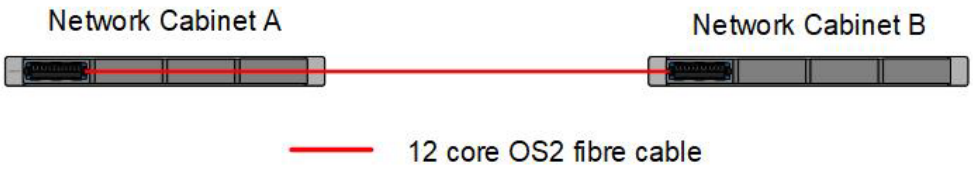


Figure 87 Network Cabinet A to B OS2 link

Each OS2 inter cabinet panel to panel link shall consist of:

- 2 qty 1U G2 unloaded fibre patch panel
- 6 qty G2 blanking panels
- 2 qty 12 Port G2 MPO Cassette straight
  - One to be mounted in Network Cabinet A
  - One to be mounted in Network Cabinet B
- 1 qty 12 core OS2 MPO fibre cable assembly– length to be determined by vendor
- 2 qty engraved patch panel label – for labelling the patch panel
- 12 qty engraved patch panel label – for labelling the individual ports
- Velcro type cable ties – suitable quantity for installation (Velcroed on the bends and loose laid on straight runs)
- 2 qty cable labels for OS2 MPO fibre cable assembly – one at each end of the cable run

6.5 Diverse routing of fibre

Each MER and SER shall follow the same diverse fibre routing rules.

MER and SER new builds

- If the building contains more than 1 riser then the diverse fibre cables shall not share the same riser.
- If the building contains only 1 riser, then the fibre cables may share the same riser but shall be on separate containment in a box section metallic trunking with lid and separated by the maximum possible distance permitted by the riser size.
- Diverse fibres shall not share the same route within a corridor
- Diverse fibres may share the same corridor if they approach the MER and SER from different directions
- If diverse fibres must share the same route, it shall only be adopted on written permission from iSolutions and the diverse fibre cables are on different containment and separated by ≥ 1.5m

- The diverse fibre routes shall enter the building through separate building entry points separated by ≥ 5m
- Diverse fibre cables shall not share the same external ducting
- External ducting shall be separated by ≥ 5m

Environment	Depth (mm)
Pavement or Grass	500
Verge	600
Urban Roads	750

Table 1 Duct depth

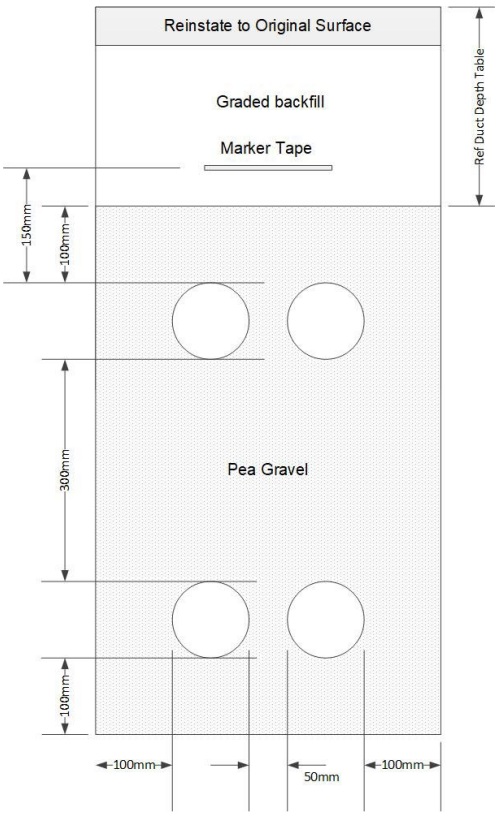


Figure 88 External 4 way ducting separation gap depth

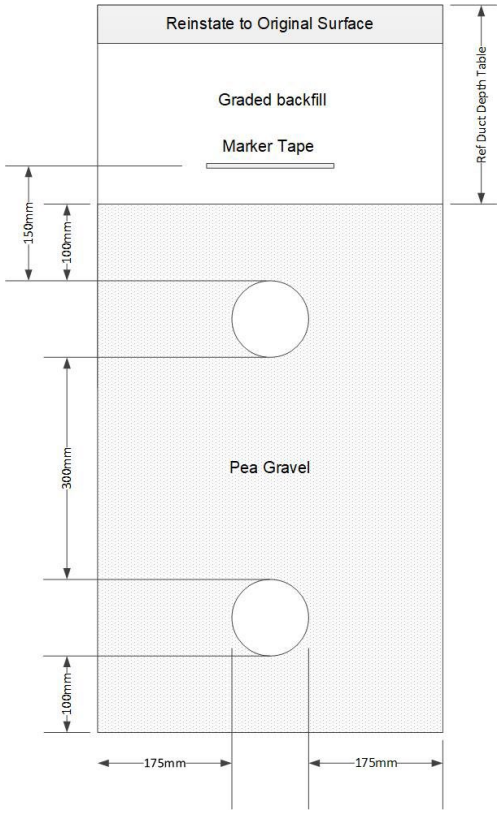


Figure 89 External 2 way ducting separation gap depth

6.6 Fibre Polarity

All installed fibre cables, installed between two patch panels, shall be straight. All fibre patch cords shall be flipped.

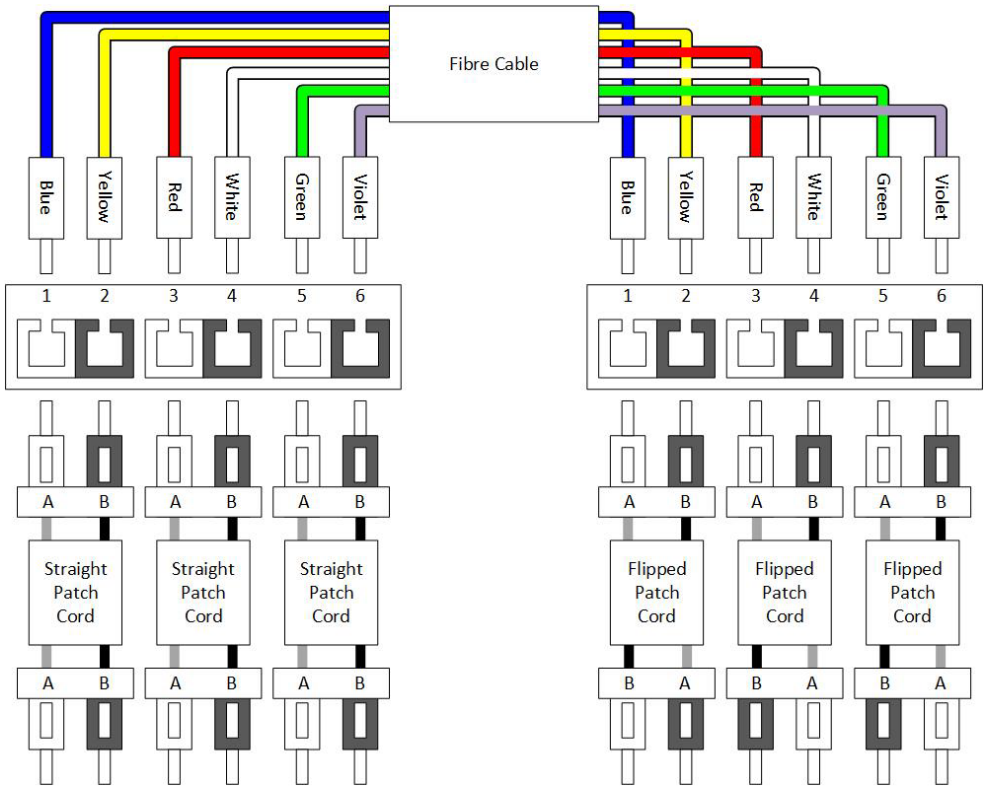


Figure 90 Fibre polarity

6.7 Fibre Joint Arrangements

The two options for the fibre joint arrangements are dual and single. The rules for dual and single are detailed in the previous section.

6.7.1 Dual Joint Arrangement

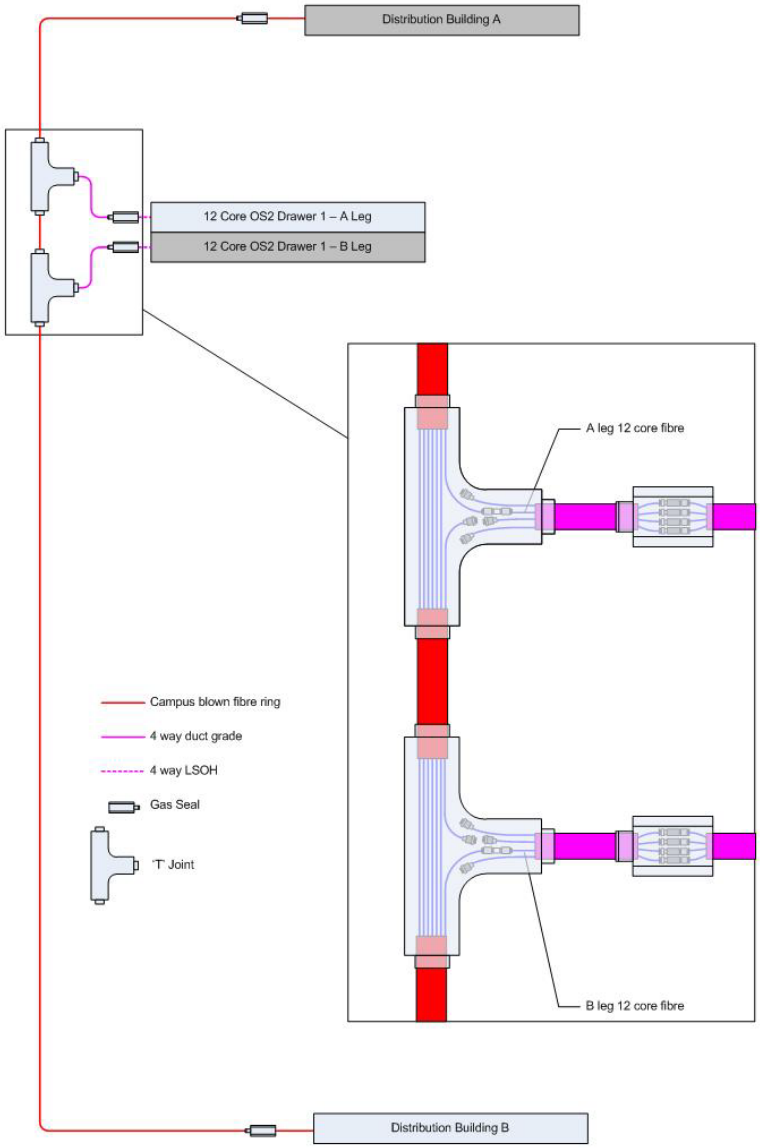


Figure 91 Dual blown fibre joint arrangement

Where a building needs a feed from the blown fibre campus ring the ring shall be broken into at the two diverse access chambers. The same tube shall be cut in both the chambers i.e. if tube 2 is cut in the chamber that will provide the A leg then tube 2 shall also be cut in the chamber that feeds the B leg.

The cut tube that now links chamber A and B shall be capped off with an external end blocking cap. The A leg tube shall be jointed onto the first 4 way blown fibre building feed and the B leg feed must be jointed onto the second 4 way blown fibre building feed. All tubes that are not to be used in the two off 4 way building feeds shall be capped off with external end blocking caps.

6.7.2 Single Joint Arrangement

Where a building needs a feed from the blown fibre campus ring the ring shall be broken into at the single access chamber. The required tube shall be cut. The A and B leg tube shall be

jointed onto the 4 way blown fibre building feed. All tubes that are not to be used in the 4 way building feed shall be capped off with external end blocking caps.

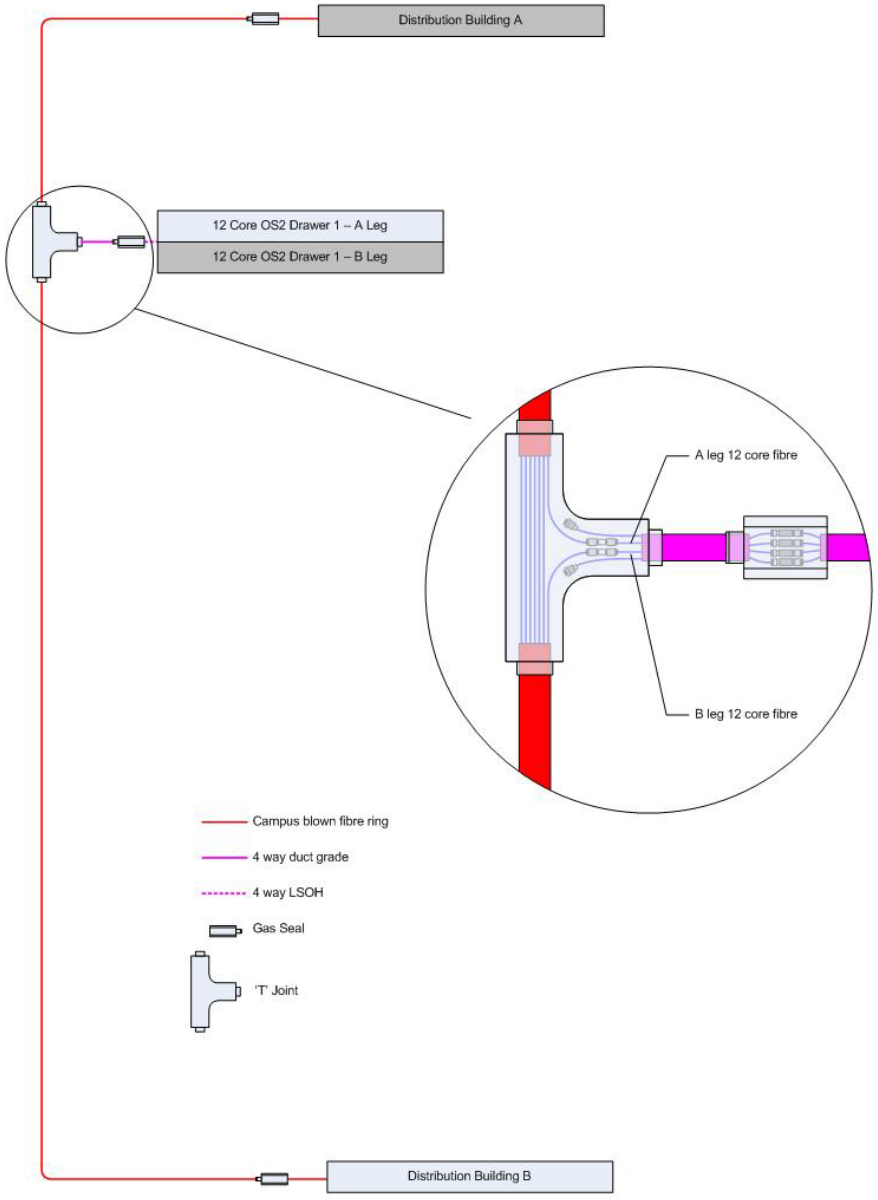


Figure 92 Single blown fibre joint arrangement

6.8 Fibre Backbone Testing

The following requirements shall be met when performing testing and commissioning on backbone fibre cabling systems.

Fibre test results are presented before go live and after telecom room sign off/handover to allow go live to take place with a go live change.

Midblow and gas seal photos are required for all core buildings and pits before go live.

All backbone fibre cabling systems shall be tested against the requirements of Appendix H. The Contractor shall seek at time of installation guidance from TE on the most up to date and appropriate testing documentation.

Each fibre optic core shall be tested to confirm that it meets the insertion loss requirements, as detailed in EN 50173-1. Multimode fibre shall be tested at 850nm and 1300nm wavelengths Singlemode fibre shall be tested at 1310nm and 1550nm wavelength. Tests shall be made in both directions of each core of the installed cable. For each optical fibre channel the following test results shall be recorded:

- Power meter measurements to verify:
  - Overall attenuation to the nearest 0.1dB in both directions
  - Confirmation of polarity and mapping of fibre cores onto patch panel terminations
- Fluke Fibre Optic Cable Tester to verify:
  - Cable PASS or FAIL
  - Any basic information on the state of the link measured by the selected Fluke tool.
- OTDR Measurements to:
  - Characterise the fibre link and its events with a recorded trace record
  - Identify stressed fibre and severe bends
  - Detect bad connections, terminations and splices
  - Measure fibre length

Failures detected during testing shall be duly noted. All faults shall be rectified by The Contractor and any damaged cables shall be replaced with new cables in complete runs. Cable joining or running of part segments shall not be accepted; all equipment presenting failures shall be replaced by new equipment.

Test results where the result is closer to the limit than the tolerance of the test equipment may be noted as ‘PASS*’. A ‘PASS*’ test result shall have terminations remade and retested. In the event the result remains a ‘PASS*’ it shall be treated as a pass.

6.8.1 Witness Tests

iSolutions, or a University Representative, reserves the right to attend site to witness cable tests and complete random sample testing upon completion of tests. Witness testing and random sample testing shall be agreed with The Contractor prior to commencement.

6.8.2 Test Records

Testing records shall be documented electronically in their original format and written to a CD-ROM where upon completion of testing they shall be reviewed by The Client. The Contractor shall free issue any software required to read the test results.

6.8.3 Test Equipment

The model and serial number of any test equipment used shall be recorded for each relevant test.

7 Emergency Voice Communication (EVC)

7.1 Overview

All general telephones shall be VoIP based and as such do not form part of this section. The only traditionally based voice switch telephones shall be public emergency phones, equalities act, refuge call points, critical alarms and lift phones.

The voice distribution covers campus and building distribution for BT and the University of Southampton voice cabling. The BT cabling solution is to be specified and provided by BT and as such does not come under the specification of this document. This specification covers the University of Southampton voice cabling and from the demarcation of BT to the equipment.

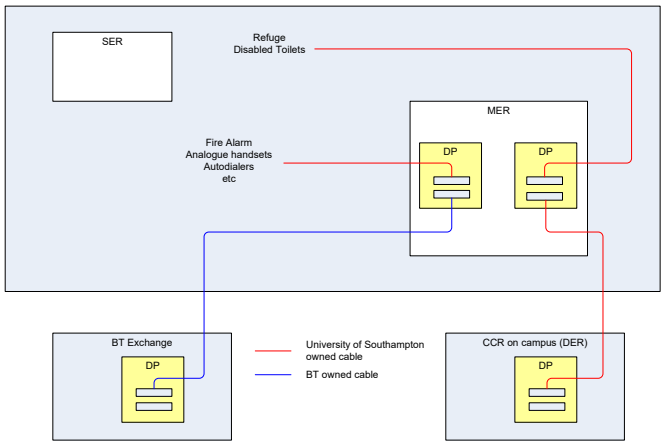


Figure 93 University and BT demarcation for voice cabling

The campus voice distribution for a new build extends from the main telecommunications room to the nearest campus exchange.

The EVC copper trunk supply cable shall be terminated in a DP within the MER.

7.2 External/Internal Trunk Cable Media Selection

Cable types, pair count and where they are used are normally:

- Internal/external – 50 pair CW1308FLH (LSOH version of CW1308)

Clarification must be sought from iSolutions on the final number of pairs to be installed

7.3 Internal Horizontal Cable Media Selection

Cable types, pair count and where they are used are normally:

- Internal Horizontal – FireTuf ® grade cables capable of fire resistant to BS5839 26.2E > 2hrs @ 950^{0}C, BS6387 > 3hrs @ 950^{0}C and BS EN 50200 > 3hrs @ 950^{0}C

7.4 User Case Outlet Quantities

Each User Case will demand different requirements from a voice block wiring infrastructure. The main User Cases and associated technologies have been defined below as the minimum requirements for outlet concentrations.

User Case	LJU Outlets	Direct Terminated
Disabled Toilet	1 per room (4 pairs)	1 per room (1 pair)
Public Emergency/DDA Phone	1 per position (4 pairs)	
Lift Telephony	1 per lift (4 pairs)	
Fire Alarm		1 per position (4 pairs)
Autodialers		1 per position (4 pairs)
EVC call point as a result of risk assessment for hazardous area of activity		1 per position (4 pairs)

7.5 Emergency Voice Design

The voice design is split into two links, the campus distribution and the building distribution.

The internal/external voice cable may be installed on existing cable basket that is dedicated to structured cabling. Where there is no suitable existing containment then new cable basket shall be fitted. The basket shall be 50mm in width.

The Contractor shall be responsible for procuring, installing, testing and commissioning of the building EVC components in conjunction with the University of Southampton. iSolutions will be responsible in connecting and activating the building EVC solution on to the core critical network.

The main contractor will be responsible for procurement and installation of:

- Call points
- Building wiring
- DP in MER
- Copper trunk cable install back to B85
- Connection at B85
- Cost of a new line card for the EVC exchange
- For sites over 7Km where fibre is installed each site core shall be fitted with a UPS at both ends
- Testing and commissioning
- The University will be responsible for commissioning of new building on to the EVC exchange

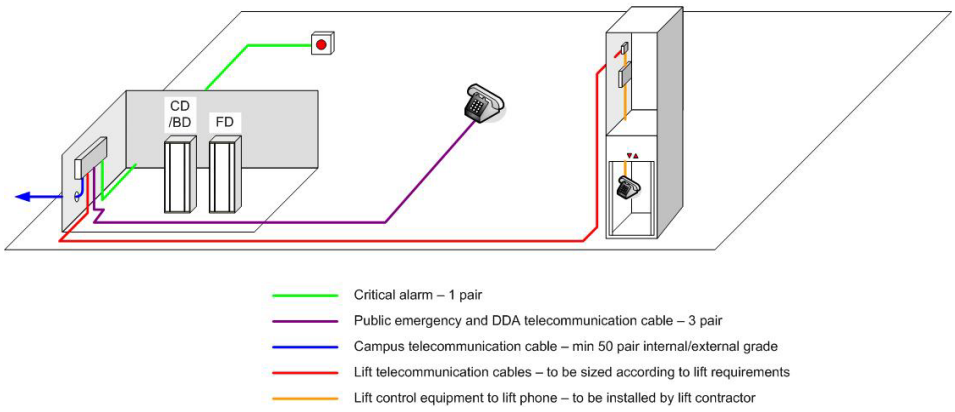


Figure 94 Voice block wiring design

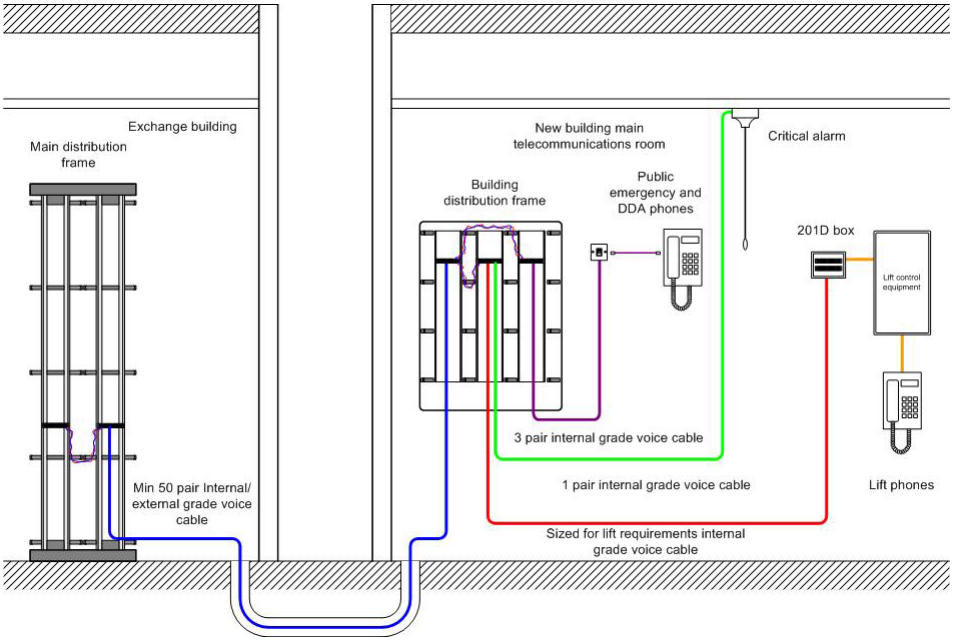


Figure 95 Building distribution backbone

7.5.1 University of Southampton Campus Emergency Voice Trunk

The campus emergency voice distribution for a new build extends from building 85 voice distribution frame/box to the emergency voice distribution frame/box within the allocated MER.

