

University of Wolverhampton
IT Services

Specification for Installation of Network Cabling

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This document gives the general requirements for network cable installation at the University. It should be read in conjunction with specific requirements for a particular project (e.g. size and type of cabinets, type and number of cores for fibre optic cabling).

In general, network cable installations must comply with BS 6701:2004 unless otherwise agreed with the IT Services department.

All active equipment will be procured outside the scope of this specification.

Copper cabling

1. Unless otherwise specified, all cables and components must meet Cat5E standards (BS EN 50173-2:2007 Class D).
2. No cable may exceed 90m in length. Where cable consolidation units are used under suspended floors, this limit must apply to the entire run, from patch panel to final network outlet.
3. Cables which terminate inside a room must be contained in plastic conduit, and/or enclosed in dado trunking. If the number of cables terminating in a room exceeds the capacity of conduit, plastic trunking may be used.
4. Cables in corridors must be enclosed in dado trunking, or contained in steel or plastic trunking or conduit.
5. Cables in other locations (e.g. ceiling voids) must be supported on cable tray or basket, or contained in steel or plastic trunking.
6. No single run of containment must exceed 30 metres in length, or contain more than two 90-degree bends, to avoid problems when installing additional cabling.
7. Bundles of cables must not be aggregated using plastic or metal tie-wraps. Velcro is the only material to be used for this purpose.
8. Where UTP cables are run in the same containment as power cables, segregation distances must be maintained as specified in BS EN 50174-2:2008.
9. Where network outlets are mounted in dado trunking, the UTP cables must not pass through the mains compartment, as specified in BS EN 50174-2:2008.
10. Cables must not be routed within 300mm of equipment that generates electrical noise, such as transformers and fluorescent lights.
11. Pairs must be in accordance with EIA/TIA568B.
12. If cables are terminated in an area where building construction or refurbishment works are in progress, the patch panels must be covered to prevent ingress of dust.
13. All UTP patch leads will be supplied by the University.

Fibre optic cabling

1. The University has OM1, OM2, OM3 and OS2 fibre already installed, but for new installations we use the following types, as defined in BS EN 50173-1:2007:
 - a. OM3, for all new multimode links.
 - b. OS2, for all new singlemode links. We do not mandate use of loose-tube or blown fibre: the requirement is for use of fibre meeting specification B1.3 in EN 60793-2-50, i.e. having an optical window at 1383nm. OS1 fibre which meets this requirement will be acceptable.
2. Unless otherwise specified, the following requirements apply:
 - a. Links between buildings must consist of 12 cores multimode and 12 cores singlemode as above. These may be supplied as one or two physical cables.
 - b. Links within buildings (i.e. between comms rooms) must consist of 24 cores multimode as above.
3. If cables are installed in external ducts, the fibre must be rodent-resistant internal/external grade.

4. Fibres must be terminated using LC connectors into new 48-way panels with strain relief glands. Glands must fit tightly to the cables they protect. Connectors must be capped.
5. On each link, receive positions on the patch panel at one end must be connected to transmit positions on the panel at the other end, and vice versa.
6. Unused holes in patch panels must be fitted with grommets to exclude dust.
7. All fixings inside patch trays (e.g. splice packs) must be mechanical rather than self-adhesive, as adhesive tends to deteriorate over time.
8. Multimode cable may be terminated with pigtails or glued and polished connectors (including “hot-melt” systems). Singlemode cable must be terminated with pigtails. Crimp and polish systems are not acceptable due to their higher typical losses.
9. Where fibres are joined, the University has a preference for fusion rather than mechanical splices, because of their lower losses. If mechanical splicing is to be used, details of the proposed system used must be supplied.
10. Care must be taken to avoid contaminating the end surface of fibre connectors. These may be checked by the University as part of the acceptance procedure.
11. Waste resulting from fibre optic termination is hazardous and must be safely disposed of. The Fibre-Optic Industry Association’s Technical Support Guide: FIA-TSD-2000-5-3 may be used as a guide.
12. The patch panels at both ends of a link must be of the same type, and polarity of cores must be consistent between the two ends.
13. In corridors or rooms fibre cables must be enclosed in trunking. In voids it must be supported on cable basket, fastened to walls or traywork, or enclosed in trunking.
14. Where cables are left unterminated in an area where building construction work is in progress, the ends of the cables must be sealed to prevent ingress of moisture, and the cables secured to walls rather than left on floors to prevent damage.
15. Where a fibre cable enters a building, at least 2 metres of slack must be left as a coil in a suitable location near the entry point, to permit later repairs to the cable.
16. All fibre patch leads will be supplied by the University.

