



Communications and Cabling Standards

	Information and Communications Technology
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SECTION 1 GENERAL

1.1 INTRODUCTION

The purpose of this standard is to specify the design, installation, maintenance, decommissioning and removal of communications cabling infrastructure at the University of Sydney.

Communications cabling infrastructure includes cables, cable pathways, and spaces dedicated to communications cable such as communications rooms and risers.

This standard is intended to be used by ICT staff, installers and designers.

Electrical consultants/designers must identify any relevant information contained within which needs to be passed on to architects and other designers and ensure that the information is received in time to produce a design conforming with the requirements contained within the standard.

1.2 QUESTIONS AND INQUIRIES ABOUT THIS STANDARD

Contact the relevant Project Manager in relation to Project or the Communications Infrastructure Analyst, ICT Communications Services on (02) 8627 7840.

1.3 VIEWING THIS DOCUMENT BETTER

Many of the illustrations in this document are vector graphics which will magnify clearly. Use a PDF viewer to zoom in on details such as labelling. For a hard copy, print more detailed illustrations such as the schematics at A3 size or larger.

1.4 TERMS AND ABBREVIATIONS

All terms and abbreviations used in this document are defined in the AS/ZS 3080:2013 standard.

1.5 OWNERSHIP

All permanently installed data and voice cabling inside buildings and between buildings is part of the University communications cabling infrastructure and form part of the services provided by the Information and Communications Technology (ICT) department of the University of Sydney.

All communications rooms and spaces are allocated to ICT as reflected by the University's space register. The campus underground communications ducting network, comprising conduits, pits and manholes, is also the property of ICT along with any aerial communications cables and dedicated poles.

Any proposed alteration to the cabling infrastructure must be submitted to ICT for approval.

Where the University has engaged a contractor to recover a communications cable by destructive means, any scrap cable is deemed to be the property of the contractor. Cablers are required to dispose of scrap cable responsibly.

The University will inform the contractor if any cable is to be recovered whole and undamaged and returned to ICT.

1.6 UPDATES TO THE COMMUNICATION STANDARDS

To maintain the currency of the Communications Cabling Standard, ICT is committed to periodically updating the standard to incorporate new industry practices, materials and information gained from post implementation reviews.

Suggestions for improvements to the Communication Cabling Standard are welcomed and consultants are encouraged to notify us immediately.

1.7 INTERFACE WITH OTHER SERVICES

Designed by	Task
Civil Engineer	Manhole drains
Mechanical Engineer	Communications room air conditioning Confirm that no general air-conditioning ducts are to be run through the communications room
Architect	Communications room architecture Communications riser cupboard architecture Access to cable pathways Visible cable pathways Position for any public phone, student welfare phone or emergency phone Confirm that workstations can accommodate Cat 6A F/UTP cables correctly Position lift FDP and specify enclosure Provision ELV cupboards for non-communications electronic services
Structural Engineer	Penetrations for lift FDP Penetrations for communications
Lift Company	Connection to lift FDP
Fire Services Consultant	Fire sprinkler head cages in communications room
Hydraulics Consultant	Fire sprinkler head cages in communications room Confirm that no plumbing is to be run through the communications room

1.7.1 MODULAR FURNITURE

Cable pathways in modular furniture must be suitable for Category 6A F/UTP cable bend radius. The basket type of under-desk cable tray has been the most successful at achieving this.

Ensure that faceplates for modular furniture have a flat surface where the required traffolyte labels can be fixed. Faceplates are to be supplied for approval prior to commencement and ordering.

1.8 APPLIED STANDARDS AND UNIVERSITY OF SYDNEY REQUIREMENTS

Cablers and cabling installations shall comply with all applicable Australian laws and regulations, whether explicitly referenced in this standard or not.

The cabling system is based on industry standard documents. The applicable standards are given in the following list and shall be conformed to. Where these standards have subsequently been amended or revised, the latest versions shall be conformed to.

The University of Sydney Communications Cabling Standard, as included in this document

University of Sydney Parts List for Communications Cabling

Cat 6A F/UTP "Foil UTP" version, published separately from this document ("the Parts List")

Telstra Work Instruction 010254 W06

Australian Standards

AS/NZS 3000:2016	SAA Wiring Rules
AS/NZS 3080:2013	Telecommunications installations - Generic cabling for commercial premises
AS/NZS 3084:2003	Telecommunications installations - Telecommunications pathways and spaces for commercial buildings
AS/NZS 3085.1 2003	Telecommunications installations - Administration of communications cabling systems: Basic requirements
AS/NZS 4703:2007	Electrical wiring in furniture
AS/NZS IEC 61935.1:2012	Specification for the testing of balanced and coaxial information technology cabling Part 1: Installed balanced cabling as specified in ISO/IEC 11801 and related standards
AS/NZS ISO/IEC 14763.3:2012	Telecommunications installations – Implementation and operation of customer premises cabling - Testing of optical fibre cabling
S/NZS 2967	Optical fibre Communication Cabling System Safety
AS/NZS IEC 60825.1	Safety of Laser Products
AS/NZS IEC 61935.1	Specification for the testing of balanced and coaxial Information technology cabling
	Testing of optical fibre cabling
ISO/IEC 14763.3	
AS/CA S008:2010	Requirements for customer cabling products
AS/CA S009:2013	Installation requirements for customer cabling (Wiring rules)
AS 5488:2013	Classification of Subsurface Utility Information (SUI)
ACA TCPR 2000	Telecommunications Cabling Provider Rules 2000
Building Code of Australia	

International Standards

ISO/IEC 11801:2011	Information technology - Generic cabling for customer premises
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If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity.

1.9 MANUFACTURER'S INSTRUCTIONS

It is the cabler's responsibility to obtain the manufacturer's instructions before installing or otherwise using a cabling product. All cablers will hold appropriate and current qualifications to install that manufacturer's product.

1.10 INCLUSION OF THIS STANDARD IN DOCUMENTATION PACKAGES

Both this standard and the Parts List shall be copied into specifications for indoor and outdoor communications work, to ensure that all contractors quote from the same version.

The Parts List is updated regularly. Include the current version from the website.

Any specification which does not include the Parts List and (where applicable) details for the pits and manholes is incorrect. In this circumstance the tenderer is to obtain the missing information during the tender period.

1.11 NEW STRUCTURES

All new buildings, however small, must be connected to the underground communications ducting network at the time of construction, if they are being connected to electrical power. Spare electrical conduits are not to be provisioned for future communications connection.

Any structure with a fire system, lift phone or emergency phone must have a copper lead-in cable connected.

Outdoor structures such as pumphouses, sewerage treatment plants and utility meters require communications cabling to facilitate current and future remote monitoring. Appropriate space for communications equipment must be provided within the equipment housing, and the communications conduits must be connected to the underground communications ducting network.

It is not to be assumed that optical fibre and voice grade communications cables will necessarily have their origin at the same point as the electrical power at a structure. ICT will specify the required ducting connections, which may not run in the same direction as the electrical conduit connections.

1.12 DESIGN AND CONSTRUCT PROJECTS

Where ICT has contributed to the reference design, the sizes of communications rooms and numbers of racks, including empty racks, represent ICT's assessment of the minimum required for ongoing service to the floor space. These sizes and quantities are not to be reduced in tender responses or reverse briefs.

Where underground ducting and manholes are specified, these also represent a minimum acceptable provision which is not to be reduced.

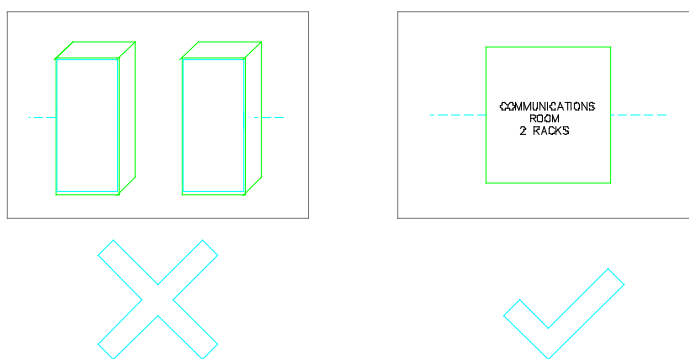
1.13 SCHEMATIC (SINGLE LINE DIAGRAM)

For work involving more than two communications rooms, the communications schematic shall be drawn as three separate schematics. One shall show optical fibre cables, one shall show voice grade cables, and one shall show Category 6A 4-Pair F/UTP cabling (both backbone and horizontal).

The schematics for fibre and 4-Pair F/UTP may be combined if the runs for these are identical.

Sample schematics for a building with four communications rooms in a stack, two risers and two building entry points are given in this document.

Exact rack elevations including equipment positions, cabling patch panels and FOBOTs will be provided by ICT. Schematic drawings are not to include this level of detail, to avoid any ambiguity. Rack sets are to be shown as simple rectangles. Quantities of racks are to be included in the schematic.



1.14 BUILDING CODES AND ROOM NUMBERS

All University buildings have a building code. For example, the building code of the Services Building is "G12".

Some buildings which look like one building are in fact regarded as separate buildings and have different building codes for different sections.



Many University buildings have missing level numbers at the bottom, such as not having a level 1. This is because buildings which are joined together have matching level numbers across the joins.

Room numbers shown on construction plans are not necessarily official University room numbers. Cablers are advised to make a formal request for the official room numbers before ordering traffolyte labels through Campus Infrastructure Services (CIS).

For a new building, even the final floor level numbers may be different. To avoid problems, designers are required to seek the advice of the Space Information Officer early in the design phase.

When a room with existing wiring is refurbished, but keeping the existing communications wiring, new labels must be fixed at both ends of all cables if the room number has been changed.

Communications rooms must have a room number. The door must have a sign giving the room number and the description "Communications".

It is important to avoid renumbering existing communications rooms, as the room number will be referred to on the traffolyte labelling of many existing outlets in the building. The expense of changing all the labelling may be substantial.

1.15 TYPE OF TELEPHONE SYSTEM

ICT is installing IP telephones in new buildings, through building refreshes and in some refurbished areas of existing buildings. Strategically softphone options including Skype for Business/Teams and mobile phones may be part of the solution offerings.

At hospital campuses, telephone services are usually provided by the hospital.

Small refurbishments of existing buildings normally have the type of phone that is already in use in the building.

The type of phone and who provides it must be confirmed with ICT in conjunction with the business.

1.16 UPS POWER TO COMMUNICATIONS

University communications rooms are not fed with UPS power as a standard. If the building power fails, the network and any IP telephones will cease functioning while the power remains in a failed state. Generally, occupants of the building are evacuated during a power outage and therefore the additional ongoing costs for UPS power is unwarranted. Do not specify UPS power where ICT has not requested it, as unnecessary UPSs are a maintenance burden. If UPS is required, the design and specification must be confirmed with ICT.

Lift phones and emergency phones are connected by the copper lead-in cable to the building and are powered down the line from the telephone exchange or the batteries of the University PABX. These services will remain working for a reasonable period of time during a blackout.

UPS power is only installed in major communications rooms which feed a sector of the campus.

1.17 ACTIVE EQUIPMENT (ETHERNET SWITCHES AND NETWORK ROUTERS)

Ethernet switches and network routers are generally procured by ICT staff. They are generally not supplied by builders or their subcontractors.

Should a specification imply that active network equipment be supplied to the University, an RFI is to be raised immediately for clarification. This situation arises primarily in Security designs.

As some building systems need to be connected to the University network before they can be commissioned, it may be necessary for ICT staff members to be inducted on a building site so that they can commission the network before general handover of the area.

1.18 POWER OVER ETHERNET

Networked equipment shall be powered locally or by standard IEEE-compliant Power Over Ethernet as supplied by the Cisco ethernet switches in the communications rooms. Power injectors are not permitted.

1.19 FIRE SYSTEM AND SECURITY CONNECTIONS BETWEEN BUILDINGS

Generally, fire system connections to a building are made over the copper telephone lead-in cable and via the data network. Dedicated fire system cables are not installed in the underground communications ducting. Please refer to CIS for more information about the fire system.

Security connections between buildings normally use the data network. Dedicated security system cables are not installed in the underground communications ducting. Please refer to CIS for more information about security systems.

1.20 STRUCTURED WIRING APPROVED INSTALLERS

Security, BMS, AV, FMS and other equipment installation contractors are not to install structured wiring to the communications room.

Where a head contractor has engaged a structured wiring installation contractor for general wiring to desks and other general areas, that contractor shall install all the structured wiring required for the project.

Where small-scale works do not have a dedicated structured wiring installation contractor, ICT shall be engaged to manage the installation through an approved installer.

All structured wiring required for security, BMS, and other services shall be shown on the electrical drawings where the general structured wiring is shown, to ensure that the structured wiring contractor will include it in their work package.

1.21 DEMARCATION BETWEEN INDOOR AND OUTDOOR COMMUNICATIONS CONTRACTORS

Indoor and outdoor communications work require different qualifications. If the work is carried out by one contractor, they will hold the appropriate and current qualifications for indoor and outdoor communication installations.

Work on underground ducting, manholes and underground grade cable is "outdoor" work. Poles and aerial cabling are "outdoor" work.

Where devices are mounted on the outside of a building and fed from inside, such as security cameras connected with F/UTP cable from an indoor communications room, this is counted as "indoor" work.

Demarcation is as follows if separate contractors are engaged: the outdoor contractor is responsible for the outdoor cable pathway up to the building entry point, including pipes through the wall. The indoor contractor is responsible for indoor cable tray or other indoor cable pathways through the building from the cable termination point to the building entry point, even if the only cable it carries will be installed by the outdoor contractor. The outdoor contractor installs the external cables for their entire length and terminates/joints them at each end.

The indoor and outdoor communications cablers, if separate, shall co-ordinate to ensure that the lead-in pipes meet the internal cable pathway in a graceful manner which will not impede safe and efficient hauling of cables.

1.22 ROLE OF THE UNIVERSITY'S ICT DEPARTMENT IN UNDERGROUND COMMUNICATIONS

ICT purchased most of the Telstra infrastructure on the University's main campus in the mid 1990s and has continued to maintain and develop the network, integrating it with pre-existing University-built infrastructure. Generally, buildings on the University's campuses do not have direct carrier lead-in ducting or cabling. ICT is accountable for the delivery of services into and throughout the University buildings.

Many pit and manhole lids on the Camperdown and Darlingtong campuses still bear their original PMG/Telecom Australia/Telstra markings, even though they are now University property.

Many University building and refurbishment contracts include indoor communications works such as installation of structured wiring. By contrast, work involving changes to the underground communications network is normally carried out directly by ICT.

In cases where a CIS project requires underground communications work associated to Campus Infrastructure Projects (CIP or capital works), the work will be carried out at the project's expense. These works will be carried out under the builder's contract to ICT's standards.

In all other projects requiring underground communications work, the work will be carried out by ICT at the project's expense, with the sole exception of projects where a substantial amount of communications civil works need to be carried out within the envelope of a building site.

As ICT owns virtually all of the ducting on the Camperdown and Darlington campuses, carrier cables normally have to be housed in this ducting together with the University's own cables.

Different arrangements may apply at campuses other than Camperdown, Darlington, Camden/Cobbitty and Cumberland, and at hospital sites. Please contact ICT for details.

1.23 UNIVERSITY BUILDINGS AT HOSPITAL SITES

Whether or not IP telephones will be installed within the building, a copper cable shall be provided to connect the building with the hospital MDF.

1.24 RESIDENCES AND TENANCIES ON UNIVERSITY PROPERTY

All residences, shops and devices such as ATMs require communications facilities.

ICT will specify the appropriate wiring and arrangements for each location.

Designers must consult ICT before planning these connections.

1.25 INSTALLATION OF LEAD-IN CABLES

University-owned lead-in cables are installed by ICT at project expense.

In cases where a CIS project requires lead-in cables associated to Campus Infrastructure Projects (CIP or capital works), the work will be carried out at the project's expense. These works will be carried out under the builder's contract to ICT's standards. This includes provision and installation of a suitable pathway for the cable from the building entry point to the communications room.

Designers must take care to document this pathway explicitly in the electrical drawings and ensure that it is large enough to carry the maximum number of cables that can be inserted through the building entry point conduits.

The requirement for the builder to price this pathway cannot always be derived from the communications schematic, as the builder may not have any internal cables to install in that direction. The explicit documentation of the pathway is necessary to avoid contract variations.

1.26 PAY TV CABLES

Pay TV cables and equipment are not permitted in any ICT space, including communications rooms, risers, and the underground communications ducting network.

1.27 TELECOMMUNICATIONS CARRIER CABLES

Any proposal to install a cable owned by a telecommunications carrier at a University site must be reviewed by ICT.

Generally, tenants are not permitted to have direct carrier cable connections.

1.28 PACKAGING OF UNDERGROUND COMMUNICATIONS WORK

Where underground communications installation work falls within the scope of a larger package of works, the underground communications work is to be documented in a separate package from the electrical specification.

The electrical specification shall contain a clause stating that the underground communications work is packaged separately and does not form part of the scope of the electrical contractor's works.

The underground communications package shall include the following statement:

"This underground communications work is to be carried out by specialist tradespeople holding Telstra qualifications, as described within the Communications Design Installation Standards. Contractors without the relevant Telstra qualifications are not to participate in the quoting or installation of the underground communications infrastructure."

1.29 WORK HEALTH AND SAFETY

All contractors attending site for any University communications cabling works must complete the University contractor induction, provide Safe Work Method Statements for sighting if requested covering all activities, and attend an induction with ICT's Communications Infrastructure Analyst. Proof of insurance is required if not engaged under a government panel contract. All staff are always required to carry a University of Sydney contractor card when on site and when requested provide the card for identification checks. Failure to produce a University of Sydney contractor card may result in removal from site.

When working within Campus Infrastructure Services (CIS) controlled sites, all contractors are required to comply with all CIS work health and safety processes, guidelines and requirements. This will include specific building inductions as required. If engaged by ICT, the leading hand will be briefed by the ICT Project Manager of the specific WHS requirements for the works. If in doubt, contact the CIS Project Manager or the ICT Project Manager.

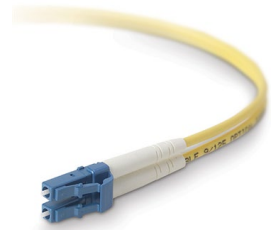
Traffic control, where identified and required, will be managed through the engaging Project Manager. Before commencing works requiring traffic control, the Project Manager must approve the traffic control plan and communicate to CIS security and traffic management.

For clarity, contractors should not begin any activity for the University without a Scope of Works and signed engagement contract.

1.30 RECORDS

Record books are only used at Krone frames. Do not supply record books for racks.

SECTION 2 OPTICAL FIBRE CABLING



2.1 OPTICAL FIBRE TOPOLOGY

Each building shall have a primary distribution communications room ("main communications room") and a secondary distribution communications room ("secondary communications room"). This is normally the main communications room at the bottom of the building and the secondary communications room at the top.

The building shall be fed with a minimum of two external optical fibre cables, approaching the building via diverse paths and entering the building via different building entry points. One cable shall feed the main communications room and the other shall feed the secondary communications room. The two cables shall not cross inside the building.

Each floor communications room shall have two optical fibre cables leaving it, one to the main communications room and one to the secondary communications room. These should travel via different risers and not cross anywhere.

The main communications room and the secondary communications room must be connected to one another with optical fibre as well, preferably via two different routes through the building.

Examples of cable pathway arrangements which are not considered sufficiently diverse are:

1. Two risers in the same room or close to one another in the same corridor;
2. Two building entry points within a short distance of one another, or entering the same room;
3. Two cable trays running parallel down a corridor whether separated or not.

ICT must review and approve all proposed backbone cable pathway arrangements.

The University of Sydney does not use optical fibre joints in its cabling topology.

2.2 FIBRE TO THE DESKTOP

The University of Sydney does not install fibre to the desktop. Where a specific need is identified, generally associated to high speed research infrastructure, these are to be raised to ICT for review and approval.

2.3 TYPE OF OPTICAL FIBRE

All new optical fibre is to be single mode.

The glass fibre is to be type B1.3, also known as ITU G.652c or G.652d. This glass is commonly known as "OS2 glass".

Optical fibre cable to be installed underground must be loose tube gel-filled cable with a polyethylene sheath and a nylon over-sheath. "Indoor outdoor" tight-buffered cable may not be used in underground ducting, but may be used under awnings and in service tunnels.

2.4 OPTICAL FIBRE CORE QUANTITIES

For external installations use:

- 24 core SM cables between buildings
- 12 core SM cables to very small buildings (e.g. sheds, gatehouses, electrical substations.)
- Major optical fibre runs on campus may use larger cable sizes such as 48 or 96 cores.

For internal installations use:

- 24 core SM cables

Where multiple cables are to be terminated in a communications room, these sizes indicate the sizes of the individual cables to be installed, not the total number of cores to be terminated in the room.

2.5 SPECIFIED CABLE SIZES ARE TO BE INSTALLED

Where a certain size of optical fibre cable has been specified, only that exact size is to be installed.

For example, two 24 core cables are not acceptable where a 48 core cable has been specified, and a 24 core cable is not acceptable where only a 12 core cable has been specified, even if only 12 cores of it are terminated.

All cores of each cable are to be terminated at the time of installation.

2.6 OPTICAL FIBRE CONNECTORS

The existing University Campus infrastructure is installed using LC connectors for both single mode and multimode cable.

Optical fibre cables shall be terminated using fusion splicing and pigtails only. Direct (hand) termination is not permitted except for pre-manufactured and tested patch leads. All connectors on pigtails shall be Ultra PC (UPC) factory polished.