Where a direct point to point copper link cannot be installed, a highly available alternative connection shall be provided – for example a PSTN trunk.

The voice distribution frame/box shall act as a jumpered cross connect.

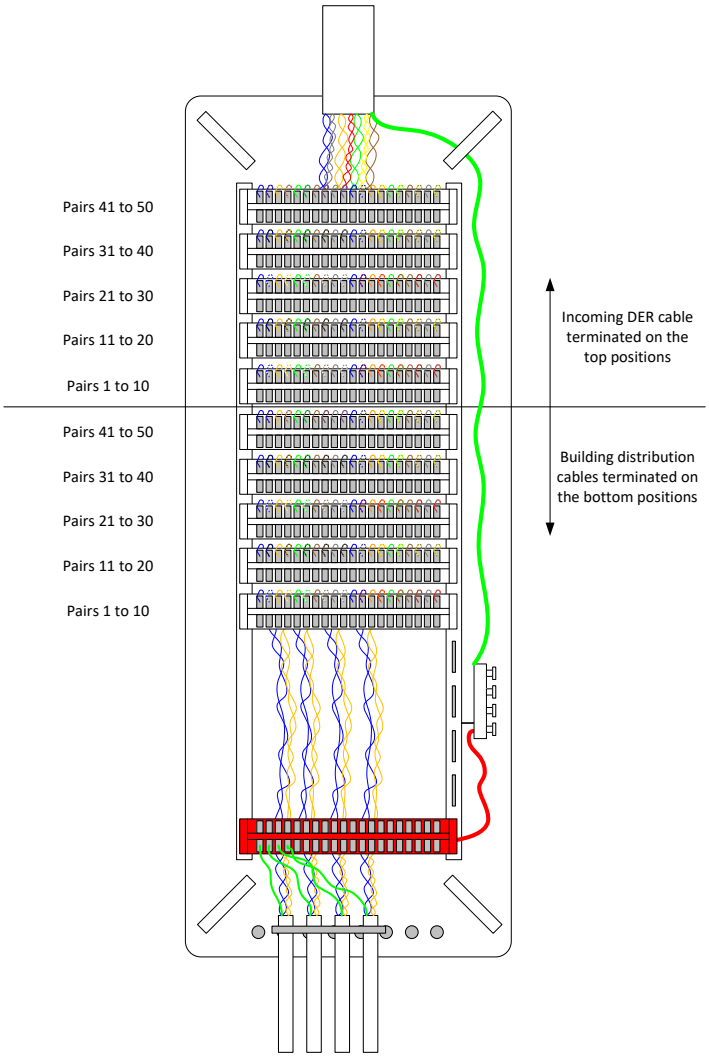


Figure 96 Telco DP box showing jumpered cross connect

Each trunk link shall consist of:

- 1 qty suitably sized CommScope KRONE 237 voice frame, cabinet or wall box in the MER (sized to accommodate the 50 pair cable or to be specified by iSolutions and a further 50 pairs for distribution and a single voice earth module)
- 1 qty printed label – frame, cabinet or wall box
- 1 qty internal/external 50 pair voice cable (or to be specified by iSolutions) – length to be determined by Contractor
- 10 qty 237A 10 pair disconnect module (this number may change depending on the cable size)
- 10 qty 51A hinged label holder (this number may change depending on the cable size)
- 10 qty printed label – 51A label holder (this number may change depending on the cable size)
- 1 qty red 10 pair earth module
- 1 qty green earth sleeve for each EVC cable
- Velcro type ties – suitable quantity for installation (every 300mm within the communications room and every 600mm outside of the communications room. Additional Velcro type ties shall be used as necessary)

- XX qty cable label for each 50 pair cable run – approved type of cable label at each end of the cable run, each manhole, building entry, riser floor and ceiling access points

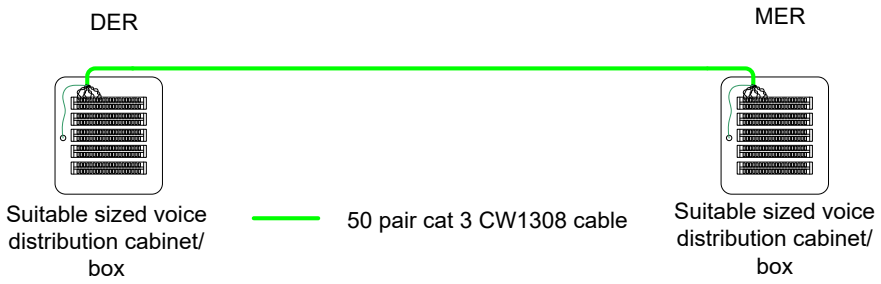


Figure 97 Campus voice link design

7.5.2 Refuge and Disabled Toilets – From the University of Southampton DP

The building emergency voice distribution extends from the voice distribution frame or wall box within the MER/SER to the terminal equipment or TO i.e. fire alarm, refuge point etc.

Each link shall consist of:

Each phone distribution extends from the voice patch panel within the MER/SER to the TO.

Each link shall consist of:

- 1 qty 237A 10 pair disconnect module mounted in the MER frame, cabinet or wall box
- 1 qty 51A hinged label holder
- 1 qty printed label – 51A label holder
- 1 qty LJU
- 1 qty single or double gang back box
- 1 qty outlet label
- 1 qty gland for outlet
- 1 qty 4 pair cat 5e SF/UTP FireTuf ®cable – length to be determined by Contractor
- 1 qty green earth sleeve for each FireTuF cable
- Velcro type ties – suitable quantity for installation (every 300mm within the communications room and every 600mm outside of the communications room. Additional Velcro type ties shall be used as necessary)
- 2 qty cable label for each FireTuf ® cable run – approved type of cable label at the DP and TO.

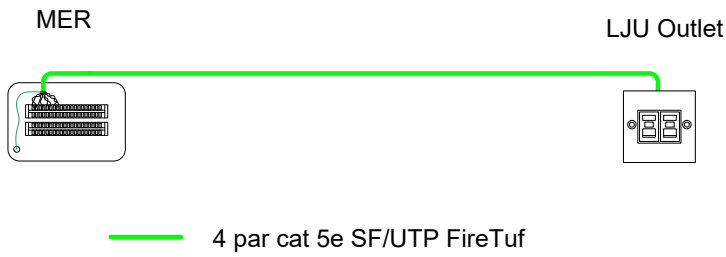


Figure 98 Refuge and disabled toilets telephony

7.5.3 Fire Alarm, Critical Alarm, Refuge Call Point, Autodilaers etc – From the BT demarcation point

The building emergency voice distribution extends from the voice distribution frame or wall box within the MER/SER to the terminal equipment or TO i.e. fire alarm, refuge point etc.

The refuge call point product specification is presented in Appendix F.

Each link shall consist of:

- 1 qty 237A 10 pair disconnect module mounted in the MER frame, cabinet or wall box
- 1 qty 51A hinged label holder
- 1 qty printed label – 51A label holder
- 1 qty LJU
- 1 qty single or double gang back box
- 1 qty outlet label
- 1 qty gland for outlet
- 1 qty 4 pair cat 5e SF/UTP FireTuf ®cable – length to be determined by Contractor
- 1 qty green earth sleeve for each FireTuF cable
- Velcro type ties – suitable quantity for installation (every 300mm within the communications room and every 600mm outside of the communications room. Additional Velcro type ties shall be used as necessary)
- 2 qty cable label for each FireTuf ® cable run – approved type of cable label at the DP and TO.

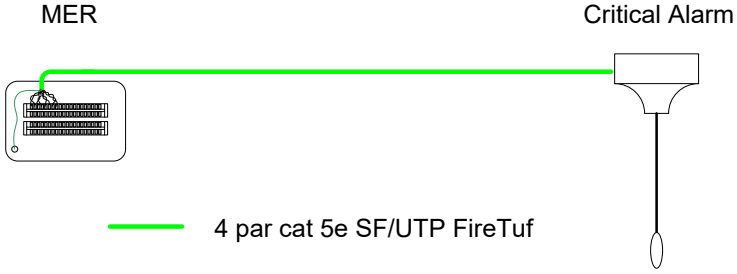


Figure 99 Fire alarm, critical alarm, autodialers etc.

7.5.4 Lift Telephony – From The University of Southampton DP

All lift telephony on new building projects shall be provided by the EVC system. Where no EVC is provided an auto-dialler shall be installed.

- 1 qty suitably sized CommScope KRONE 237 wall box located in the lift plant room
- 1 qty printed label –wall box
- XX qty 237A 10 pair disconnect module at each end (4 pairs for each lift telephone)
- XX qty 51A hinged label holder at each end (4 pairs for each lift telephone)
- XX qty printed label – 51A label holder at each end (4 pairs for each lift telephone)
- XX qty 4 pair cat 5e SF/UTP FireTuf ®cable – length to be determined by Contractor (4 pairs for each lift telephone)
- Velcro type ties – suitable quantity for installation (every 300mm within the communications room and every 600mm outside of the communications room. Additional Velcro type ties shall be used as necessary)
- 2 qty cable label for each FireTuf ® cable run – approved type of cable label at the patch panel and TO.

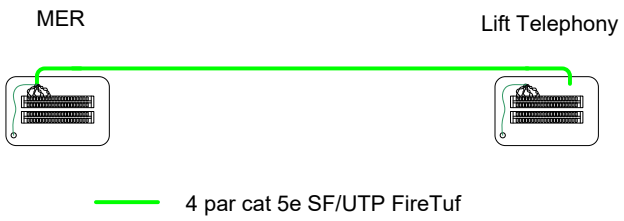


Figure 100 Lift telephony

8 Auditing

8.1 CommScope Audit

iSolutions reserves the right to request an audit from a CommScope representative on the structured cabling element of the project. The CommScope representative shall be given access to all areas where structured cabling products have been installed or are to be installed.

The installer shall provide, at the request of the CommScope representative, sufficient resources to assist in the removal of ceiling tiles, access equipment for high level access, lifting floor tiles, lifting man hole covers etc.

Any areas of concern that may impact on the warranty, at the time of inspection or during the 25 year warranty period, shall be resolved at the cost of the installer. Any areas of concern that do not impact the warranty, now or during the 25 year warranty period, but are deemed to not fulfil the requirements of this specification or industry good practices, shall be resolved at the cost of the installer.

8.2 iSolutions Audit

iSolutions reserves the right to audit all elements of the project as defined by this specification and industry best practices. The iSolutions representative shall be given access to all areas.

The installer shall provide, at the request of the iSolutions representative, sufficient resources to assist in the removal of ceiling tiles, access equipment for high level access, lifting floor tiles, lifting man hole covers etc.

Any areas of concern that conflict or fail to comply with this specification shall be resolved at the cost of the main contractor.

8.3 iAuditor

iSolutions have standardised on iAuditor This cost shall be included the integrators bid to the main contractor and highlighted as ‘iAuditor templates construction’.

Engagement and access to iAuditor is mandatory for all projects requiring copper and fibre work packages for the university and will be measured against current UOS specification version in force at the time.

A template shall be made available to the IT Integrator and this template shall be used as a pre-commissioning tool for all work indicated within the iAuditor template. It is not acceptable for the IT Integrator to not complete the template together with photographic evidence where requested. The IT Integrator shall build into their costs a license from iAuditor and also the time to record the data.

Recording of data shall include entering photographic evidence of the completion of all works as detailed within this specification. Typical examples of this are taking photographs of the placement of the cabinet, installation of the cat 6a patch panels front and rear etc. For external duct works it is essential that photographs are taken of the duct routes before backfilling, construction of duct chambers, blown fibre into and out of each duct chamber etc. The reports are generated automatically within iAuditor.

The contact details for Ethicus Consultancy Ltd are:

- Karl Tryner
- Email: karl.tryner@gmail.com

- Tel: 01242 620906
- Mob: 07768 325759

- Joseph Tryner
- Email: josephtryner@gmail.com
- Tel: 01242 620906
- Mob: 07972454576

8.4 Caplum

iSolutions have standardised on Caplum to record the physical structured cabling infrastructure for copper and fibre. All data input into Caplum shall be undertaken by Ethicus Consultant Ltd. The installer shall engage with Ethicus Consultancy on a project by project basis and build into their costs a project-based fee to cover

the capture and input of structured cabling data into Caplum. This cost shall be included the integrators bid to the main contractor and highlighted as 'Caplum Structured Cabling Capture'.

The contact details for Ethicus Consultancy Ltd are:

- Karl Tryner
- Email: karl.tryner@gmail.com
- Tel: 01242 620906
- Mob: 07768 325759

- Joseph Tryner
- Email: josephtryner@gmail.com
- Tel: 01242 620906
- Mob: 07972454576

9 Roles and Responsibilities

9.1 General

The Main Contractor shall appoint an authorised Commscope partner Data Contractor and authorised Cisco integrator.

The design of the cabling system will include input from the Building Designer, Main Building Contractor, Electrical Contractor, Specialist Data Contractor, Estates and Facilities Project Leader and iSolutions. Close liaison between all parties is required to deliver building design and services suitable for installation of structured cabling to EN 50173 & EN 50174.

Corporate membership by the Data Contractor of BICSI and individual qualification to BICSI RCDD standard should be considered favourably alongside other accreditations the Main Contractor may require.

Key points to take into account during the design phase include

- Number of points required
- Cable pathways
- Building and Floor distributors (hub rooms) specification
- Power and cooling
- Component choice
- Installation scheduling
- Quality control

9.2 Responsibilities

The responsibilities for the installation of the cabling system, supply and installation of the data network components to a commissioned solution in compliance with all university specifications are as follows:

9.2.1 Building Designer

- Provide Building Distributors and Floor Distributors (hub rooms) to the specification provided by iSolutions (below).
- Provide details of locations and quantities of hub rooms and data outlets along with detailed drawing to iSolutions. Accurate drawings are to be issued prior to start of cabling system installation showing individual outlet positions with single/double/quad outlets being clearly marked. As a guide, in single occupancy offices there should be a minimum of three data points installed within 1.5m of the anticipated primary desk location.
- Building/floor distributors (hub rooms)
  Ensure that there are adequate hub rooms to service the building and that no office outlet is more than 90 metres cable distance from a hub room.
  Design each hub room to accept at least one 800mm x 800mm equipment racks. The space required for a room containing two racks is approx. 2800mm x 2000mm to allow an engineer to gain safe access to the front, rear and side of rack, and the doors to open fully.
  As an estimate, the amount of space required within a rack for active equipment shall be equal to the amount of space taken by passive components.

9.2.2 Main Contractor

- Provide services to support equipment racks in each hub room. To include power, cooling (air conditioning), lighting, fire detection and containment for cabling.
- Provide cable pathways sufficient to accommodate structured cabling system (including allowance for any future expansion).
- Ensure earthing and bonding compliance to BS EN 50310.
- Provide two diverse duct routes into the building, linking into the existing University duct system so as to provide diverse routing of cables to the Data Network core.
- Provide all MAC address information for all installed network-enabled equipment. This shall be communicated by populating the table in Appendix G.
- Design cabling system.
- Supply and install equipment racks.
- Install and test of cabling system.
- Install and test of fibre optic links between hub rooms.
- Supply and installation of all sundry rack accessories stated elsewhere in this document, including cable management arms.
- No IP addresses shall be allocated until this information has been provided to the University of Southampton.
- Design of data network at a physical and logical level in compliance with issued UOS specifications, approval required by iSolutions
- Supply of all data networking hardware
- Supply and patch all copper circuits to active data network switches
- Supply and clean fibre patch leads prior to installation
- Design of the wireless data service in compliance with UOS issued wireless specifications seeking approval from iSolutions.
- Supply of all wireless access points
- Patch all mains cords of network hardware
- Installation of all data networking switches
- Pre stage for configuration all data network hardware and wireless access points
- Supply and patch of all fibre patch cords
- Supply and install all cat 6a 0.5m patch cords for APs
- Completion of all fibre patching and labelling
- Completion of all copper patching and labelling
- Install and test fibre optic links to the University's data network (external to the new/refurbished building).
- Carry out wireless heat map off plan
- Produce wireless heat map to ensure coverage of wireless signal throughout the whole building envelope. This shall include pre-construction predictive modelling, and post-construction measured survey results. The parameters for the predictive modelling are presented in Appendix E.
- Labelling of all installed circuits Physical installation of wireless access points
- Compliance of wireless works with University specification for WIFI provision
- Complete post installation wireless heat map survey
- Caplum audit for installed circuits
- Services in hub rooms
    - Provide power from a dedicated single outlet (not a fused spur) to each power distribution block. The socket shall be secured is such a way that the plug top cannot be casually removed or switched off (e.g. located in a secure enclosure or mounted out of normal reach).
    - Provide air conditioning (cooling) to counteract the heat produced by the equipment in the rack: for reasons of access and ensuring that condensate cannot enter the equipment rack, the air conditioning shall **not** be located above the rack.
    - Provide lighting for safe working in the equipment rack. If the room has no windows then an emergency light fitting is to be provided.

  - Provide fire detection associated with the building system for remote fire monitoring.
  - Provide containment within each hub room to accommodate the structured and fibre optic cabling.
  - Provide earth terminal point for connection of equipment rack to building earth system.
- Cable Pathways
  - Provide a comprehensive distribution network of cable pathways radiating from each data equipment room to conduct individual service cables to their rooms. **The distribution must be accessible throughout its length to facilitate installation of additional circuits and to enable fault investigation.** Within the rooms provide trunking with separate lids for mains and structured cabling.
  - Provide cable pathway from the building distributor (hub room) to the cable entry point of the new building.
  - All pathways must maintain adequate separation from sources of electrical interference. Extensive guidance on pathway design is provided in the standards.
- Equipment Racks
  - Provide and install all racks.
- Structured Cabling
  - Provide, install and terminate all structured cables (including cables for Access control, BMS and any other services that are expected to run on the University's data network). These cables start at the destination office where they are terminated in an RJ45 faceplate. At the rack all cables are to be terminated on RJ45 patch panels. Cables to be tested with tester that is certified for testing the installed cabling and the results supplied to iSolutions. Circuits are to be labelled at both ends in accordance with iSolutions standard.
- Building Distribution (BD) Fibre Optic
  - The Data Contractor shall install, terminate and test all BD fibre optic cables.
- Campus Distribution (CD) Fibre Optic
  - The Data Contractor shall install, terminate and test all CD fibre optic cables.
  - Supply and patch and label all copper and fibre installed circuits.
  - Design, supply, installation and commissioning of a building wide Emergency Voice Communication system in compliance with UOS issued specifications.

- **All works in strict compliance with the university IT and cabling specifications issued.**

9.2.3 Estates & Facilities

- Ensure information regarding:
  - Access Control
  - BMS
  - CCTV
  - Emergency lighting

  and any other device that needs a connection to the data network is passed to the project leader and iSolutions.
- Support of Access control and BMS is not provided until after building handover, due to the fact that iSolutions need to install the active equipment that connects to the University's data network. If Access control and BMS are required before building handover, the following items need to be completed.
  - The building distributor (hub room) needs to be in a completed state with all structured cabling and fibre links external to the building installed and tested. This must include the data cables to the Access and BMS controllers.

  - iSolutions staff must be able to get access to the hub room to install power on the active equipment and link it to the University's data network.
  - Once the active equipment has been installed and switched on there shall be no interruptions to the mains power supply feeding the rack.
  - iSolutions will notify the type and number of lock to be fitted to doors
  - The hub room shall be in a clean sterile state with all works completed.
- To determine the number and location of DDA refuge call phones throughout the building.
- To determine the number and location of public emergency and lift phones throughout the building.

9.2.4 iSolutions

- iSolutions will issue all IT specifications.
  - iSolutions will approve the design, the cable and components for the structured cabling system that has been proposed.
  - iSolutions will review and comment on the high and low level designs issued by the main contractor and approve if compliant with the issued university specifications.

10 Documentation

Documentation requirements from the University.

- NA Mandate
- NA Design Principles
- NA Fibre Highfield Concept Plan
- NA Core Architecture Concept Plan
- NA Edge Switches_and_fibre.xlsx
- Agreed Labelling Scheme
- University of Southampton Specification (15.0).docx
- Additional requirements: B48, Physics
- Caplum Import spreadsheet
- Risk Assessment for omission of and RCD in ICT cabinets

10.1 As Built Documentation

Three sets of hand over documentation shall be submitted 2 weeks after practical completion has been granted by the university. The documents shall be in hardcopy and electronic format and include:

10.1.1 Documentation from Data contractor

- Prior to construction:
  - Design submission
- As constructed drawings of the internal and external installations:
  - Cabinet layouts to include all fibre and copper patch panels along with labelling of patch panels and ports
  - Building floor plans in AutoCAD to show all TO positions with port numbers, containment routes and sizes, telecom rooms, cabinet locations, building entry points, internal Building backbone routes between MER and SER etc
  - Site plans in AutoCAD to show external Campus backbone cable routes between DERs, and spurs to MERs etc
- Data formatted ready for load into Caplum (a template can be provided) showing relationship and connectivity of:
  - Cables, Pits, Buildings, BEPs, DAs
  - TDUs, Gas Seals
  - Racks, Panels, U positions
  - Tubes, Fibre bundles, Panels, ports
  - Labels applied to all components
- Fibre Optic test results – OTDR and power meter at both wavelengths
- Copper test results – CSV format for all installed permanent links
- Fibre and copper test results are presented before go live and after telecom room sign off/handover to allow go live to take place with a go live change.
- Inventory of components used including tubes, fibre, joints, labelling and terminations
- Health and Safety file
- Patching records for all fibre and copper patch leads
  - Service type, PoE, 10 Base T etc
  - Outlet number
  - Distribution and terminal patch panel number
  - Distribution and terminal patch panel port number
  - Switch and port number
  - Room number

    - Room location
- Spare capacity statement (including stubs or other elements put in place for later expansion)
- Thresholds
    - % Use of fibre bundles.
    - % Use of tubes
    - % Use of internal tray capacity
    - % Use of external duct capacity / BEP

10.1.2 Documentation from fibre Contractor

- Fibre Optic inspection results
- Warranty

10.1.3 Documentation from Civil or Buildings contractor

- Duct construction design
- Site duct routes marked onto Estates AutoCAD plans
- Building Entry Point construction

10.2 Electronic Recording

Main contractor/IT integrator to record in to Caplum, sample 10 checked by client, any failures will require 100% audit. (I-Auditor)

It is the responsibility of the University Client to representative or Project Manager to ensure funds are allocated for completing this mandatory work, following practical completion.

It is a requirement for CAD drawings displaying outlet positions to be used for documentation.

10.2.1 Major new installations by an externally Appointed Data Contractor

For all new installations, the Data Contractor must provide a documentation pack at a minimum conformant with the requirements of section 10. This will include the information that is needed to populate the management toolset. The data shall be loaded into Caplum by the Contractor and presented to iSolutions before project completion.

The data entered into Caplum shall be audited by the University approved contractor below:

The contact details for Ethicus Consultancy Ltd are:

- Karl Tryner
- Email: karl.tryner@gmail.com
- Tel: 01242 620906
- Mob: 07768 325759

- Joseph Tryner
- Email: josephtryner@gmail.com
- Tel: 01242 620906
- Mob: 07972454576

Where information is found to be missing, incomplete, or subject to discrepancy, an audit will need to be carried out before the data can be successfully loaded into the management toolset.

The University approved contractor named above shall be used for this audit and recording exercise.

It is the responsibility of the University Client representative or Project Manager to ensure funds are allocated for completing this mandatory work, following practical completion.

11 Standards

11.1 Standards

All stated standards shall be adhered to, but not limited to, where applicable. In the case of conflict between standards the most onerous standard shall be adhered to for the individual section under discussion.

All stated standards shall be adhered to, but not limited to, where applicable. In the case of conflict between standards the most onerous standard shall be adhered to for the individual section under discussion.

11.1.1 British Standards Institute

- BS 6701:2016:+A1:2017 Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance
- ***BS 7671:2018*** Requirements for Electrical Installations. IET Wiring Regulations
- BS 5328: Part 1:1997 Guide to specifying concrete including AMD 7174, July 1992
- BS 5328: Part 2:1997 Methods for specifying concrete mixes including AMD 7174, July 1992
- BS 6031 Code of Practice for Earth Works.
- BS EN 50626-1. Conduit systems buried underground for the protection and management of insulated electrical cables or communication cables. Part 1. General requirements.