All cabling

1. Cables must be made of LSZH material with flame-retardant sheath, complying with IEC60332-1-2.
2. All cables must consist of an unbroken run between the two points to be connected. No jointing of cables is permitted.
3. Installation practice must comply with BS EN 50174:2008 series standards. In particular, attention should be paid to the following:
 - a. Observing minimum cable bend radii.
 - b. Not exceeding maximum pulling force for any cable.
 - c. Not crushing any cable, particularly at bends in containment.
 - d. On copper cables, not stripping more cable sheath or untwisting more of the cores than permitted.
 - e. Using the correct tools as recommended by the cable manufacturer.
4. In general, two-compartment dado trunking is to be used unless the electrical installation requires the capacity of three-compartment.
5. New containment must not be filled to more than 60% of its maximum capacity.
6. All containment must be attached using screws and plugs. Self-adhesive fixing is not acceptable.
7. All joints in containment must be made using manufactured fittings. Unprotected butt or mitre joints are not acceptable.
8. Where cables or containment pass through floors or walls, holes must be sealed with a fire-resistant material in accordance with IEE 17th edition cabling regulations (BS7671:2008).
9. All spare/waste materials are to be removed from the site by the installer, leaving the installation area in a clean state. In particular, this includes brick/plaster dust and swarf from drilled holes, cable reels and cut tails from nylon cable ties.

Cabinets

Cabinet requirements depend greatly on the nature of the room in which they are to be housed. For example, installations in existing buildings may require the use of wall-mounted cabinets, and those in large air-conditioned rooms may more appropriately employ four-post open-frame racks. The specification for a particular installation may replace any part of this section, but general principles of accessibility and safety apply in all cases.

1. Our preferred cabinet is the Excel 800 series. Unless otherwise specified, cabinets are to meet these requirements:
 - Between 42U and 47U in height, 800mm wide x 1000mm deep.
 - Front door to be framed toughened glass with lock.
 - Side panels to be removable and rear door lockable.
 - Levelling feet to be installed.
 - The minimum clearance between the front rails and the door to be 125mm, to ensure that the door can be closed once panels have been patched.
 - If more than one cabinet is required in one comms room, cabinets are to be bayed together.
2. Each cabinet requires at least 800mm of free space in front and behind, to permit access to contained equipment. Each cabinet or group of bayed cabinets also requires at least 500mm of free space to either side.
3. Any enclosed cabinet intended to contain active equipment must be fitted with axial cooling fans in the top cover. If the cabinet contains a power strip (see 7 and 8 below), the fan panel should be fitted with a three-pin mains plug and connected to it. If not, it should be fitted with a cable terminating in an IEC C14 mains plug, for connection to C13 socket on a cabinet UPS.

4. **If the building is for the sole use of University staff and students**, then terminations should be as follows:
 - Fibre patch panels to be at the top of the cabinet.
 - 2U of clear space to be left below the bottom fibre panel.
 - Thereafter 1 x 48-way or 2 x 24-way UTP patch panels, followed by 1U cable management strip (fixed ring type), then 1U free space for active equipment. Repeat this layout down the cabinet.
 - At least 10U of free space is to be left at the bottom of each cabinet.
 - Vertical cable bundles inside cabinets must be routed in such a way that they do not obstruct later installation of active equipment, which may be up to 600mm deep.
5. **If the building will have non-University tenants**, then terminations should be as follows:
 - UTP and fibre terminations to be in separate cabinets from active equipment.
 - All fibre patch panels to be in one cabinet, at the top.
 - Cabinets housing patch panels are to alternate with those intended for active equipment.
 - Within the racks for patch panels, 1U horizontal management strips (fixed-ring type) should alternate with 1U UTP panels. Vertical cable management should be provided at each side of the cabinet.
 - At least 10U free space is to be left at the bottom of each cabinet provided to house UTP terminations.
 - Cabinets provided for active equipment are not to be fitted with cable management.
6. If the room has a suspended floor, then cable entry should be from beneath the cabinet. If not, then unless otherwise specified, cable entry should be from above at the rear of the cabinet.
7. **If the room housing the cabinet has power supplied by a UPS**, then each cabinet which will house active equipment will require one 10-way vertical three-pin power strip mounted at the back of the cabinet.
8. **If the room housing the cabinet does not have UPS power protection**, then one 32A Commando socket is to be located adjacent to each cabinet or bayed group of cabinets, for connection to a UPS which will be supplied and installed by the University.
9. We do not require cleaners sockets in comms rooms.

Earthing

All cabinets and metallic containment elements must be earthed in compliance with the requirements of BS EN 50310:2006. Each room dedicated to housing cabinets must have an earth bonding point for this purpose, connected to the Telecommunications Bonding Backbone in the building's main communications room.