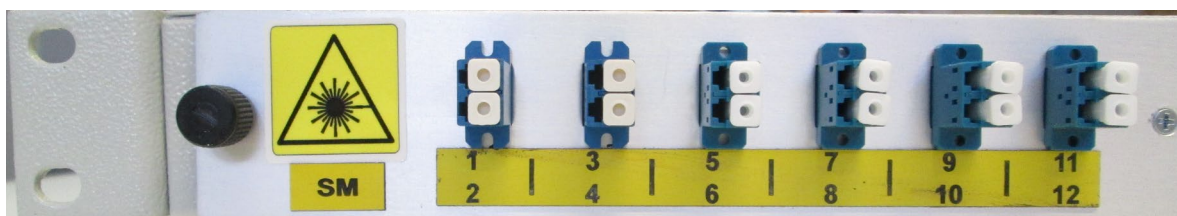
Pre-terminated optical fibre cables are not permitted.

2.7 OPTICAL FIBRE POLARITY

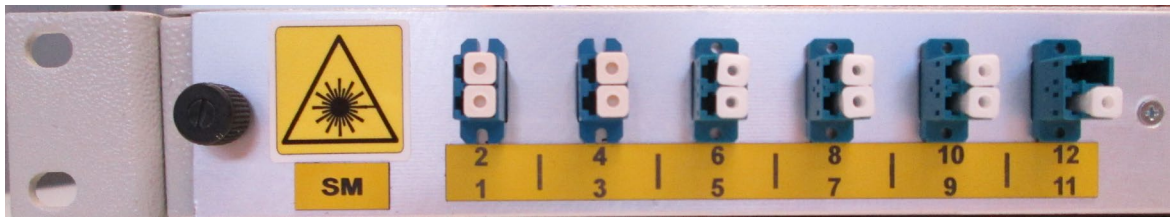
Optical fibre cables are to be terminated "crossed", so that core 1 is terminated on outlet 2 with core 2 terminated on outlet 1 at each end.

2.8 OPTICAL FIBRE OUTLET NUMBERING

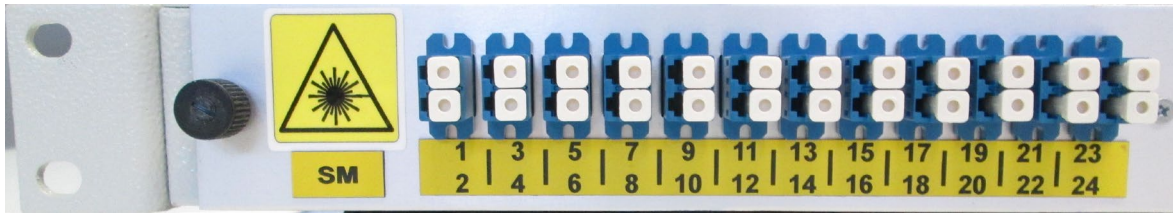
A end



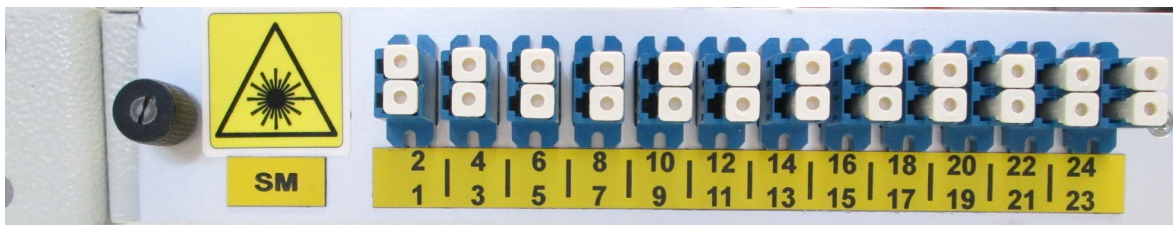
B End



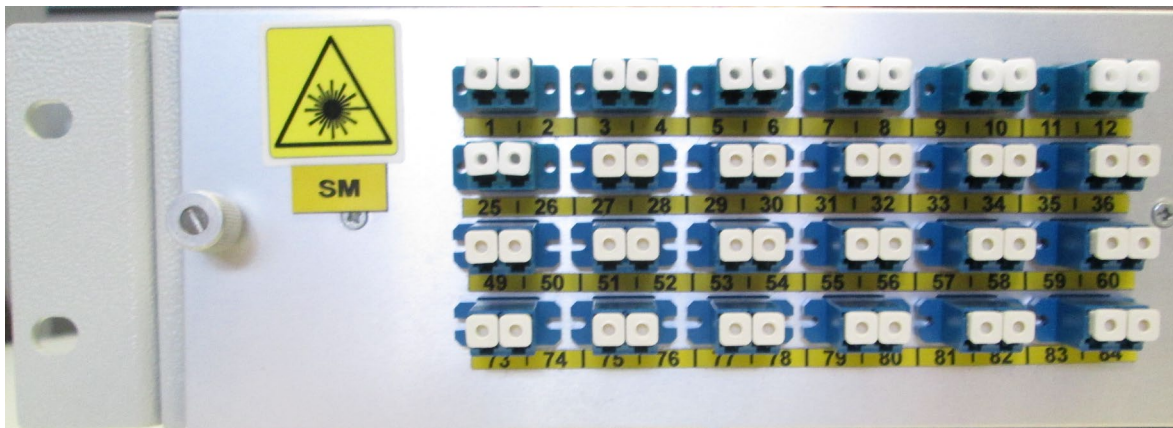
A End



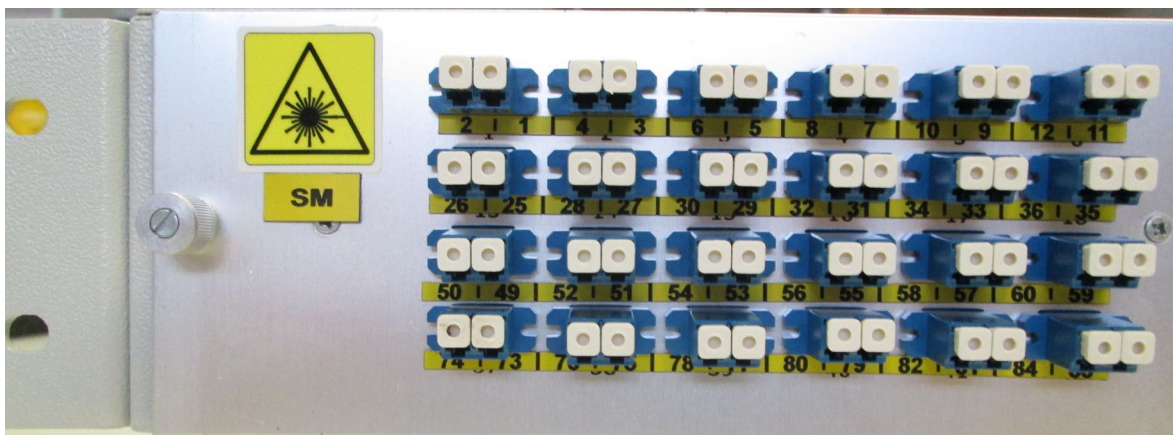
B End



A End



B End

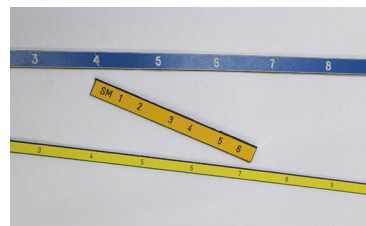


2.9 OPTICAL FIBRE LABELLING

2.9.1 LABEL MATERIAL AND SIZE

All FOBOT labels are made of engraved traffolyte. Sizes shall be similar in proportion to the illustrations. Pit labels shall be made of UV-stable traffolyte.

Internal cables shall be labelled at the back of the FOBOT with self-laminating wrap type labels



Label type	Background colour	Text colour
FOBOT cable detail label	White	Black
FOBOT single mode outlet numbering	Yellow	Black
FOBOT multimode outlet numbering	Blue	White
Pit label	White	Black

2.9.2 LABEL INFORMATION

Cable detail labels at FOBOTs show:

- Composition of cable
- Destination of cable
- Length of cable
- Route information if diverse risers or routes are used internally
- Cable number for cables between buildings

Cable numbers are issued by Mr James Ding, Senior Professional Officer, ICT.

FOBOT outlet numbering labels show:

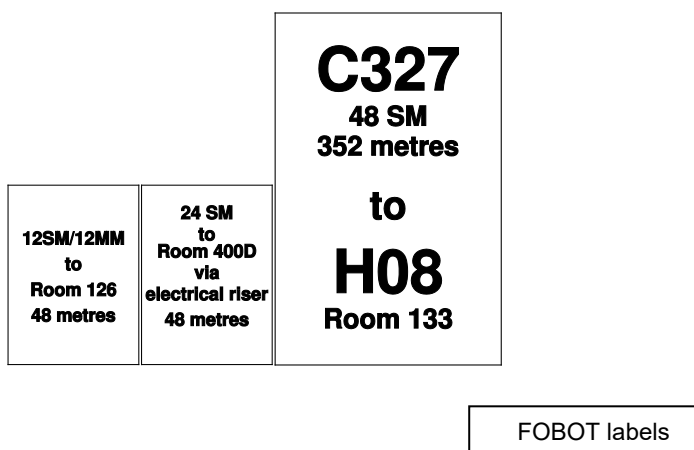
- Type of fibre core (SM or MM)
- Number of core in cable (composite cables have 1SM and 1MM, etc.)

Labels in pits show:

- Cable number
- Termination locations

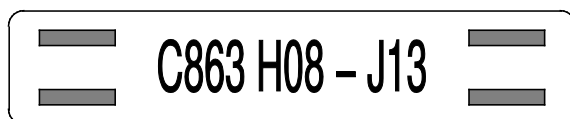
2.9.3 FOBOT LABEL ILLUSTRATIONS

Refer to the illustrations below and the labelling FAQ section of this document. You can use your PDF viewer to zoom in on the labels on the FOBOT illustrations also.



2.9.4 PIT LABELS

Pit labels shall be fixed to the cable in all pits and manholes, all risers, at every penetration, and at the back of the FOBOT.



2.10 OPTICAL FIBRE PATCH CORDS

Optical fibre patch leads are supplied by the University. Optical fibre patch cords can be pre-manufactured and tested.

Optical fibre patch leads shall be routed so that FOBOTs with swinging doors can be opened by optical fibre technicians (i.e. with the lead heading towards the hinges of the door).

2.11 CABLE SLACK

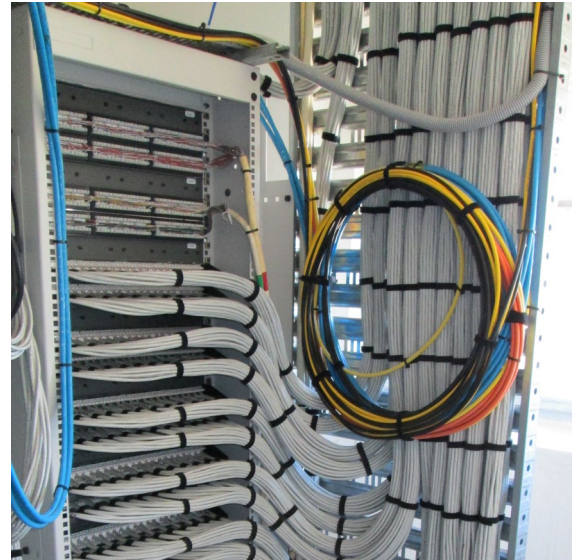
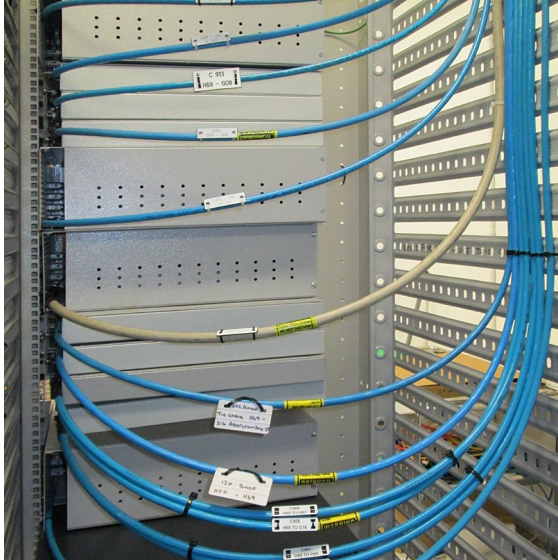
Cable slack and service loops are not to be left at the rack.

For internal cables, house the slack in the ceiling or under the floor, close to the communications room.

For external cables, house the slack in the pit or manhole, correctly racked on cable bearers.

For internal cables, allow at least 4m slack at each end.

For external cables, allow at least 15m slack at each end.



2.12 MECHANICAL SPLICES PROHIBITED

Mechanical splices are not permitted. Only fusion splices are acceptable.

2.13 SPLICES BETWEEN OPTICAL FIBRE CABLES PROHIBITED

Optical fibre cables shall not be spliced together in FOBOTs or pits, other than for emergency temporary repairs.

Where optical fibre cores are to be installed from point A to point B and also from point A to point C, one cable shall be run from A to B and another from A to C, even if sections of the cable runs are parallel.

2.14 TESTING

2.14.1 GENERAL

All cabling links shall be 100% tested to verify performance under installed conditions to AS/NZS 3080:2013 and the manufacturer's certified installer agreement (if applicable).

Only full passes are acceptable; star passes are counted as fails.

Optical return loss testing, which is optional in AS/NZS 3080:2013, shall be performed for all single mode cables over 100m long.

Any legacy multimode fibre which is being reterminated shall pass OM1 tests.

All single mode optical fibre shall pass OS1 tests. Where the cable also passes OS2 tests, the cable shall be reported as having passed OS2 rather than OS1.

Underground grade (loose tube) single mode optical fibre shall pass OS2 tests.

All cores shall be tested for continuity and polarity.

The length of each core shall be measured and recorded in the test result.

All test result documentation shall refer to the cores by the numerical outlet numbers used on the permanent traffolyte labels on the FOBOTs.

Results of all tests shall be presented to ICT for approval.

2.14.2 CALIBRATION OF TEST EQUIPMENT

Test results shall be accompanied by a current calibration certificate for the test equipment used. The certificate shall be issued by a service centre certified by the test equipment manufacturer and shall show the date of calibration and the required date of next calibration.

2.14.3 LIGHT SOURCE AND POWER METER TESTING

LSPM testing is compulsory for all optical fibre links.

The test method shall be AS/NZS ISO/IEC 14763-3:2012, either the 1-cord test method or the 3-cord test method.

All cores shall be tested at two appropriate wavelengths and in both directions. For multimode fibre, test at 850 nm and 1300 nm.

For single mode fibre, test at 1310 nm and 1550 nm.

2.14.4 OTDR TESTING

Single mode cables over 100m long shall be tested using an OTDR to produce a signature trace and measure the optical return loss.

A launch lead and tail cord shall be used. The launch lead shall be at least 500m long and the tail cord shall be at least 100m long.

The OTDR instrument shall have been calibrated by a certified calibration laboratory within the twelve months immediately preceding the date of testing.

The test shall be performed once on each core for each wavelength. A second test of the core in the opposite direction is not required.

The test result will be PASS when the following conditions are met:

1. Mated connector reflectance does not exceed -35 dB for single mode.
2. The loss through the front connector, including the fusion splice between the pigtail and the cable, does not exceed 0.65 dB, which allows 0.5 dB for the mated connector and 0.15 dB for the fusion splice.

3. The loss through the rear connector, including the fusion splice between the pigtail and the cable, does not exceed 0.65 dB, which allows 0.5 dB for the mated connector and 0.15 dB for the fusion splice.
4. There are no embedded events in the length of the cable, confirming that the installed cable consists of a front connector, a rear connector, two fusion splices and a manufactured length of cable only. Cables including extra connectors, extra splices (joints) or any damage, stress or repairs will not be accepted.
5. Testing has been carried out at both 1310 nm and 1550 nm.
6. Test data provided is suitable for and capable of establishing the status of all events along the cable.
7. The dead zone of all reflective events shall not exceed 15m.
8. Pulse width has been set between 10 ns and 30 ns inclusive.

Supply OTDR results for test review in two formats:

1. Bellcore-Telcordia electronic format (".sor" file), which will allow the cursors to be moved when the file is opened with appropriate software;
2. PDF, one page per core at each wavelength, with cursors positioned to include the front and rear end connectors in the loss measurement. Include an event table (LSA assessment) and show the two-point loss.

2.14.5 PIGTAIL MANUFACTURER'S SPECIFICATION TO BE PRESENTED

Together with the test results, present the manufacturer's specification for each pigtail installed. This must include:

1. The brand name of the pigtail
2. The model name and part number of the pigtail
3. The manufacturer's measurement of the loss through the individual pigtail

2.14.6 TEST RESULT REVIEW

Optical fibre test results shall be reviewed either by the wiring system manufacturer or by a NATA-accredited inspection body.

All signature traces shall be reviewed by a NATA-accredited inspection body.

Any costs associated with test result review shall be included in the installer's quote.

The installer must provide the manufacturer's warranty certificate, and/or the NATA report and Statement of Compliance, before ICT will accept the optical fibre installation.

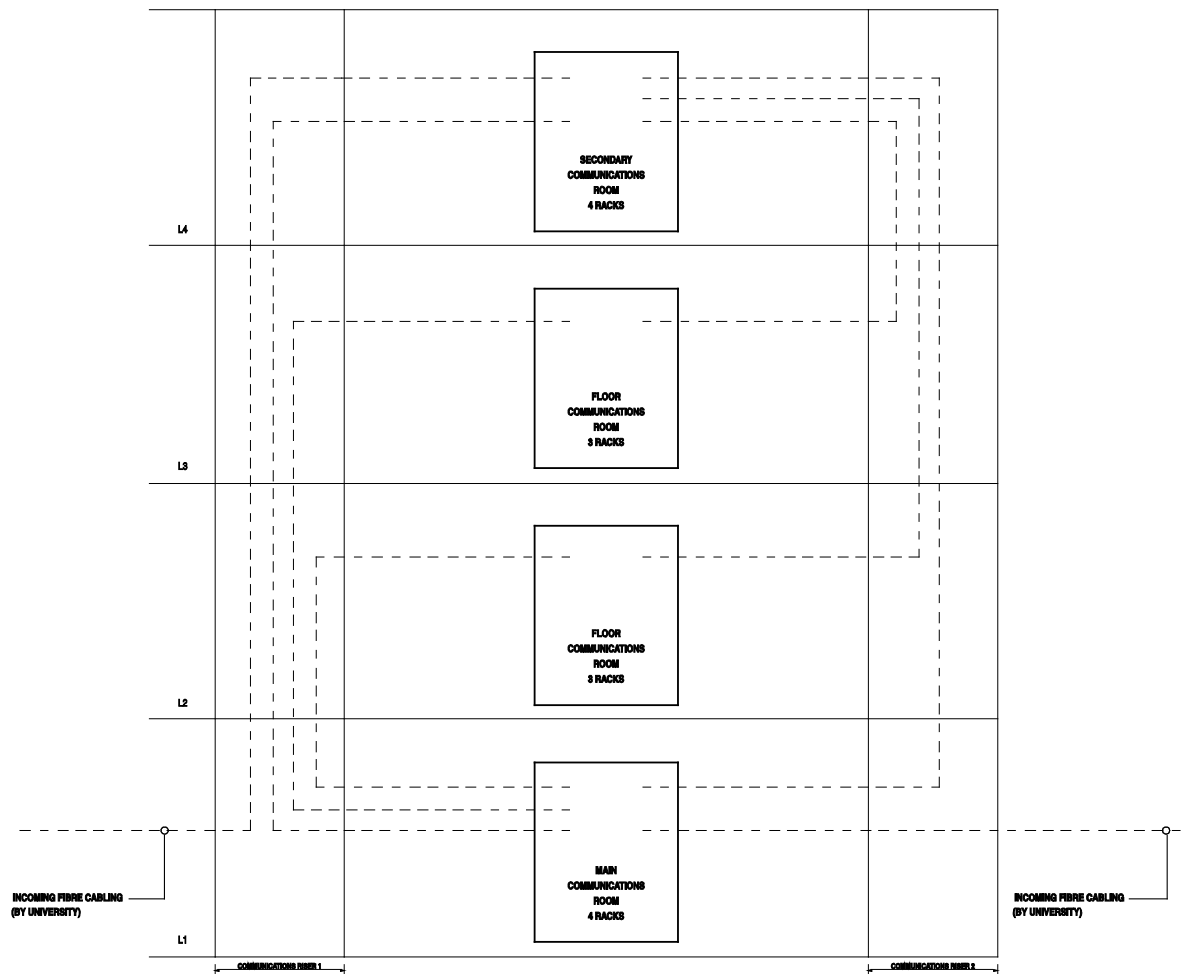
The NATA inspection body shall provide copies of the test result review reports directly to ICT as well as to the installer.

At the time of writing, the only local NATA-accredited inspection body for optical fibre was VTI services, www.vti.net.au

2.15 SAMPLE OPTICAL FIBRE SCHEMATIC FOR A SIMPLISTIC BUILDING

NOTES:

1. ALLOW FOR ALL NECESSARY CABLE TRAYS, CONDUITS, CATENARY WIRES AND SKIRTING DUCT FOR THE RETICULATION OF CABLING
2. ALL CABLES 24 CORE SINGLE MODE
3. SPECIFIED CABLE SIZES ARE TO BE INSTALLED
4. MAIN AND SECONDARY COMMUNICATIONS ROOMS MAY ALSO BE USED AS FLOOR COMMUNICATIONS ROOMS WITH EXTRA RACKS.