11.1.2 Cenelec

- BS ***EN 50173-1:2018*** Information technology. Generic cabling systems. General requirements
- BS ***EN 50173-2:2018*** Information technology. Generic cabling systems. Office premises
- BS ***EN 50173-3: 2018*** Information technology. Generic cabling systems. Industrial premises
- BS ***EN 50173-5: 2018*** Information technology. Generic cabling systems. Data centres
- BS ***EN 50173-6:2018*** Information technology. Generic cabling systems. Distributed building services
- BS ***EN 50174-1: 2018*** Information technology. Cabling installation. Installation specification and quality assurance. ***It is recommended to follow the requirements of Remote Powering class 3***
- BS ***EN 50174-2: 2018*** Information technology. Cabling installation. Installation planning and practices inside build. ***It is recommended to follow the requirements of Remote Powering class 3***
- BS EN 50174-3:2013 Information technology. Cabling installation. Installation planning and practices outside buildings

- BS EN 50346:2002+A2:2009 Information technology. Cabling installation. Testing of installed cabling

- BS ***EN 50310:2016+A1:2020 Telecommunications bonding networks for buildings and other structures***

- BS EN 61537:2007 Cable management. Cable tray systems and cable ladder systems

Additional standards:

- ***ISO/IEC TR 24704:2004 Customer premises cabling for wireless access points***

Refer to the following standards for guidance on designing and deploying PoE networks (it is recommended to plan for RP3 or 100W on all cables):

- ISO/IEC TS 29125 Information Technology— Telecommunications Cabling Requirements For Remote Powering Of Terminal Equipment
- CENELEC CLC/TR 50174-99-1 Information technology—Cabling installation—Part 99-1: Remote powering
- ISO/IEC 14763-2:2019 Information technology — Implementation and operation of customer premises cabling — Part 2: Planning and installation

Additional standards for reference:

- TIA-4966:2022 Telecommunications Infrastructure Standard for Educational Facilities. The standard recommends Category 6A for new education facilities based on the need for high-performance infrastructure required for wired and wireless connectivity
- TIA TSB 184-A Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
- NEC NFPA 70 Code E TIA 569-2 Additional pathway and space considerations for supporting remote powering over balanced twisted-pair cabling

11.1.3 IEC

EN IEC 61076-3-122:2021 connectors for electrical and electronic equipment - Product requirements - Part 3-122: Detail specification for 8-way, shielded, free and fixed connectors for I/O and data transmission with frequencies up to 500 MHz and current-carrying capacity in industrial environments

IEC 61156-5:2020 Multicore and symmetrical pair/quad cables for digital communications - Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz - Horizontal floor wiring - Sectional specification

IEC 61935-1-2:2018 Specification for the testing of balanced and coaxial information technology cabling - Part 1-2: Installed balanced cabling as specified in ISO/IEC 11801 - Additional requirements for measurement of resistance unbalance with field test instrumentation

IEC 61280-4-1:2019+AMD1:2021 Fibre-optic communication subsystem test procedures – Part 4-1: Installed cabling plant – Multimode attenuation measurement

IEC 61280-4-2:2014 Fibre-optic communication subsystem test procedures - Part 4-2: Installed cable plant - Single-mode attenuation

IEC 61280-4-5 Ed1: Installed Cable Plant – Attenuation measurement of MPO terminated fibre optic cabling plant

Additional details for fibre testing

Field Testing Guidelines for Fiber-Optic Cabling Systems – CommScope document available.

11.1.4 Miscellaneous

- British Telecommunications PLC Specification LN 550 (Issue 9)
- COSHH Regulations 2015.
- DISC PD 1001 A Guide to Electromagnetic Compatibility & Structured Cabling.
- HAUC Code of Practice for reinstatement in the public Highways
- Health & Safety "Avoiding Danger from Underground Services HS (G) 47
- Highways act 1980
- Local Authority Regulations 2015
- NJUG 04 Identification of small underground services.
- NJUG 07 Positioning of utilities mains and plant for new works.
- NJUG 10 Guidelines for the planning, Installation and Call Out of Utilities Services in the proximity of trees.
- RIDDOR: Reporting of injuries, Diseases and Dangerous Occurrences Regulations 2013.
- Safety at Street Works and Road Works - A code of practice.
- CLP Regulation
- EPA 1990
- EAW 1989
- Health and Safety at Work etc. Acts 1974 (HSAW) including but not limited to:
    - Management of Health and Safety at Work Regulations 1999
    - Workplace (Health, Safety and Welfare) Regulations 1992
    - Provision and Use of Work Equipment Regulations 1998
    - Personal Protective Equipment at Work Regulations 1992
    - Manual Handling Operations Regulations 1992
    - Construction (Design and Management) Regulations 2015
    - CPR Construction Products regulations

12 Component Specification

The specification for the major elements comprising the structured cabling solution shall be defined below. Products shall be fully compliant to all requested standards for all parameters.

1.1 Copper Cat 6a

- CommScope – Cat 6a FFTP Cca - 884035958/16
- CommScope - Cat 6A jack shielded - 2153449-2
- CommScope - Single shuttered angled 25x50mm module – 65401802-00
- CommScope - Faceplate Double BS 50mm unpopulated – 1711399-1
- CommScope - Faceplate Quad BS 50mm unpopulated – 1711400-1
- CommScope - Shielded CAT 6/6A 24 Port Patch Panel – 760237046
- CommScope – 48 port loaded quick fit patch panel - 760237066
- CommScope – For PP Above – Saddle & Velcro Strap Kit – 760229179
- TrueNet® RJ45 Cat 6a UTP and shielded MiniPod
    - MiniPod, 6 way unpopulated (to be used for Cat 6a shielded) - 2153217-6
    - MiniPod, 4 way unpopulated (to be used for Cat 6a shielded) - 2153217-4
    - MiniPod, 3 way unpopulated (to be used for Cat 6a shielded) - 2153216-3
- CommScope – Cat 6a MiMo Patch Leads
    - Cat 6a patch cord 0.5m S/FTP LSOH – CO1MMN2-08M050
    - Cat 6a patch cord 1m S/FTP LSOH - CO1MMN2-08M001
    - Cat 6a patch cord 2m S/FTP LSOH - CO1MMN2-08M002
    - Cat 6a patch cord 3m S/FTP LSOH - CO1MMN2-08M003
    - Cat 6a patch cord 5m S/FTP LSOH - CO1MMN2-08M005

1.2 Fibre

- CommScope – FOMM50 LEAD OM4 1.8MZ LC - LC D 3M - 2160046-3
- CommScope – FOMM50 PIGTAIL OM4 0.9S LC 2M - 2160042-2
- CommScope – FOSM PIGTAIL 0.9S YL LC/PC TUNED 1M - 6536880-1
- CommScope - 1U PANEL 24LC DUPL MM - 4-1671000-8
- CommScope - 1U PANEL 24LC DUPL SM - 4-1671000-4

- CommScope - EPX-1U-MOD-ENC – 760249998
- CommScope - 360DPis-12LC-LS – 760230938
- CommScope - 360DPis-12LC-SM – 760230946
- CommScope - 360DPis-12LC-SM – 760230946
- CommScope - 360G2 MOD Panel Blank – 760109462

1.3 Blown Fibre

- NetCeed – 12f OS2 2KM pan - 891509
- NetCeed – 12f OS2 4KM pan - 890754
- NetCeed – 8f OS2 2KM pan - 834367
- NetCeed - 4-way external duct grade tube - 826308
- NetCeed - 7-way external duct grade tube - 826309
- NetCeed - 12-way external duct grade tube – 7823067
- NetCeed - 2-way internal LSZH tube – 826311
- NetCeed - 4-way internal LSZH tube – 826310
- NetCeed – 7-way internal LSZH tube – 826312
- NetCeed – 12-way internal LSZH tube - 826313
- NetCeed - Prysmian external tube distribution closure - 819442
- NetCeed - in-line rubber seals (use with 819442) - 809798
- NetCeed - End of line filler (use with 819442) - 890432
- NetCeed - internal tube distribution unit – 827981
- NetCeed - Gas seal unit - 826582
- NetCeed - external ‘T’ piece - 829162
- NetCeed - 5mm connector - 835631
- NetCeed - gas seal connector 5mm - 835054
- NetCeed - Tube sealing end cap 5mm - 828001
- NetCeed – water blocking connector 5mm - 826812
- NetCeed – end cap - 828333
- NetCeed - blown fibre manifold - 822179
- NetCeed - close down assembly - 778810

1.4 Powered Fibre

- Powered Fibre Cable

- PFC, single mode, 2F, I/O, 12AWG, CCA – PFC-S02L12
- PFC, single mode, 4F, I/O, 12AWG, CCA – PFC-S04L12
- PFC, single mode, 2F, I/O, 12AWG, CCA – PFC-302L12
- PFC, single mode, 4F, I/O, 12AWG, CCA – PFC-304L12

- Power Supplies
  - Power express distribution shelf with alarm module – PFP-PX-S1
  - Power express distribution module supports max. 8 devices – PFP-PX-8M
  - Power express blank slot panel – PFP-PX-SF
  - SPS rectifier power distribution shelf – PFP-SPS-S1
  - 1600W SPS power rectifier module – PFP-SPS-1600M
  - SPS rectifier controller display – PFP-SPS-C1
  - SPS rectifier blank slot panel – PFP-SPS-SF
- Power over Ethernet Extenders
  - PoE extender with Aruba bracket – PFU-P-A-O-030-01
  - PoE extender with wall/pole mounting bracket – PFU-P-B-O-030-01
  - 2 port PoE extender – PFU-P-C-O-060-02
  - 60W single port PoE extender – PFU-P-C-O-060-01
- Power Extenders
  - Power extender with 48VDC output – PFU-48-C-O-060-01
  - Power extender with 12VDC output – PFU-12-C-O-060-01

Appendix A Fibre Inspection and Cleaning

A.1 Warnings

- Turn off lasers sources prior to inspection and cleaning
- Ensure that the patch lead or link is disconnected at both ends
- Wear appropriate fibre safety glasses that are matched to the laser source
- Never use alcohol around spark sources or open flames
- Never look into a fibre connector/plug while the system lasers are on
- Never clean a fibre connector/plug without a means of inspection
- Never use unfiltered inspection magnifiers
- Never touch the face of fibre connectors and plugs
- Never reuse the same section on a cleaning cassette or a cleaning tissue
- Never touch the cleaning surface of a tissue or cassette
- Never touch the dispensing bowl of an alcohol bottle

A.2 Inspection

1. Ensure that all lasers sources are turned off
2. Ensure that the link or patch lead is disconnected at both ends
3. Remove the protective cap and store in a clean resealable container
4. Ensure that the magnifier has the same connector type as the patch lead or link to be inspected
5. Insert the fibre plug into the magnifier and adjust the focus to provide a clear image of the fibre face
6. Check for contaminants and scratches to the requirements of IEC 61300-3-35. Section A6 shows some typical examples of contaminations.
7. If required clean the plug as detailed in section A3 below and repeat steps 1 to 7 as many times as required to remove contaminants
8. Immediately replace the end cap or plug into the equipment

A.3 Dry Cleaning With Cartridge or Card Based Products

1. Ensure that all lasers sources are turned off

2. Ensure that the link or patch lead is disconnected at both ends
3. Remove the protective cap and store in a clean resealable container
4. Select the type of dry cleaning device to be used i.e. automatic cartridge, manual cartridge, card/pocket cleaners
5. Ensure that the cleaning device has an unused surface showing
6. Hold the fibre face gently against the cleaning surface. For singe none APC plugs rotate the plug by 90^0. For multiple core plugs do not rotate. For APC plugs hold face at same angle as the cleaning surface
7. Slide the plug along the face of the cleaning area in the same direction as the arrow
8. For cartridge based cleaners ensure that the used surface is moved along
9. Repeat section A2 Inspection and if required steps 1 to 8 as many times as necessary

A.4 Dry Cleaning With Lint Free Wipes

1. Ensure that all lasers sources are turned off
2. Ensure that the link or patch lead is disconnected at both ends
3. Remove the protective cap and store in a clean resealable container
4. Select an unused lint free wipe
5. Fold the wipe into a square of 4 to 8 layers thick
6. Ensure that the face of the wipe is not touched
7. Whilst holding the wipe gently swipe the plug onto the wipe in a figure of 8 motion
8. It is important to not press hard when swiping the wipe or scratches will occur
9. Expose another unused layer of the folded wipe and repeat steps 6 to 8
10. Dispose of the wipe
11. Repeat section A2 Inspection and if required steps 1 to 10 as many times as necessary

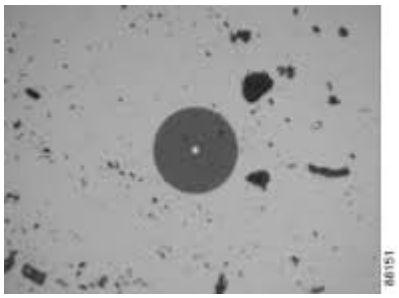
A.5 Wet Cleaning With Lint Free Wipes

1. If wet cleaning does not remove the contamination wet cleaning may be undertaken. Wet cleaning shall never be done prior to attempting to remove contamination by dry cleaning
2. Ensure that all lasers sources are turned off
3. Ensure that the link or patch lead is disconnected at both ends
4. Remove the protective cap and store in a clean reseal able container

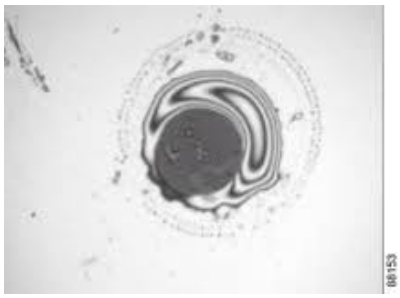
5. Select an unused lint free wipe
6. Fold the wipe into a square of 4 to 8 layers thick
7. Ensure that the face of the wipe is not touched
8. Moisten one section of the wipe with 99% Isopropanol Alcohol ensuring that there is still a dry section available
9. Whilst holding the wipe gently swipe the plug onto the **WET** section of the wipe in a figure of 8 motion
10. Immediately after gently swipe the plug onto the **DRY** section of the wipe in a figure of 8 motion
11. It is important to not press hard when swiping the wipe or scratches will occur
12. Dispose of the wipe
13. Repeat section A2 Inspection and if required steps 1 to 12 as many times as necessary

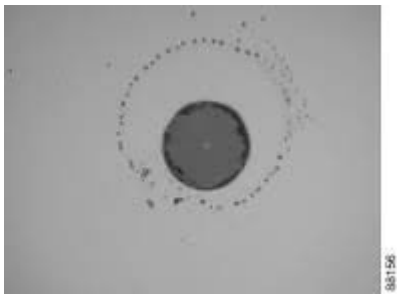
A.6 Contamination Examples

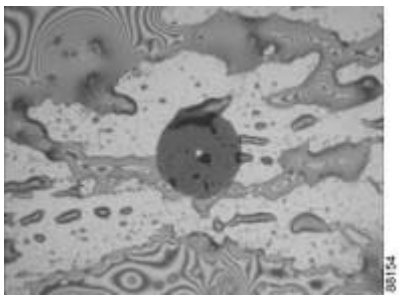
1. Dust contamination



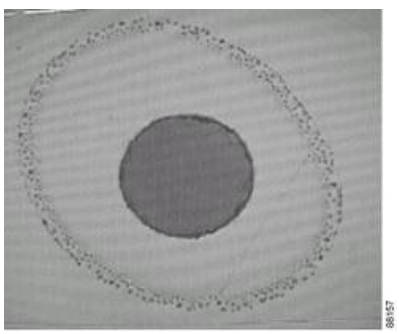
2. Liquid contamination



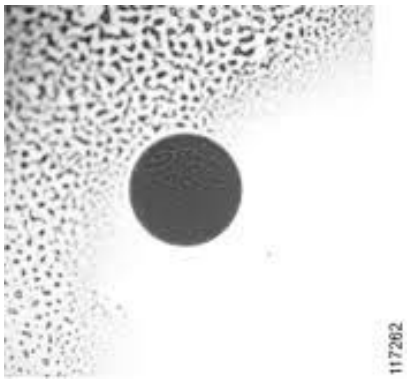




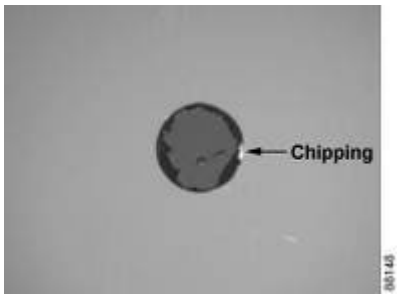
3. Dried residue



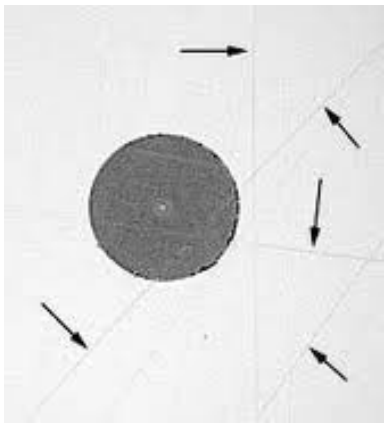
4. Alcohol residue



5. Chipped



6. Scratched



Appendix B Patching for Copper and Fibre

B.1 Copper Patch Panel Patching in Single Cabinets

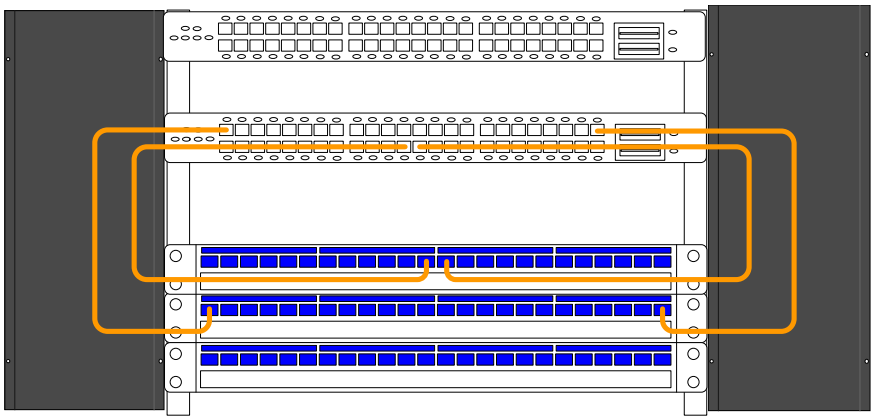
1. The length of the patching route SHALL be measured, and a correct sized patch lead selected

2. The correct grade and type of patch lead SHALL be selected i.e. if the permanent link is category 6a F/FTP a category 6a F/FTP patch lead SHALL be used

3. Patch panel ports on the left-hand side (50% of total ports on the panel) SHALL be patched to the left-hand side of the patch panel

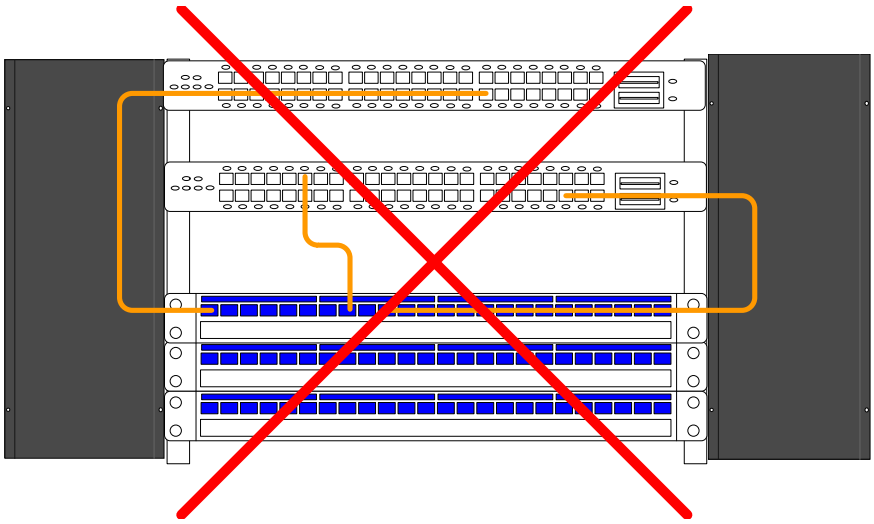
4. Patch panel ports on the right-hand side (50% of total ports on the panel) SHALL be patched to the right-hand side of the patch panel

5. The vertical cable management at the ends of the patch panels SHALL be used to contain the patch leads vertically



6. Vertical cable management SHALL be used. It is not acceptable to patch directly in front of the panels or to patch ports on the right-hand side of the panel to the left-hand side, and vice versa or to patch into the wrong horizontal cable management panel

7. Vertical cable management SHALL not be used to take up slack cable. The patch lead SHALL be the correct length



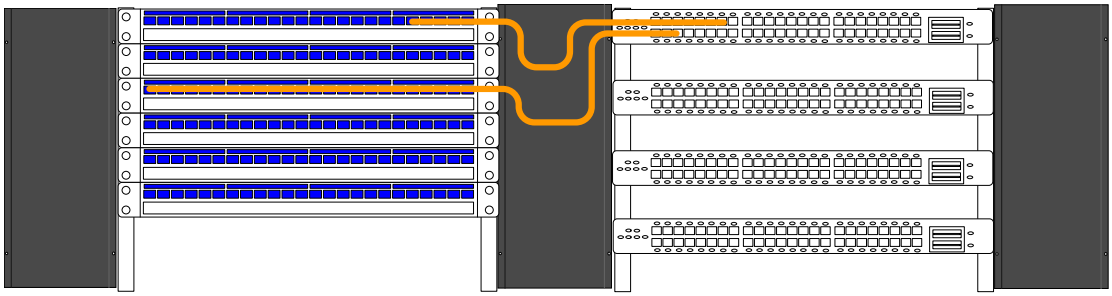
B.2 Copper Patch Panel Patching in Multiple Cabinets

1. The length of the patching route SHALL be measured, and a correct sized patch lead selected

2. The correct grade and type of patch lead SHALL be selected i.e. if the permanent link is category 6a F/FTP a category 6a F/FTP patch lead SHALL be used

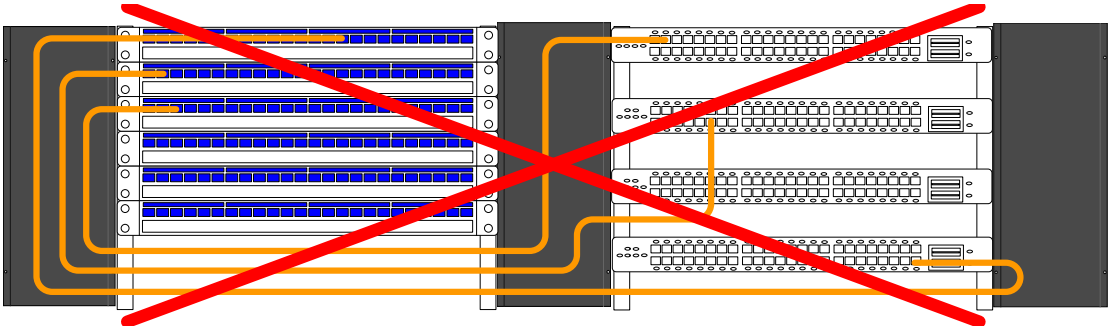
3. All patch panel ports SHALL be patched to the right-hand side of the patch panel

4. The vertical cable management between the patch panel cabinet and the network switch cabinet SHALL be used to contain the patch leads vertically



5. Vertical cable management SHALL be used. It is not acceptable to patch directly in front of vertical managers or to patch ports on the left-hand side vertical manager