Wireless

The University now provides wireless coverage as standard in all new buildings, and is adding it to many existing ones. If UTP outlets are required for wireless installations then these will be clearly identified on plans and in room data sheets (where applicable).

The University uses Cisco access points, and prefers those which are designed for ceiling mounting, either on a suspended ceiling grid or directly to a solid ceiling. If parts of a new building have ceilings on which it is not practical to install this type of access point, there is an alternative wall-mount design, but this needs to be made clear at the design stage. The access points do not require a mains supply.

Where possible, the University will select locations for mounting access points close to a wall or pillar. If the ceiling has a grid with removable fibre tiles, the outlets should be installed 10-15cm above the ceiling. If the ceiling is suspended, but of a type which is less easy to remove (e.g. metal or fibre panels), the outlets should be 10-15cm below the ceiling. If the outlet is not near a wall, it can be located on a solid ceiling.

To minimise exposure of its own staff to hazardous working conditions (i.e. working at height) all access points must be installed by the data installer. The access points, mounting brackets and UTP patch leads will be sourced by the University and free issued to the installer, who must give the University's representative five working days' notice of readiness to begin installation. The University is happy to explain the mounting procedure to the installer's staff.

Because it is difficult to carry out wireless surveys until construction is finished, the University will often require more outlets to be installed for wireless than may be needed to provide adequate coverage. In such cases we may wish to carry out a survey as the access points are being installed, to ensure that they are only located where needed.

Access points must not be connected until their outlets have been successfully tested.

Labelling

If there is an existing labelling convention in this building, the labelling format should agree with it. If there is any uncertainty about the format to be used, it must be discussed with the IT Services department before the installation starts. Other requirements below, not related to the content or format of the labels, apply in all cases.

If there is no existing labelling convention in this building, each UTP outlet must be labelled using the format "cabinet/panel/outlet", where "cabinet" identifies the cabinet holding the UTP patch panel that the outlet is terminated on (from 1 upwards, allowing for any existing cabinets in the same building, and assigned by the installer), "panel" is the number of the patch panel (1 for the top panel in a cabinet, 2 for the next and so on), and "outlet" is from 1 to 24 (or 48) as shown on the patch panel. Each cabinet must have a label giving its cabinet identifier at the top, and each panel must have a label at the left-hand end identifying the panel number within that cabinet.

If underfloor cable consolidation units are used, then labels must be affixed both to the socket on the consolidation unit and to the final outlet provided for the end user.

Each fibre cable must be labelled with the University standard building identifier and cabinet number (as above) of the cabinet containing the other end, and the type and number of fibres. The labelling on each fibre patch panel must identify the core numbers within each cable.

Testing: general

The University must be invited to witness the testing of all cabling, and will generally choose about 10% of links to witness. Five working days notice must be given of the start of testing.

Testing: copper cabling

All permanent links must be compliance tested in accordance with IEC 61935-1 to ensure that they meet the performance requirements for the cable type installed (i.e. BS EN 50173-2 Class D Permanent Link in the case of Cat5E). All pairs must be tested. The test equipment must be warranted by the manufacturer for level 3 UTP certification. Fluke DTX and DSP series are suitable examples. The tester must be maintained as recommended by the manufacturer. Test leads and connectors must be checked regularly for wear.

All outlets must have their permanent labels at both ends before testing is started. If labelling is changed after testing is done, the links affected must be re-tested.

An electronic copy of the test results for each link must be supplied on CD.

Testing: fibre optic cabling

Fibre optic cables must be certification tested using light source and power meter equipment in accordance with IEC 61280-4-1 (for multimode optical fibres) and IEC 61280-4-2 (for single mode optical fibres). The Fluke CertiFiber is an example of a suitable device.

Tests on multimode fibre must be done at both 850 and 1300 nm. Singlemode fibre must be tested at 1310nm. The test method used should be TIA OFSTP-14 (multimode) , Method B, One Cable Reference. Test results should include the expected loss (based on length, splices and connector pairs) as well as the observed loss.

The test equipment must be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy (normally 12 months).

The fibre optic launch cables and adapters must be of high quality and the cables must not show excessive wear resulting from repetitive coiling and storing of the test equipment interface adapters. No index matching gel shall be used. The end face of the launch lead must be cleaned before each set of tests, to avoid contamination of the connectors under test.

The length of each cable must be calculated from cable markings and recorded as part of the test results.

The results of fibre testing must be supplied in electronic form on CD.

Warranty

If an installation includes all the network cabling on a floor or in a building, then unless otherwise stated, the University will require a manufacturer warranty (15 to 25 years) to be supplied on completion.