OPTICAL FIBRE CABLING SCHEMATIC

SECTION 3 4-PAIR F/UTP CABLING

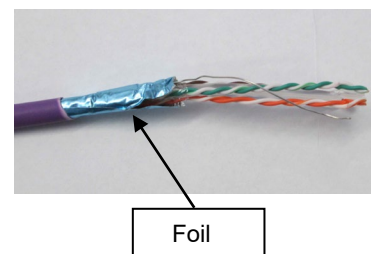
3.1 CLASS OF WIRING SYSTEM AND TYPE OF CABLE

For a new building or complete rewiring of an area, a Class EA wiring system with Category 6A F/UTP cable shall be installed.

For minor extensions to existing Class D and Class E wiring systems, Category 6 U/UTP cable may be used at the discretion of ICT if the last old patch panel is not yet full.

Refurbishment projects must only install Class EA wiring with F/UTP.

F/UTP cable must be earthed. Refer to the Earthing section.



3.2 LOGICAL CATCHMENT AREAS

Each communications room has a 'catchment' area in the building, to which it feeds 4-pair F/UTP cabling.

Other than in transitional arrangements, catchment areas shall not overlap.

The catchment area relates to the standard specification on the maximum length of 4-pair F/UTP cabling being 90 metres in length. Every part of the building shall belong to a catchment area, so that a 90m cable can reach it.

Inconsistencies are to be avoided. For example, floor boxes shall be run back to the same communications room as other cables from the same room, even if some of the cables run in the ceiling of the floor below.

3.3 BACKBONE CABLING

Where the building communications rooms are less than 90m apart, the 4-pair F/UTP backbone cabling shall comprise 12 cables run in parallel with the fibre backbone cabling.

Where two building communications rooms are more than 90m apart, there is no requirement for F/UTP backbone cables between those rooms.

3.4 HORIZONTAL CABLING AND TELECOMMUNICATIONS OUTLETS (TOS)

3.4.1 QUANTITY OF TOS

Building	Outlets per workstation in offices	Outlets in agile based working	Labs	Other
With IP phones	2	1	1 per computer plus 1 spare every pod	Determined on a project basis
With soft phones	2	1		
Without IP phones	2	1		

In other spaces, including storage space, circulation spaces and plant room, the minimum number of telecommunications outlets is two, plus one outlet per 6 sqm.

Residential accommodation will have a dual outlet per room, plus additional outlets on the roof to support Wi-Fi installation.

Install 3 outlets per photocopier/multifunctional device.

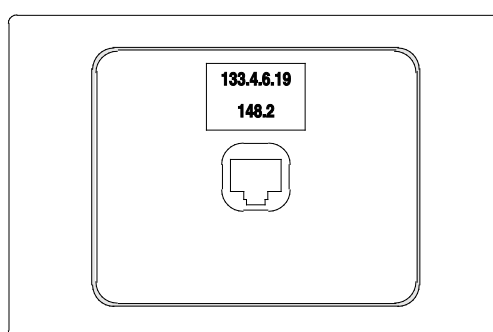
For security (Gallagher/Cardax) and BMS, provide outlets as required, plus one spare socket at each cluster of equipment panels.

3.4.2 FACEPLATES

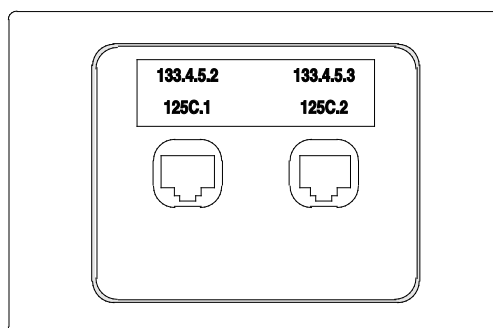
Faceplates shall have a clip-off surround to assist with painting but must also have a flat visible area which does not clip off, where the University's required labelling system is to be applied. The clip-off surround shall conceal the fixings of the faceplate.

Faceplates with offset outlets are permitted, but arrows must be included on the outlet labels to make it clear which outlet each label refers to. Refer to the illustrations below.

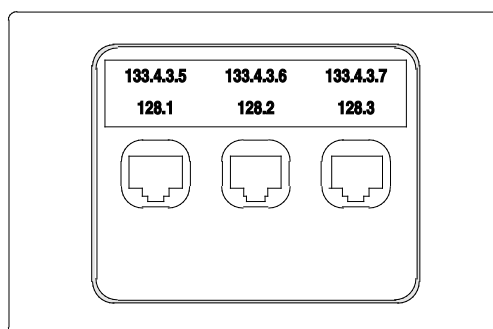
The maximum number of outlets per plate shall be 3. 4 gang quad plates are not permitted because they do not have enough labelling space. Where more than 3 outlets are required together, use a combination of dual and triple plates to make up the required number.



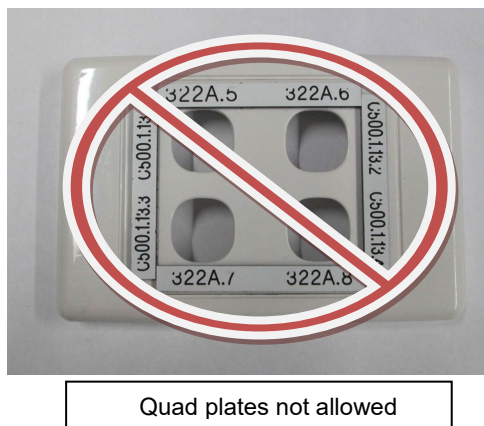
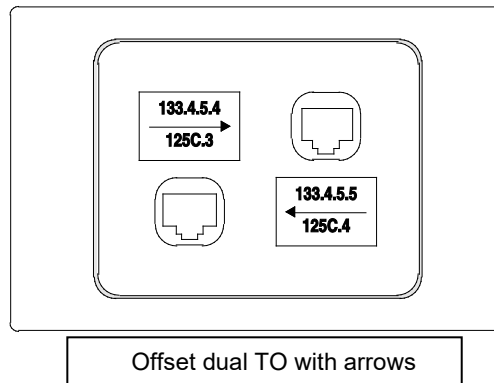
Single TO



Dual TO



Triple TO



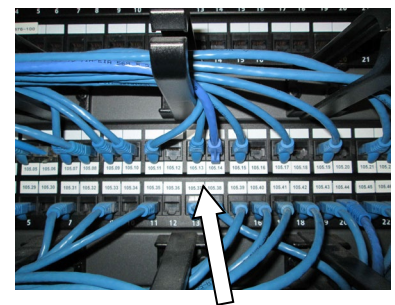
3.5 PATCH PANELS

Refer to the Parts List for the approved parts, including patch panel models.

Patch panels shall be supplied fully loaded with jacks, whether or not all jacks are required for the project.

Patch panel labels shall alternate between upper and lower where possible, so that patch leads will not cross the labels. (Refer to the adjacent photograph).

Some models of patch panel have their sockets close to the bottom of the panel, or close to the top. These panels cannot have their labels alternated.



Alternating labels

3.6 TERMINATION SCHEME

The cable termination scheme shall be T568A.

3.7 CABLE SLACK

Do not coil up cable slack at the rack. House the slack in the ceiling or under the floor near the communications room.

Allow 1m slack near the rack and 300mm slack near the TO.

3.8 LABELLING

3.8.1 LABEL MATERIAL AND SIZE

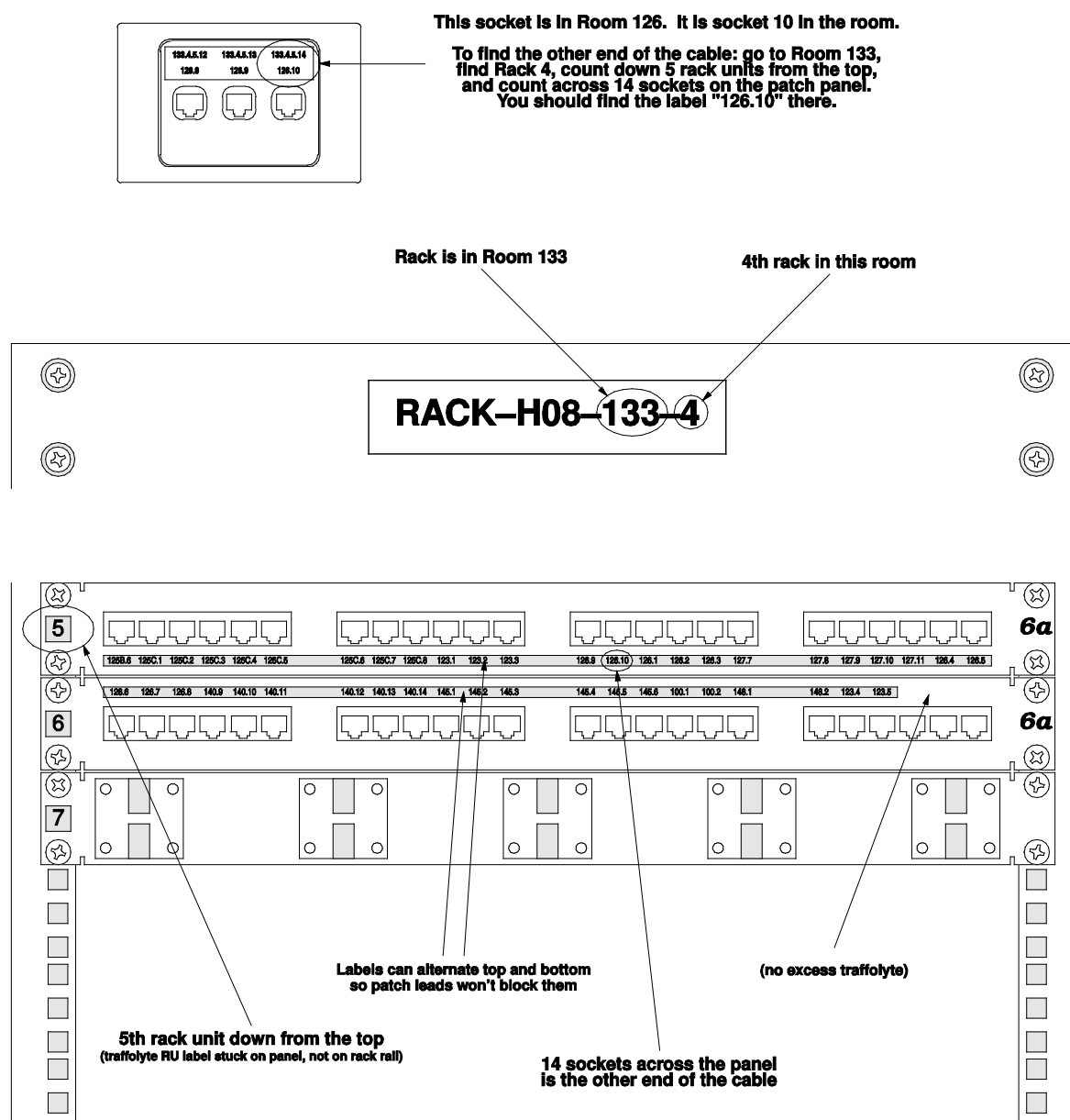
All labels are made of engraved traffolyte. Sizes shall be similar in proportion to the illustrations.

Labels for copper cabling are normally white with black text.

Arrows must be included on labels for offset faceplates.

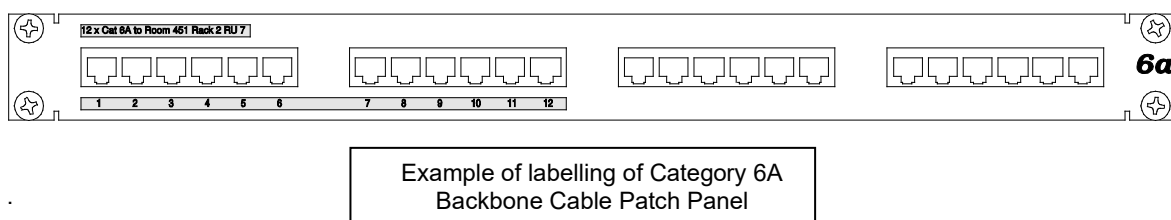
3.8.2 LABEL OF TELECOMMUNICATIONS OUTLETS AND CORRESPONDING PATCH PANELS

Refer to the detailed illustration below and the labelling FAQ section of this document.



3.8.3 LABELLING OF BACKBONE 4-PAIR UTP CABLES

Refer to the detailed illustration below.



3.9 PATCH CORDS AND FLY LEADS

Twisted pair patch cords and fly leads are to be provided by the cabler, one patch cord and one fly lead per installed cable.

3.9.1 CATEGORY REQUIREMENT

Generally patch cords and fly leads are to match the wiring system category and cable construction (shielded or unshielded).

For voice grade cabling, use Category 5e unshielded patch cords.

Flat leads may be used for RS-232 connections.

3.9.2 COLOUR OF PATCH CORDS

Circuit type	Sheath Colour
Ethernet	Blue or grey
Crossover Ethernet	Red
PSTN voice	Yellow
PABX analogue line	Yellow
PABX digital line	Yellow
RS-232	Green
ISDN	Green
ADSL	Green
Telemetry	Green
E1	Green
E1 crossover	Green
Other circuits types and specially-wired cords	Green
Wireless Access Points	Purple, white and yellow leads are used

Note that IP phones are ethernet devices which are patched with normal blue or grey patch leads.

Note that crossover cables are infrequently required with modern infrastructure.

All green patch leads should be tagged to show what type of service they are carrying.

3.9.3 LENGTHS OF PATCH CORDS AND FLY LEADS

Lengths to be confirmed for each project with ICT prior to installation. In the communications cabinet the patch lead should be long to connect from the patch panel to switch using the cable management without excessive slack in the cable. At the field end the cable should be long enough to comfortably reach to the location of the connection device.

For pricing purposes, allow for a 2.5m lead length.

3.9.4 PATCH CORD HANGER

Each communications room shall have two hangers for spare patch cords.

The hangers shall be a plastic hose reel hanger, as available from hardware stores.

The hangers shall be mounted so that a 3m patch cord hangs clear of the ground and any skirting with a small 5-10cm gap between hangers.



3.10 SHUTTERED OUTLETS

Shuttered TOs are to be installed in scientific laboratories, damp areas, clinics, and in areas frequented by small children such as childcare centres.

TOs without shutters are to be installed everywhere else.

3.11 CONSOLIDATION POINTS

Consolidation points are only to be used to terminate structured wiring at retail tenancies which have not yet been fitted out.

Consolidation points are not to be used in general University areas, neither as part of a new wiring design, nor as an attempt to extend or divert existing cable runs.

3.12 SECURITY PANELS (GALLAGHER/CARDAX)

Security panels are normally located in secure areas such as service cupboards, and are connected by ethernet to the University network. Refer to CIS's Building and Architecture design guidelines for specifications for the ELV cupboard where security equipment may be housed.

TOs for security panels shall be terminated on a wall plate and labelled in the normal manner. If a security panel is located in a makeshift, more public location, the TO must be located inside the security panel enclosure. (This is not the preferred arrangement).

TOs and power sockets for security panels must be shown on the electrical drawings. Security installers are not to install structured wiring from the communications room to the security panel location.

3.13 CEILING MOUNTED EQUIPMENT

Ceiling mounted equipment, such as cameras and wireless access points, must be plugged into a data outlet which is visible to IT staff from floor level. IT staff cannot support equipment which is plugged into inaccessible or hidden sockets.

Where sockets are mounted up high, labels should be produced in a larger font to make them easier to read from floor level, possibly with an optical aid such as a monocular or a camera.

3.14 SECURITY CAMERAS

Outlets for indoor security cameras are to be terminated on a tamper-resistant faceplate, as given the Parts List. The faceplate will not be covered by the camera housing.

The text on the traffolyte labelling is to be repeated on the outside cover in large font Brother labels.

Outlets for external security cameras where mounted on building walls shall be cabled to an internal communications room.

Installation of other outdoor security cameras must be planned in conjunction with ICT. Camera poles for freestanding cameras need communications conduit cast into the base.



3.15 DOOR PHONES

Outlets for door phones are to be terminated on a tamper-resistant faceplate, as given in the Parts List. The faceplate will not be covered by the phone.

Door phones must be mounted so that a wheelchair user can read all of the screen on the phone (nominally between 900 and 1200 above floor level).

3.16 SPLITTERS

Splitters are never to be used to try to send two separate ethernet connections down a single cable. A second cable is to be installed

Telephone technicians may use splitters to send more than one phone line down a four pair cable.

3.17 FIRE SYSTEM DATA NETWORK CONNECTIONS (RED SHEATH)

A triple data outlet is to be provided at the FIP and EWIS location. One port is for the FIP's ethernet connection, one port is for the EWIS's ethernet connection, and one port is spare.

These horizontal cables must be rated as Low Smoke Zero Halogen. It is preferred that these cables be run in red-sheathed cable. If red sheath is not available, the cable must have red wraparound labels with "FIRE" printed on them applied every metre.

The sockets are to be numbered and labelled in the normal manner, but the traffolyte labels are to be red traffolyte with white writing.

Patch leads used to connect these sockets shall have red wraparound labels on both ends, labelled "FIRE" and "EWIS" as applicable. The patch leads are to be the normal colours for ethernet connections and not red patch leads, which signify a lead wired as an ethernet crossover.

These structured wiring connections are for "fair weather" use only and do not replace the voice grade cable arrangements for Brigade Call.

3.18 UNDERGROUND GRADE CABLES

As it is unusual to run 4-pair structured wiring underground, any proposal to do so must be discussed with ICT so that an appropriate and legal solution can be designed for provisioning. Refer also to the Earthing section.

3.19 TESTING

All 4-pair twisted pair permanent links shall be 100% tested to verify performance against Class EA requirements under installed conditions to AS/NZS 3080:2013, and the manufacturer's certified installer agreement (if applicable).

Only full passes are acceptable; star passes are counted as fails.

Conformance to Class EA permanent link requires alien crosstalk to be addressed. These requirements can be addressed by in-field testing of alien crosstalk, or alternatively, Clause ZA2 of AS/NZS 3080:2013 provides details on mechanisms to address alien crosstalk without in-field testing. A manufacturer's statement of conformance is required to accompany all test data that does not contain alien crosstalk testing.

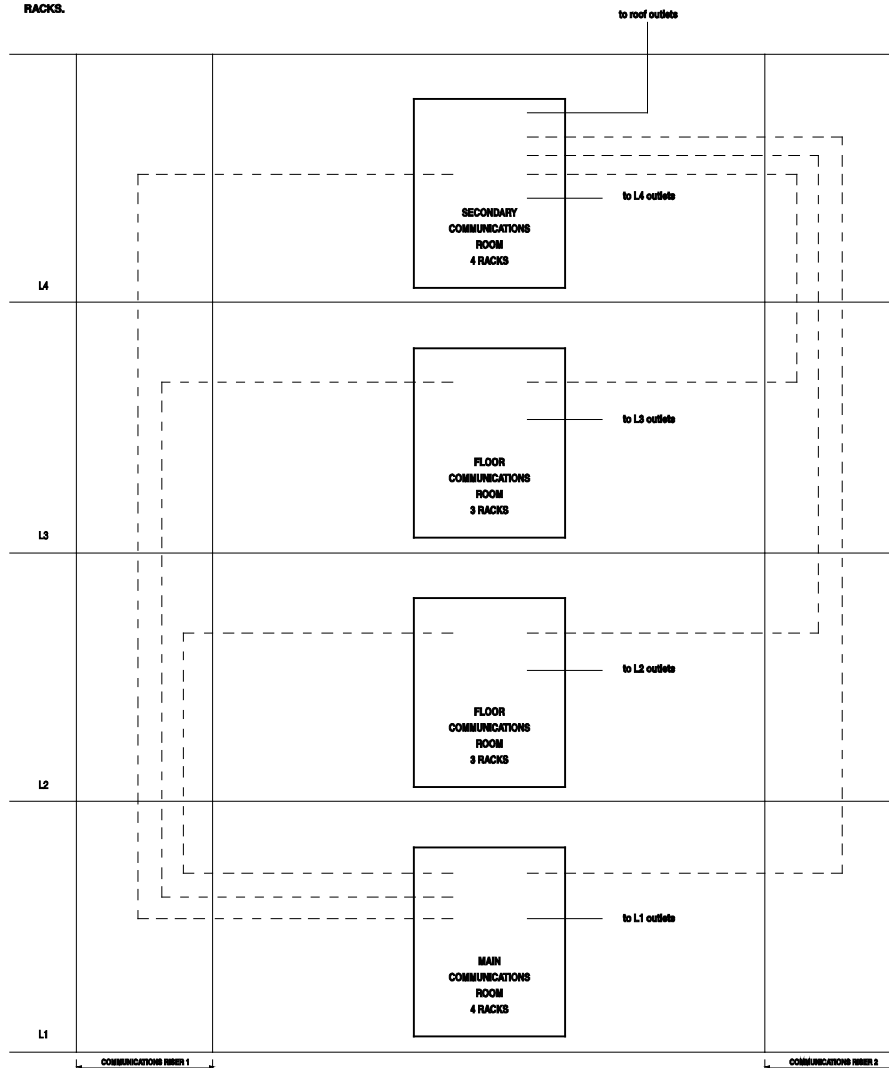
3.19.1 CALIBRATION OF TEST EQUIPMENT

Test results shall be accompanied by a current calibration certificate for the test equipment used. The certificate shall be issued by a service centre certified by the test equipment manufacturer, and shall show the date of calibration and the required date of next calibration.