6. Vertical cable management SHALL not be used to take up slack cable. The patch lead SHALL be the correct length



B.3 Fibre Split Patch Panel Patching

1. The length of the patching route SHALL be measured, and a correct sized patch lead selected

2. The correct grade of patch lead SHALL be selected i.e. if the link is OM3 an OM3 patch lead SHALL be used

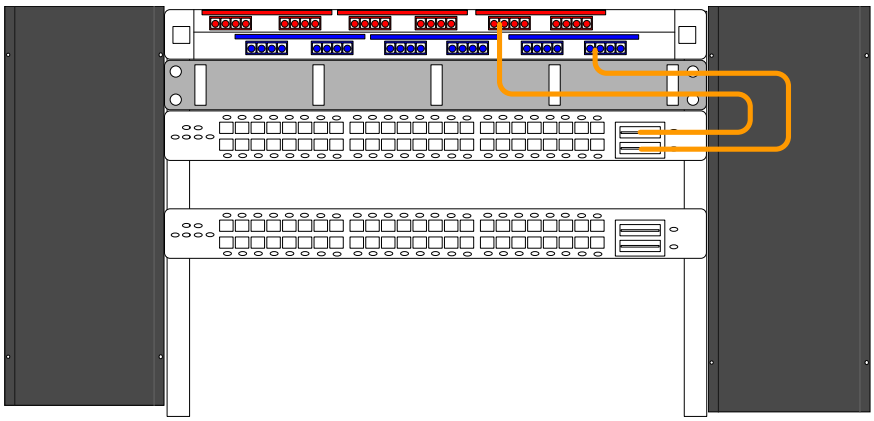
3. Patch panel ports in the top drawer of the split fibre patch panel SHALL be patched to the right-hand side of the patch panel

4. Patch panel ports in the bottom drawer of the split fibre patch panel SHALL be patched to the right-hand side of the patch panel

5. Patch panel ports in the top drawer of the split fibre patch panel SHALL be patched into the horizontal cable management panel below the split fibre patch panel

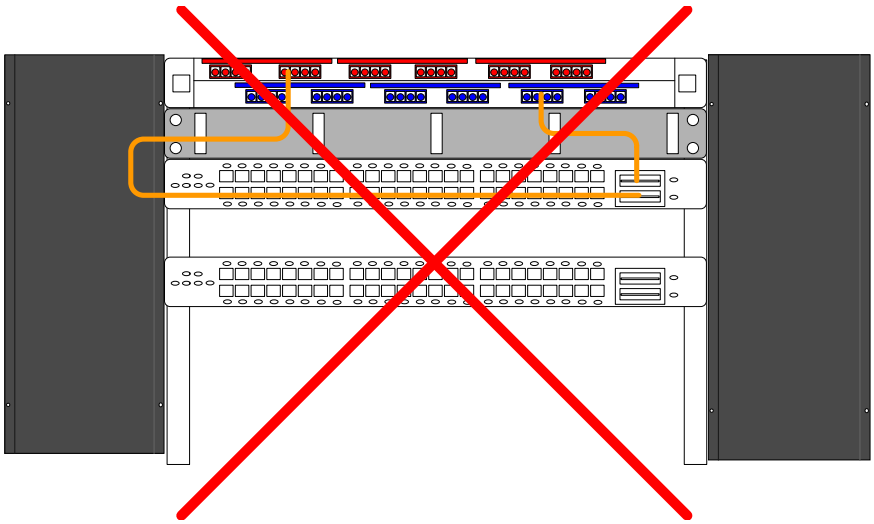
6. Patch panel ports in the bottom drawer of the split fibre patch panel SHALL be patched into the horizontal cable management panel below the split fibre patch panel

7. The right-hand side vertical cable management SHALL be used to contain the patch leads vertically



8. Horizontal and vertical cable management SHALL be used. It is not acceptable to patch directly in front of the panels or to patch ports on the left-hand side vertical cable manager

9. Horizontal and vertical cable management SHALL not be used to take up slack cable. The patch lead SHALL be the correct length



B.4 Fibre Patch Panel Patching

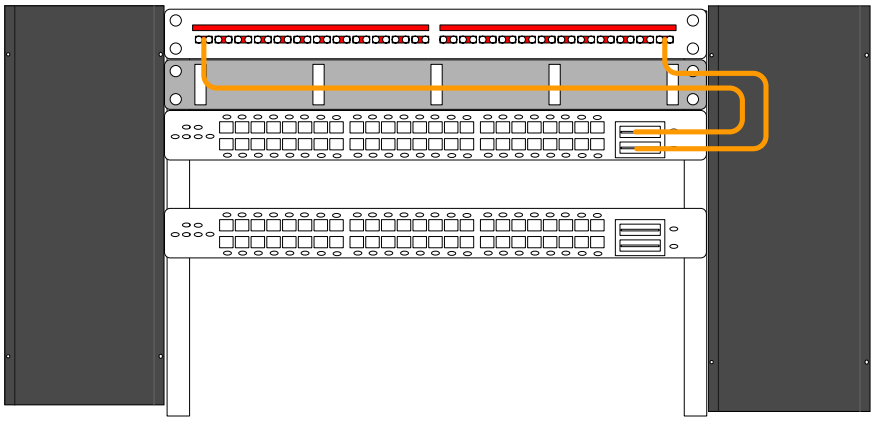
1. The length of the patching route SHALL be measured, and a correct sized patch lead selected

2. The correct grade of patch lead SHALL be selected i.e. if the link is OM3 an OM3 patch lead SHALL be used

3. All patch panel ports SHALL be patched to the right-hand side of the patch panel

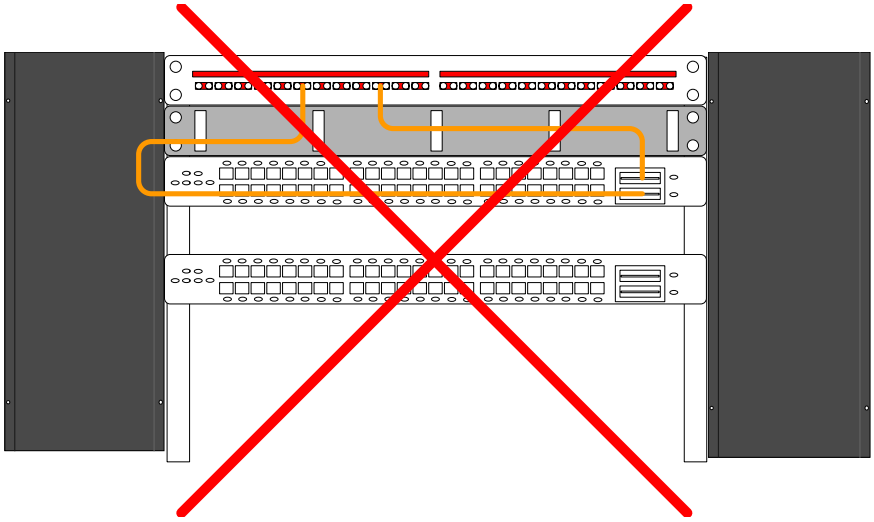
4. The horizontal cable management panel below the fibre patch panel shall be used for the management of the patch leads

5. The vertical cable management at the right-hand side SHALL be used to contain the patch leads vertically



6. Horizontal and vertical cable management SHALL be used. It is not acceptable to patch directly in front of the panels or to patch ports on the left-hand vertical cable manager

7. Horizontal and vertical cable management SHALL not be used to take up slack cable. The patch lead SHALL be the correct length



B.5 Mains Lead Patching

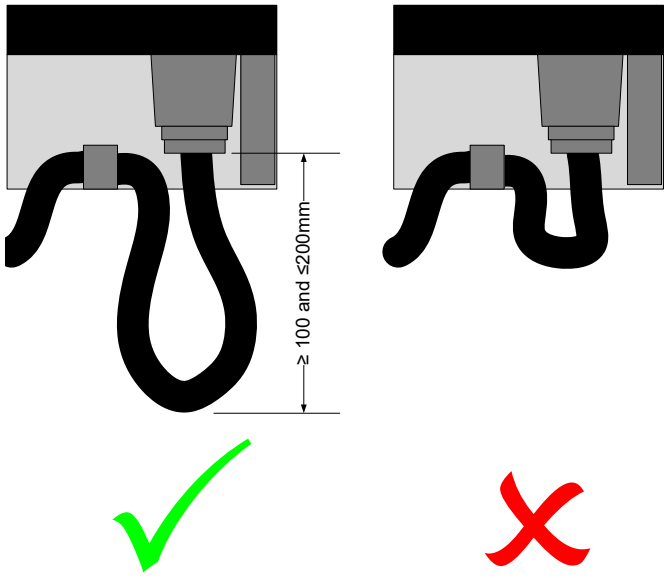
1. The main lead is patched from the PDUs to the switches

2. The mains leads from each PDU must be Velcro strapped together in no more than 24 mains leads. It is not acceptable to use cable ties

3. The bundles of cables MUST be supported on vertical cable management arms at no more than every 6U

4. Additional horizontal bars MUST be installed at the rear of each switch position and the mains leads for that switch MUST be Velcro tied to the bar

5. Where the mains lead is secured to the power module it shall have a loop that extends from the back of the module $\geqslant$100m and $\leqslant$200mm



B.6 Patching Schedule

1. Below is an example of a patching schedule

UNIVERSITY OF Southampton

Patching and Port Activations List

Job/Ticket Number:

Building	Room number	Patch Panel Position	Faceplate Number	Switch/Stack Name	Switch Slot:Port	Patch Panel Position	Requirements or Comments
Examples							
B2	6019	05-24	AC/6019/5	B2ac-stack3	1:1	05-24	B2_iss
B85	2010	03-12	SC/01/05	B85sc-stack1	3:48	03-12	Wireless
SGH/Duthie	1001	01-05	EF/CCTV	sghef-fesw2	35	01-05	CCTV
Building	**Room number**	**Patch Panel Position**	**Faceplate Number**	**Switch/Stack Name**	**Switch Slot:Port**	**WAP Number**	**Requirements or Comments**
Comments: e.g. Any errors or lack of labelling in Hub Room?							

Appendix C Labelling for Patch Panels, Minipods, Outlets, Cables and Blown Fibre Ducting

C.1 Type of Label

- The labels shall be self-adhesive engraved type
- In the UK the label type shall be Traffolyte for internal DP boxes, fibre and copper patch panels, Minipods
- he label type shall be Bradey for internal cables
- The label type shall be Critchley for external cables
- The font shall be Arial or Helvetica bold
- All text shall be centred vertically on the label
- All text shall be centred horizontally on the port, panel, faceplate etc.

C.2 Label Colour – Horizontal Patch Panel Copper Ports

- Individual ports on the patch panel shall be colour coded as detailed below.

Type	Colour
Outlets	**BLACK ON WHITE**

- The patch panels individual label shall be colour coded as detailed below.

Product	Colour
Horizontal Patch Panel	**BLACK ON WHITE**

C.3 Label Colour – Patch Panel Fibre Ports

- Individual ports on the patch panel shall be colour coded as detailed below.

Type	Colour
Singlemode Campus	WHITE ON BLUE
Singlemode Building	BLUE ON WHITE
Multimode Campus	WHITE ON BLACK
Multimode Building	WHITE ON RED

- The patch panels individual label shall be colour coded as detailed below.

Type	Colour
Patch Panel	BLACK ON WHITE

C.4 Labelling Scheme – Outlets

1. Each individual port

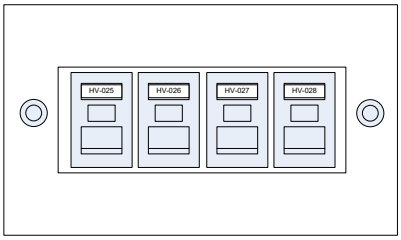
   AA - Telecom Room (AA to ZZ)

   BBB - Outlet number (001 to 999)

2. The below example for a quad outlet would be:

   Telecom Room - HV

   Ports - 025 to 028



C.5 Labelling Scheme – Minipod or Floor Box

1. Each individual port

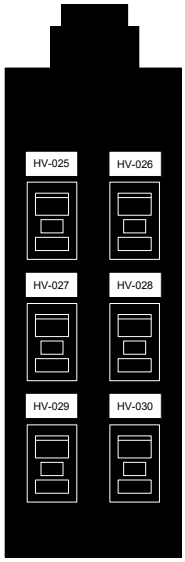
   AA - Telecom Room (AA to ZZ)

   BBB - Outlet number (001 to 999)

NOTE – the ports shall be labelled left to right and top to bottom with the top being the cable entry point.

2. The below example for a 6 way Minipod would be:

Telecom Room	-	HV
Ports	-	025 to 030



C.6 Labelling Scheme – Horizontal Patch Panel

1. A patch panel label

AA	-	Telecom Room (AA to ZZ)
BB	-	Patch Panel Number (01 to 99)
CC	-	Floor (01 to 99)

2. Minipod, floor box or transition point

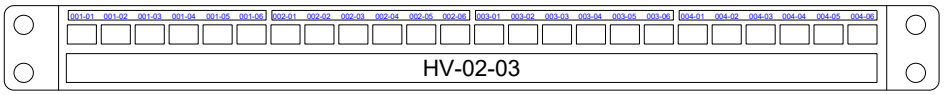
AAA	-	Minipod or Floor Box Number (001 to 999)
BB	-	Outlet number (01 to 99)

3. Single and double gang outlets.

AAA	-	Outlet number (001 to 999)

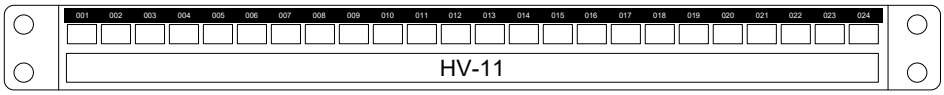
Example 1 The below example for horizontal patch panel number 02 located in telecom room HV supplying the first four off 6 port Minipods located on the 3rd floor would be:

Telecom Room	-	HV
Patch Panel	-	02
Floor	-	03
Minipod number	-	001 to 004
Ports	-	001 to 006 (on Minipods 01 to 04)



Example 2 The below example for horizontal patch panel number 11 located in telecom room HV supplying the first 24 off outlets located on the 5th floor would be:

Telecom Room	-	HV
Patch Panel	-	11
Ports	-	001 to 024



C.7 Labelling Scheme – Backbone Fibre

1. A patch panel label for each individual fibre cable

A	-	Alpha character ‘B’ to signify a building
BBB	-	Source building number (001 to 999)
CC	-	Source hub room (AA to ZZ)
F	-	Alpha character ‘F’ to signify a patch panel
GG	-	Source patch panel number (01 to 99)
HH	-	Source start fibre port number (01 to 99)
II	-	Source end fibre port number (01 to 99)
J	-	Alpha character ‘B’ to signify a building
KKK	-	Destination building number (001 to 999)
LL	-	Destination hub room (AA to ZZ)
M	-	Alpha character ‘F’ to signify a patch panel
NN	-	Destination patch panel number (01 to 99)
OO	-	Destination start fibre port number (01 to 99)
PP	-	Destination end fibre port number (01 to 99)

2. Each individual port

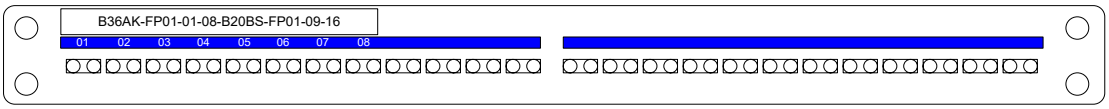
AA	-	Outlet number (01 to 99)

The below example for a fibre singlemode campus backbone patch panel would be:

Building	-	B36
Telecom Room	-	AK
Patch Panel	-	01
Start port	-	01
End port	-	08

Are connected to:

Building	-	B20
Telecom Room	-	BS
Patch Panel	-	01
Start port	-	09
End port	-	16



The above example shown details a patch panel that has one off 16 core (8 duplex channel).

C.8 Labelling Scheme – Fibre Patch Panel

1. A fibre patch panel label with white on black

AA	-	Alpha characters 'FP' to signify a Fibre Panel
BB	-	Patch panel number (01 to 99)

The below example for a fibre patch panel would be:

Fibre panel	-	FP
Fibre panel number	-	01

FP01

C.9 Labelling Scheme – Cabinet

1. Two off cabinet labels, one on the front of the cabinet and one on the rear. Colour shall be White on Red

AA	-	Telecom Room Floor (Basement – B, First – 01, etc)
BB	-	Telecom Room (01 to 99)
CDD	-	Row (A to Z) and Cabinet (01 to 99)
E	-	Front or Rear of Cabinet (F or R)

The below example for a cabinet would be:

Hubroom code	-	01
Cabinet numberr	-	01

C.10 Labelling Scheme – Commando Socket

1. A commando socket label with White on Red

AA	-	Telecom Room Floor (Basement – B, First – 01, etc)
BB	-	Telecom Room (01 to 99)
CDD	-	Row (A to Z) and Cabinet (01 to 99)
CS	-	'Command Socket'
E	-	Command Socket Identifier (A or B)

The below example for a commando socket would be:

Telecom room floor	-	01
Telecom room	-	HZ
Row	-	A
Cabinet	-	03
Command socket	-	CS
Command socket identifier	-	A

C.11 Labelling Scheme – PDU

2. A PDU label with White on Red

AA	-	Telecom Room Floor (Basement – B, First – 01, etc)
BB	-	Telecom Room (01 to 99)
CDD	-	Row (A to Z) and Cabinet (01 to 99)
PDU	-	'PDU'
E	-	PDU Identifier (A or B)

The below example for a PDU would be:

Telecom room floor	-	01
Telecom room	-	HZ
Row	-	A
Cabinet	-	03
PDU	-	PDU
PDU identifier	-	A

01-HZ-A03-PDUA

C.12 Labelling Scheme – Horizontal Cable

1. Brady wrap around label at both ends of the horizontal cable. The labelling scheme shall follow the same scheme as Minipods, floor boxes and outlets.

C.13 Labelling Scheme – Copper Patch Leads

1. Brady wrap around label at both ends of the patch lead.

AA	-	Patch Panel Number (01 to 99)
BB	-	Port Number (01 to 99)

C.14 Labelling Scheme – Backbone Fibre Cable

1. A cable label for each individual fibre cable at both ends and each riser floor

A	-	Alpha character ‘B’ to signify a building
BBB	-	Source building number (001 to 999)
CC	-	Source hub room (AA to ZZ)
F	-	Alpha character ‘F’ to signify a patch panel
GG	-	Source patch panel number (01 to 99)
HH	-	Source start fibre port number (01 to 99)
II	-	Source end fibre port number (01 to 99)
J	-	Alpha character ‘B’ to signify a building
KKK	-	Destination building number (001 to 999)
LL	-	Destination hub room (AA to ZZ)

M	-	Alpha character 'F' to signify a patch panel
NN	-	Destination patch panel number (01 to 99)
OO	-	Destination start fibre port number (01 to 99)
PP	-	Destination end fibre port number (01 to 99)

The below example for a fibre singlemode campus backbone patch panel would be:

Building	-	B36
Telecom Room	-	AK
Patch Panel	-	01
Start port	-	01
End port	-	08

Are connected to:

Building	-	B20
Telecom Room	-	BS
Patch Panel	-	01
Start port	-	09
End port	-	16

B36AK-FP01-01-08-B20BS-FP01-09-16

C.15 Labelling Scheme – Fibre Patch Leads

1. Brady wrap around label at the patch panel end of the fibre patch lead.

AA	-	Cabinet U Number (01 to 99)
B	-	Switch Stack (1 to 9)
C	-	Switch Number (1 to 9)
DD	-	Port Number (01 to 99)

2. Brady wrap around label at the switch end of the fibre patch lead.

AA	-	Cabinet U Number (01 to 99)
BB	-	Patch Panel Number (01 to 99)
CC	-	Port Number (01 to 99)

C.16 Labelling Scheme – Mains Leads

1. Brady wrap around label at both ends of the mains lead.

AA	-	Cabinet U Number (01 to 99)
B	-	Switch Stack (1 to 9)

C	-	Switch Number (1 to 9)
D	-	Feed Number

C.17 Labelling Scheme – Earth Cables for Cabinets

1. Two off earth cable labels, one at each end of the cable. Colour shall be black on yellow

AA	-	Telecom Room Floor (Basement – B, First – 01, etc)
BB	-	Telecom Room (AA to ZZ)
CDD	-	Row (A to Z) and Cabinet (01 to 99)

The below example for a cabinet earth bonding cable would be:

Hubroom code - 01

Cabinet number - 01

C.18 Labelling Scheme – Earth Cables for Suspended Floor

1. Two off earth cable labels, one at each end of the cable. Colour shall be black on yellow

AA	-	Telecom Room Floor (Basement – B, First – 01, etc)
BB	-	Telecom Room (AA to ZZ)
Floor	-	'Floor'

The below example for a suspended floor earth bonding cable would be:

Telecom room floor - 01

Telecom Room - HZ

Floor - Floor

C.19 Labelling Scheme – EVC Telco Cable

1. Two off EVC cable labels, one at each end of the cable. Colour shall be Critchley black on white

A	-	Alpha character ‘B’ to signify source building
BBB	-	Source building number (001 to 999)
C	-	Alpha character ‘B’ to signify destination building
DDD	-	Destination building number (001 to 999)
EVC	-	‘EVC’

The below example for an EVC cable from B057 to B100 would be:

Source Building	-	B057
Destination Building	-	B100
EVC	-	EVC

B057-B100-EVC

C.20 Labelling Scheme – FireTuf Cables

1. Two off FireTuf cable labels, one at each end of the cable. Colour shall be black on white

AAA	-	Outlet number (001 to 999)

The below example for a FireTuf cable would be:

Outlet 454	-	454

454

C.21 Labelling Scheme – EVC Distribution Frame, Rack or Wall Box

1. One off EVC DP labels. Colour shall be engraved traffolyte black on white

A	-	Alpha character ‘B’ to signify source building
BBB	-	Source building number (001 to 999)
C	-	Alpha character ‘B’ to signify destination building

DDD	-	Destination building number (001 to 999)
EVC	-	'EVC'

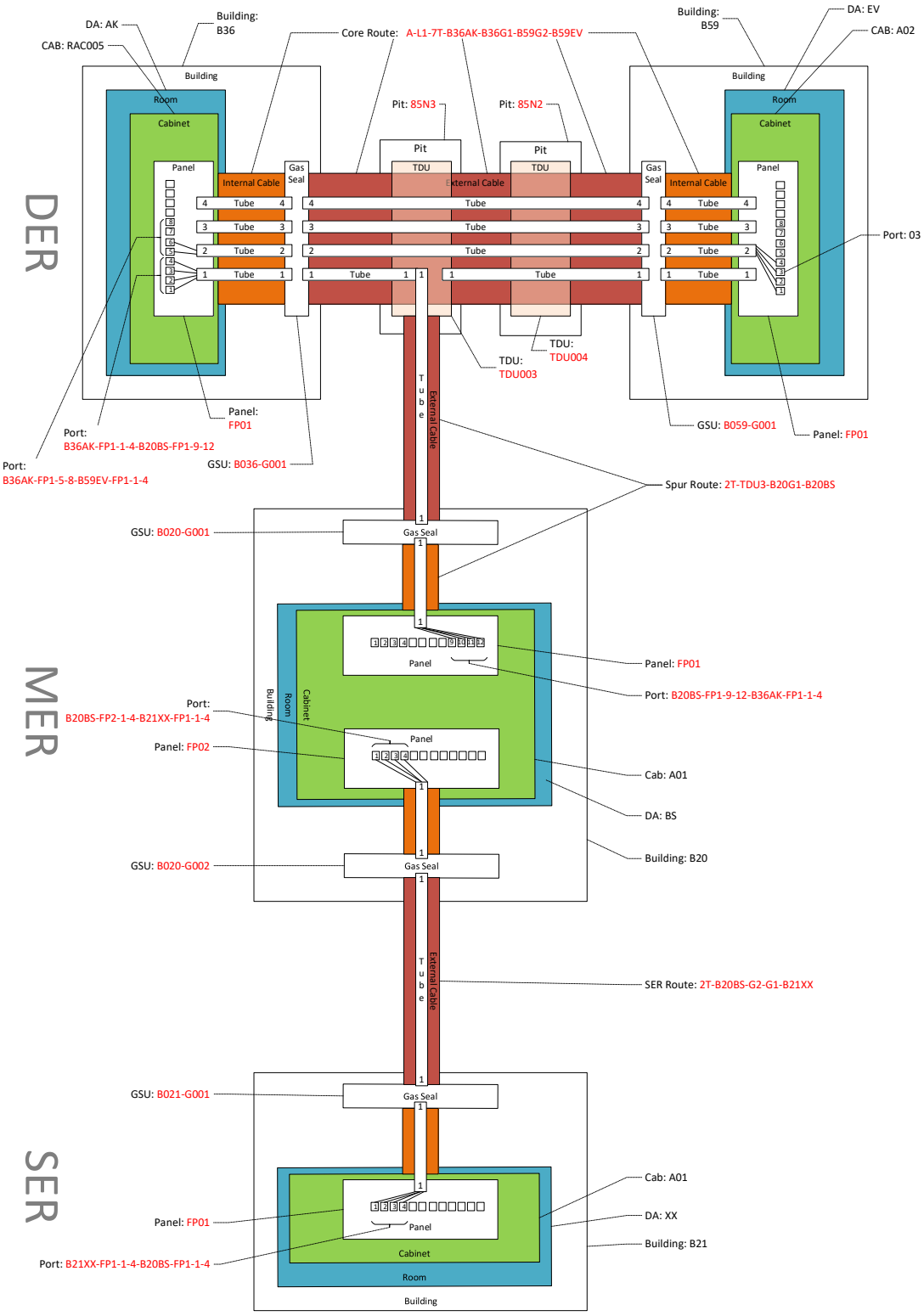
The below example for an EVC DP from B057 to B100 would be:

Source Building	-	B057
Destination Building	-	B100
EVC	-	EVC

B057-B100-EVC

C.22 Labelling Scheme – Blown Fibre Overview

The diagram below shows an end to end solution diagram of blown fibre tubing and details the different labelling components required.