3.20 SAMPLE 4-PAIR F/UTP CABLE SCHEMATIC FOR A SIMPLISTIC BUILDING

NOTES:

1. ALLOW FOR ALL NECESSARY CABLE TRAYS, CONDUITS, CATENARY WIRES AND SKIRTING DUCT FOR THE RETICULATION OF CABLING
2. ALL CABLES 12 No. CAT 6A F/UTP
3. MAIN AND SECONDARY COMMUNICATIONS ROOMS MAY ALSO BE USED AS FLOOR COMMUNICATIONS ROOMS WITH EXTRA RACKS.



CATEGORY 6A F/UTP CABLING SCHEMATIC

SECTION 4 VOICE GRADE CABLING

4.1 INTRODUCTION

The main uses of voice grade cabling are:

- 1) PABX phones
- 2) fire lines
- 3) lift phone lines
- 4) emergency phone lines, indoor or outdoor
- 5) non-University services to tenants, such as Telstra phone lines and ADSL
- 6) public phones and ATMs
- 7) any telephone which is more than 90m from a communications room, such as a car park boom gate intercom
- 8) some fax line connections
- 9) some duress buttons
- 10) some utility meters, indoor or outdoor

Voice tie cables to racks in communications rooms ensure that RJ45 sockets can be connected to carrier services from the local telephone exchange when required, as well as allowing connection of services originating on the campus.

4.2 TYPE OF CABLE

All indoor voice grade cable is to have the traditional cream-coloured sheath.

Data grade cable, such as Category 5 cable, is not to be used for any cable runs specified as voice grade cable.

No data grade cable is to be terminated at the MDF or on any other Krone frame.

4.3 SPECIFIED CABLE SIZES ARE TO BE INSTALLED

Where a certain size of voice grade cable has been specified, only that exact size is to be installed. For example, a 50 pair cable is not acceptable where two 25 pair cables have been specified, and a 100 pair cable is not acceptable where only a 50 pair cable has been specified.

All pairs of the cable are to be terminated at the time of installation.

Where multiple voice tie cables are to be run to a communications room, the usual intention is that the cables will be terminated in different racks.

4.4 TOPOLOGY

Some unrefurbished University buildings have a full topology of traditional telephone wiring, with IDFs, FDPs and 600 series sockets. The communications racks in these buildings have not necessarily had voice tie cables installed, so it is not always possible to connect a telephone line to an RJ45 socket in these areas. Traditional telephone wiring is not to be removed without first ensuring that replacement connections will be available.

Repairs and minor extensions are made to the traditional telephone wiring topology in areas where it will not be economical to install a voice tie cable at present.

The sample schematic shows typical layouts for voice grade cabling.

4.4.1 VOICE TIE TO RACK

A voice tie cable is a standard voice grade cable which connects the building MDF with patch panels on a rack in a communications room.

These cables allow circuits from the building MDF to be connected to the horizontal structured wiring.

Voice tie cables never run from patch panel to patch panel. Voice grade cabling always has at least one end terminated on a Krone frame.

4.5 CABLE CAPACITY

In areas served by PABX phones, ICT will specify the size of any voice tie cable which needs to be installed from the MDF to a rack. The cable may have a greater capacity than is required by the particular project installing it. Projects must pay for the entire tie cable of the size specified by ICT, to avoid repeated installation of small tie cables to the same communications room.

Refer to the sample schematic and tables below for cable sizes.

Cable Destination	Cable size	Termination hardware
Fire line	2 pair	2 pair block supplied by ICT, fixed adjacent to MDF
Public phone	2 pair	Leave tagged for public phone installer
Emergency phone	2 pair	Hard-wired by telephone technician at handset
Intercom or phone more than 90m from a communications room (e.g. car park boom gate)	2 pair	To suit handset
Lift FDP	10 pair	FDP
ATM	10 pair	As specified by ATM installer
Retail tenancy/cafe	10 pair	FDP or 11 way frame

Number of racks in communications room	Number of voice tie cables from MDF to communications room	Size of voice tie cables	
		IP phones area	Non-IP phones area
1	1	25 pair	As specified by ICT
2	1		
3	2		
4	2		
5	3		

4.6 TERMINATION HARDWARE

Voice grade cable may only be terminated on a Krone frame with Series 2 Krone modules, an RJ45 patch panel in a communications rack (which cannot act as an MDF), a 2 pair block or a 600 series socket. Cable should only be terminated directly on equipment terminals as a last resort.

All Krone modules shall be fitted with the correct plug numbers. (Refer to Krone catalogue.)

Modular sockets such as RJ45, RJ11 and RJ12 are not to be used to terminate voice grade cable. This ensures that a voice grade connection cannot be mistaken for a data grade connection.

Refer to the Parts List for the required Krone patch panel for voice tie cables.

10 pair cables shall be terminated on Krone series 2 modules on an FDP or an 11 way Krone frame, whichever best suits the purpose.

See the tables above for minimum voice tie cable quantities and sizes.

4.7 TERMINATION OF CABLE

All voice grade cable must follow one of the colour codes given in Appendix B of AS/CA S009:2013.

Attention is drawn to Clause 5.2 of that standard. It is a breach of regulations to terminate a cable in any order other than the manufacturer's colour code order.

At installation, each of the whippings is to be tied around each unit bundle at the sheath cut to maintain the bundle identification. All pairs must be terminated.

4.8 VOICE TIE CABLE TERMINATION PATTERN

All pairs of the voice tie cable shall be terminated on the MDF in the normal manner.

At the communications rack, 25 pairs shall be terminated on each patch panel, one pair per port. As the patch panel only has 24 ports, the 25th pair of each group shall be terminated on pins 3 and 6 of the 24th socket and not left dangling.

4.9 LABELLING OF VOICE TIE PATCH PANELS

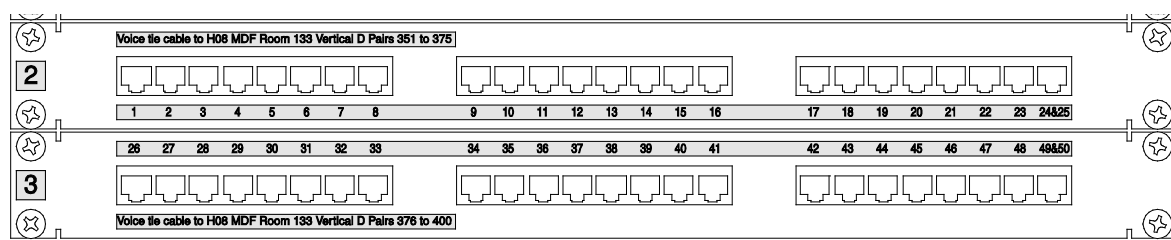
4.9.1 MATERIAL AND SIZE

All labels are made of engraved traffolyte. Sizes shall be similar in proportion to the illustrations. Labels shall be white with black text.

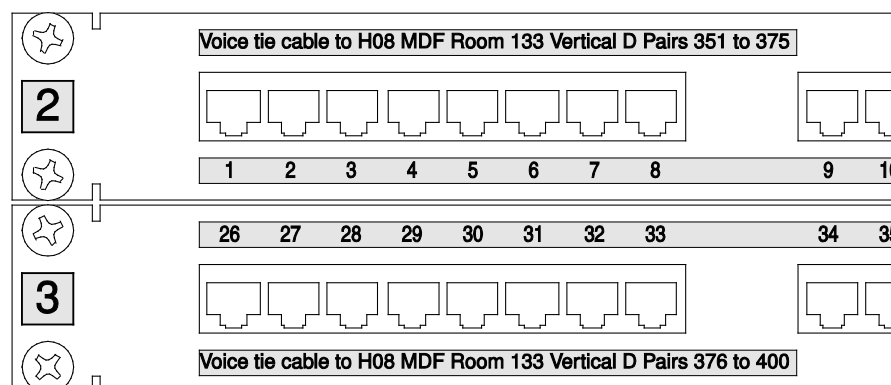
4.9.2 INFORMATION

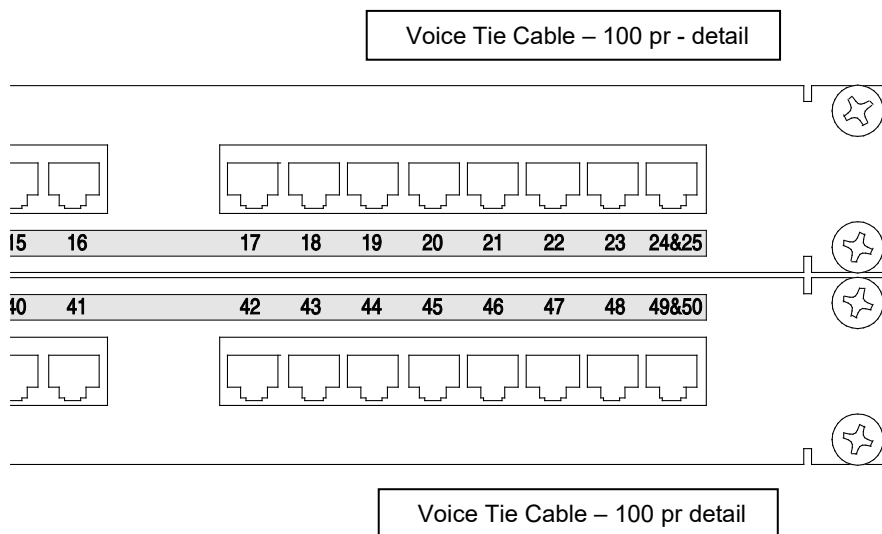
Refer to the illustrations given below and the Labelling FAQ section of this document.

Each label has different numbers from every other label. Notice the numbering of the 24th socket. Also notice the positions of the long and short labels on the different panels.



Voice Tie Cable – 100 pr





4.10 CABLE SLACK

Allow cable slack at each end of the cable, to allow for later re-termination. House the slack in the ceiling or under the floor, to prevent congestion at the frame.

4.11 VOICE GRADE TELECOMMUNICATIONS OUTLET

Telephone sockets wired to the voice grade cable system are to be types 610, 611 and 612.

Modular sockets (RJ12, RJ45, etc.) are not to be used to terminate voice grade cables.

600 series sockets and voice grade cables are not to be stripped out of rooms without ICT approval. Not all buildings have telephone tie cables to the communications racks where the data wiring terminates.

4.12 LINE CORDS

Telephone line cords are normally supplied with telephone handsets and do not need to be supplied by cabling.

Some telephone line cords come with a small modular plug, narrower than an RJ45. It is strictly forbidden to insert a small modular plug into an RJ45 socket, as it may bend the outer pins. Inserting the wrong plug also may void the warranty on the socket.

Telephone technicians must cut any incorrect plug off the line cord and fit the correct plug for the wall socket.

4.13 EMERGENCY PHONES

Any emergency phones shall be wired directly back to the building MDF in voice grade cable. No emergency phone line is to be connected via a patch panel.

IP phones are not to be used as emergency phones because they will not have service during blackouts. Emergency phones are normally powered down the line from a central location in another building or a public telephone exchange, where they have battery backup.

Refer to the Public Phones, Emergency Phones and Student Welfare Phones section.

4.14 COPPER LEAD-IN CABLE

On all larger campuses, ICT connects the University's copper lead-in cable to the building MDF. The project constructing or refurbishing the building must fund this connection.

At some sites a Telstra lead-in cable may be required. ICT will advise if this is necessary. Projects must fund any carrier lead-in cables required.

All copper lead-in cables must be tagged with Telstra-style 97/104 PVC tags in every pit and at the MDF. Note that pairs leaving University-owned pillars have an "OO" prefix rather than "O".

4.15 MDF

The building distributor for voice grade cabling shall meet all the regulations for an MDF, including clearances, irrespective of whether the distributor terminates a carrier twisted-pair lead-in cable or not. Clearances are found in AS/CA S009:2013 Appendix D.

The MDF shall be a Krone frame with Series 2 Krone modules. ICT will specify the size, parts and layout of the MDF, including jumper rings and horizontal jumper guides.

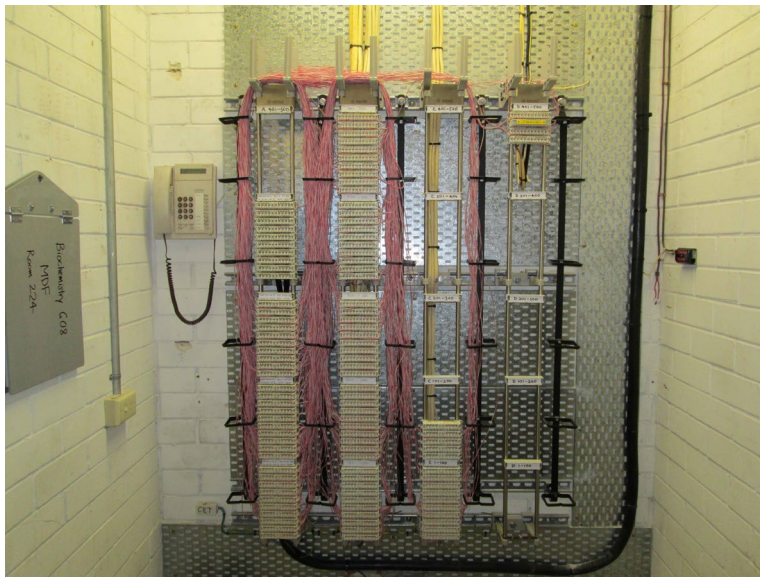
When expanding an MDF, new verticals must match the existing verticals in height, and all jumper management accessories must be provided.

The MDF must be supplied with Krone label holders for every ten module positions. For example, a pair of 27 way frames requires four label holders.

The entire MDF frame is to be earthed to a Communications Earth Terminal at the frame.

The MDF is normally a wall-mounted unit. In an area which is outdoors or needs to be hosed out or is very dusty (greenhouses, gardens, chicken sheds), it is better to terminate the telephone cable on a rack-mounted Krone frame in the same cabinet as the rest of the communications equipment.

The copper lead-in cable is never to be terminated on patch panels.



MDF frame

4.16 LIFT FDP (LIFT LOCAL DISTRIBUTOR)

Cables and hardware for lift phones must be installed, labelled and maintained to the highest standard.

The 10 pair cable for the lift phone must be terminated on a small Krone frame as close as possible to the lift motor room or lift control cubicle. This FDP acts as a demarcation point between the telephone technician and the lift technician, and greatly accelerates the clearing of faults on lift lines, allowing lifts to be brought back into service. Each lift car shall have a separate phone line with a separate service number.

The standard position for the Lift FDP is in the top passenger floor lift lobby. The architect and lift company must detail the housing for the FDP, which might be a small cupboard similar to a fire hose reel cupboard. The Lift FDP must be located in a public area; it must not be placed out of sight in a plant room or electrical riser.

The Lift FDP enclosure must be labelled "Communications" on the door and must be lockable with ICT's BiLock cylinder, which will be fitted by the University Locksmith.

The Lift FDP must have a record card showing the service number of each lift car. Refer to the illustration below.

The cable pathways to the Lift FDP must be readily re-enterable. The cable from the MDF to the Lift FDP is to be run in normal cable pathways where ICT's workers can trace and maintain it; the cable must not be run up the inside of the lift shaft.

The Lift FDP must be readily identifiable by the telephone technician for ease of access and speed of resolution of issues. Readers are reminded that lifts without a working phone must be locked out of use, which affects disabled access and many other important activities.

The wiring system designer must bring the requirements for the Lift FDP to the attention of the Architect, Lift Company and Structural Engineer during the design phase, as it may have consequences for the lift shaft formwork.

The cables from the MDF to the Lift FDPs and emergency phones must be single lengths of cable without any joins. If these cables are ever damaged, they must be replaced in one length from end to end with new cable.

These cables must be tagged every ten metres and at every level of a riser so that they can immediately be identified by maintenance workers.

Where a new Lift FDP is being retrofitted to an existing lift shaft, a lockable surface mounted box may be used with the lock changed to a BiLock.

For new lifts, a Krone FDP is to be housed in an enclosure specified by the architect. The enclosure must comfortably fit the FDP, whose dimensions are 42mm deep x 190mm high x 135mm wide. The enclosure is to be fitted with a BiLock cylinder.



VERTICAL RECORD CARD							
PAIR	SERVICE NUMBER	FROM		PAIR	SERVICE NUMBER	FROM	
		VERT	PAIR			VERT	PAIR
10				20			
9				19			
8				18			
7				17			
6				16			
5				15			
4				14			
3	12837		13	13	Lift car 6		3
2	67889		12	12	Lift car 5		2
1	14890		11	11	Lift car 4		1

BOX No. Lifts 4, 5 & 6 PAIRS 1 - 10 TO B 371-380 (MDF Room 134)

4.17 FIRE LINE CONNECTION AT MDF

The red cable from the Fire Information Panel is run to the MDF by the fire technician. It terminates on a 2 pair block next to the MDF. A short length of cream 2 pair cable is used to hard-wire the fire line to the lead-in cable. No jumpers are used.

The 2 pair block is the demarcation point between the fire technician and the telephone technician.

The fire line pair on the MDF is to be protected with a red dummy plug (Krone part 6089 2 356-00.)

ICT will supply the 2 pair block and cream 2 pair. This is to be noted on the voice grade cabling schematic.

Upstream of the building MDF, the fire line will be connected to an aggregation point in the fire system. Jumpers shall be run in blue and white jumper wire, and the fire line must be protected by a dummy plug at every point where it is jumpered.

All jumpers run by the telephone technicians are to be connected straight through. The fire technician must make any polarity adjustments on the "fire" side of the demarcation point.

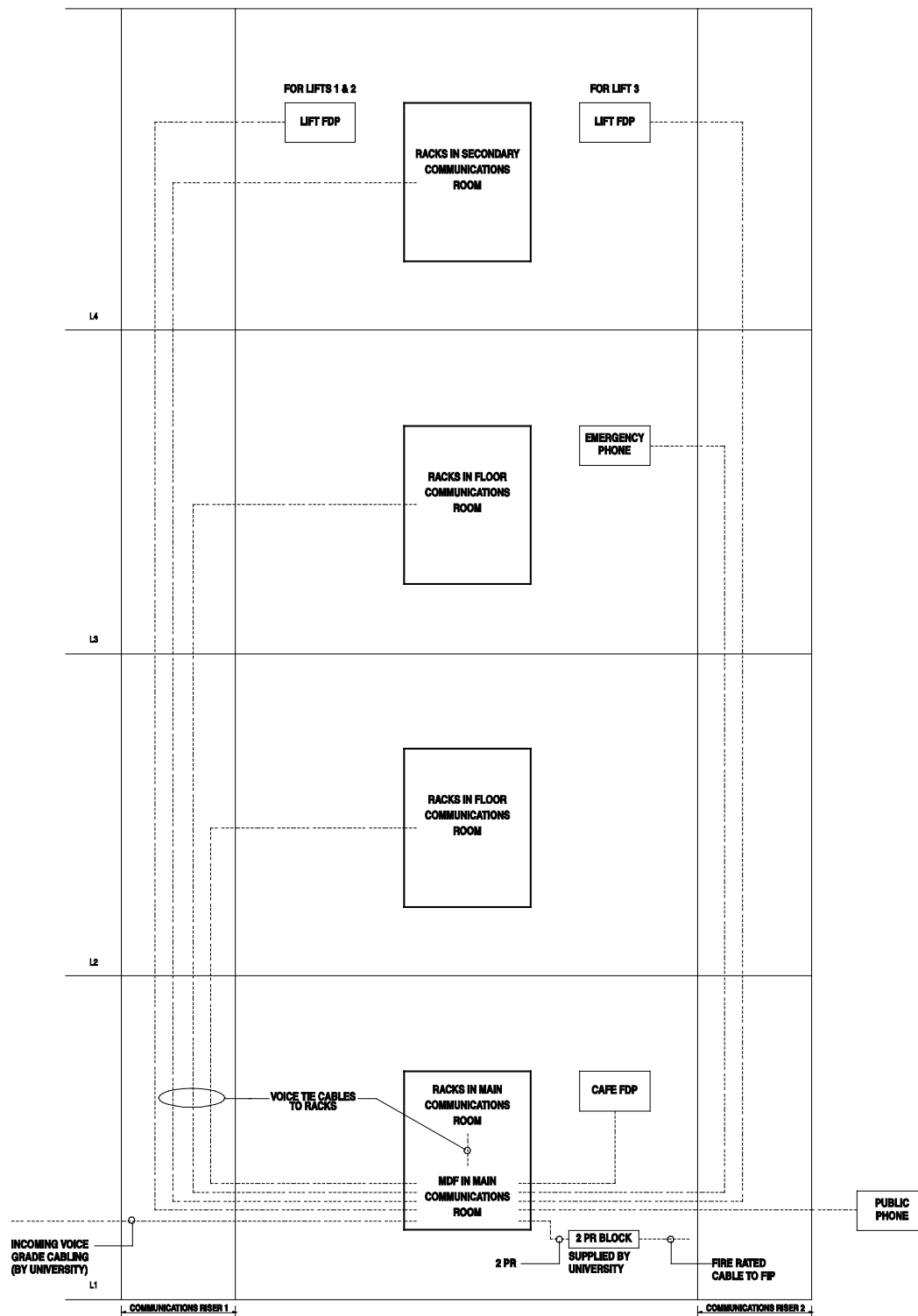
4.18 TESTING OF VOICE GRADE CABLING

Cablers must test the installed cables by "buzzing" each pair out individually with an F set to ensure that all pairs are continuous and are terminated in correct rotation.