The below table details the component identifier summary.

Identifier	Assigned by	Uniqueness	Identifier Example

Organisation	UoS		UoS
Site	iSolutions	Organisation	HFC
Pit	Estates	Organisation	85N6
Gas Seal	Integrator	Building	G1
TDU	Integrator	Organisation	TDU001
Building	Plannon	Organisation	B36
Building Entry Point	Integrator	Building	BEP1
Room	Plannon	Building	2059
DA	iSolutions	Organisation	AK
Cabinet	iSolutions	DA	RAC005
Panel	Integrator	DA	FP1
Port	-	Panel	B36AK-FP1-1-4-B20BS-FP1-9-12
Route	Integrator	Site	A
Leg	Integrator	Route	1
Core Route	Integrator	Organisation	A-L1-7T-B36AK-B36G1-B59G2-B59EV
Spur Route	Integrator	Organisation	2T-TDU3-B20G1-B20BS
MER to SER Route	Integrator	Organisation	2T-B44CB-B44AI
Tube	-	Cable Segment	*<core or spur route label>*-2
Core	-	Cable Segment	*<colour coded>*
Segment	caplum	Caplum	n/a - internal Caplum construct

C.14a Labelling Scheme – Blown Fibre Gas Seal

A label on every Gas Seal in each building. Label numbers are unique per building.

1. Traffolyte engraved label on each Gas Seal with White on Red.

A	-	Alpha character 'B' to signify a building
BBB	-	Building number (001 to 999)
C	-	Alpha character 'G' to signify a Gas Seal Unit
DDD	-	Gas Seal number (001 to 999)

The below example for a Gas Seal Unit would be:

Building	-	B
Building Number	-	036
Gas Seal	-	G
Gas Seal Number	-	001

B036-G001

C.14b Labelling Scheme – Blown Fibre TDU

A label on every TDU. Label numbers are unique per site.

Engraved label on each TDU with Black on White.

AAA	-	Alpha characters 'TDU' to signify a TDU
BBB	-	TDU number (001 to 999)

The below example for a TDU would be:

TDU	-	TDU
TDU Number	-	075

TDU075

C.14c Labelling Scheme – Core Blown Fibre Duct Route

A label displayed at key points on each main fibre-optic cable route e.g. pits, building entry points, terminations etc.

1. Critchely label on each blown fibre tube unit.

A	-	Duct route that the cable takes between site cores (A to Z)
B	-	Alpha character 'L' to signify a Leg Number
C	-	Leg number (0 to 9)
DD	-	Number of tubes in the blown fibre unit (00 to 99)
E	-	Alpha character 'T' to signify a blown fibre Tube unit
F	-	Alpha character 'B' to signify a building
GGG	-	Source building number (001 to 999)

HH	-	Source hub room (AA to ZZ)
I	-	Alpha character ‘B’ to signify a building
JJJ	-	Source building number (001 to 999)
K	-	Alpha character ‘G’ to signify Gas Seal unit
LLL	-	Source gas seal number (000 to 999)
M	-	Alpha character ‘B’ to signify a building
NNN	-	Destination building number (001 to 999)
OO	-	Destination gas seal number (00 to 99)
P	-	Alpha character ‘B’ to signify a building
QQQ	-	Destination building number (001 to 999)
RR	-	Destination hub room (AA to ZZ)

The below example for a core route blown fibre tube unit would be:

Duct route	-	A
Leg	-	L
Leg number	-	01
Number of tubes in the unit	-	07
Tube	-	T
Building	-	B
Source building number	-	36
Source hub room number	-	AK
Building	-	B
Source building number	-	36
Gas seal	-	G
Source gas seal number	-	001
Building	-	B
Destination building number	-	59
Gas seal	-	G
Source gas seal number	-	002
Building	-	B
Destination building number	-	59
Destination hub room number	-	EV

A-L1-7T-B36AK-B36G1-B59G2-B59EV

C.14d Labelling Scheme – Spur Blown Fibre Duct Route

A label displayed at key points on each spur fibre-optic cable route e.g. pits, building entry points, terminations etc.

1. Critchely label on each blown fibre tube unit.

AA	-	Number of tubes in the blown fibre unit (00 to 99)
B	-	Alpha character ‘T’ to signify a blown fibre Tube unit
CCC	-	Alpha characters ‘TDU’ to signify a TDU
DDD	-	TDU number (001 to 999)
E	-	Alpha character ‘B’ to signify a building
FFF	-	Source building number (001 to 999)
GG	-	Source hub room (AA to ZZ)
H	-	Alpha character ‘B’ to signify a building
III	-	Source building number (001 to 999)
J	-	Alpha character ‘G’ to signify Gas Seal unit
KKK	-	Source gas seal number (000 to 999)

The below example for a core route blown fibre tube unit would be:

Number of tubes in the unit	-	02
TDU	-	TDU
TDU Number	-	003
Tube	-	T
Building	-	B
Building number	-	20
Hub room number	-	BS
Building	-	B
Building number	-	20
Gas seal	-	G
Source gas seal number	-	001

2T-TDU003-B20BS-B20G001

C.14e Labelling Scheme – MER to SER Duct Route

A label displayed at key points on each spur fibre-optic cable route e.g. pits, building entry points, terminations etc.

1. Critchely label on each blown fibre tube unit.

AA	-	Number of tubes in the blown fibre unit (00 to 99)
B	-	Alpha character ‘T’ to signify a blown fibre Tube unit
C	-	Alpha character ‘B’ to signify a building
DDD	-	Source building number (001 to 999)
EE	-	Source hub room (AA to ZZ)
F	-	Alpha character ‘B’ to signify a building
GGG	-	Destination building number (001 to 999)
HH	-	Destination hub room (AA to ZZ)

The below example for a core route blown fibre tube unit would be:

Number of tubes in the unit	-	02
Tube	-	T
Building	-	B
Building number	-	44
Hub room number	-	CB
Building	-	B
Building number	-	44
Hub room number	-	AI

2T-B44CB-B44AI

Appendix D Main Contractor Hub Room Sign Off checklist

D.1 Check List

- Each line item MUST be signed off as YES or NO
- The document MUST be signed off as completed – Company Name, Name of Person, Signature and Date

Building: Hub room number:	YES/NO
Has Hub room deep clean been completed	
Item	
Physical	
Size of room - 1 x Rack = 2.4 x 3.4 (2 x rack = 3.2 x 3.4)(4 x rack 3.4 x 4.7) 5 x Rack with UPS (3.4 x 5.9)	
Door signage in place	
iSolutions Hub room door lock fitted Mult T Lock M50 University issue	
Door handle furniture in place	
Door decoration completed	
Glass toughened vision panel in place	
Ceiling decorated and free of snags	
Walls decorated and free of snags	
Is the floor finish anti-static	
Floor finished and free of snags	
If windows are present have they been fitted with film	
If windows are present have they been fitted with security measures	
Has all fire stopping been fitted	
Is there clear, safe access to the hub room	
Electrical	
Lighting and power controls present	
Lighting providing an even coverage of the room	
All electrical containment in place	
2 x 32 amp commando sockets mounted above each active rack	
2 x 12 way Raritan PDU's mounted in each active rack, zero U style	
Each PDU supply must be on a separate breaker from the distribution board	
Smoke detector fitted	
All components of the Racks have been physically earth bonded	
Double UTP outlet fitted for a telephone	
All data containment complete	

25% additional capacity provided for additional channels	
Audibility of the nearest fire alarm sounder checked	
UPS installed and commissioned by Vertiv and connected to Life Net, output wired to frame PDU's.	
Raritan PDU's connected to network and accessible on network for temperature reporting.	
Camera connected to network and streaming images.	
IT	
Ortronics Mighty Mo 20 Frames installed with vertical cable managers	
Test results supplied for all horizontal cabling	
As built drawings supplied	
Data fibre schematic drawings supplied	
Patching schedule supplied	
Door and sides fitted	
Racks are bayed and labelled	
Patch panels labelled	
Fibre and copper cables labelled	
All fibre and copper patch cables are labelled	
Mains patch cables labelled	
Mechanical	
10kW cooling installed and working for MER and 5Kw for SER	
Failover test witnessed for transfer from free cooling to DX cooling and reverse back to free cooling.	
No wet services supplies or drainage to pass through or over hub room	
Cooling not fitted over the rack	
Cooling fed electrically off own electrical isolator	
24 hour cooling provided 24 x 365 days of the year	
Temperature of room between 21 - 23 degrees	
Cooling controller in place	
Earthing	
Hub room earth bar installed	
Frame earth bars installed	
Frame earth bars bonded to the telecom room earth bar	
Frame doors, side panels, plinths and top cover bonded to the cabinet earth bar	
Patch panels bonded to the frame earth bar	
PDUs bonded to the frame earth bar	

Company:

Name:

Signature:

Date:

Appendix E WLAN Predictive Modelling Parameters

WLAN predictive modelling shall be in accordance with the latest version of the below iSolitions specifications. The latest version shall be obtained from iSolutions before design work is undertake.

- WLAN standards performance specification detail
- Wireless LAN Standards
- Wireless LAN standards Checklist

Appendix F - Call Point Specification

Viking E-1600-45A-EWP. University Framework supplier for EVC is Daisy Communications.

Appendix G - MAC Address Information

UNIVERSITY OF Southampton

MAC addresses

Project Name
Ref
Date

Company	Service	Location	MER/Hub connection	Mac address	Outbound to Internet	Inbound from Internet

Lines shall be added for equipment as appropriate

Appendix H DCIM Configuration

H.1 MER - Requirements and commissioning of UPS Life Net for Vertiv remote monitoring

Vertiv UPSs must be setup to connect to LIFE.

Details of the service are available on the Vertiv site

https://www.vertivco.com/en-us/services-catalog/maintenance-services/remote-services/life-services/

Details on configuring the LIFE services

https://www.vertivco.com/globalassets/shared/Liebert-IntelliSlot-Unity-Card-UM-EN-NA-SL-52645.pdf

Requirements:

- Request a static IP (Including stack name, Card MAC Address)
- Vertiv must configure the UPS LIFE service as part of the UPS commissioning process.
- Email soc@soton.ac.uk the MAC addresses and device details (Make, Model and location)

H.2 Supply and commission 1U Raritan PDUs

It is expected that all PDU installations for suppling power to the racks is solely supplied by Raritan, where a 0U PDU is insufficient a 1U Raritan PDU may be added to support POE injectors.

List of expectable parts;

- Switchable PDU – Part Number: PX3-5190CR-Q1

  https://www.raritan.com/product-selector/pdu-detail/px3-5190cr-q1

Requirements

- 2 x Static IP assigned via DHCP for each PDU(See “Request a Static IP address“ Including stack name, PDU MAC Address(es) and location in rack
- 1 x C19 to C20 power lead.
- Patch each PDU with 1 or 2 x Cat 6 cable to switch stacks (See diagram below)
- 6mm Earth cable and correctly sized Insulated Crimp Ring Terminals.
- All empty outlets must be switched off
- Email soc@soton.ac.uk the MAC addresses and device details (Make, Model and location)

H.3 Supply and commission 0U Raritan PDUs

It is expected that all PDU installations for suppling power to the racks is solely supplied by Raritan

List of expectable parts;

- Switchable PDU – Part Number: PX3-1493V
- Single Temp and Hum Sensor – Part Number: DX2-T1H1
- Pair Temp and Hum Sensors – Part Number: DX2-T2H2
- Leak Sensor – Part Number: DX2-WSC-35-KIT
- Sensor Hub – Part Number: DX2-ENVHUB4
- PIR Sensor – Part Number: DX2-PIR

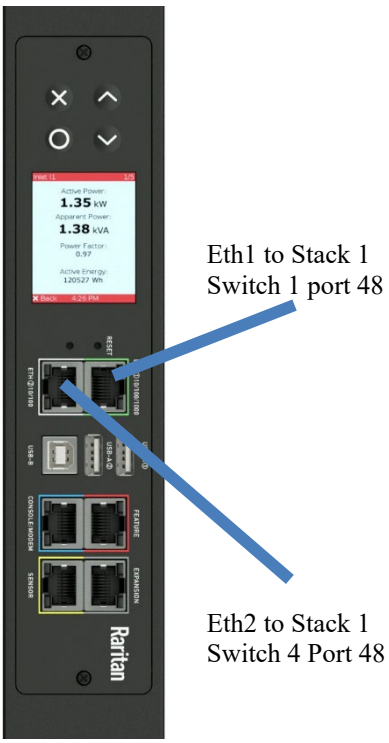
https://www.raritan.com/products/power/accessories/environmental-sensors

Sensor installation guide https://d3b2us605ptvk2.cloudfront.net/download/px3/version-3.4.0/SensorGuide_1B_3.4.0.pdf

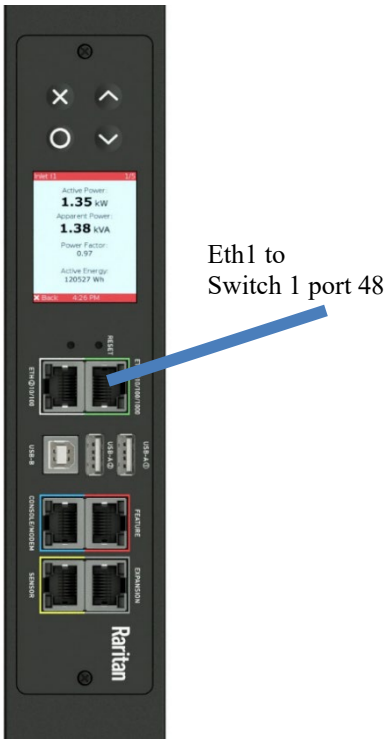
Requirements

- 2 x Static IP assigned via DHCP for each PDU(See "Request a Static IP address" Including stack name, PDU MAC Address(es) and location in rack
- 2 x 32Amp Command sockets per powered rack
- 1 x Pair Temp and Hum Sensor per rack (Required for all non MERs)
- Patch each PDU with 1 or 2 x Cat 6 cable to switch stacks (See diagram below)
- 6mm Earth cable and correctly sized Insulated Crimp Ring Terminals.
- PDU orientation – outlet 30 at top of rack
- All empty outlets must be switched off
- Email soc@soton.ac.uk the MAC addresses and device details (Make, Model and location)

Multiple switch deployment



Single switch rack



As part of the technical submission please provide a diagram of the equipment to be fitted and the layout of all parts for technical approval.

H.4 IEC Leads

List of acceptable parts;

https://www.raritan.com/assets/re/resources/data_sheets/RE-ds-SecureLock.pdf

Colour requirements and layout – PDU1 Red and PDU2 - Blue

Example

PDU1 - IEC C13/C14 – Colour Red – Example use, Netbotz, VICOM

PDU1 - IEC C19/C20 – Colour Red – Example use, VICOM storage, 1U Raritan PDUs

PDU2 - IEC C19/C20 – Colour Blue – Example use, VICOM storage, 1U Raritan PDUs

PDU1 - IEC C14/C15 – Colour Red – Example use, Cisco Switches

PDU2 - IEC C14/C15 – Colour Blue – Example use, Cisco Switches

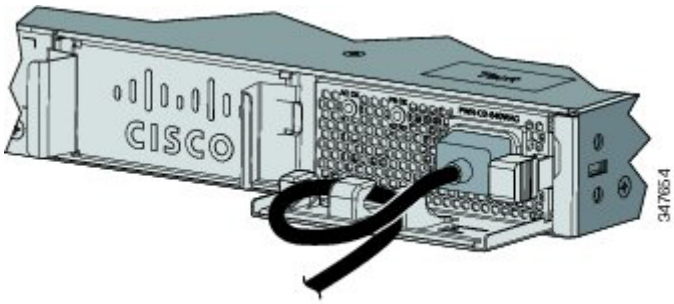
AVAILABLE SECURELOCK POWER CABLES		
IEC C13/C14 SecureLock Cables	Pack of 6 SecureLock locking cables, 0.5 Meter up to 3.0 Meter, 16AWG, 1 x IEC C-14, 1 x IEC C-13	
Black Cables	Red Cables	Blue Cables
SLC14C13-0.5M-6PK	SLC14C13-0.5MK1-6PK	SLC14C13-0.5MK2-6PK
SLC14C13-1.0M-6PK	SLC14C13-1.0MK1-6PK	SLC14C13-1.0MK2-6PK
SLC14C13-1.5M-6PK	SLC14C13-1.5MK1-6PK	SLC14C13-1.5MK2-6PK
SLC14C13-2.0M-6PK	SLC14C13-2.0MK1-6PK	SLC14C13-2.0MK2-6PK
SLC14C13-2.5M-6PK	SLC14C13-2.5MK1-6PK	SLC14C13-2.5MK2-6PK
SLC14C13-3.0M-6PK	SLC14C13-3.0MK1-6PK	SLC14C13-3.0MK2-6PK
IEC C19/C20 SecureLock Cables	Pack of 6 SecureLock locking cables, 0.5 Meter up to 3.0 Meter, 16AWG, 1 x IEC C-19, 1 x IEC C-20	
Black Cables	Red Cables	Blue Cables
SLC20C19-0.5M-6PK	SLC20C19-0.5MK1-6PK	SLC20C19-0.5MK2-6PK
SLC20C19-1.0M-6PK	SLC20C19-1.0MK1-6PK	SLC20C19-1.0MK2-6PK
SLC20C19-1.5M-6PK	SLC20C19-1.5MK1-6PK	SLC20C19-1.5MK2-6PK
SLC20C19-2.0M-6PK	SLC20C19-2.0MK1-6PK	SLC20C19-2.0MK2-6PK
SLC20C19-2.5M-6PK	SLC20C19-2.5MK1-6PK	SLC20C19-2.5MK2-6PK
SLC20C19-3.0M-6PK	SLC20C19-3.0MK1-6PK	SLC20C19-3.0MK2-6PK
IEC C14/C15 SecureLock Cables	Pack of 6 SecureLock locking cables, 0.5 Meter up to 3.0 Meter, 16AWG, 1 x IEC C-14, 1 x IEC C-15	
Black Cables	Red Cables	Blue Cables
SLC14C15-0.5M-6PK	SLC14C15-0.5MK1-6PK	SLC14C15-0.5MK2-6PK
SLC14C15-1.0M-6PK	SLC14C15-1.0MK1-6PK	SLC14C15-1.0MK2-6PK
SLC14C15-1.5M-6PK	SLC14C15-1.5MK1-6PK	SLC14C15-1.5MK2-6PK
SLC14C15-2.0M-6PK	SLC14C15-2.0MK1-6PK	SLC14C15-2.0MK2-6PK
SLC14C15-2.5M-6PK	SLC14C15-2.5MK1-6PK	SLC14C15-2.5MK2-6PK
SLC14C15-3.0M-6PK	SLC14C15-3.0MK1-6PK	SLC14C15-3.0MK2-6PK
SLC14C15-3.5M-6PK	SLC14C15-3.5MK1-6PK	SLC14C15-3.5MK2-6PK
SLC14C15-5.0M-6PK	SLC14C15-5.0MK1-6PK	SLC14C15-5.0MK2-6PK

The correct length cable must be installed to connect an appliance to the PDUs.

IEC leads shall not be bundled together.

Velcro may be used to retain an IEC Lead.

IECs connected to Cisco Switches must be looped as shown below.



Active Switch Cabinet IEC layout

Type	Outlet	PDU1	PDU2
IEC320 C13	30	Reserved for EMS	Not used
IEC320 C13	29	Not used	Not used
IEC320 C13	28	Stack 1 Switch 1	
IEC320 C13	27		Stack 2 Switch 2
IEC320 C19	26	Supply to 1U PDU	
IEC320 C13	25	Stack 1 Switch 3	
IEC320 C13	24		Stack 1 Switch 4
IEC320 C13	23	Stack 1 Switch 5	
IEC320 C13	22		Stack 1 Switch 6
IEC320 C19	21	Supply to 1U PDU	
IEC320 C13	20	Stack 1 Switch 7	
IEC320 C13	19		Stack 1 Switch 8
IEC320 C13	18	Stack 1 Switch 9	
IEC320 C13	17		
IEC320 C19	16	Supply to 1U PDU	
IEC320 C13	15		
IEC320 C13	14	Stack 2 Switch 1	
IEC320 C13	13		Stack 2 Switch 2
IEC320 C13	12	Stack 2 Switch 3	
IEC320 C19	11	Supply to 1U PDU	
IEC320 C13	10		Stack 2 Switch 4
IEC320 C13	9	Stack 2 Switch 5	
IEC320 C13	8		Stack 2 Switch 6
IEC320 C13	7	Stack 2 Switch 7	
IEC320 C19	6	Supply to 1U PDU	
IEC320 C13	5		Stack 2 Switch 8
IEC320 C13	4	Stack 2 Switch 9	
IEC320 C13	3		
IEC320 C13	2		
IEC320 C19	1	Supply to 1U PDU	

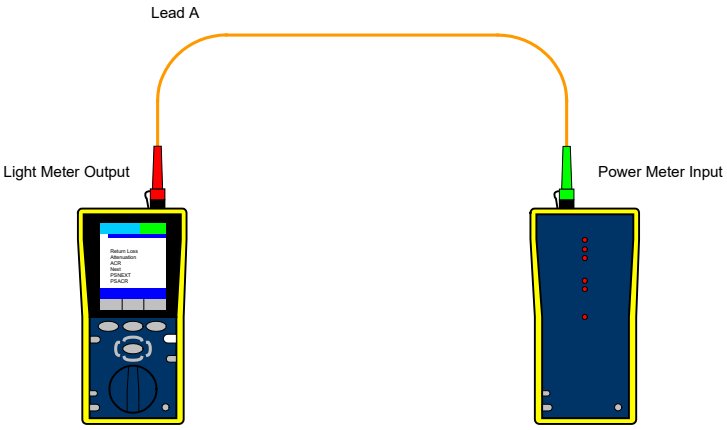
H.5 Requesting a Static IP address

This should be done using the form located within the main document page.