4.19 SAMPLE VOICE GRADE CABLE SCHEMATIC FOR A SIMPLISTIC BUILDING

NOTES:

1. ALLOW FOR ALL NECESSARY CABLE TRAYS, CONDUITS, CATENARY WIRES AND SKIRTING DUCT FOR THE RETICULATION OF CABLING
2. ALL CABLES TO HAVE CREAM SHEATH
3. SPECIFIED CABLE SIZES ARE TO BE INSTALLED



VOICE GRADE CABLING SCHEMATIC

4.20 RECORD BOOK AND HOLDER

Every Krone frame must have a record book or card.

A Krone frame that can terminate more than 1000 pairs must have a hard cover loose-leaf record book. ICT will supply suitable pages for the standard grey plastic type.

Booklet-style record books must be kept in a Krone record book holder mounted near the frame. Loose-leaf books must be hung from a suitable hanger.

Cablers must enter the details of new and reterminated cables in the record book, giving as much information as possible.

Cablers must do their best to tag or label the cables at ends where there is no frame. For example, the gas meter cable might be tagged at the equipment terminals with information such as "2 pair to H08 MDF, D 221-222". Cablers leaving bare cable ends for other workers to terminate should leave the cables tagged in this manner.

Voice tie cables are labelled in traffolyte at the communications rack. Record books are not used at communications racks.

2 pair to outdoor sign, rear of building

2 pair to boom gate intercom, basement car park

FIRE LINE

10 pair to ATM, level 1 foyer near Room 112

10 pair to Shop 1, level 3 east side

2 pair to payphone under front awning

2 pair to gas meter in garden outside Room 130

2 pair to emergency phone, Room B44

100 pair to Room 141, B 201-300

25 pair to Room 200D rack 1 RU 2

100 pair to Room 350C Rack 1, rows 2,3,5,6

10 pair to Lift FDP, corridor C800, lifts 4, 5 & 6

SECTION 5 WIRELESS ACCESS POINT INSTALLATION

5.1 OVERVIEW

It is the University's goal to offer the most advanced technology available while ensuring that stable and reliable services are maintained for the benefit of the University community. The number of wireless base stations (WAP) to be installed is steadily increasing as wireless devices become an integrated element of the University experience. Staff and especially students use multiple devices simultaneously increasingly consuming increasing volumes of data. The University of Sydney Communications infrastructure Group will continue to evaluate available wireless network industry standards and equipment to ensure that the University meets this goal. The wireless installer will install, patch and label wireless access points.

5.1.1 WIRELESS DESIGN REQUIREMENTS

Wireless vendors are to provide Wireless LAN survey, design, reporting and configuration services for the University of Sydney as defined in this standard. The following requirements are to be delivered and documented in all wireless design and installations:

Item	Description	ICT Sign off required
5.1.1	Predictive Visual Desktop Design of all floor plans indicating proposed locations of the Wireless Access Points.	Y
5.1.2	Full Floor/Building Dual Band 2.4 and 5GHz Pre-Deployment Active RF Survey including:	Y
5.1.2.a	Perform WLAN active survey – full floor coverage to the target RF metrics in section 2.b of this table.	
5.1.2.b	Target RF metrics:	
5.1.2.b.i	RSSI = -64dBm or higher for 2.4GHz	
5.1.2.b.ii	RSSI = -61dBm or higher for 5GHz	
5.1.2.b.iii	SNR = 25dB or higher.	
5.1.2.b.iv	Channel width 20MHz or 40MHz if dynamic 802.11Aac capable	
5.1.2.b.v	Overlap between adjacent cells should be between 15%-20% (by area).	
5.1.2.b.vi	Co Channel interference is to be minimized as much as possible, signal strength of adjacent AP's on the same channel to be targeted to <=-85dBm – Where this is unavoidable it must be indicated in the survey reports.	
5.1.2.b.vii	Survey readings should be taken every 2.5 meters.	
5.1.2.b.viii	Survey readings should be taken until the signal strength reaches -85dBm or until it drops out.	
5.1.2.b.ix	There is to be minimum leakage outside the premises or between floors unless it is necessary to achieve the required coverage.	
5.1.2.b.x	As a guide - capacity should be dimensioned to 25 users per Access Point, assuming 2 devices per user, thus a total of 50 devices per Access Point.	
5.1.2.c	Provide full WLAN detailed design reports outlining the survey parameters and type of survey equipment used including:	Y

5.1.2.c.i	Floor plans indicating proposed and existing AP locations and names.	
5.1.2.c.ii	Combined heat maps of AP's per floor for the 2.4GHz band each indicating SNR, RSSI, noise, co channel interference and other interference sources.	
5.1.2.c.iii	Combined heat maps of AP's per floor for the 5GHz band each indicating SNR, RSSI, noise, co channel interference and other interference sources.	
5.1.2.c.iv	Antenna types and placement/orientation.	
5.1.2.c.v	A table of statically assigned power and channel settings for AP's in 2.4GHz band, Cisco RRM assigned power and channel settings are not acceptable. Power is to be expressed in both dBm and Cisco Prime values (1-8).	
5.1.2.c.vi	A table of statically assigned power and channel settings for AP's in 5GHz band, Cisco RRM assigned power and channel settings are not acceptable. Power is to be expressed in both dBm and Cisco Prime values (1-8)	
5.1.2.c.vii	All designs should be modeled on the Cisco 3800 series of access point or within a residential college the Cisco 1800 series of access points. The Access point to be used for the survey will be provided by the University of Sydney.	
5.1.2.c.viii	It is the responsibility of the vendor to supply any required antennas.	
5.1.2.c.ix	Actual photograph of each survey AP in proposed location.	
5.1.2.c.x	Neighboring RF interferers.	
5.1.2.c.xi	Recommendations for changes to existing AP's (if any).	
5.1.2.c.xii	All survey tool data files are to be included with the report All AP's are to be marked up on the floor plans within the survey files	
5.1.3	Full dual band WLAN Spectrum Analysis of 2.4 and 5GHz RF of floor/building including:	Y
3.a	Identification and location of sources of interference.	
3.b	Analysis of data with report showing:	
3.b.i	RF profile	
3.b.ii	Locations of sources of interference	
3.b.iii	Recommendations for mitigation	
3.b.iv	Spectrum analysis files are to be included with the report	
5.1.4	AP Deployment and Management per Floor/Building via Cisco Prime including:	Y
4.a	Configure AP's as per RF plan in the detailed design.	
4.b	Rename new and existing AP's to university's naming convention.	
4.c	Disable radios of AP's to be removed.	
4.d	Load and scale floor plans with all internal and external walls defined.	
4.e	Place AP's onto floor plans/maps.	
5.1.5	Full Floor Dual Band Post Passive surveys including:	Y
5.a	WLAN Passive survey to verify coverage as per design.	
5.b	Provide final report to include:	

5.b.i	Summary of the survey.	
5.b.ii	Combined heat maps of AP's per floor for the 2.4GHz band each indicating SNR, RSSI, noise, co channel interference and other interference sources	
5.b.iii	Combined heat maps of AP's per floor for the 5GHz band each indicating SNR, RSSI, noise, co channel interference and other interference sources.	
5.b.iv	Floor plans showing AP locations.	
5.b.v	Table of AP names and MAC addresses with power and channel settings presented in excel format as well as a screenshot from Cisco Prime.	
5.b.vi	List of Rogue AP's and location. This list is to be presented as a table and sorted from highest to lowest signal strength.	
5.b.vii	List of old Sydney Uni AP's to be removed.	
5.b.viii	All Survey Tool data files are to be included with the report All AP's are to be marked up on the floor plans within the Survey files	

5.1.2 Coverage and out of scope

Generally, all spaces internal and around buildings must have wireless coverage to this specification. This includes

- Plant rooms
- Car parks
- Outdoor areas, including
 - The perimeter seating and pathways external to buildings
 - Balconies and rooftop areas open to Staff/Student use
 - Rooftop spaces to service plant equipment such as air-conditioning, solar infrastructure, etc

General areas out of scope include:

- Toilets
- Fire stairwells

5.1.2 WIRELESS NAMING CONVENTION

The University uses the following naming convention for Access Points: -

AIR-XXX-Lxx-XX

Where: -

AIR is always prefixed for each Access Point

XXX identifies the building code

Lxx identifies the floor level of the building

XX denotes the sequential number of the Access Point

For example, the first access to point to be installed in building A35 on Level 8 would be named **AIR-A35-L8-01**.

5.1.3 WIRELESS ACCESS POINT LABELLING

To label the access points:

a) Print the MAC address (MAC: XX XX XX XX XX XX) and the WAP Name for each device using a Dymo labeller and affix it to the WAP unit (See example: Image 4) The WAP name is to be provided to the wireless installer by the wireless integrator.

b) Provide a schedule in excel format of data outlet identifier (e.g. D200.1.1.13), MAC address (XX XX XX XX XX XX) WAP Name (e.g. AIR-A31-L02-1), switch and switch port to University of Sydney ICT and the wireless integrator as per template below

Unit ID	Building Level	Patch ID	MAC Address	WAP Name	Switch Name	Switch module/port
1	e.g. 02	e.g. D200.1.1.13	e.g. XX XX XX XX XX XX	AIR-A31-L02-01	c4i-a35-6	2/7
2	e.g. 02	e.g. D200.1.1.14	e.g. XX XX XX XX XX XX	AIR-A31-L02-02	c4i-a35-6	3/10

5.1.4 WIRELESS ACCESS POINT STANDARD INSTALLATION

Install the Access Point as per the wireless integrators detailed design document in the exact locations marked on the floor plans and plug into data outlet using white CAT6A F/UTP cable as per the image below. Device is to be patched in the communications room into an ICT provided PoE switch port, both ends of the patch lead in the communications room is to be clearly labelled with the WAP identifier. Labels must be self-laminating and adhesive with a clear laminate to protect the imprint and capable to withstand a temperature range of °C to 135°C.

All Access Points are to be secured to the mounting bracket with a cable tie.



5.1.5 WIRELESS ACCESS POINT RESIDENTIAL INSTALLATION

For wireless access point installation in residential accommodation please contact ICT to agree the mounting of the access point.

SECTION 6 DISTRIBUTED ANTENNA SYSTEM (DAS) DELETE THIS

Mobile device and carrier connectivity are affected by a number of factors including proximity to external carrier towers, device being utilised and materials used in the construction of modern, thermally efficient buildings. Modern construction techniques utilise metal oxide in various forms in the external glass finishes resulting in poor mobile phone coverage. To ensure the carrier service and mobile coverage within buildings are met, a distributed antenna system (DAS) is installed providing small antennas throughout the building to serve as repeaters. ICT have built a communications Facility (BTS Hotel) allowing Telecommunications providers to distribute their signal on campus efficiently key locations.

DAS future-proofs the building for future mobile technologies such as the forthcoming 4G-plus and 5G carrier networks.

6.1.1 DAS DESIGN CONSIDERATION

Similar to wireless, DAS implementations have the similar design guidelines, with one difference. Designs must accommodate capacity and coverage for the four major cellular carriers (Telstra, Optus, Vodafone and TPG). The DAS will be designed for all spaces within the buildings to provide ubiquitous cellular coverage, based on forecasted capacity.

Deployment of any DAS needs to be carefully planned and engineered. The design and deployment of a DAS for a location is influenced primarily by interference and capacity planning factors.

The design must also consider the potential load on the DAS. Many smartphones in one area such as a large classroom or teaching space, for example, may require the use of two or more antennas configured to balance load.

6.1.2 DAS DESIGN

The project will engage a DAS engineer to complete the design for review and approval by ICT. This is essential to ensure a consistent environment for cellular coverage at the University.

The deployment activation, testing and handover must be completed by a suitably qualified expert under the project management or by extending the engagement of the DAS engineer. The DAS will be integrated and connected to a University BTS Hotel solution, through engagement and consultation with ICT.

Item	Description	ICT Sign off required
6.1.2.1	Predictive Visual Desktop Design of all floor plans indicating proposed locations of the DAS Points.	Y
6.1.2.2	Passive DAS design for all current mobile technologies within 700,850, 900, 1800, 2100, 2300 and 2600Mhz	
6.1.2.3	Designed to meet the number of carriers specified in MCF (Mobile Carriers Forum) DAS Design specification MCF2014, 03/04/2014	
6.1.2.4	Delivery and installation of end to end solution, including head end node in BTS Hotel room. Solution to be compatible with Sun Wave equipment.	
6.1.2.5	Specify DC power, air conditioning and environments requirements to support the DAS solution.	

6.1.2.6	Buildings located on Camperdown Campus will be fed from CPC. Buildings on Darlington will be fed from J13.	
6.1.2.7	All antennas must be installed at least 1m away from metallic material and obstructions.	
6.1.2.8	Deliver as built documentation and all tests results	Y
6.1.2.9	Handover to the University Network Support team	Y

SECTION 7 PUBLIC PHONES AND EMERGENCY PHONES

7.1 WIRING FOR PUBLIC PHONES

Public phones may be indoor or outdoor.

Public phones must have a 2 pair cable run from the phone location directly to a building MDF. Connections via structured wiring are not acceptable to public phone providers.

Outdoor public phones may be mounted on a building wall or be freestanding. Freestanding units will need underground communications and electrical ducting.

Electrical power shall be provided to the phone location for the public phone's power supply and any required lighting.

As public phones should be installed at a height accessible to wheelchair users, wiring connections shall be located at the appropriate height to allow this. Installers should check with the public phone provider for the required dimensions.

7.2 EMERGENCY PHONES

Emergency phones fall into two categories:

1. Handsets in public areas, programmed to dial University Security automatically when taken off hook.
2. Handsets in staff areas which can be used to dial arbitrary numbers. The handset is usually wall-mounted and has a phone list of useful numbers mounted next to it. A green safety sign may be used to indicate the emergency phone's location.

All emergency phones must be analogue handsets which are powered down the line from a battery-backed system outside the building, such as a PABX or public telephone exchange.

The cable for an emergency phone is always to be run in one piece from the MDF to the handset, without any joins, jumpering or sockets.

University Security can advise on appropriate locations for emergency phones in public areas.

For an isolated or lightly-occupied building, an emergency phone line shall be installed unless it can be justified that the facility is not warranted. The University's Work Health and Safety Services department can assess the situation if required.

SECTION 8 COMMUNICATIONS ROOMS AND RACKS



8.1 GENERAL

Communications rooms shall be provided to house communications infrastructure in a building.

Only communications equipment is allowed in these rooms.

8.1.1 PROHIBITED EQUIPMENT

Communications rooms are not to house computer equipment, AV equipment, security equipment, distribution boards, BMS equipment, departmental servers or the like. Such equipment is required to be located in separate spaces from the communications room. Exceptions to this rule can only be approved by the Manager, ICT Communications Services

No equipment of any type is to be installed in communications riser cupboards.

Refer to CIS's Building and Architecture design guidelines for specifications for the ELV cupboard where miscellaneous electronic building equipment may be housed.

8.1.2 NUMBER AND LOCATION OF COMMUNICATIONS ROOMS

The number of communications rooms needs to be determined in conjunction with ICT, as it may not be necessary to locate one on each level of a building. Ideally, if designed correctly, fewer rooms is more efficient using less physical space and requiring less duplication of services. Compliance with the 90m cable length limit shall be achieved and it is preferred that the communications room be located centrally to the space that it is serving to minimise cable lengths and the associated cost of cabling, where this does not conflict with the access requirements. Centrally located locations also minimise the number of communications rooms required.

For refurbishment projects in existing buildings, consideration needs to be taken in conjunction with ICT of areas outside the current scope when sizing the communications room.

Communications rooms generally shall be located off 'public' corridors or foyers. Where this is not possible it is acceptable to locate the communications room off a corridor that has access card control, provided this is achieved without the need to interact with any local staff member or the use of any additional key. Under no circumstances is the access route to a communications room to be via a teaching space.

The communications room should be situated over or adjacent to the communications riser, particularly where the communications room serves more than one floor. Where the communications room is not adjacent to the communications riser, the route between the two shall be via corridors and foyers so that future cabling does not cause disruption to departmental spaces.

8.1.3 WALLS

Walls shall be appropriately insulated to maintain the efficiency of the air conditioning.

Acoustic insulation shall be installed where noise from communications equipment may be unwanted in neighbouring spaces.

8.1.4 DOORS

The doors to communications rooms shall be smoke sealed where opening off fire egress. Doors shall swing to a position flat against a wall. Doors shall be key locked (BiLock – to University's Communications Cupboard Key System) and are not to be controlled by the building access control system.

The door shall have a sign showing the room number and the designation "Communications".

8.1.5 CEILING

In general, communications rooms are not to have false ceilings – a painted concrete soffit is preferred. Where a plaster ceiling is required (e.g. the top floor of a building with a metal deck roof), the plaster is to be dust sealed and at a height above that of the false ceiling in adjacent rooms, so that the cables do not need to penetrate the ceiling within the communications room. T bar ceilings with ceiling tiles are not acceptable.

No air conditioning ducts or other ceiling mounted services shall be installed near the communications racks. The space above the racks needs to be kept clear for suspending communications cable trays and pendant power.

8.1.6 FLOOR

The communications room shall be dust sealed and have a solid and fixed floor. Metal grilles are not permitted. Access floors are not normally required, and are less compatible with lab racks, which must be secured to the floor.

An approved anti-static floor covering, such as anti-static vinyl or conductive linoleum, shall be installed, either in sheet form or as tiles. A plain light colour is preferred; black is not acceptable.

The floor covering shall be installed prior to the racks being fixed in place. The timing of the installation of the flooring needs to take into consideration the time needed to complete the cabling and rack installation. Where new floor covering is to be installed in an existing communications room, anti-static vinyl tiles or approved equivalent shall be used, with spare tiles provided for future changes. Lab racks shall only be fixed to the floor in the presence of the University's Network Group – this requirement is to be incorporated into the design drawings.

8.1.7 PAINT

Walls and ceilings shall be painted white.

8.1.8 LIGHTING

Lighting must be provided to the front and rear of the racks.

Lights may be continuous fluorescent batten lights or similar modern, efficient equivalent fittings suspended on unistrut, or individual fluorescent fittings suspended on chains. Wire guards or weatherproof fittings must be used, not standard diffusers.

Lighting shall be manually controlled from each doorway (not via movement sensors).

8.1.9 MECHANICAL

The air conditioning to the communications system shall be dedicated to that room to provide 24 hour/day 365 days/year cooling. The air conditioning must automatically restart after a blackout. All air conditioning will be managed through the Building Management System (BMS)

Where no specific heat load figure has been given, assume 8000 BTU/h per rack, including future racks planned for the room.

The required temperature range is 22-24 °C.

As communications rooms do not house servers, CRAC units are not normally required; discuss any proposal for CRAC units with ICT Communications Services before specifying.

General air conditioning ducts shall not pass through the communications room.

8.1.10 HYDRAULICS AND OTHER SERVICES

Plumbing pipes shall not pass through the communications room, nor shall other services not required in the room.

8.2 RISER CUPBOARDS

Communications riser cupboards shall not be shared with any other service.

No equipment of any type is to be installed in a communications riser cupboard, nor are any power outlets to be provided within. The only permitted use of the cupboard is the orderly reticulation of cables.

Communications riser cupboards shall be lockable (BiLock, as for communications rooms), shall have a room number, and shall have a sign showing the room number and the designation "Communications".

8.3 RACKS

8.3.1 TYPE AND SIZE

The University of Sydney requires the use of 45 RU racks in all new communications rooms. Racks taller than 45RU are only to be installed with ICT's approval. A "safe step" must be provided for all rooms.

For refurbishments of existing buildings, ICT will specify the actions required in regard to the existing racks and whether or not additional ones of the same type are to be installed.

Where a communications room has been designed to accommodate a certain number of racks, all of the racks shall be installed at once, even if some of them will remain empty for the time being.

Racks shall be solidly fixed to the floor.

8.3.2 MAKESHIFT ARRANGEMENTS

Where approval is granted by ICT for a makeshift arrangement to be adopted, closed cabinets are to be used. As cabinet racks are only used as communications locations in undesirable locations, this standard does not give many details about cabinet racks. Designers must obtain approval for any makeshift arrangement from ICT's Communications Services, including approval for proposed clearances.

Where cabinet racks are used for communications, they shall be full height (45RU) and floor mounted. Front doors shall be clear plexiglass. Rear doors shall be metal. All doors shall be lockable.

Cabinet racks shall have movable front and rear mounting rails. The mounting rails shall be installed to provide sufficient space between the rails and the doors for transceivers and patch cords to protrude from the equipment without being squashed.

Refer to the Parts List for patch cord management requirements.

Wall-mounted cabinets are not acceptable. Only in exceptional circumstance and with approval through consultation with ICT will they be utilised.

8.3.3 RACK RAILS

All rack mounting rails shall accommodate cage nuts. Rails with threaded holes are not acceptable.

The front mounting rails of a cabinet rack may need to be moved back from the manufacturer's default position so that the deep cable managers on the Parts List can be installed without fouling the closing of the cabinet door.

8.3.4 SITE VISIT

Cablers installing racks for the University must arrange a site visit from an ICT Communications staff member to finalise the position of the racks before the racks are fixed to the floor.

Rack layout elevations are normally agreed on and documented during the site visit.