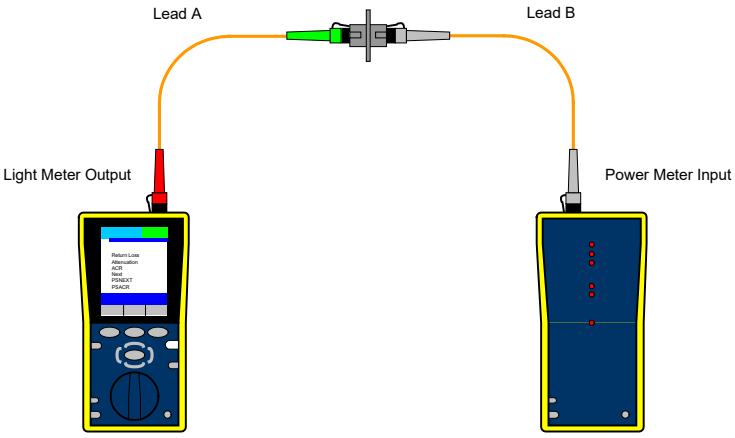
Appendix I – Testing for Single Mode Fibre Links

I.1 Test Reference Cord (TRC) Verification –For LSPM

1. Check that the tester is in calibration (proof of independently calibration by Contractor may be requested). If out of calibration do not use.
2. Ensure that the tester has more than 25% of its battery life left, if less than 25% the unit must be recharged
3. Select two leads to be accessed for use as TRCs. One lead will be known as lead A and the second as lead B. The leads must be:
    - 2m in length
    - One end to be the same connector type as the tester and the other the same type as the link to be tested
    - Cable must be the same type as the link under test i.e. OS2 etc
4. Check the condition of the leads by means of visual inspection using a microscope or fibre viewer
5. Clean both ends of the leads
6. Plug lead A into the light source meter connector labelled ‘Output’
7. Plug lead A into the power meter connector labelled ‘Input’

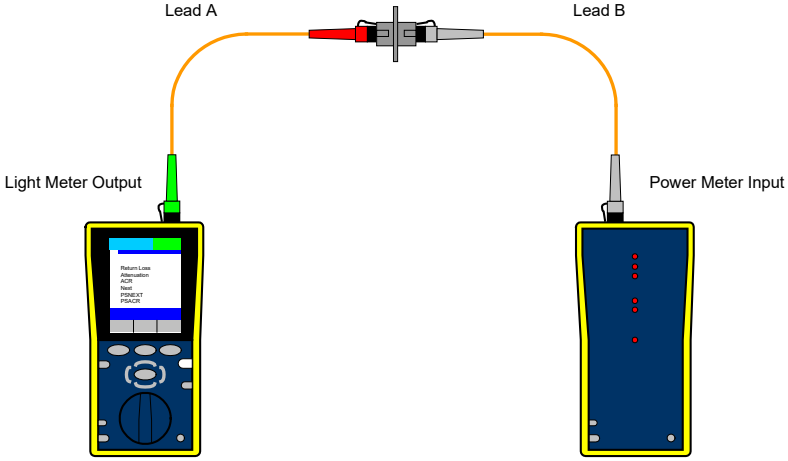


8. Record the power meter reading
9. Remove lead A from the power meter
10. Insert lead B into the power meter connector labelled ‘Input’
11. Connect lead A to lead B with a single mode coupling adapter



12. Record the result with the LSPM set in relative mode

13. Flip lead A so that the connector coupled with lead B now connects to the light meter connector labelled ‘Output’ and the connector coupled with the light meter connector labelled ‘Output’ connects to lead B



14. Record the result with the LSPM set in relative mode

15. If the results from steps 10 and 12 both fall within 0.2dB for LC, SC and ST connectors lead A can be used as a TRC.

I.2 Reference Setting -1 Jumper Method

For testers that have the same connector as the test link or have interchangeable connectors the 1 jumper method must be used.

1. Check that the tester is in calibration (proof of independently calibration by Contractor may be requested). If out of calibration do not use.

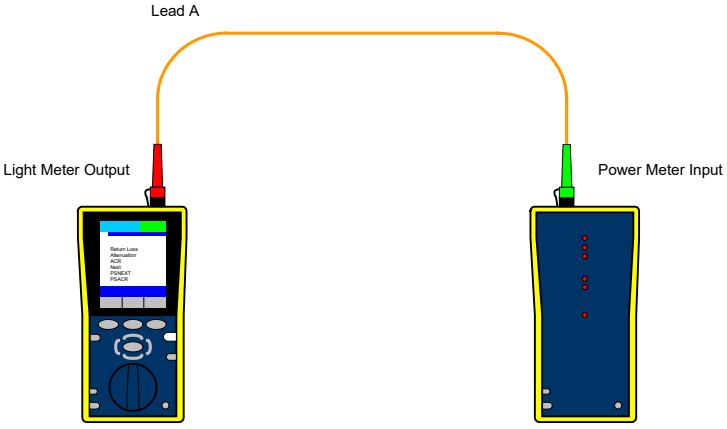
2. Ensure that the tester has more than 25% of its battery life left, if less than 25% the unit must be recharged

3. Select the two reference leads to be used for testing. One lead will be known as lead A and the second as lead B. The leads must be:

    - 1 to 5m in length

- Cable must be the same type as the link under test i.e. OS2 etc
- The leads must be known referenced leads and must be referenced at the start of each day

4. Check the condition of the leads by means of visual inspection using a microscope or fibre viewer
5. Clean both ends of the leads.
6. Plug lead A into the light source meter connector labelled ‘Output’
7. Plug lead A into the power meter connector labelled ‘Input’



8. Ensure that the result is less than -80.2dB at 1310 and 1550nm
9. Reference the power meter reading

I.3 Reference Setting -3 Jumper Method

For testers that have a **different** connector as the test link and do not have interchangeable connectors reference the 3 jumper method **shall** be used.

1. Check that the tester is in calibration (proof of independently calibration by Contractor may be requested). If out of calibration do not use.

2. Ensure that the tester has more than 25% of its battery life left, if less than 25% the unit must be recharged

3. Select the two reference leads to be used for testing. One lead will be known as lead A and the second as lead B. The leads must be:

   - 1 to 5m in length
   - Cable must be the same type as the link under test i.e. OS1, OS2 etc
   - The leads must be known referenced leads and must be referenced at the start of each day

4. Select the field calibration cord to be used for testing.

   - ≤2m in length
   - Cable must be the same type as the link under test i.e. OS2 etc
   - The lead must be a known field calibration lead and must be referenced at the start of each day

5. 4. Check the condition of the leads by means of visual inspection using a microscope or fibre viewer

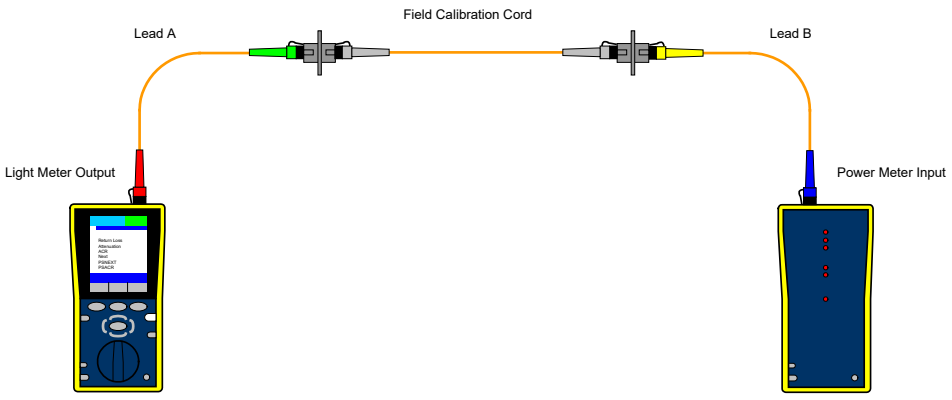
6. Clean both ends of the leads

7. Plug lead A into the light source meter connector labelled 'Output'

8. Plug lead B into the power meter connector labelled 'Input'

9. Connect one end of the field calibration lead to lead A with a single mode adapter

10. Connect the other end of the field calibration lead to lead B with a single mode adapter



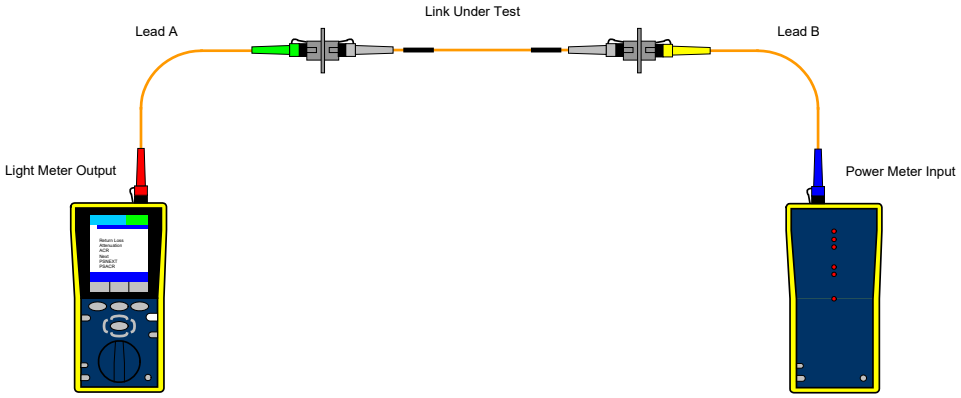
11. The loss budget must be better than -0.2dB at 1330 and 1550nm

12. Reference the power meter reading

I.4 Testing

Testing the link is the same for the 1 and 3 jumper method. The difference comes in the calculation of the budget. This calculation is detailed at the end of this section.

1. Having referenced the LSPD using jumper method 1 or 3 and under no circumstances removed the connections from the LSPD.
2. Plug lead A into the light source meter connector labelled 'Output'
3. Plug lead A into one end of the fibre link to be tested
4. Plug lead B into the power meter connector labelled 'Input'
5. Plug lead B into the remaining end of the fibre link to be tested



6. Test and record the link at 1330 and 1550nm
7. Repeat the process for the other direction unless the test equipment allows Bi-Directional testing in which case the 2nd leg of the duplex link is tested by swapping the input and output fibres connected to the link.

I.5 Testing Parameters – 1 Jumper Method

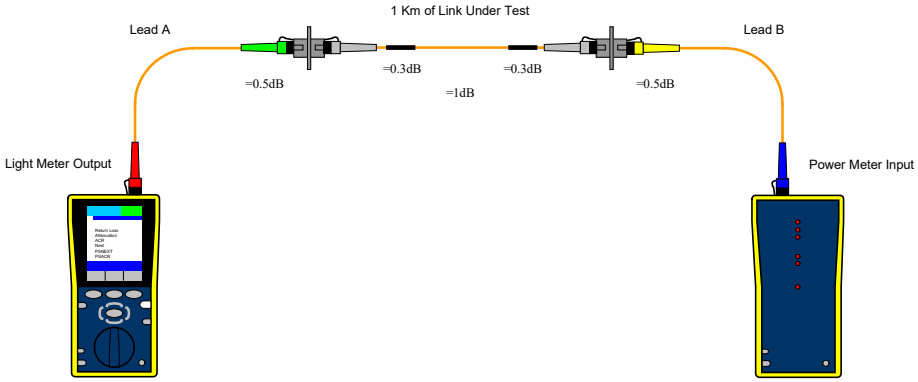
For tests that have used the 1 jumper method referencing the following parameters apply for 1330 and 1550nm.

Attenuation criteria for mated plugs, as defined by EN 14763

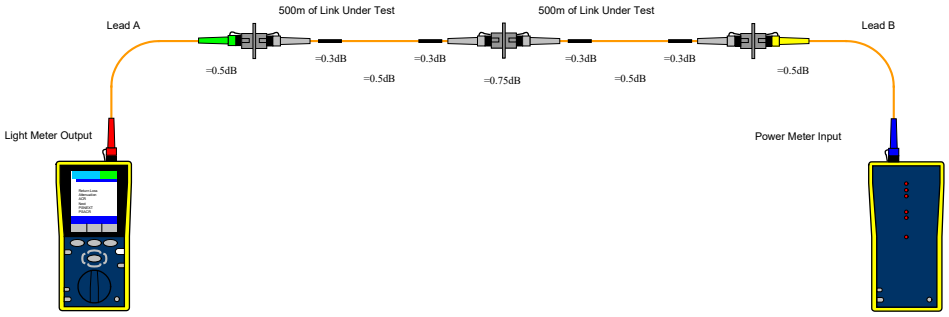
Mated Insertion Loss	Multimode Fibres	
	Reference Plug	Unreferenced Plug
Reference Plug	0.2dB	0.5dB
Unreferenced Plug	0.5dB	0.75dB

Attenuation criteria for cable, as defined by EN 14763

Insertion Loss	OS2 Fibre Cable per km	
	1310nm	1550nm
OS2	1.0dB	1.0dB



Where the link consists of two connectors the loss budget = 0.5 + 0.5 + 0.3 + 0.3 + 1.0 = 2.6dB for 1330 and 1550nm.



Where the link consists of three connectors the loss budget = 0.5 + 0.75 + 0.5 + 0.3 + 0.3 + 0.3 + 0.3 + 1 = 3.95dB for 1330 and 1550nm.

Any subsequent connectors in the link would be calculated as 0.75dB loss as they are unreferenced to unreferenced connections.

I.6 Testing Parameters – 3 Jumper Method

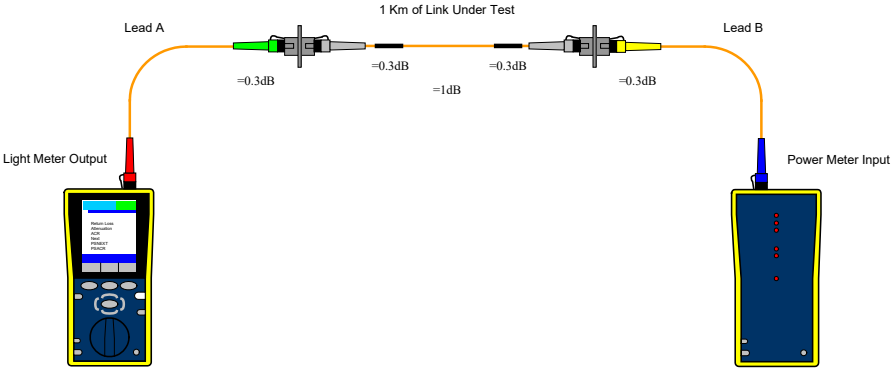
For tests that have used the 3 jumper method referencing the following parameters apply for 1330 and 1550nm.

Attenuation criteria for mated plugs, as defined by EN 14763

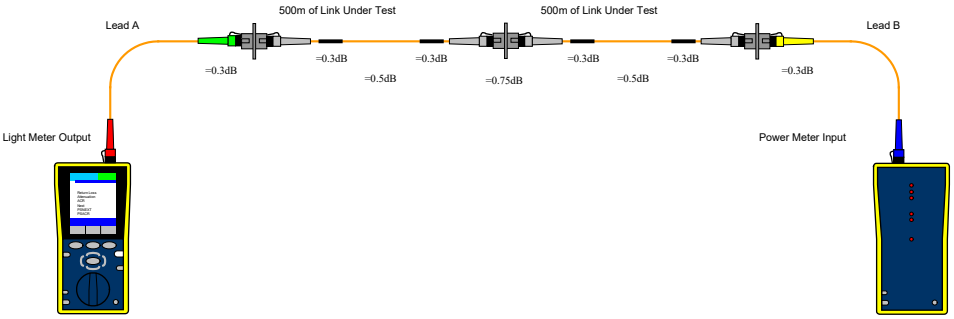
Mated Insertion Loss	Multimode Fibres	
	Reference Plug	Unreferenced Plug
Reference Plug	0.2dB	0.5dB
Unreferenced Plug	0.5dB	0.75dB

Attenuation criteria for cable, as defined by EN 14763

Insertion Loss	OS2 Fibre Cable per km	
	1310nm	1550nm
OS2	1.0dB	1.0dB



Where the link consists of two connectors the loss budget = 0.3 + 0.3 + 0.3 + 0.3 + 1.0 = 2.2dB



Where the link consists of three connectors the loss budget = 0.3 + 0.75 + 0.3 + 0.3 + 0.3 + 0.3 + 0.3 + 1 = 3.55dB

Any subsequent connectors in the link would be calculated as 0.75dB loss as they are unreferenced to unreferenced connections.

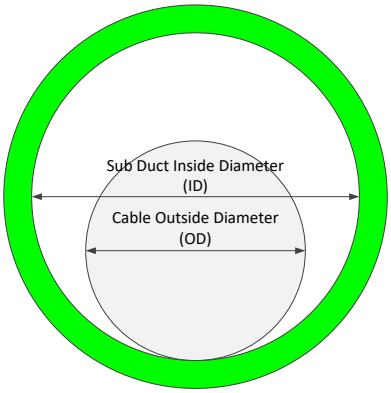
Appendix J – External Ducting for Telecommunication Cables

J.1 Ducting Capacity

1. Each duct shall not be filled beyond the specified fill rates shown in NEC Code 2008:
    - 1 off cable/sub duct ≤ 53%
    - 2 off cables/sub ducts ≤ 31%
    - 3 off cables/sub ducts ≤ 40%
2. When installing three or more cables/sub ducts avoid ratios of duct internal diameter to cable sub duct external diameter of 2.8 to 3.1
    - Example 1 - for a duct of 110/94 avoid cable/sub duct external diameters of 32 to 36mm
    - Example 2 - for a duct of 65/50 avoid cable/sub duct external diameters of 16 to 18mm

J.2 Sub Duct Sizing

1. Cables to be pulled into sub ducts shall be of a ratio of ≤0.67 for Sub duct ID to Cable OD



Diameter Ratio = Sub Duct ID/Cable OD
The ratio must be ≤0.67

2. The standard sizes for sub ducts for CommScope loose tube fibre cables are:

CommScope Loose Tube Fibre Cables			
Number of Cores	Fibre Cable OD (mm)	Sub Duct Min. ID (mm)	Sub duct size OD/ID (mm)
4 to 12	6.4	9.55	16/10
16	7.5	11.19	16/12
24 to 48	11.5	17.16	25/20

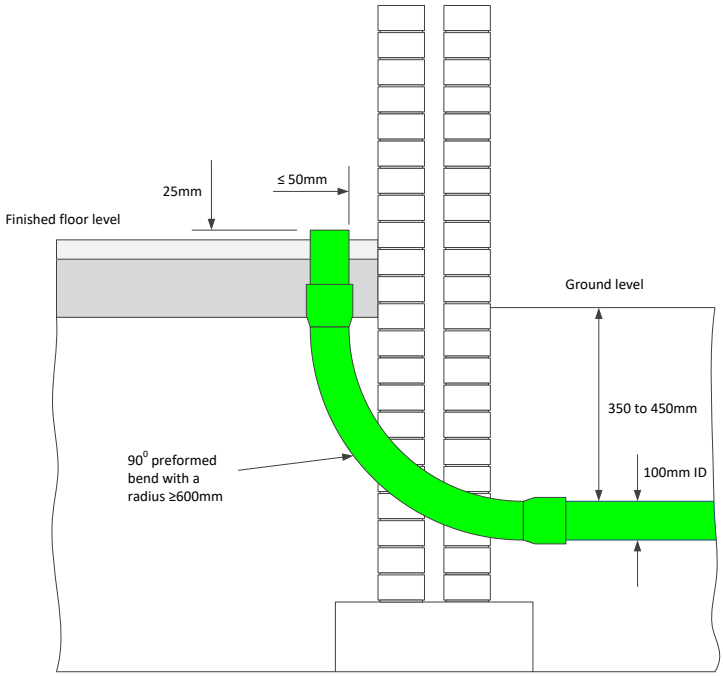
3. All three sized sub ducts will not fall within the 32 to 36mm for a 110/94mm ducting system

J.3 Ducting and Sub Ducting Construction and Colour

1. All ducts shall be:
    - Compliant to BS EN 50086-1 and BS EN 50086-2-4
    - BS EN 60529 – IP47 rated
    - Twin wall construction
    - Straight sections – no coiled ducting to be used
    - Shall be 100mm internal diameter
    - All ducts to be manufactured from HDPE
    - Smooth bore internally
    - To be green in colour
2. All sub ducts shall be:
    - Compliant to BS EN 50086-1 and BS EN 50086-2-4
    - BS EN 60529 – IP47 rated
    - Single wall construction
    - Low friction permanent internal coating
    - All ducts to be manufactured from HDPE
    - Smooth bore internally
    - To be green in colour

J.4 Building Entrance New Builds

1. In new builds the external ducts shall enter from under the building
2. Slow radius 90^0 preformed bends shall be used with a radius of no less than 600mm
3. The slow radius bend shall be fitted with spigots that can, and shall be sealed with solvent cement
4. The duct shall enter the building at a height of between 350 and 450mm below ground level
5. The duct shall finish 25mm above the finished floor level
6. The duct shall be ≤50mm from the external wall
7. All ducts to be green in colour



J.5 Building Entrance Existing Builds

1. In existing buildings that require a new building entrance the external ducts shall enter from under the building
2. An aperture will be made in the building fabric with core drilling rigs or other none vibration methods

3. The aperture shall be cut at 45^0 and the drilling rig shall be anchored and set to this angle. It is not acceptable to core drill using hand held machines

4. The aperture shall allow for a 25mm gap around the duct to be installed

5. Slow radius 45^0 preformed bends shall be used with a radius of no less than 600mm

6. The slow radius bend shall be fitted with spigots that can, and shall be sealed with solvent cement

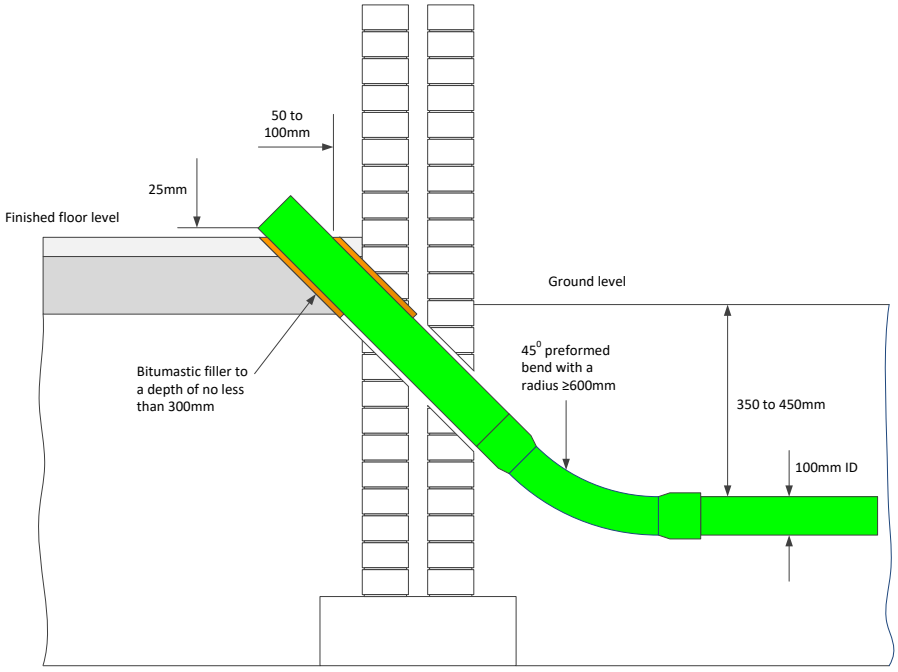
7. The duct shall enter the building at a height of between 350 and 450mm below ground level

8. The duct shall finish 25mm above the finished floor level

9. The duct shall be between 50 and 100mm from the external wall

10. The 25mm gap around the duct shall be sealed with a bitumastic compound to a depth of no less than 300mm

11. All ducts to be green in colour



J.6 Building Entrance Basement for New Builds

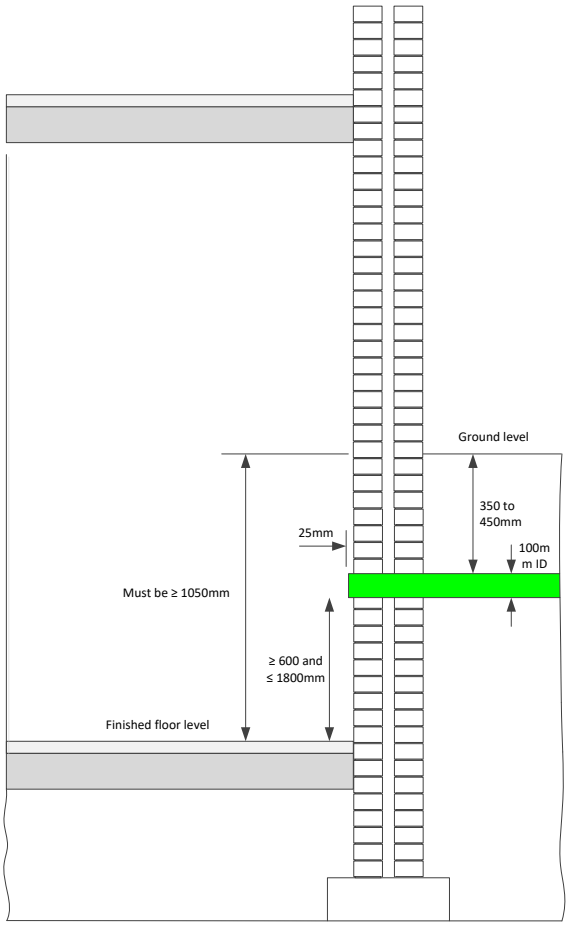
1. In new builds where there is a basement level the external ducts shall enter from the side of the building

2. The duct shall enter the building at a height of between 350 and 450mm below ground level

3. The duct shall enter the building at a height of between 600 and 1800mm above the finished floor level

4. The duct shall finish 25mm clear of the finished wall

5. All ducts to be green in colour



J.7 Building Entrance Basement for Existing Builds

1. In new builds where there is a basement level the external ducts shall enter from the side of the building

2. An aperture will be made in the building fabric with core drilling rigs or other none vibration methods

3. The aperture shall be cut at 90^0 to the wall and the drilling rig shall be anchored and set to this angle. It is not acceptable to core drill using hand held machines

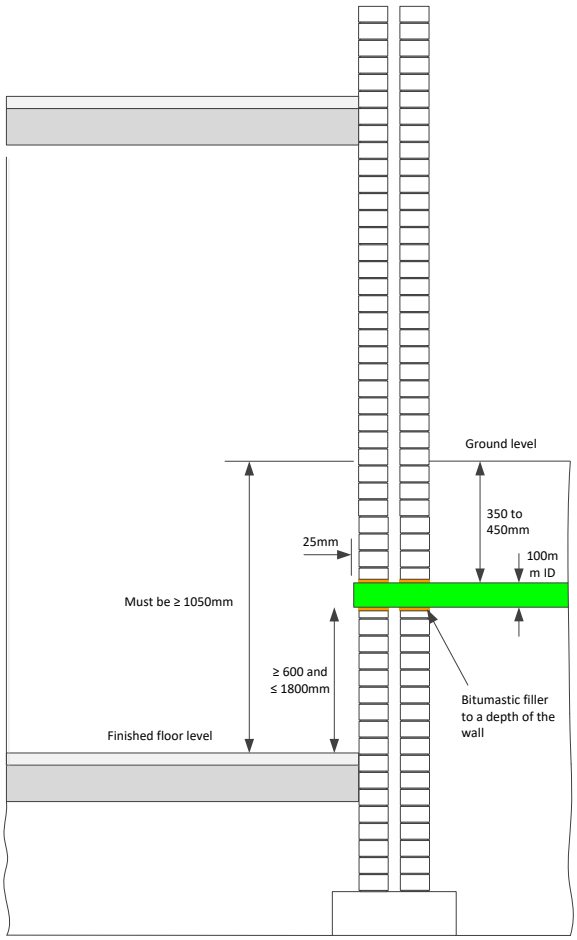
4. The aperture shall allow for a 25mm gap around the duct to be installed

5. The duct shall enter the building at a height of between 350 and 450mm below ground level

6. The duct shall enter the building at a height of between 600 and 1800mm above the finished floor level

7. The duct shall finish 25mm clear of the finished wall

8. All ducts to be green in colour



J.8 Building Entrance Where Access Pits Can Flood into a Building

1. A suitable sized mechanical duct plug shall be fitted to the building entry duct system

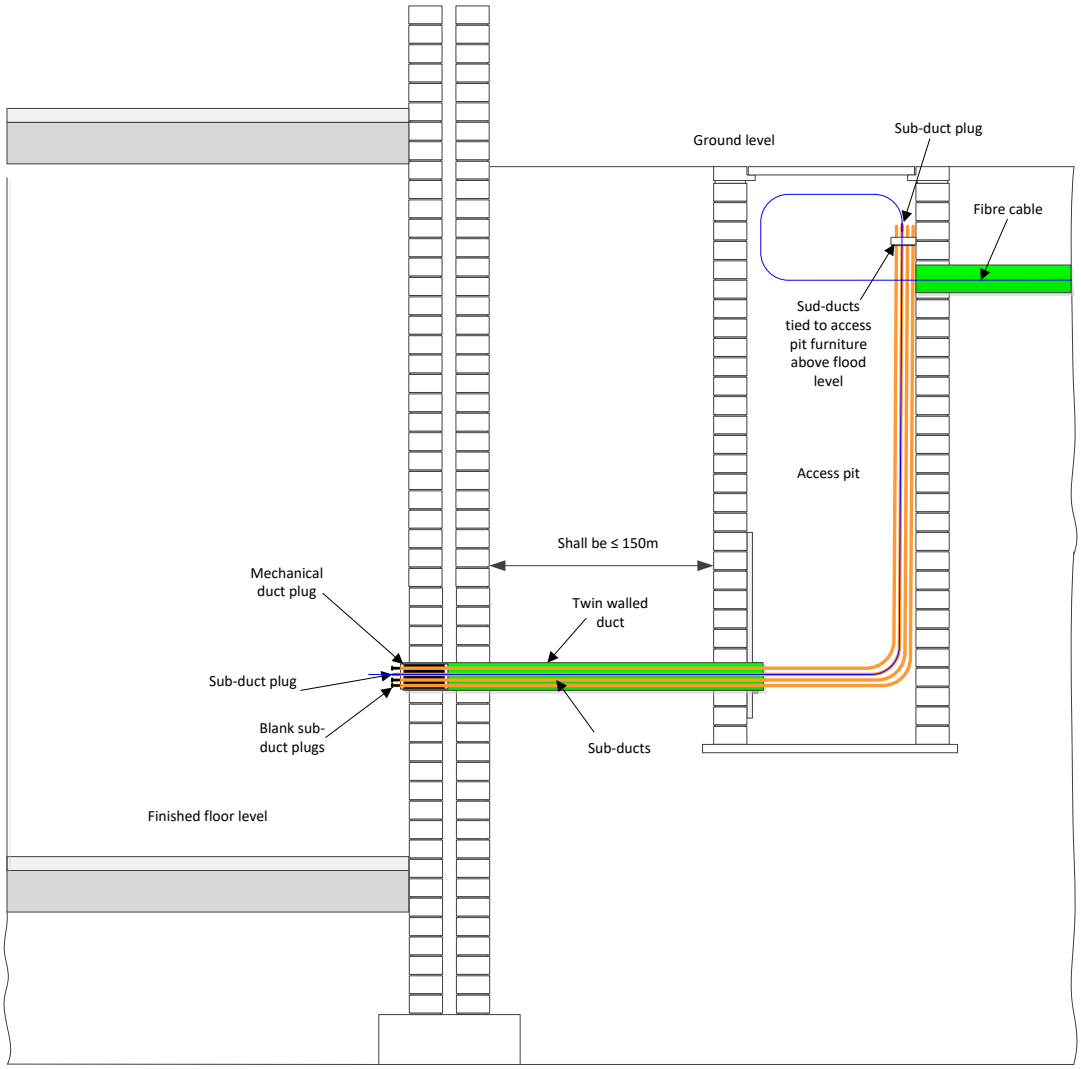
2. The mechanical duct plug shall be sized to cater for multiple sub ducts

3. The maximum number if sub ducts that the mechanical duct plug can cater for shall be installed on day 1

4. The sub ducts shall be tied to the access pit furniture above the maximum flood level

5. Blank duct plugs shall be fitted at both ends of all unused sub ducts

6. Suitable sized mechanical sub duct plugs shall be fitted at both ends of a sub duct that has a fibre cable(s) installed. This may be required to cater for multiple fibre cables



J.9 Ducting Laying

1. The Installer is responsible for the planning, routing and excavation of the ducting

2. IT services will have the final say regarding the proposed route and positioning of chambers and building entries

3. The Installer shall seek and gain clearances from IT Services before any excavation work commences

4. The Installer is responsible for any repairs required to services that are damaged during the works, unless previously identified as damaged

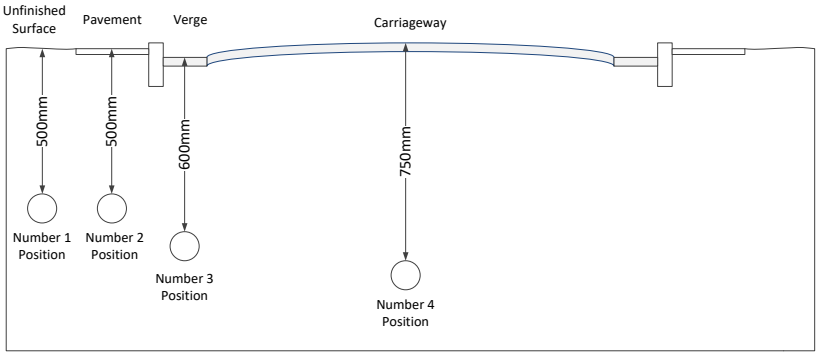
5. Straight sections of ducts shall be secure to each other with the correct solvent cement for the socket and spigot ends or couplers

6. Ducts shall be laid in as straight a line as possible

7. Duct organizers shall be used to prevent undulations. One to be fitted either side of a joint and at 1m intervals along the length of a duct run

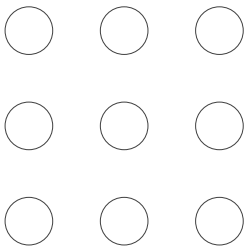
8. The order of preference for duct positioning is

   - Unmade surface
   - Verge
   - Footway
   - Carriageway



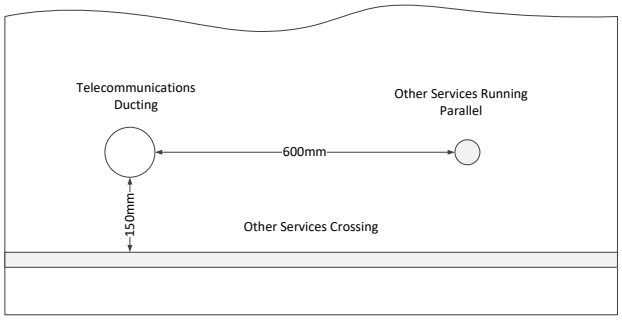
9. Recommended duct formations are

No. of Ducts	Formation	
2	1 row of 2 columns	
4	2 rows of 2 columns	
6	2 rows of 3 columns	
8	2 rows of 4 columns	

9	3 rows of 3 columns	

10. The ducting shall be greater than or equal to 600mm from other services that run parallel

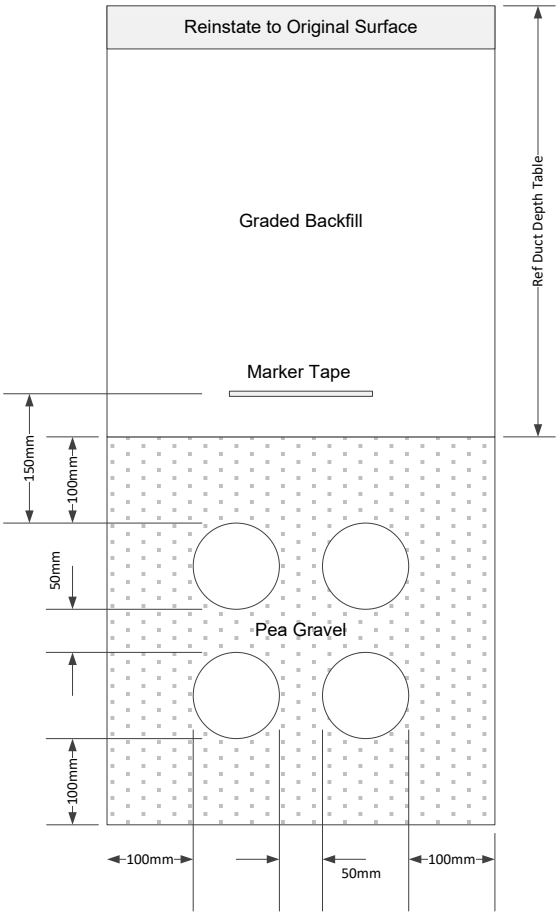
11. The ducting shall be greater than or equal to 150mm from other services that cross the ducting path



J.10 Ducting Depth

1. Depth of ducting for the different surface finishes are:

Environment	Depth (mm)
Pavement or Grass	500
Verge	600
Urban Roads	750



J.11 Duct Route Deviation

1. Where possible ducts shall follow a straight route
2. Access pits shall be installed where the route deviates more than 1:30 horizontally or 1:60 vertically
3. Preformed bends of 90^0 and 45^0 are only permissible at building entry points and there cannot be more than 1 preformed bend in any one run
4. Long slow curves are permitted but shall exceed 50m in radius
5. Access pits shall be positioned at no more than 150m apart
6. For every 2m rise in between access pits the duct run shall be halved

J.12 Roding and Roping

1. Ducts that require roding may be undertaken with continuous or 3m section rods
2. The rod ends shall be protected with leader and follower devices to prevent damage to existing cables

3. Only one draw rope may be installed into one duct at a time
4. Draw ropes that have been used to draw in a new cable shall be replaced with a new rope
5. Draw ropes shall be tied off onto the access pit furniture in a tidy manner
6. Draw rope lengths may be spliced together but it is not acceptable to joint using knots
7. Draw ropes shall be made of polypropylene or other none biodegradable plastic
8. Draw ropes shall have a minimum draw strength of 550kg

J.13 Marker Tape

1. Fibre
    - None biodegradable plastic coated aluminium maker tape
    - 150mm above the top duct
    - Central to the duct trench
    - 150mm in width
    - Yellow in colour
    - Marked at 1200mm centres with bold contract lettering ‘FIBER OPTIC CABLE BELOW’
2. Copper
    - None biodegradable plastic maker tape
    - 150mm above the top duct
    - Central to the duct trench
    - 150mm in width
    - Yellow in colour
    - Marked at 1200mm centres with bold contract lettering ‘TELECOMMUNICATIONS CABLE BELOW’

J.14 Duct Seals

1. Where ducts and sub ducts are being installed the ends shall be sealed with a blank duct plug to prevent the ingress of dust and water

    - These shall be installed at both ends of a duct run during none working hours or working hours when it is raining

2. Where ducts and sub ducts enter an access pit and are left empty a duct plug shall be installed

3. Where ducts enter a building or access pit a multi aperture duct plug shall be used. The duct plug shall be of a split design to allow removal without the cutting of cables or sub ducts

    - The multi aperture duct shall have sealing plugs fitted to the correct aperture size for the sub duct or cable to be sealed against the ingress of gas and water

    - Empty apertures shall be fitted with hole plugs to seal against the ingress of gas and water

    - Sub ducts with cables installed shall be sealed with a simplex duct plug against the ingress of gas and water

J.15 Sub Duct

1. Traditional fibre cables shall be installed within sub ducts

2. The sub duct shall be the correct size for the fibre cable

3. The sub duct run shall be continuous

4. Sub ducts shall not be tied to access pit furniture but shall pass through the pit in a straight a line as possible

5. Sub ducts shall not be coiled within access pits

6. Sub duct sections shall be jointed a threaded connection and sealed with a collapsible cold seal or with compression connectors

7. Where a sub duct passes through an access pit in a straight direction the sub duct may be pulled through in one continuous pull or be jointed as detailed above

8. Where a sub duct passes through a chamber at an angle of 45^0 or more the sub duct shall be cut at 100 to 200mm within entering the access pit – to facilitate labelling

9. All open sub ducts with no cables installed shall be sealed with a blank duct plug against the ingress of water and gas

10. All sub ducts with cables pulled into them shall be sealed with a simplex duct plug against the ingress of water and gas

J.16 Access Pits

1. Materials for the access pits are
    - Bricks – Engineering bricks to Class B (BS 6100)
    - Mortar – 3:1 mix of sand to cement
    - Cement – EN197-1:2000 BS12 ordinary mix
2. The pit dimensions shall be a minimum of 1310(l) x 610(w)
3. The access pit shall be constructed on a floor slab of dimensions 150mm in depth and overhanging the access pit by 200mm on all sides
4. The depth of the access pit shall be ≥850mm
5. A sump hole of dimensions 200(w) x 200(l) x 200(d) shall be cast in the floor slab
6. Ducts entering an access pit shall
    - Not be within 150mm of any corner
    - Be ≥100mm from the floor slab – from the bottom of the duct
    - Enter at the required depth – section 9. Duct Depth
    - Finish flush with the access pit wall
    - Be sealed to the access pit wall with bitumastic material
7. Where the depth of chambers exceeds 700 mm below the finished surface of the adjacent ground or carriageway, manhole steps complying with BS EN 13101 shall be built in, as specified in BS EN 1917. Steps should be located at the end remote from any side entry ducts bolts to be tied into one side wall to support the ironwork
8. Minimum of two off wall brackets at a spacing of 700mm apart on the longest wall side. Brackets shall extend from 100mm from the floor slab to 100mm from the cover frame
9. Two off cable bearer brackets to be fitted at each depth of ducting to enter the access pit i.e. if there are ducts entering at 600mm and 750mm there shall be two off brackets at 600mm and two off brackets at 750mm
10. Pulling eyes of a diameter of 22mm to be installed 50mm below each duct or column of ducts. The pulling eye shall have a 10,000 pulling strength
11. Cover frame set squarely on the access pit on a bed of mortar. The frame shall be securely pinned to the wall structure on all side

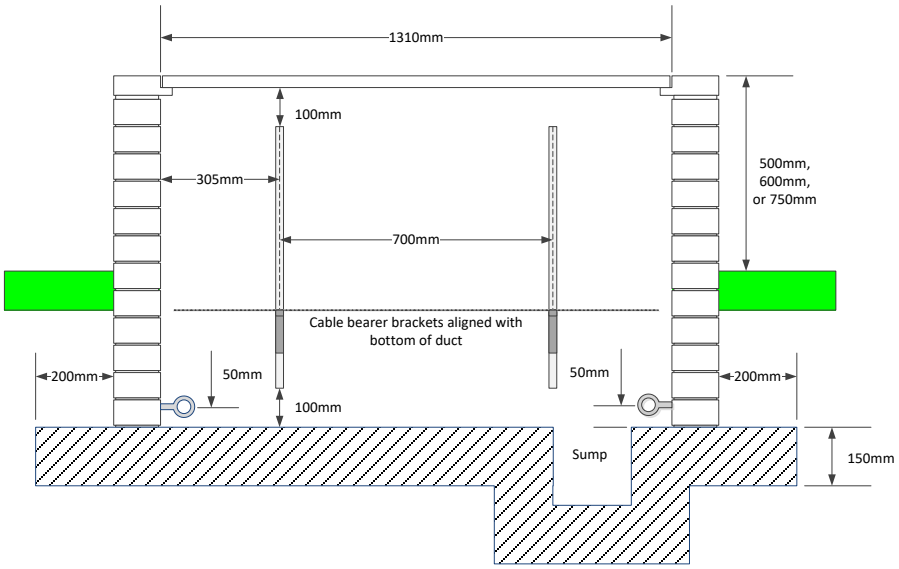
12. A cover(s) to BS EN 124 (latest revision)

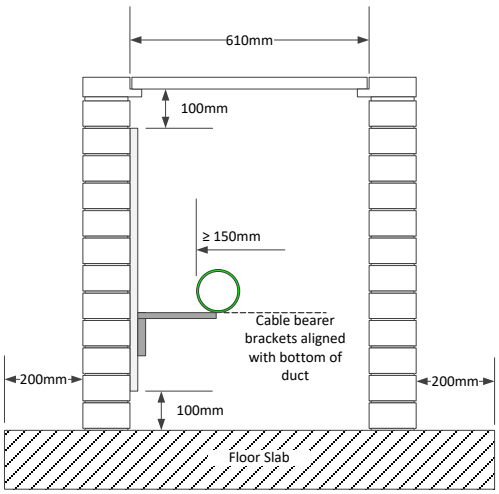
13. Electrical cables exceeding ELV shall not share the same ducting or access pits as telecommunication cables

14. Access pits shall be positioned to provide a safe working area for maintenance and pulling in new cables

15. Where ducts pass beneath roads access pits shall be positioned at each side of the road crossing

16. Where there is known future requirement for ducts, poke outs shall be installed that run 0.5m to 1m from the access pit





J.17 Access Pit, Duct and Sub Duct Labelling

1. All ducts and sub ducts shall be labelled at each access pit and building entry/exit

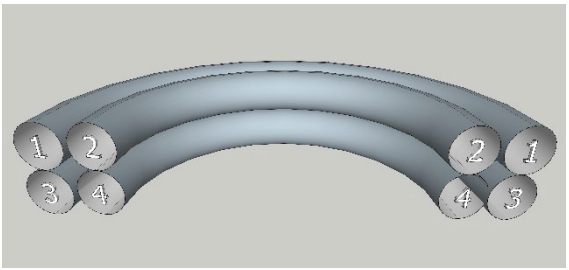
2. The label shall be engraved on a plastic tags

3. Plastic engraved tags shall be black writing on a yellow background

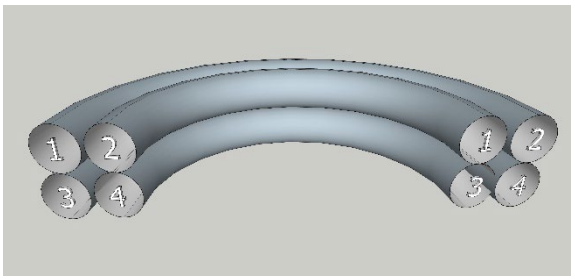
4. There shall be apertures at each end of the tag that can accommodate cable ties

5. The tag shall be secured to the sub duct with two off external cable ties

6. Each bank of ducts shall be labelled at all chamber entry/exit points and building entry points. The label shall identify which building or chamber the bank of ducts is connect to. The individual duct labels shall correspond at each end and not read left to right



Correct labelling of ducts



Incorrect labelling of ducts

7. To facilitate operations and administration, all jointing chambers and covers should be clearly labelled.

8. The labels should identify the jointing chamber as a telecommunications facility

9. The labelling scheme should be consistent throughout the system of chambers and each chamber should have a unique identifier

J.18 Duct Testing

1. All ducts shall be tested prior to the installation of sub ducts or cables

2. A mandrel of length ≥250mm and a diameter of 90% of the internal diameter of the duct shall be pulled through the entire length of the duct

3. The mandrel shall have a rope attached to both ends to allow the mandrel to be withdrawn in the event of a blockage

4. If the mandrel is pulled through with debris attached a brush of length ≥200mm and a diameter of 110% of the internal diameter of the duct shall be drawn through in the same manner as the mandrel

5. Once the duct is clear of debris and a mandrel can be drawn through without obstruction a draw rope shall be installed

J.19 Rodent Protection

1. At the duct entries into chambers, all spare space shall be filled with stainless steel wire wool over a duct length of ≥100mm from the end of the duct.

J.20 Duct Sealing to Building Fabric

1. For above ground building entries

   - The lead-in ducts that will be contained within the wall/floor shall be cleaned thoroughly with methylated spirit or isopropyl alcohol

   - Treated all round the circumference for a minimum length of 300mm with suitable solvent weld

   - Before the solvent weld dries approved bitumastic compound applied all around the circumference for a minimum length of 300mm. The bitumastic material shall finish 50mm beyond the finished surface level

   - The remaining 50mm shall be filled with a resin mortar flush to existing surfaces

2. For below ground building entries, the installer shall agree how the integrity of the waterproofing to the building will be maintained with the University Estates Faculty team leader for the building concerned.

Appendix K – Risk Assessment for omission of RCDs in ICT Cabinets

This document covers the requirements for Risk Assessment where, for the avoidance of unwanted tripping it is deemed appropriate to omit RCD protection for socket outlets not exceeding 32A in a fixed ICT cabinet.
A Risk assessment is required under the exception detailed under clause 411.3.3 of the BS7671 18th edition regulations.

"Clause 411.3.3 Additional requirements for socket-outlets and for the supply of mobile equipment for use outdoors

In AC systems, additional protection by means of an RCD with a rated residual operating current not exceeding 30 mA shall be provided for:

(i) socket-outlets with a rated current not exceeding 32 A in locations where they are liable to be used by persons of capability BA1, BA3 or children (BA2, BA3),
(ii) socket-outlets with a rated current not exceeding 32 A in other locations, and (iii) mobile equipment with a rated current not exceeding 32 A for use outdoors.

An exception to (ii) but not (i) or (iii) is permitted where a suitably documented risk assessment undertaken with the involvement of a skilled person (electrically) determines that RCD protection is not necessary."

This risk assessment relates to technical spaces listed in the location table.