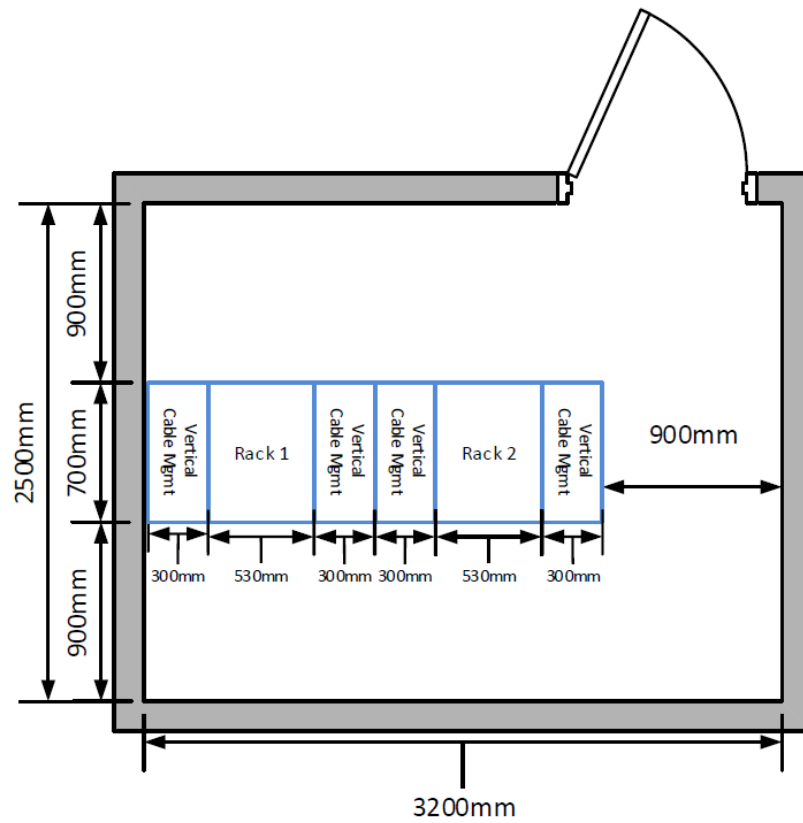
8.4 SIZE OF COMMUNICATIONS ROOM AND COMMUNICATIONS RACKS

The sizes of the communications rooms are to take into consideration all access and circulation requirements and allowances for future expansion.

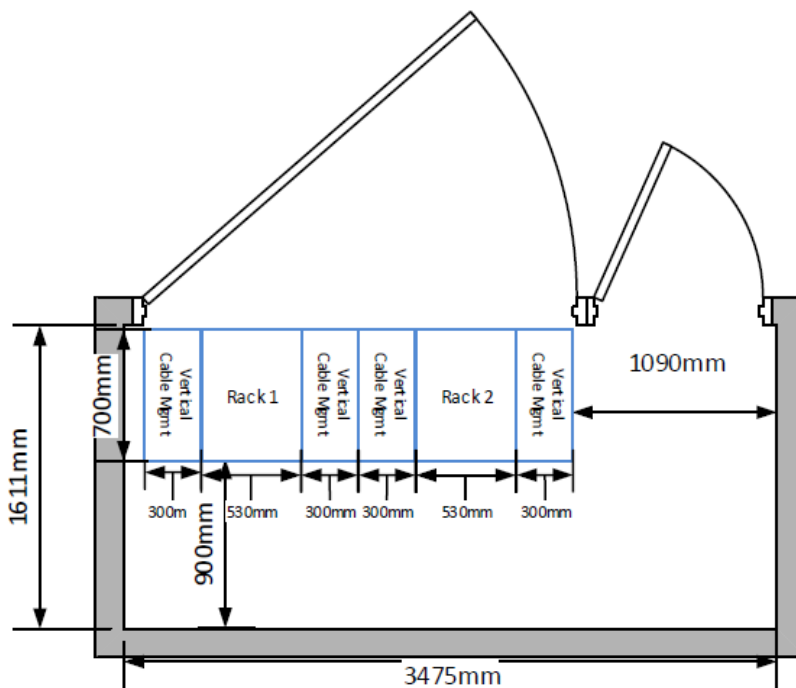
Obtain confirmation from ICT on the requirements for future expansion.

Cabinets require 900mm on at least three sides to accommodate work health safety requirements for Communications rooms. In addition, adequate height shall be provided in the room for people, racks and overhead cable trays.

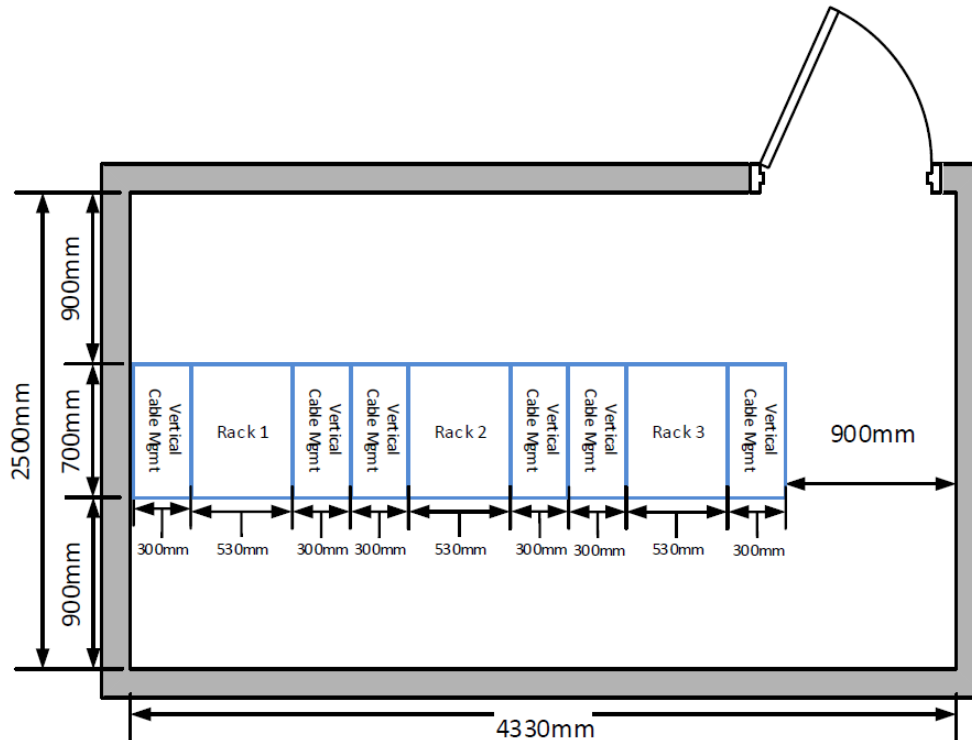
The following is a typical arrangement for a room requiring 1, 2 and 3 rack room configuration and sizing.



Typical 2 cabinet Communications Room



Optional 2 cabinet Communications Room hallway opening



Typical 3 cabinet Communications Room

Estimation formula to develop a floor plan for a comms room:

For a comms room with n racks, $n > 0$ width = $1110 n + 1200$ mm

depth = 2600 mm + DAS allocation + MDF allocation

DAS allocation = 200 mm if required

MDF allocation = 100 mm if required

These dimensions can be utilised to develop a floor plan for a communications room.

8.5 NETWORK SUB CENTRE

In key campus locations network sub centres provide the consolidation point for connectivity from a number of buildings and connectivity to core/ external services. They may also form carrier aggregation points. The sizes of the communications rooms are to take into consideration all access and circulation requirements and allowances for future expansion.

Obtain confirmation from ICT on the requirements for network sub centres.

8.6 RACK LAYOUT (RACK ELEVATION)

Rack layouts are designed by the ICT Communications Services. The example below shows a 3 rack main or secondary communications locations within a building.

Designers are reminded that ICT supplies the active equipment in the racks, hence the need for ICT to design the layout to suit the intended equipment, and to specify where the pendant power outlets are to be hung. ICT will specify the number of racks to be installed, including empty racks for expansion.

Optical fibre is mounted at the top of a rack, followed by any Class EA F/UTP backbone cables to other communications rooms. Backbone cables will be installed in their own separate rack in communications rooms with multiple racks. Where a main communications room or secondary communications room also acts as a floor distributor, separate racks shall be provided for the different functions.

A voice tie cable to the MDF is mounted at the top of each patch field of horizontal wiring.

ICT frequently installs modular ethernet switches which take up fourteen rack units and several dedicated power circuits. Substantial amounts of space must be allocated to the active equipment.

In addition to the space required for the cable terminations and active equipment, 50% spare rack space is to be provided in each communications room rack set. This provides for growth and changes over the buildings expected 20-30 life cycle.

8.7 RACK AND PANEL LABELLING

8.7.1 LABEL MATERIAL AND SIZE

All rack and panel labels are made of engraved traffolyte. Sizes shall be similar in proportion to the illustrations. Labels shall be white with black text.

8.7.2 SEQUENTIAL NUMBERING OF PANELS

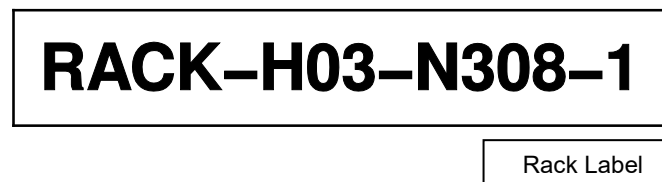
Each installed panel is numbered with its initial rack unit position/s, counting up from the bottom as per industry standard. The labels are fixed to the left-hand bracket of each panel. Refer to the Patch Cord Management placement detail illustration and the 4-pair F/UTP labelling illustration.

Any existing installations will continue with the numbering standard as installed in that location. Any changes to existing locations must be specifically advised and approved.

8.7.3 LABELLING OF RACK

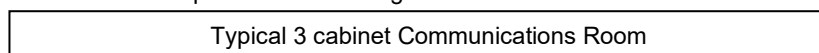
The rack label shall be fixed in the middle of the top crossbar of the rack.

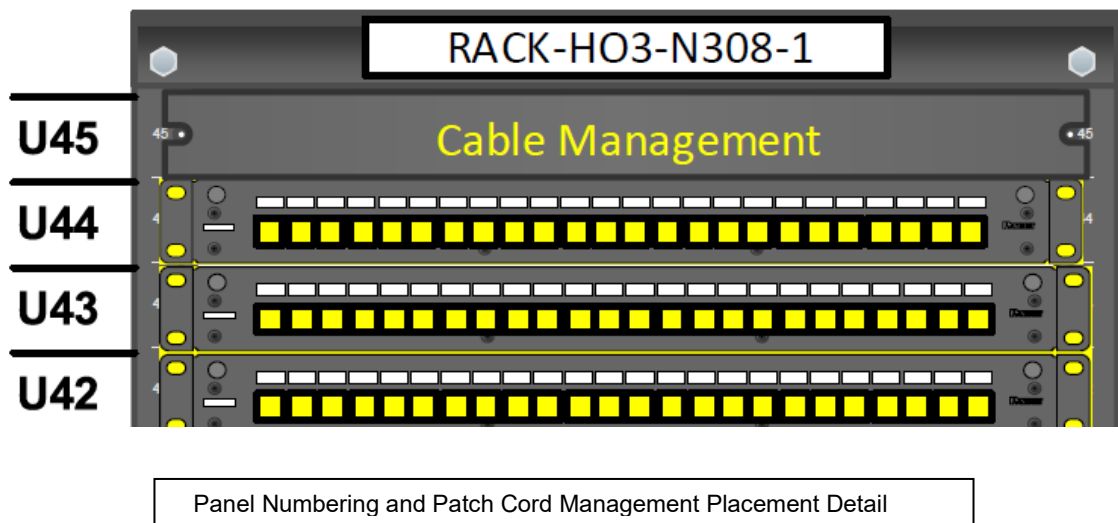
The rack label shows the building code, the room number and the rack number in the room.



Rack Label

For sequential numbering of panels, refer to the Panel Numbering and Patch Cord Management Placement Detail illustration below and the 4-pair F/UTP labelling illustrations.





8.8 PATCH CORD MANAGEMENT

Provide one horizontal cable management at rack units 01, 15 and 45. Additional cable management may be required depending on documented final design. Refer to the Parts List.

High patch cord pathways across the tops of racks, known as "raceways", are a WHS hazard for communications workers. Raceways are not utilised. The function of a raceway is implemented by installing extra horizontal patch cord managers in the top rack units of each rack, to make a horizontal row.

Vertical patch cord management is part of the rack set and shall be provided in accordance with the Parts List.

8.9 VERTICAL CABLE POSITION

Cable at a rack shall not protrude into the active equipment area (between mounting rails), so that it does not block the installation of active equipment.

8.10 CABLE SLACK

All efforts should be made to keep slack cable out of the rack.

8.11 NON-RACK-MOUNT EQUIPMENT IN RACKS (RACK SHELVES)

Some items of communications equipment, such as ADSL modems, do not have rack mounting brackets. When such equipment needs to be installed in a communications rack, it must sit on a rack shelf.

The top of another piece of equipment, such as an ethernet switch, is not to be used as a substitute for a shelf.

8.12 POWER OUTLETS

8.12.1 QUANTITIES

To be determined by ICT on a case by case basis.

For new buildings, allow for 10 such power outlets per floor communications room.

Provide power outlets for empty and future racks by installing extra circuits to junction boxes in the communications room, which will allow the socket outlets to be positioned and installed later without a switchboard shutdown. For large rack sets, allow for 10 power outlets at every second rack. Round surface

mount junction boxes or roses are suitable to terminate power wiring for future pendant outlets. The permanent traffolyte labels for the circuits shall be installed at the junction boxes and are to be transferred to the socket outlets when they are installed.

Socket positions will be confirmed during the site visit.

Ordinary GPOs shall be provided on the walls of the communications room for general power for test equipment, vacuum cleaners, power tools, etc. These outlets are to be positioned opposite the front of the racks.

If there is no Communications Earth Terminal in the communications room, a CET is to be installed at the same time as any new power circuits are connected or any other electrical shutdown. See the Earthing section.

No electrical power is to be provided in communications riser cupboards.

8.12.2 SIZE

15 Amp (or greater as advised) single phase – each outlet on a dedicated circuit.

For small server rooms, allow for two 32A single phase circuits per rack.

8.12.3 TYPE

Lab racks: Industrial captive screw socket - Clipsal SS15/15N pendant captive outlet. Flex shall be used for the drop; TPS cable is not acceptable.

Communications cabinets: IP66 captive outlets

Server racks in small server room: IP66 captive outlets, pendant just above rack roof

Surface-mount electrical conduits and accessories are acceptable in the communications room.

8.12.4 DEDICATED SWITCHBOARD PERMITTED

The prohibition on switchboard installation in communications rooms may be only be exempted in the case where the switchboard serves the communications room exclusively.

ICT must approve the position of the switchboard to ensure that clearances for future racks are maintained.

8.13 RACK POWER STRIP

Where up to 3 racks are installed in a Communications Room – 2 power strips shall be provided, complete with captive screw plug.

Where greater than 3 racks are installed in a Communications Room – 1 power strip per 2 racks shall be provided, complete with captive screw plug.

The horizontal rack power rail shall be positioned at the bottom of the active/fibre rack, with the power sockets facing towards the back of the rack.

Refer to the Parts List for additional details.

SECTION 9 INSTALLATION OF INDOOR AND SURFACE CABLING

9.1 CONDUIT

Non-Metallic Conduits (PVC) and Fittings

9.1.1 JOINTS

Use cemented joints. Adopt the manufacturer's recommended procedure for making joints.

9.1.2 WALL BOXES

Standard size wall boxes shall be of the same material as the conduit. Where special size boxes are specified and where such boxes are not obtainable in UPVC, use prefabricated metal boxes.

9.1.3 FITTINGS

Use inspection-type fittings in accessible and exposed locations.

9.1.4 CONDUIT SETTING

Where possible, have conduit bends pre-formed by the manufacturer. At site, use correctly sized springs to form sets in UPVC conduit. Bends shall be of large radii and, after setting, shall maintain effective diameter and shape. Reject conduit sets distorted by kinks, wrinkles, flats or heating.

9.1.5 EXPANSION JOINTS

Install flexible couplings where structural expansion joints occur in buildings and in straight runs not embedded in wall chases or floor slabs. Install conduit saddles close to the flexible coupling in a manner which allows free movement for expansion and contraction.

9.1.6 MECHANICAL DAMAGE

In situations where the conduit is exposed to mechanical damage and external to buildings, provide mechanical protection to UPVC conduit to a height of not less than 3m above ground or platform level.

9.2 CABLE AND CONDUIT SUPPORTS

Trays used in the building shall be either ladder tray or basket tray ("shopping trolley tray"). Where trays will be exposed, architectural approval is required.

Ladder tray shall be equivalent in quality to Unistrut ladder tray or Breseight 353/02223 tray.

Trays shall not have any sharp edges or burrs. For ladder tray, the top edge shall be folded over to provide a "soft edge".

Cable tray may be galvanised, pre-painted or chromed after manufacture.

"Waterfall" fittings or split conduit shall be fitted at the edge of the tray where cables leaving the tray may press down on it.

Perforated tray ("Admiralty pattern tray", "cheese grater tray") is not acceptable, except as the internal tray of a cabinet rack.

9.2.1 SUPPORT SYSTEM

Bends, connectors, trays, ladders, brackets and other supports necessary to make a complete cable or conduit support system shall be of the same manufacture and sized to adequately support the installed cable.

9.2.2 GALVANIZING OF STEEL TRAYS

Galvanize after manufacture to AS 1650.

Minimum thicknesses are as follows:

For trays up to 150mm wide	-	1.0mm
For trays from 150mm wide to 300mm wide	-	1.2mm
For trays over 300mm wide	-	1.6mm

9.2.3 CLEARANCE FROM HEAT

Maintain at least 200mm clearance from hot water pipes and 500mm clearance from boilers or furnaces.

9.2.4 VERTICAL CABLE MANAGERS AT RACKS

Each lab rack set shall be fitted with vertical cable management to reticulate cabling into the racks.

All vertical cable management for rack set shall be installed at the time of the rack installation, whether the racks are full, empty or partially filled.

9.3 SKIRTING DUCTS

Unless otherwise stated, use 2 channel duct, providing metallic shielding, approved by the University, and capable of supporting standard Australian pattern faceplates.

Ensure that the skirting duct and any cable ways within workstations are suitable for Category 6A F/UTP cables.

9.4 FLOOR BOXES AND TABLE BOXES

Samples of proposed floor boxes and table boxes must be supplied for approval complete with sample outlets fitted.

These boxes must be able to accommodate the required labelling for data, electrical and AV outlets.

9.5 CABLE PATHWAYS TO BE ACCESSIBLE AFTER INSTALLATION

The University must be able to augment, repair and remove the indoor cabling plant without the need to make and then repair holes in ceilings or remove light fittings.

Where set ceilings are used, sufficient easily removable ceiling access panels must be installed to allow future cable installation and removal.

Main cable routes are to incorporate cable tray, with minor routes incorporating catenary wires.

Cables must only be tied where they can be reached from the access panels.

During construction the builder is to assist the cabler to mark the positions of the future access panels on the slab above for the cabler to refer to.

SECTION 10 INSTALLATION OF UNDERGROUND AND AERIAL CABLING



10.1 SPECIALIST NATURE OF WORK

The University of Sydney has an extensive underground cabling system that has been constructed to Telstra standards. This system and standard of works is to be maintained.

Due to the specialist nature of this work and the standard of work required, any external cabling, conduit and pit works are to be incorporated into a specialist package, separate from the Electrical works.

All workers involved in underground communications work at the University of Sydney shall have the relevant qualifications as described in Appendix A.

10.2 DESIGN OF UNDERGROUND DUCTING NETWORK

The following principles apply:

- ICT designs conduit runs and junctions in accordance with good practice.
- The design of appropriate extensions to the campus ducting network is undertaken by ICT, taking into account the overall needs of the network as well as the needs of the project in question.
- All extensions and modifications to the University's underground communications ducting network, including pits and manholes, are designed by ICT's Communications Infrastructure Analyst.
- Ample conduit capacity and pit/manhole capacity must be installed, so that the University does not have to re-excavate the area to support future requirements or projects.

- Manholes are to be sized correctly for the number of conduits entering, including likely future conduits.
- Pits and manholes should be designed to be in non trafficable locations as a key design principle. They are potential places of work and having these in trafficable locations increases risk.
- Pits and manholes shall be capable of having their walls raised and having the angle of their lids adjusted slightly to conform with future landscaping.
- The ducting network must be flexible, so that junctions can be added in the future.
- Minimisation of the number of pits and manholes to be built is not a design principle of the University underground ducting network.
- University underground assets do not generally appear on plans from Dial Before You Dig. Obvious surface features such as pit and manhole covers are essential to the correct location of underground services. It is to be assumed that workers will not necessarily have access to accurate maps.
- Telecommunications carriers have a legal right to install their own ducting. The University's ducting network shall be installed to the carrier standards, to minimise the likelihood that any carrier will refuse to house its cables in the University ducting.
- Ducting runs shall not take diagonal "short cuts". Generally, ducting runs shall be parallel or perpendicular to existing alignments such as building walls and roads.
- Ducting segments between manholes shall be as straight as possible, without kinks.
- Conduit runs shall be no longer than 100m between manholes.
- Bends in underground conduit are to be minimised, and preferably avoided by using shaped manholes to turn through an angle. Under no circumstances shall a ducting run have a total of more than 180 degrees of bends in it.
- Pits and manholes shall be positioned at points suitable for likely future ducting branches.
- Pits and manholes shall be installed at both sides of a road crossing or trafficable area.
- Pits and manholes shall be placed at each change of direction.
- Avoid placing manholes in locations which inhibit correct cable hauling.
- Each ducting run shall terminate in a pit, in a manhole, at a marker post, or at the building entry point of a building. As a last resort, ducting is to be capped off with well-fitting plastic caps. It is strongly preferred that any "obsolete" ducting run be terminated in a pit so that the ICT can find the ducting easily when it is required again for use.
- Underground ducting assets are only to be abandoned as a last resort. Every effort shall be made to repair damaged ducting.

10.3 DESIGN LIFE OF UNDERGROUND COMMUNICATIONS DUCTING

The University of Sydney continues to install new cable in underground communications ducting network components that were installed in the 1960s and earlier.

All underground communications ducting, pits and manholes are to be assumed to have a useful life of the infrastructure that it is supporting. Buildings are expected to have a useful life in excess of 20-30 years.

The University is very likely to modify the topology of any section of the ducting network during its life.

Communications ducting, with its long life, frequently outlives the building it was installed to serve.

10.4 RESTRICTED ACCESS TO UNDERGROUND DUCTING

Only workers meeting ICT standards for underground services work may work in ICT's underground communications ducting network. Qualifications are to be provided and checked by ICT prior to engagement and commencing work.

Workers locating underground services may open ICT's pits and manholes for that purpose only.

10.5 TELSTRA MANHOLE BUILDER TRADE

All underground communications conduit and manhole installation is to be carried out by a specialist contractor recognised as a qualified manhole builder by Telstra. All manholes are to be personally built by the qualified manhole builder. Where existing communications cables pass through the manhole excavation, the excavation shall be carried out personally by the qualified manhole builder.

10.6 RESTRICTIONS ON SUBCONTRACTING ARRANGEMENTS

Where this type of work is managed directly by the University, a specialist telecommunications industry company must be directly engaged by the University to carry out the work. The crew leader for the engagement must be a staff member of the specialist company, not a subcontractor.

In the case where communications civil work is to be carried out under a builder, the builder must directly engage the specialist telecommunications industry company. The crew leader for the engagement must be a staff member of the specialist company, not a subcontractor. The crew leader must hold the relevant qualifications as given below.

Under no circumstances is underground communications work to be procured via an electrical contracting company.

10.7 QUALIFICATIONS

10.7.1 PRESENTATION OF QUALIFICATIONS

Prior to the proposed commencement of work on the underground network, workers must provide copies of their relevant Telstra qualifications to ICT. The following forms will be accepted:

- Accredited Contractor Certificate, accreditation cards for contracted work, training certificates, and equivalent documentation issued by Telstra and its predecessor organisations
- A Statement of Attainment or equivalent documentation issued by a Registered Training Organisation

If the qualifications are not provided ICT requires four weeks' advance notice of the name of the proposed qualified manhole builder before this section of the work begins, so that the credentials of the workers can be checked.

In the case of incomplete training records, ICT may, at its discretion, accept that a worker has completed prerequisite courses if the worker presents documentation for completion of a course which has known prerequisites.

ICT will maintain a list of workers who have already presented their qualifications, so that they do not need to present them repeatedly.

10.8 UNRELIABILITY OF UNIVERSITY UNDERGROUND SERVICES PLANS

Underground services plans issued by the University are to be used only as a guide to the locations of underground services. The University has changed surface levels and angles in numerous places, and surface features shown on plans may no longer exist. The depths and distances shown on these plans are not reliable. Furthermore, most of the Darlington Campus is built on land which formerly had terrace houses and small commercial buildings; the ground there is full of undocumented services. Some recently-installed underground services have not been added to University plans.

Even where information marked on plans may be annotated as having AS 5488 Quality Level A, all works are to be completed with due care. Uncertain finished levels on building sites make it difficult for trenching contractors to be sure of the final depth of cover over the service they have installed, and surface features existing at the time of installation may be demolished during the overall works. In some cases there are no nearby surface features which can be used as points of reference.

10.9 UNDERGROUND COMMUNICATIONS CONDUITS

All materials are to be Telstra type with "communications" marking, such as those supplied by Iplex and Vinindex. These conduits do not necessarily have the same internal dimensions as electrical conduits of the same nominal size.

All conduit bends are to be large radius, such as 22.5 degree 5 metre radius bends.

All conduits shall be fitted with Telstra conduit bushes.

All conduits are to be bedded in 100mm clean sand.

White "Communications" warning tape is to be laid at least 100mm above the conduits.

Where conduits are laid beneath soft surfaces such as grass and gardens, underground cable cover is to be laid together with the warning tape to give the conduits extra mechanical protection. Cable cover may either be plain black type, but made to the same strength as standard electrical cable cover, or cable cover with white communications markings that serve also as warning tape. Orange electrical cable cover is not permitted.

Conduits are to be installed with minimum depth of cover 600mm under roadways, both publicly and privately owned. Under paths, lawns, gardens and other non-trafficable areas the minimum depth of cover is to be 450mm.



10.10 CONDUIT QUANTITIES, ROPES AND SUBDUCT

ICT will specify the required conduit quantities for any new conduit runs. New conduit runs normally consist of four P100 conduits. P50 conduit is only installed to enter small outdoor enclosures such as parking meters and watering systems.

Very small buildings such as sheds may be connected to the ducting network with only 2 x P100 conduits.

All new structures which will be connected to electrical power shall be connected to the underground communications ducting network, whether communications and electronic security are required initially or not. Refer to the New Structures section.

All new conduits are to be roped with Telstra hauling rope ("Parramatta rope").

In each segment of new conduit, one of the four conduits is to have four 32mm Telstra-style subducts installed. Each subduct is to have a jet line (orange polypropylene draw cord) installed.

10.11 INSTALLATION OF UNDERGROUND CONDUIT BY TRENCHING

Underground communications conduit is to be installed by trenching.

Trenching may be carried out by hand, by mechanical excavation, or by vacuum excavation.

Where a conduit run is likely to encounter large tree roots, the cost of vacuum excavation is to be included in the price.

Saw cut existing concrete or bitumen surfaces in a straight line to a depth of 75mm before excavation is commenced. Lift and store paving slabs for later reinstatement.

After excavation, clear trenches of sharp projections. Installation depth must be referred to ICT when rock is encountered in the excavation.

Backfilling in roadways is to be with 14:1 self-settling stabilised sand delivered wet from a concrete plant in an agitator truck. Backfilling under footways is to be 20:1 stabilised sand. Dry stabilised sand may only be used in night work and must be mechanically compacted.

10.12 EXCLUSIVE TRENCHES

Underground communications ducting is to be installed in an exclusive trench. Shared trenches with other services are not to be used, as they diminish or rule out the possibility of building a new manhole over the ducting run in the future.

The University frequently "tees off" from existing ducting runs by building new manholes over them.

10.13 DIRECTIONAL BORING

The use of directional boring to install communications conduit is strictly forbidden as a general practice. Directional boring will only be utilised in extreme solutions after all other options have been exhausted. An example of one direction bore is the crossing of Parramatta Road.

10.14 DIRECT BURIED CABLES

All underground communications cables are to be enclosed in conduit. Direct buried cables are forbidden.

10.15 ESTIMATION OF CONDUIT RUN DISTANCES

Telstra construction plans show the distance between proposed manholes in metres. Telstra manhole builders are not trained to estimate these distances from the scaled drawings used in the general construction industry.

When engaging a Telstra manhole builder, the head contractor should estimate these distances and mark them up on the plan before sending it to the Telstra manhole builder for pricing.

Manhole builders are advised to ensure that they receive these estimates individually from each firm which asks for a quote, and not to rely on one firm's distance estimates to price the same work for another firm.

10.16 BUILDING ENTRY POINT (LEAD-IN CONDUITS)

External conduits are to enter either sideways through a wall, or vertically through the floor slab against a wall. Generally the conduits will terminate at the perimeter of the building and the cables will continue to the communications rooms via internal pathways such as cable trays.

Under no circumstances are the lead-in conduits to emerge from the floor to the inside of a rack or a position in the middle of a room, making it difficult to reticulate external cables to other parts of the building.

10.17 PITS AND MANHOLES

Note: the term "manhole" will be used in this section to cover the various terms "pit", "manhole" and "access chamber".

Manholes are to be designed to be in non-trafficable locations. Manholes are places of work and therefore require protection from vehicular traffic. Having manholes in non-trafficable locations eliminates the risk of vehicular traffic while the manhole is in use. Where the design does not accommodate placing manholes in non-trafficable locations the reason for this is to be documented and provided to ICT. In these cases, the next controls are appropriate pit lids rated to the traffic conditions and/ or bollards. These will be on a case by case basis.

All manholes are to be reinforced concrete, cast in situ, constructed by a specialist contractor accredited as a manhole builder with Telstra.

No plastic pits, polycrrete pits, or precast chambers are permitted. All manholes are to be built to current and historical PMG, Telecom Australia and Telstra designs as used in NSW. The standard manhole built at the University is the CL 426 4-lid manhole. Where a specific manhole design has not been given, the CL 426 4-lid manhole is to be priced.

All manholes are to be built to the norms of Telstra Work Instruction 010254 W06 (formerly Appendix 31), with the exception of the floor island.

For quoting purposes, a manhole is to be assumed to have a turret, two straight bells and one side bell with a bullnose wall, two benches, and a 200mm wide concrete border cast around the frame.

Bell lengths are assumed to be two thirds of the length of the cast iron covers. Allow for the chamber to be up to 1.3m deep. Allow for a compliant manhole ladder. Cast a sump into the floor of the manhole, suitable for a standard manhole pump.

Cast iron frames are to be cast in separately from the main manhole pour, for the ability to re-set the frame afterwards if required. However, in public roadways, cast the frame in during the main pour for strength.

Whether or not to cast unistrut into the manhole walls is left to the discretion of the manhole builder.

The University may need to raise manholes after construction. All manholes are to be built with concrete thickness and steel mesh reinforcement to suit the manhole being modified to have a depth of up to 2m. Refer to the Telstra Work Instruction for these dimensions.

Workshop drawings of proposed ducting and manhole configurations shall be submitted to ICT's Communications infrastructure Analyst for approval before construction.

In non-trafficable locations all manhole lids must bear the marking "Comms" or "Communications" in order to meet regulations. Cast iron lids with the correct markings are available from the Wagga Iron Foundry. In the case of WT-5, WT-6 or 75/13 lids, which are not produced in a "comms" version, the Telstra logo is to be ground off at the foundry and the contractor is to fit one lid from each set with a brass "communications" badge in the following manner: a square recess is to be ground into the lid, holes are to be tapped into it, and the brass plate is to be attached using four brass hammer screws.

Certain sizes of Telstra manhole lid are available in infill versions. ICT discourages the use of the infill lids, as the standard lids are harder wearing and lighter to lift. If infill is desired, the best result is obtained with infill that can be poured in wet, such as concrete or aggregate. Pavers generally crack over time, as the pan of the lid is quite shallow. The success of cobblestones depends on the skill of the paving installer.

Infill materials such as mortar shall be left to set in the infill compartments only. Any material spilt or smeared on the upper cast iron edges or surrounding area is to be removed.

Builders must take care to give the correct finished surface level to the manhole builder. The tops of manholes can be adjusted after construction, but at a cost. It is normally possible to build the level up, but there are limitations on how far the turret can be cut down.



10.18 DRAINAGE OF MANHOLES

It is desirable that communications manholes be drained via stormwater lines. Where a package of works includes civil works as well as communications manhole installation, allowance shall be made in the civil documentation package for the plumber to connect any new communications manholes to the stormwater, and to check the fall of any inter-manhole drainage lines installed by the manhole builder.

Telstra manhole builders are not trained in laying stormwater lines and cannot be relied upon to get the fall right.

Plumbers must fit a flap valve if discharging to a pit or chamber, or a reflux valve if discharging to a branch pipe, to prevent ingress of stormwater detritus into the manhole during heavy rain.

The manhole drain must be covered by a grating.

10.19 GATIC-TYPE LIDS

Gatic-type lids are strictly forbidden. This sealed type of lid is designed to keep effluent and sewer gas from escaping from sewerage. Gatic-type lids have many maintenance disadvantages when used on underground services which do not require their sealing properties.

Telstra-type manhole lids are generally footpath grade. Manholes in roadways are to be avoided. If a roadway manhole is unavoidable, ICT will recommend the most suitable type of cast iron frame and lid. ICT owns some patterns at the Wagga Iron Foundry.

"Invisible" Gatic-type infill lids, such as lids which are built up with brass or stainless steel extensions, are strictly forbidden.



10.20 RAISING AND LOWERING OF PITS AND MANHOLES

When replacing the footpath or landscaping an area, it may be necessary to raise or lower existing communications pits or manholes.

This work is only to be carried out by a Telstra manhole builder.

Where an existing chamber is unable to be modified, it must be replaced to current standard. ICT will nominate the replacement type.

Where the ground level is to be lowered, extensive works may be required to achieve a legal depth of cover over communications conduits.

10.21 PITS AND MANHOLES NOT TO BE BURIED OR OBSTRUCTED

Under no circumstances is a communications pit or manhole to be rendered inaccessible by burying it. No equipment is to be installed, nor is any tree to be planted, that may obstruct access to a communications pit or manhole via any of its lids.

10.22 PERMANENT REINSTATEMENT



After excavation, reinstate the surface to the satisfaction of the Grounds Manager, Campus Infrastructure and Services. Refer to CIS's Trenching and Excavation design guidelines.

Note that Telstra manhole builders normally offer temporary reinstatement only. Others trades must be engaged to perform permanent reinstatement.

10.23 AS-BUILT DIAGRAM OF UNDERGROUND DUCTING

An as-built diagram of underground ducting shall be supplied. The diagram shall be drawn with the Australian Standard symbols given in AS/NZS 3085.1 (Telstra symbols).

Conduit lengths shall be shown in metres, from pit centre to pit centre.

Hand-drawn as-built diagrams will be accepted. Diagrams need not be to scale, but shall show the ducting relative to building outlines, roads and other landmarks and give the depth of cover.

Show an amount for preparing an AS 5488 Quality Level A as-built diagram separately from the main price, and indicate the style and technology that will be used to produce such a diagram for that price, such as "hand-drawn by contractor on hard-copy map provided by University, measured with measuring tape from existing surface features". Any difficulties with establishing levels, such as in gardens, should be referred to CIS.

The standard as-built diagram with Telstra symbols shall always be provided separately and submitted to ICT.

10.24 INSTALLATION OF UNDERGROUND AND AERIAL CABLES

All underground and aerial communications cables are installed by ICT. ICT uses workers with special Telstra qualifications to install these cables, cable jointers who have been trained for Telstra Primary Works.

ICT does not use electrical contracting companies to install underground communications ducting, manholes or cables.

Installation of underground cables is not included in a builder's scope. However, builders must install the indoor cable pathways needed for ICT's lead-in cables if they do not already exist. This applies even if the builder's scope does not include any other cables to be run in that direction.

The University avoids the use of aerial cables, other than as temporary lead-ins to site sheds.

10.25 CABLE BEARERS (MANHOLE RESTS)

Cable bearers (manhole rests) shall be installed by the cabler who is installing the cable through a manhole. The cost of supplying and installing the cable bearers, including "liquorice" and end caps, shall be included in the price for installing the cable.

10.26 UNDERGROUND COMMUNICATIONS FAQ

Question	Answer
Why are the manholes you use larger than the types I have specified/installed at other sites?	You are probably thinking of the little Telstra pits that you see in suburban streets. Those pits are used to bring tiny little telephone cables into houses. Our layout is more like the CBD. In the CBD you will see lots of bigger pits and manholes. Larger capacity conduit runs need bigger chambers.
So, pits aren't meant to contain a tangled mess of cables?	Definitely not. Cables and joints are supposed to be carefully supported. Messy, congested pits can lead to cable damage.
What's the difference between a pit and a manhole?	A pit is a small chamber with all of its surfaces within arm's reach from ground level. A manhole is a bigger chamber that you climb down into. Look in AS/NZS 3085.1 and you will see that there are different symbols for them.
Why do you only build in concrete?	Every other type falls apart, or is hard to re-level successfully. The University is an owner-occupier who is never going to sell, so it's important to build infrastructure that lasts. Plenty of our concrete pits and manholes are already forty or fifty years old.
How do you know which types of pits fall apart?	We have more than 400 pits and manholes on our main campus, of varying ages. We are responsible

	for maintaining them.
Why aren't pre-cast Telstra manholes acceptable?	There are several reasons but one important reason is that pre-cast Telstra manholes are not intended to be re-levelled after installation. Cast in situ manholes can be re-levelled any number of times. The ability to re-level the manhole is very important at the University. Many of our manholes have been re-levelled more than once.
I am an electrical consultant. How can I make sure that the underground communications design will meet Telstra standards? Do I need to study Telstra documents?	ICT's Communications Infrastructure Analyst will provide you with all the necessary information during the design phase. If any unusual situations arise, ICT will seek advice from a specialist Telstra consultant.
How does the separate documentation package for underground communications help? It is extra work for the electrical consultant to type it up.	The builder is required to engage the underground communications contractor directly. It's impractical for the builder to do this if the underground communications details are embedded in the electrical package.
I am a builder. This is the first time that I have been asked to manage underground communications works separately from the electrical works. Why do you need me to do this?	Building contracts frequently contain special requirements from the client, requirements that reflect previous experience. It is not appropriate for us to give exact details of past problems here, but we can tell you that our analysis has identified the separate packaging and supervision of the underground communications to be critical for producing a good outcome.
I am an electrical contractor. A builder has sent me your underground communications spec to quote on. Should I contact the Telstra manhole builder myself?	No. You have to pass the spec back to the builder, as the builder is required to engage the Telstra manhole builder directly. Please accept our best wishes for a successful quote on the indoor communications installation work.
I am a builder. My formworkers say that they can easily knock up some manholes for you, more cheaply than the quote the Telstra manhole builder has given me. Can you give me some drawings?	Telstra manholes are a miniature Design and Construct job. Construction drawings are not used. The manhole might look like a simple, plain box from the top, but underneath they are very technical. The Telstra manhole builder is trained to shape the manhole for correct cable hauling and cable flow, which will meet carrier standards. Formworkers are not able to do this.
Why aren't the lead-in cables part of the building contract?	ICT directly manages the installation of lead-in cables to minimise risk to cables feeding other buildings.
I am a project manager. My project is one of the few that need underground ducting work. Why do I have to pay for a full-size conduit run when we will only be installing one cable in it right now?	This is an interesting question. The answer is also a question: "The one cable needed for your project also passes through existing ducting runs that were not funded by your project. Do you think the University should have skimped when that earlier ducting was installed, so that your project had to re-excavate the existing routes as well?"
I do see why full-size ducting runs need to be installed, but I am hoping that ICT will be able to help my project cover the cost. Is funding available?	Projects normally need to cover the full installation cost from their own funding. However, ICT bears the cost of the ongoing maintenance of the underground communications network, which is considerable. All projects silently benefit from that.

SECTION 11 EARTHING

11.1 COMMUNICATIONS EARTH SYSTEM (AS/CA S009)

Each communications room shall be provided with a Communications Earth System.

The earthing system shall be designed by a professional engineer.

A Communications Earth Terminal ("CET") is to be installed in each communications room, typically mounted on the wall. The CET and the communications bonding conductor to the electrical switchboard are to be documented on the electrical drawings, and the CET is to be shown on the communications drawings.

If an existing communications room does not already have a CET, a CET shall be fitted when any additional power circuit is connected to the room.

TRC earthing systems (violet sheath) are not normally required.



11.2 DEMARCATION POINT BETWEEN TRADES

The Communications Earth System (green and yellow sheath) is part of the communications cabling installation, not the electrical installation.

Designers should be mindful that the CET is a demarcation point between the electrical and communications cabling trades. The communications earth system must be used for any earthing connections which may need to be modified, extended or removed by a registered communications cabler who does not hold an electrical licence.

Communications cablers are not allowed to run wiring on electrical trays, so the CET must be positioned conveniently for reaching the communications cabling pathways in the communications room.

Registered communications cablers should not be put at a disadvantage by needing to bring in licensed electrical workers to carry out trivial earthing tasks which should have been facilitated by the Communications Earthing System.

11.3 LABELLING OF CET

The CET shall be labelled "Communications Earth Terminal" in engraved traffolyte.

11.4 LABELLING OF COMMUNICATIONS BONDING CONDUCTOR

The green/yellow earth cable from the CET to the electrical switchboard shall be labelled in accordance with S009. An engraved traffolyte label, similar to a pit label (see Optical Fibre section) shall be used, attached to the earth cable with cable ties.

11.5 EARTHING OF MDF FRAME

MDF frames are to be earthed to a CET.

11.6 EARTHING OF SHIELDED CABLING SYSTEMS

Cablers installing shielded cabling systems must ensure that the earthing of the shields complies both with AS/CA S009 and the manufacturer's advice.

Metallic racks, trays and other conductive parts are to be earthed according to the recommendations of the structured wiring system manufacturer. The earthing system designer is to make reasonable provision for such earthing connections in the design documentation and make any necessary adjustments after the brand and model of wiring system has been confirmed.

11.7 EXISTING EARTH STAKES AND EARTH LOOPS

Twisted pair horizontal wiring is not to cross electrical earthing boundaries in a building. Where buildings join together or have obvious earlier and later wings, the number of earth stakes and the consequent electrical earthing boundaries must be identified before the layout of horizontal wiring is planned.