Version History	Version	Date	Comments
Draft	V.001	04.03.24	Issued for comment

Distribution			
Name	***Location***	***Responsibility***	***Distribution***
Michael Powell	University of Southampton	Critical Infrastructure	Agreement
Kieran Connolly	University of Southampton	Electrical Design	Agreement
Mick Brooker	BGIS	Account Lead	Agreement
Elliot Frost	BGIS	Technical	Agreement

Guidance on assessing risk level

Likelihood (1-5) should consider the following to determine the likelihood of an incident:

1. Speak with Client H&S team and/or review reported related accidents and incidents.
2. Speak with Estates and Facilities Electrical Design Engineer.
3. Check if any reported RIDDOR incidents based on same power distribution arrangement.
4. The location of sockets and associated connected equipment.
5. The environment.
6. Class of equipment connected. If unknown should assume class I.
7. Maintenance regimes.
8. Whether the Installation will be under the control of an instructed person using approved Standard

   Operating Procedure

   - BA1 – Ordinary person (non-electrically skilled or instructed)
   - BA2 – Children
   - BA3 – Disabled persons

The Severity (1-5) should consider the following:

1. Previous incidents resulted in electric shock or uncontrolled electrical discharge.
2. The impact of omitting RCDs.
3. Any existing remedials noted on the EICR that could impact electrical safety.
4. Check the EICR relating to the bonding for the associated circuit.

Indicative 5x5 risk matrix.

5 x 5 Risk Assessment Matrix						
Likelihood (Probability)	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		Consequence (Impact)				

"Traffic Light" control system
low risk, continue with existing control measures
medium risk, additional controls required
high risk, additional controls required

Likelihood (Probability)	5	almost certain
	4	probable
	3	possible
	2	possible (under unfortunate circumstances)
	1	rare
Consequence (Impact)	5	fatality
	4	major injury, resulting in disability
	3	injury that requires medical attention
	2	minor injury, first aid required
	1	minor injury, no first aid

The risk is dependent on the conditions and control measures detailed below being in place.

Description of Hazard Being Assessed	Potential for harm Likelihood x Severity = Risk Level (1-5)		
	Likelihood (1-5)	Severity (1-5)	Risk Level (1-25)
Omission of RCDs for socket outlets risk outcome	**3**	**3**	**9**
Control measures in place to reduce likelihood or severity	**Potential for harm Likelihood x Severity = Risk Level (1-5)**		
	Likelihood (1-5)	Severity (1-5)	Risk Level (1-25)
Omission of RCDs risk outcome	**2**	**3**	**6**

Outcome Possibilities and Level of Risk	
Low Risk 1-6	**2** possible (under unfortunate circumstances) **x 3** Injury that requires medical attention **= 6** low risk (continue with existing control measures)
Medium Risk 8-12	**3** Possible **x 3** Injury that requires medical attention **= 9** medium risk (additional controls required)
High Risk 15-25	-

Risk Assessment Outcome & details of control measures:

In support of this risk assessment, I visited the University Campus and reviewed the installations of ICT cabinets in a range of spaces which had been adapted to house equipment in a temperature-controlled environment. The installation methodology supports the safe removal of hardware by a power pathway of high level or underfloor commando type sockets. These in turn feed high quality integrated PDU strips with factory moulded IEC whips making the final connection to the ICT equipment. All transitions meet ip2x and are correctly fused to provide discrimination and automatic disconnection of supply under fault condition. Enquiries have been made to establish any prior incidents relating to injury to operatives when working in these technical spaces, response being none recorded. Access to the environments where each of the ICT cabinets are located is controlled via a master key only available to authorised persons. The equipment and services have been installed to a very high standard with good use of containment for routing of mains and fibre optic cables both of which are correctly dressed, secured, and separated.

The risk assessment identified ICT operatives as *non-electrically skilled,* categorised in BS7671 18th edition under clause 411.3.3 as *BA1 – Ordinary person.* Initial considerations of 3x3 for likelihood and severity respectively equated to an overall score of 9, giving a medium risk in the absence of 30ma RCD protected final circuits. Additional mitigations once in place could reduce the final score to 6. Whilst the severity will remain unchanged the likelihood of injury could be adjusted to 2 as *possible (under unfortunate circumstances)*

These mitigations comprise of the following points:

- ICT operatives BA1 – Ordinary person *non-electrically skilled* **to become** *instructed persons.*
- Instructed person training with Standard Operating Procedure for Change of PDU & Patching Activities.
- 32a Commando S/O to have provision to apply safety lock and caution sign (LOTO) for safe isolations.

Site Name	Building Name	Room	Floor
Highfield	Electronics and computer science	EF35197	0
Highfield	Music	5005	1
Highfield	Music	1007	1
Highfield	Building 2A Lecture Theatre	2069	1
Highfield	Law	3061	3
Highfield	Law	1075	1
Highfield	Eustice	3021	3
Highfield	Nuffield Theatre	0051 plant rm	?
Highfield	LANCASTER	1033	1
Highfield	Lanchester	3005	3
Highfield	AI wood lab	wall mounted	1
Highfield	Engineering Workshops	1033	1
Highfield	Energy Centre	2007	1
Highfield	Tizard	3037	3
Highfield	Tizard	1015	1
Highfield	Wolfson/Rayleigh	1001	1
Highfield	Wolfson	2037	2
Highfield	Electronics and computer science project laboratories	35390	1
Highfield	Mitchell wind tunnel	?	1
Highfield	Jubilee Sports	Sports cupboard Hall	1
Highfield	Jubilee Sports	2017	2
Highfield	ISVR	1001	1
Highfield	HIGH VOLTAGE LAB	loft	3
Highfield	B21 Labs	2075	2
Highfield	engineering	1007	1
Highfield	Engineering	2028/9	2
Highfield	design studio	1050 E&f 59595	0
Highfield	Escience Building	1015	1
Highfield	Escience Building	1073/1009	1
Highfield	OPEN DATA SERVICE BUILDING	2701	2
Highfield	CHEMISTRY	2005	1
Highfield	CHEMISTRY	1059	1
Highfield	Froude	1007	1
Highfield	Graham Hills	3025	3
Highfield	Synthetic Chemistry	1041 E&F38704	1
Highfield	Synthetic Chemistry	2011 E&F38655	2
Highfield	Synthetic Chemistry	3011 E&F38599	3
Highfield	Synthetic Chemistry	4011 E&F38543	4
Highfield	Synthetic Chemistry	5011 E&F 38489	5
Highfield	EEE Building	4089	4
Highfield	EEE Building	4059	4
Highfield	EEE Building	5	1
Highfield	EEE Building	2083	2
Highfield	EEE Building	3089	2
Highfield	EEE Building	3059	3
Highfield	Estates (Maintenance)	Locksmiths E&F 64068	1
Highfield	Education	2016 E& F 64996	2
Highfield	David Kiddle	1015	1
Highfield	David Kiddle	2055	?
Highfield	Library (inc. buildings 10 12 & 14)	2059	2
Highfield	Library (inc. buildings 10 12 & 14)	2013	2
Highfield	Library (inc. buildings 10 12 & 14)	Plant room	0
Highfield	Library (inc. buildings 10 12 & 14)	4049	4
Highfield	Library (inc. buildings 10 12 & 14)	3021 E&F 64152	3
Highfield	Library (inc. buildings 10 12 & 14)	1033	1
Highfield	Library (inc. buildings 10 12 & 14)	1506 / Print Centre	1
Highfield	Library (inc. buildings 10 12 & 14)	5017	5
Highfield	George Thomas	1023 cage	1

Site Name	Building Name	Room	Floor
Highfield	George Thomas	4097	4
Highfield	George Thomas	1021	1
Highfield	Staff Social Centre	266 kitchen	1
Highfield	Garden Court Refectory	275 E&F 58395	1
Highfield	Stat Science Research Institute	3011	3
Highfield	West Building & Staff Social Centre	127 corridor	G
Highfield	West Building & Staff Social Centre	240 Big Hall	1
Highfield	Early Years Centre	1033	1
Highfield	Early Years Centre	1019	1
Highfield	Student union	Room 215 Plantroom E&F 57139	1
Highfield	Students' Union/Refectory	Apparatus room	?
Highfield	Shackleton building	3103	3
Highfield	Shackleton	3025 / 3017	3
Highfield	Shackleton	1061	1
Highfield	Shackleton building	3101	3
Highfield	Health Profs & Rehab Sciences	1010	1
Highfield	Physics	3093	3
Highfield	Physics	3101HP	3
Highfield	Physics	1016	1
Highfield	Physics	3085	3
Highfield	Physics	4071	4
Highfield	physics and science	4605/5508	4
Highfield	Physics	5051	5
Highfield	University Health Centre	2017A	2
Highfield	Turner Sims Concert Hall	Storeroom E&f 64826	G
Highfield	New Mountbatten	2053	2
Highfield	New Mountbatten	3004	3
Highfield	New Mountbatten	3037	3
Highfield	New Mountbatten	4017	4
Highfield	New Mountbatten	4034	4
Highfield	Mathematics	3025	3
Highfield	Mathematics	8029	8
Highfield	Mathematics	3019	3
Highfield	Students' Union Retail Centre	1011 Store	1
Highfield	Murray Building	4119	4
Highfield	Murray Building	2107	2
Highfield	Murray Building	3051	3
Highfield	Murray Building	1061	1
Highfield	New Zepler	1245	1
Highfield	New Zepler	1245	1
Highfield	New Zepler	2205	2
Highfield	New Zepler	3231	3
Highfield	New Zepler	4239	4
Highfield	B59P (pop up building)	1001	?
Highfield	Gower	L2 east	2
Highfield	Gower	Admin	?
Highfield	Nightingale	2037	2
Highfield	Nightingale	1017	3
Highfield	Nightingale	3061	1
Highfield	Life Sciences	1503	1
Highfield	Life Sciences	2507	2
Highfield	Life Sciences	2503	2
Highfield	Life Sciences	3503	3
Highfield	Life Sciences	3514	3
Highfield	Life Sciences	4503	4
Highfield	Life Sciences	6503	6

Site Name	Building Name	Room	Floor
Highfield	Life Sciences	7525	7
Highfield	Life Sciences	7503	7
Highfield	Centenary building	3007 E&f 58513	3
Highfield	Centenary building	7009 E&F 39600	7
Highfield	Centenary building	1035 E&F 39692	1
Highfield	Centenary building	5007 E&F 39727	5
Highfield	Interchange Kiosk	1011 bin Store	1
Highfield	26 University Road	1005	1
Highfield	Detact Portakabin Premier	office	1
Avenue	Parkes 65	1011	1
Avenue	Parkes 65	2017	2
Avenue	Parkes 65	3017	3
Avenue	Parkes 65	1171	1
Avenue	Parkes 65	2145	2
Avenue	Parkes 65	1099	1
Avenue	Parkes 65	2105	2
Avenue	b65P (pop up building)	1003	?
Avenue	Archaeology 65A	2196	2
Avenue	Archaeology 65A	1227	1
Avenue	Burgess 65B	2011	2
Avenue	Aubrey House	Storeroom E&F 55104	1
Avenue	Aubrey House	Storeroom E&F 55135	1
Highfield Hall	Highfield Hall, Wolfe House	Wolfe Rm128	?
Boldrewood	New Boldrewood	2017	2
Boldrewood	New Boldrewood	3051	3
Boldrewood	New Boldrewood	4055	4
Boldrewood	New Boldrewood	5055	5
Boldrewood	Annexe	2009	2
Boldrewood	Annexe	3009	3
Boldrewood	Annexe	1025	1
Boldrewood	D & G	?	1
Boldrewood	D & G	?	5
Boldrewood	D & G	?	3
Boldrewood	D & G	?	4
Boldrewood	D & G	?	2
Boldrewood	H Block	1013	1
Boldrewood	H Block	3029	3
Boldrewood	34 Bassett Crescent East (PSYCHOLOGY)	Kitchen	?
Winchester	East Site	Room 1011	1
Winchester	East Site	Plant room 2091 Under stage	1
Winchester	East Site	Room 2033	1
Winchester	Administration	Room A1011 Room A1009	1
Winchester	Graphics Building	1035	1
Winchester	South Building formerly Graphics	Room T1029	1
Winchester	East Site	Room 2111	1
Winchester	West side lecture theatre	Room 2003	1
Winchester	Erasmus - House 01	1730-01 E&F 42081	3
Winchester	Erasmus - House 02	1730-02 E&F 42102	3
Winchester	Erasmus - House 04	1730-04 E&F 42145	3
Winchester	Erasmus - House 06	1730-06 E&F 42187	3
Winchester	Erasmus - House 08	1730-08 E&F 42228	3
Winchester	Erasmus - House 10	1730-10 E&F 42270	3
Winchester	Erasmus - House 12	1730-12 E&F 42312	3
Winchester	Erasmus - House 14	1730-14 E&F 42354	3
Winchester	Erasmus - House 16	1730-16 E&F 42396	3
Winchester	Erasmus - House 18	1730-18 E&F 42438	3

Site Name	Building Name	Room	Floor
Winchester	Erasmus - Flat 19	1730-19 E&F 42461	3
Winchester	Erasmus - Flat 21	1730-21 E&F 42503	3
Winchester	Erasmus - Flat 23	1730-23 E&F 42545	3
Winchester	Erasmus - Flat 25	1730-25 E&F 42587	3
Winchester	Erasmus - Flat 27	1730-27 E&F 42629	3
Winchester	Erasmus - Flat 29	1730-29 E&F 42671	3
Winchester	Erasmus - Flat 31	1730-31 E&F 42713	3
Winchester	Erasmus - Flat 33	1730-33 E&F 42755	3
Winchester	Erasmus - Flat 34	1730-34 E&F 42776	3
Mayflower Halls	Block A	1003	1
Mayflower Halls	Block A	1005	1
Mayflower Halls	Block A	?	1
Mayflower Halls	Block B	1015	1
Mayflower Halls	Block B	16105	1
Mayflower Halls	Block C	1012	16
City Centre	Studio 144, John Hansard Gallery	MER First Floor	1
City Centre	Studio 144, John Hansard Gallery	City Eye First Floor	1
City Centre	Studio 144, John Hansard Gallery	SER Ground Floor	0
City Centre	1 Guildhall Square	3007	3
City Centre	1 Guildhall Square	4011	4
Beech mount	Beech mount House	EF51798	1
Highfield Hall	Aubrey House	Storeroom E&F 55104	1
Highfield Hall	Aubrey House	Storeroom E&F 55135	1
Highfield Hall	Highfield Hall, Wolfe House	Wolfe Rm128	?
Gateley	Gateley Hall	Flat 8	?
Gateley	Gateley Hall	Flat 12	?
Romero	Romero Hall	Flat 29	?
Romero	Romero Hall	Flat 23	?
Romero	Romero Hall	Flat 9	?
City and Gateway	block b	7001	7
City and Gateway	block c	2001(41527)	2
City and Gateway	block d	7001(42029)	7
Bassett House	Bassett House	no room number	0
Chamberlain	Chamberlain A	2012	2
South Hill	South Hill A	Ef52798	1
Chamberlain	Chamberlain B	3011 E&F 52124	3
Chamberlain	Building D	E&F 52452	3
South Hill	South Hill B	E&f 52959	1
Chamberlain	Chamberlain C	EF 52280 R3012	3
South Hill	South Hill C	EF53063 Plant Room	1
Chamberlain	Building E	E&f 52632	3
Glen Eyre	Glen Eyre Hall Block A Richard Newitt	E&F 46390 Cleaners Room	1
Glen Eyre	J Block Glen Eyre Reception	0001	0
Glen Eyre	Glen Eyre Hall Block B Richard Newitt	E&F 46463 Cleaners	1
Glen Eyre	Bungalow 4	no room number	Loft
Glen Eyre	Glen Eyre Hall Block C Richard Newitt	E& F 46477 Cleaners	1
Glen Eyre	Glen Eyre Hall Block D Richard Newitt	E&F 46517 Cleaners	1
Glen Eyre	Glen Eyre Hall Block E Richard Newitt	E&F 46560 Cleaners	1
Glen Eyre	Glen Eyre Hall Block F Richard Newitt	E&f 46611 Cleaners	1
Glen Eyre	Glen Eyre Hall Block G Richard Newitt	E&F 46645	1
Glen Eyre	Glen Eyre Hall Block H Richard Newitt	E&F 46696	1
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Selbourne	E&F 50144	2
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Selbourne	E&F 50368	0
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Jellicoe	Ef 50411	?
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Jellicoe	Basement Plant EF 50728	0

Site Name	Building Name	Room	Floor
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Roll	Bike Shed Plant Room E&f 51072	0
Glen Eyre	Glen Eyre Hall, Chancellor's Court, Roll	Flat 231-236 E&F 50773	2
Glen Eyre	Block F Glen Eyre Hall Old Terrace	No number	2
Glen Eyre	Block J Glen Eyre Hall Old Terrace	1st floor	?
Glen Eyre	Glen Eyre Hall Dining Hall	Old telephone booth	0
Beech mount	Beech mount House	EF51798	1
Glen Eyre	Laundry	no room number	0
Glen Eyre	Glen Eyre Hall Hillside	Flat 221-229 "Hub NTL 1A"	2
Glen Eyre	Glen Eyre Hall Block W Richard Newitt	E&F 46753	0
Glen Eyre	Block Q Glen Eyre Hall New Terrace	External Ef 51359	0
Glen Eyre	Block Q Glen Eyre Hall New Terrace	Main Q Block Rack	0
Glen Eyre	Block T Glen Eyre Hall New Terrace	NTL/Store Ef 51740	0
Hartley Grove	Hartley Grove A	EF 53220	4
Hartley Grove	Hartley Grove A	EF 53551 Flats 471-476	4
Hartley Grove	Hartley Grove B	E&F 53851 Flats B351-B356	3
Hartley Grove	Hartley Grove C	E&F 54075 Flats c431-436	1
Connaught	Computer room	E&F 46319	2
Connaught	Main Building Entrance Foyer	E&F 46298	1
Connaught halls	block B old quad	cleaner cupboard	1
Connaught halls	block c Old Quad	cleaner cupboard E&F 45689	1
Connaught halls	block D Old Quad	cleaner cupboard E&F 45714	1
Connaught halls	Block E Old Quad	cleaner cupboard /E&F 45739	1
Connaught halls	block F Old Quad	cleaner cupboard E&F 45776	1
Connaught halls	block G Old Quad	cleaner cupboard E&F45800	1
Connaught halls	block h Old Quad	cleaner cupboard E&F 45825	1
Connaught halls	Block J Old Quad	E&F 45861	2
Connaught halls	block M	Store	1
Connaught halls	block P	E&F 45861	1
Connaught halls	block Q	?	1
Connaught halls	Block R	EF 46132	1
Connaught halls	block s	Ef46262	1
Montefiore	block A	2a 502 EF 56049	2
Montefiore	block A	3B 505 E&F 56100	3
Montefiore	block b	plant room	0
Montefiore	block b	2a 502 E&F 49150	2
Montefiore	block b	2B 505 E&F 49168	2
Montefiore	block b	2c 505 E&F 49178	2
Montefiore	block b	3d 509 EF 49140	3
Montefiore	block c	E&F 44865	1
Montefiore	block d	E&F 45025	1
Montefiore	block E	E&F 42895	2
Montefiore	block f	E&F 45185	1
Montefiore	block g	E &F 45345	1
Montefiore	block h	E&F 45505	1

Site Name	Building Name	Room	Floor
Montefiore	block j	E&F 43037	2
Montefiore	block k	Hub E&F 43181	2
Montefiore	block L	Hub E&F 43324	2
Montefiore	block m	(Hub) E&F 43475	2
Montefiore	block N	E&F 43618	2
Montefiore	block p	Hub E&F 43761	2
Montefiore	block Q	Hub E&F 43904	2
Montefiore	block R	E&F 44047	2
Montefiore	block S	Hub E&F 44190	2
Montefiore	block T	Hub E&F 44333	2
Montefiore	laundry room	Boiler Room E&F 55478	1
Montefiore	block v	E&F 44445	1
Montefiore	block W	E&F 44580	1
Montefiore	block x	E&F 44717	1
Montefiore	reception	E&F 55471	1
Montefiore	block S	Hub E&F 44190	2
Chilworth	3 Venture Road	?	G
Chilworth	Epsilon House	Cupboard, left of entrance door	1
College Keep	College Keep	?	?
Belgrave Estate	Unit 13 Print Centre	end office	1
South Stoneham	South Stoneham Tower	Basement near tank room	?
General Hospital	Southampton's Centre for Cancer Immunology	1031	1
General Hospital	Southampton's Centre for Cancer Immunology	2039	2
General Hospital	Southampton's Centre for Cancer Immunology	3076	3
General Hospital	Southampton's Centre for Cancer Immunology	4053c	4
General Hospital	South Academic Block	AC102	C
General Hospital	South Academic Block	AB235	B
General Hospital	South Academic Block	AB85	B
General Hospital	South Academic Block	AA1	A
General Hospital	South Academic Block	AA8	A
General Hospital	Duthie	Basement	A
General Hospital	South Academic Block	AC012	C
General Hospital	South Academic Block	AA7A	1
General Hospital	Lab & Path Block	LG02	G
General Hospital	Lab & Path Block	LC52	C
General Hospital	Lab & Path Block	LB83A	B
General Hospital	Lab & Path Block	LE81A	E
General Hospital	Lab & Path Block	LE538	E
General Hospital	Lab & Path Block	LD429	D
General Hospital	Centre Block	CC318	C
General Hospital	Centre Block	CF269	F
General Hospital	Centre Block	EF118	F
General Hospital	P/Anne Maternity Unit	Breast Imaging Unit	E
General Hospital	IDS	DS A 07	1
General Hospital	Duthie	DB102	1
General Hospital	Princess Anne	F604	F
General Hospital	Duthie	CSD	?
General Hospital	Lab & Path Block	LF655	F
General Hospital	Duthie	Basement	0
General Hospital	Somers Cancer Research	CS/PRA	E
General Hospital	Somers Cancer Research	CS/C16A	?
General Hospital	MRC Building	MR/G106	1
General Hospital	MRC Building	MR/417	4
General Hospital	CENTRAL BLOCK	CC318	C
General Hospital	CENTRAL BLOCK	CF269	F

Site Name	Building Name	Room	Floor
General Hospital	DUTHIE	DA003	-1
General Hospital	DUTHIE	DB102	B
General Hospital	EYE UNIT	B4103	B
General Hospital	LAB & PATH BLOCK	LD429	D
General Hospital	CENTRAL BLOCK	LE81A	E
General Hospital	LAB & PATH BLOCK	LF655	F
General Hospital	LAB & PATH BLOCK	LG02	G
General Hospital	LAB & PATH BLOCK	LC52	C
General Hospital	LAB & PATH BLOCK	LE528	E
General Hospital	MODULAR BUILDING	MB010	0
General Hospital	MRC BUILDING	MR/G106(IT ROOM)	1
General Hospital	MRC BUILDING	MR/417(STORE)	4
General Hospital	P/ANNE MATERNITY UNIT	BREAST IMAGING UNIT	1
General Hospital	P/ANNE (CORRIDOR)	F604	F
General Hospital	LIBRARY STOREROOM	AA8	1
General Hospital	SOUTH ACADEMIC BLOCK	AA75	1
General Hospital	SOUTH ACADEMIC BLOCK	AA7A	1
General Hospital	SOUTH ACADEMIC BLOCK	AB235	B
General Hospital	SOUTH ACADEMIC BLOCK	AC102	C
General Hospital	SOUTH ACADEMIC BLOCK	LB85A	A
General Hospital	SOMERS CANCER RESEARCH	CS/PRA (PLANTROOM)	E
General Hospital	SOMERS CANCER RESEARCH	CS/C16A (KITCHEN)	A

Risk Assessment Outcome(s)

Risk/~~Task~~ assessed with/~~without~~ control measures or safe systems of work in place ~~and~~/is deemed to be an acceptable/~~unacceptable~~ outcome (delete as appropriate)

Risk assessor – (Designer for new installations, inspector for existing)

Risk Assessor	**Company**	**Signature**	**Date**
NAME			
Authorising Engineer/SAP	**Company**	**Signature**	**Date**
NAME			
H&S representative	**Company**	**Signature**	**Date**
NAME			

Data Centre IT Lead		
NAME		**Date informed**
Data Centre Management	**Position/Post**	**Date informed**
NAME	DUTY HOLDER	