11.8 EARTH CABLES FROM MULTIPLE SWITCHBOARDS

Some power circuits in a communications room may have been connected to a different electrical switchboard from the one the CET is connected to or will be connected to. It is the responsibility of the earthing system designer to identify any corrective actions which may need to be taken when this situation is encountered.

11.9 UNLABELLED EXISTING EARTH TERMINAL

Where an existing earth terminal with a green/yellow earth cable is present in a communications room, but is not labelled "Communications Earth Terminal", it does not meet the regulations for a CET and must not be used by registered communications cablers.

A licensed electrician who is also a registered cabler shall be engaged to examine the terminal and the wiring feeding it. If it is otherwise compliant as a CET, it shall then be labelled by the electrician. Any arrangement which cannot be rectified shall be removed.

Any existing earth terminals with violet or red earth cables (TRC system) may only be used in a manner compliant with current regulations. Refer to S009. Allow for a CES to be installed to any communications room which only has a TRC installed.

SECTION 12 INSTALLER AND SYSTEM WARRANTY

A manufacturer's system warranty is to be provided for any job where at least one full new patch panel of horizontal wiring is installed. The warranty shall be valid for a minimum of fifteen years.

For other wiring jobs, an installer's warranty must be provided, which shall be valid for a minimum of fifteen years. All cable test results are to be provided to Communication Services before the work will be signed off as completed.

Underground communications civil works must be warranted by the installer for a minimum of twelve months.

SECTION 13 DEMOLITION, DAMAGE AND REPAIRS

13.1 GENERAL

Communications cables are either to be maintained in full working order (including termination), or be fully removed.

Incomplete demolition of obsolete communications cabling is a serious problem at the University of Sydney. Obsolete cables choke racks and cable pathways, inhibiting installation and upgrading works. Obsolete cables also increase the fire load of a building.

All damage to ICT assets shall be reported to ICT before any repairs or related actions are performed. Repairs shall only be performed by contractors authorised by ICT.

13.2 DEMOLITION

13.2.1 REMOVAL OF OBSOLETE CABLES AND TERMINATION HARDWARE

Where a cable has become obsolete, the entity which caused it to become obsolete shall pay for the full removal of the cable between its termination points. The termination hardware is also to be fully removed where applicable.

- For horizontal data wiring, removal typically involves removing the wall socket and the cable from the wall socket to the communications room. The labels at the rack are to be removed or blacked out. Remove the wiring carefully from patch panel jacks so they can be reused.
- For traditional telephone wiring, removal typically involves removing a 600 series socket and a 2 pair cable back to a telephone frame such as an FDP. Where a telephone frame is obsolete, the frame is to be removed, and the cable feeding it is to be removed back to the upstream telephone frame, and so on.
- For optical fibre and other backbone cabling, removal typically requires removing one or more cables between communications rooms and/or the MDF.
- Obsolete cables leaving the building must be removed back to the originating building.

Communications wiring may only be demolished under the direct supervision of a registered cabler and with approval of ICT.

13.2.2 DEMOLITION OF BUILDINGS

Where a project is demolishing a building, the project must pay for the lead-in cables to be removed by ICT as part of the decommissioning works.

Leaving the lead-in cables of a building lying in the dirt can cause technical faults in other buildings. Furthermore, live cables in the same ducts can be damaged if an excavator catches an obsolete cable and pulls on it.

Underground duct space is a valuable commodity. Removal of obsolete lead-in cables ensures that the duct space is made available for reuse.

13.2.3 MAKING GOOD

Builders shall allow to make good any temporary holes needed during cable removal, including holes made outside the main site (such as in the ceiling of the corridor towards the communications room). It is not acceptable to chop obsolete cabling at the border of the building site.

Surface-run cables may have been painted over since installation. These cables shall be removed carefully, to minimise damage to the paintwork.

Whether or not paintwork is to be made good shall be at the discretion of the University's project manager. Project managers are urged to assess the likely need for making good of paintwork and allow a provisional sum to cover this work if required.

Where sockets have been removed from walls, leaving a hole, they may either be covered with blank plates, or made good in another way. The University's project manager will decide what is appropriate for each area.

Disused indoor and surface conduits and accessories shall generally be removed, but may be left in place for reuse at the discretion of the University's project manager.

13.2.4 DAMAGE TO CABLES

All damaged communications cables are to be replaced from end to end at the expense of the entity that caused the damage. After replacement, the damaged cables are deemed obsolete and are to be removed as described above, also at the expense of the entity that caused the damage.

Where a composite optical fibre cable has been damaged, ICT will nominate the replacement cable type, which may be a composite cable or a single mode cable of an equivalent number of cores.

ICT may require the use of a cable joint as a temporary measure to restore service while a permanent replacement is organised. The cost of the joint shall also be borne by the entity that caused the cable damage.

Some University cables are more than a kilometre long. Contractors working near these cables may wish to take out special insurance to cover the replacement cost of these cables if they are damaged.

13.3 DAMAGE TO UNDERGROUND CONDUITS

Underground communications conduits have a different life cycle from underground electrical conduits and other services. Urban communications conduits form a ducting network, allowing cables to be installed between arbitrary points without ad hoc excavation. As communications technology changes and demand rises, new cables are installed and obsolete cables are removed to recover duct space.

All branches of the ducting network, including spare conduits (expansion space), must be kept in good order so that cables can be installed, housed and removed efficiently. When cables are accidentally cut, damage to ducts can prevent prompt cable repairs, transforming a potentially short outage into a long term disruption.

Damaged underground conduits are to be repaired by a Telstra manhole builder, at the expense of the entity that caused the damage.

13.4 DISCOVERY OF EXISTING UNDERGROUND ASSET DAMAGE

Workers from any trade might uncover existing damage to ICT underground assets during excavation, such as crushed conduits. ICT must be notified immediately if such damage is found, so that it can be repaired while the excavation is still open. ICT will make every effort to minimise inconvenience to the other workers, both time-wise and physically.

SECTION 14 ACCEPTANCE

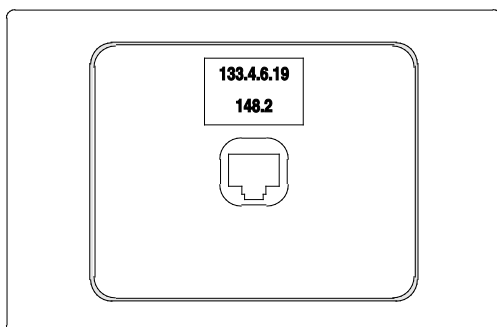
For the installations to be accepted, the following conditions must be met;

1. The installation complies with the specifications given in this document. Where ICT has agreed to a variation to the specifications in writing, the installation must comply with the agreed changes.
2. All required documentation has been handed over to ICT, including test results, warranty certificates and the TCA1 form.
3. There are no general defects that may affect the communications installation, such as dirt, damage or incomplete building works.

14.1 COMMON REQUIREMENTS

1. Regular project reporting for the duration of the project, including Progress Status Reports, Project Change Requests, Project dependencies, Issues and Risk register
2. Coordination with University ICT Project manager, University Building Construction Project Manager and the Builders relevant Project managers/Contractors
3. Cisco systems are the current supplier of all ICT communications equipment for the university. The university will procure all wireless AP's and controllers. A minimum lead time of 8 weeks must be provided to ICT to procure Cisco equipment.
4. Any additional materials required such as RF coax, mounting brackets, antenna mounting rails, AP enclosures, and exterior mounting hardware are to be supplied by wireless design contractor.
5. Review of documentation, test plans, test results, as built and handover documentation to be provided with 5 business days for detailed review and feedback.
6. Connection to the Campus network requires two weeks notification and approval through change management.

SECTION 15 LABELLING FAQ



Question	Answer
What is the name of this cable?	148.2
Where is the other end of the cable?	Go to Room 133, find rack 4, count down 6 rack units to the panel marked 6 and count 19 sockets across the panel. Look for the socket label "148.2" in this position.
Why is your labelling system so detailed? It's a lot of work for me to figure out all those numbers when I am preparing my label order.	The University campus is a place with lots of oddities in its layout. ICT staff need to be able to find the other end of cable quickly. This is why our labels include the "address" of the other end. When this address is missing, we can waste a lot of time, and sometimes we never find the other end at all.
What should I do if a previous cabler has numbered the patch panels incorrectly?	If you are adding a new panel, always give it a number that hasn't already been used. Try to keep numerical order - use "4a" if you are filling in a gap between existing panels numbered "4" and "5".
Do I have to put panel numbers on the cable managers?	Yes. Remove any manufacturers' labels to make room.
How do I number panels which are 2RU or greater?	A 2RU panel needs two panel numbers on it, a 3RU needs three panel numbers. These are generally older installations and highly unlikely to be installed in current installations.
Does a 3RU fibre tray have three panel numbers stuck on it?	Yes. These are generally older installations and highly unlikely to be installed in current installations.
Do the panel numbers go on the rack rail or on the panel?	On the panel. If we ever move the panel, the number moves with it. Moving of panels is discouraged.
Why are the RUs counted from the bottom up?	This is industry standard. The University has many locations that also utilise top down.
How many panel numbers should I order?	<p>If you have installed the rack, order all the panel numbers (usually 45) and leave the remainder in the room for future use. You can put them in a plastic bag and tie it to the rack.</p> <p>If you are just installing a few panels, order panel numbers for just your panels, or use spare ones that you have found in the room.</p>
How many separate pieces of traffolyte am I allowed to use when labelling sockets and patch panels?	When labelling copper, you can use as many pieces as you wish. For example, to label a triple outlet, you can use six pieces of traffolyte, or three, or one. When labelling a patch panel, you can use one long strip, a few long strips, or all individual labels. Our illustrations show the minimum possible number of pieces, but all possibilities are compliant.
It takes more time to stick many individual labels on, and it is harder to	One-piece labels normally look much neater. However, if a large label has a mistake on it, you will need to replace the whole label,

stick them on straight.	not just the bit that has the mistake. It's your choice.
Will I be defected if my labels are stuck on crookedly?	Probably. Why not use a ruler or a small spirit level or a cardboard jig to help you put them on straight?
I am labelling my new socket and I'm not sure if other sockets are hiding behind the furniture. How should I number my socket to avoid clashes?	Check the rack at the communications room for more sockets in the room. If still unsure, just pick a high-ish number for the socket. It doesn't matter if there are gaps in the numbering, but it is a problem if two sockets have the same name.
Can I use black traffolyte on dark wall plates? It looks better.	Yes, but only after you have submitted a sample to us and we have approved it. It's hard to read the white writing unless the engraving is good quality. Remember that we have to read this writing in the gloom under people's desks.
Is laser engraving acceptable?	Yes, but ensure that the stroke width and the cutting depth are similar to traditional engraving. Laser machines can make labels with writing so fine that it looks thin and grey instead of clear and black.

APPENDIX A

QUALIFICATIONS FOR UNDERGROUND AND AERIAL COMMUNICATIONS CABLING WORK AT THE UNIVERSITY OF SYDNEY

At the University of Sydney, underground and aerial communications cabling work is only to be carried out by tradespeople with specialist qualifications which are internal to the carrier telecommunications industry. For each type of underground or aerial communications cabling task, the required qualifications are given below.

Restrictions on subcontracting arrangements

Where this type of work is managed directly by the University, a specialist telecommunications industry company must be directly engaged by the University to carry out the work. The crew leader for the engagement must be a staff member of the specialist company, not a subcontractor. The crew leader must hold the relevant qualifications as given below.

In the case where this type of work is to be carried out under a builder, the builder must directly engage the specialist telecommunications industry company. The crew leader for the engagement must be a staff member of the specialist company, not a subcontractor. The crew leader must hold the relevant qualifications as given below.

Under no circumstances is underground communications work to be procured via an electrical contracting company.

A 1.1 PRESENTATION OF QUALIFICATIONS

Four weeks prior to proposed commencement of work on the underground network, workers must provide copies of their relevant Telstra qualifications to ICT. The following forms will be accepted:

- Accredited Contractor Certificate, accreditation cards for contracted work, training certificates, and equivalent documentation issued by Telstra and its predecessor organisations
- A Statement of Attainment or equivalent documentation issued by a Registered Training Organisation

In the case of incomplete training records, ICT may, at its discretion, accept that a worker has completed prerequisite courses if the worker presents documentation for completion of a course which has known prerequisites.

ICT will maintain a list of workers who have already presented their qualifications, so that they do not need to present them repeatedly.

Note: Where a worker was assessed for ICT by a specialist consultant under the provisions of Clause 9.5 of the *University of Sydney Communications Cabling Standard* 1 July 2013, the assessment certificate will be accepted in place of other forms of qualifications listed above.

A 1.1.1 QUALIFICATION SET CJ

In this section, wherever a person is required to hold *Qualification Set CJ*, this is an abbreviation for the following set of Telstra qualifications:

Pit and Pipe
Cable Hauling
Jointing Basic
Jointing Advanced
Jointing Advanced - Rearrangements and Cutovers
Jointing > 400 pair (Machine Jointing) or Joints - AMP STACK Modular Connectors
Lead Plumbing
Aerial Cable Construction

A 1.1.2 CREW LEADER - DEFAULT REQUIREMENTS

For any task where specific qualification requirements have not been specified for the crew leader, the crew leader shall hold *Qualification Set CJ*.

The leader of the work crew must take responsibility for ensuring that each member of the crew is competent in performing the tasks assigned to them in accordance with all parts of this specification and with safe and sound practice.

A 1.2 CIVIL WORK

This work includes:

- installation, maintenance and removal of pits (including non-Telstra models)
- construction, maintenance and demolition of manholes
- installation, maintenance and removal of underground conduits

Notes

1. Installation of cable bearers (manhole rests) is normally carried out as part of cabling work, not civil work.
2. High pressure water flushing and pipe camera inspection may only be carried out by a worker who has been individually approved by ICT. In general, this type of worker is a plumber, who must be supervised by the civil work crew leader.

A 1.2.1 CREW LEADER

The leader of the civil work crew must hold the following Telstra qualifications:

Qualification Set CJ (see above)
Manhole Construction and Maintenance

A 1.2.2 OTHER CREW MEMBERS

The leader of the civil work crew must take responsibility for ensuring that each member of the crew is competent in performing the tasks assigned to them in accordance with Telstra practice, to meet Telstra standards.

All members of the civil work crew must be regularly practising in Telstra underground communications work.

A 1.2.3 EXCAVATION AROUND UNENCLOSED CABLES

Where unenclosed existing communications cables pass through a pit or manhole excavation, the excavation work at that location may only be carried out under the direct supervision of the civil work crew leader.

A 1.2.4 WORKING WITH ASBESTOS CEMENT

Some older communications pits and underground conduits are made from asbestos cement. ICT has published information about these in the University's *Asbestos Register*.

No crew member may participate in modification or removal of any asbestos-containing material without first presenting evidence to ICT of appropriate training and/or licensing in accordance with the *Work Health and Safety Regulation 2011*.

A 1.3 UNDERGROUND COPPER CABLING

A 1.3.1 HAND HAULING

All members of the hauling crew must be regularly practising in Telstra underground communications work. For hand hauling of underground copper cables of up to 200 pairs, or hand hauled recovery of underground copper cables of any size, qualification requirements for the crew leader are:

Qualification Set CJ (see above)

The leader of the work crew must take responsibility for ensuring that each member of the crew is competent in performing the tasks assigned to them in accordance with Telstra practice, to meet Telstra standards. Alternatively, a crew leader and crew qualified for hauling with mechanical aids and hauling of large cables (see below) may undertake the task.

A 1.3.2 HAULING WITH MECHANICAL AIDS AND HAULING OF LARGE CABLES

All members of the hauling crew must be regularly practising in Telstra underground communications work. For hauling of underground copper cables with mechanical aids, or any hauling of underground copper cables in excess of 200 pairs, the crew leader must hold the Telstra qualification:

Main Cable Hauling

The leader of the work crew must take responsibility for ensuring that each member of the crew is competent in performing the tasks assigned to them in accordance with Telstra practice, to meet Telstra standards. The crew member who takes responsibility for the cable flow and cable racking in pits and manholes must hold the following Telstra qualifications:

Qualification Set CJ (see above)

A 1.3.3 JOINTING OF UNDERGROUND COPPER CABLES

Every person carrying out underground copper cable jointing work must hold the following Telstra qualifications:

Qualification Set CJ (see above)

For jointing of cable > 400 pairs, the jointer must also hold this Telstra qualification:

Jointing > 400 pair (Machine Jointing)

A 1.3.4 WORKING ON PRESSURISED UNDERGROUND COPPER CABLING

Every person working on pressurised underground copper cabling, including taking air pressure measurements, must hold the following Telstra qualifications:

Qualification Set CJ (see above)

Note: This requirement does not apply to a specialist air machine technician authorised by ICT.

A 1.3.5 TERMINATION OF UNDERGROUND COPPER CABLING AT A DISTRIBUTION FRAME

To terminate underground copper cable at a distribution frame, a person must fulfil one of the following requirements:

- i. Be a PABX technician authorised by ICT to work on the University's PABX and related equipment
- ii. Be a current or former Telstra exchange technician
- iii. Hold one of the following Telstra qualifications:

*Jointing Basic
Installation and Maintenance
Exchange MDF practices*

The crew leader must also fulfil one of these requirements.

A 1.3.6 TERMINATION OF UNDERGROUND COPPER CABLE AT A PILLAR

Every person making pillar tails, installing pillar tails or otherwise working on termination of cable at or for a pillar must hold the following Telstra qualifications:

Qualification Set CJ (see above)

The crew leader must also fulfil this requirement.

A 1.3.7 JUMPERING AT A PILLAR

To jumper at a pillar, a person must fulfil one of the following requirements:

- i. Be a PABX technician authorised by ICT to work on the University's PABX and related equipment
- ii. Be a carrier technician authorised by ICT to connect, test or disconnect a line, or clear a fault on an existing line
- iii. Be a current or former Telstra exchange technician
- iv. Hold one of the following Telstra qualifications:

Jointing Basic

Installation and Maintenance

Exchange MDF practices

The crew leader must also fulfil one of these requirements.

A 1.3.8 REBUILDING A MAIN DISTRIBUTION FRAME

To rebuild a main distribution frame, a person must fulfil one of the following requirements:

- i. Be a PABX technician authorised by ICT to work on the University's PABX and related equipment
- ii. Be a current or former Telstra exchange technician
- iii. Hold *Qualification Set CJ (see above)*.

The crew leader must also fulfil one of these requirements.

Note: Jumpering at a distribution frame is considered to be indoor wiring work.

A 1.4 UNDERGROUND OPTICAL FIBRE CABLING

A 1.4.1 HAULING AND RECOVERY OF UNDERGROUND OPTICAL FIBRE CABLE

Optical fibre cable is only to be hauled and recovered by hand.
Requirements are the same as for hand hauling of underground copper cable.

A 1.4.2 JOINTING OF UNDERGROUND OPTICAL FIBRE CABLE

Every person carrying out underground optical fibre cable jointing work must hold one of the following Telstra qualifications:

Optic Fibre - Installation, Splicing and Maintenance or equivalent Telstra-accredited external optical fibre course

The crew leader must hold the following Telstra qualifications:

Qualification Set CJ (see above)

Note: Jointing of underground optical fibre cable is a rare activity at the University.

A 1.4.3 TERMINATION OF UNDERGROUND OPTICAL FIBRE CABLE

This is considered to be indoor work and is not subject to any special requirements for underground cabling work.

A 1.5 UNDERGROUND COAXIAL CABLING

A 1.5.1 HAULING OF UNDERGROUND COAXIAL CABLING

This work may only be carried out by hand. Requirements are the same as for hand hauling of underground copper cable.

A 1.5.2 REPAIR OF UNDERGROUND COAXIAL CABLING

This may only be carried out by a technician authorised by ICT to work on ICT's Distributed Antenna Systems. The crew leader is to be individually approved by ICT.

A 1.5.3 RECOVERY OF OBSOLETE UNDERGROUND COAXIAL CABLING

This work may only be carried out by hand. Requirements are the same as for hand hauling of underground copper cable.

A 1.6 HAULING AND RECOVERY OF SUBDUCT

Where subduct is hauled or recovered by hand, requirements are the same as for hand hauling of underground copper cable.

Where subduct is hauled or recovered with a mechanical aid, requirements are the same as for hauling of underground copper cabling with mechanical aids.

A 1.7 AERIAL CABLING

This section applies to copper cables, optical fibre cables, and coaxial cables.

Note: Temporary construction wiring, such as telephone lines to site sheds, is exempt from these requirements. Such wiring must be installed safely and be fully removed at the end of the construction work.

A 1.7.1 HAULING AND RECOVERY OF AERIAL CABLE

All members of the hauling crew must be regularly practising in Telstra line work.

The crew leader must hold the following Telstra qualifications:

Qualification Set CJ (see above)

or

Aerial Cable Construction

Cable Hauling

Main Cable Hauling

The leader of the work crew must take responsibility for ensuring that each member of the crew is competent in performing the tasks assigned to them in accordance with Telstra practice, to meet Telstra standards.

A 1.8 JOINTING INVOLVING AERIAL CABLE AND AERIAL-TYPE CABLE

Every person carrying out copper cable jointing work involving aerial cable and aerial-type cable must hold the following Telstra qualifications:

Qualification Set CJ (see above)

The crew leader must also fulfil these requirements.

No person may carry out aerial jointing of optical fibre cabling or coaxial cabling without special permission from ICT.