CURTIN UNIVERSITY

PROJECT DELIVERY GUIDELINES

DATA COMMUNICATIONS CABLING REQUIREMENTS

000313

Curtin University

Details of revisions			
Level	**Details**	**Date**	**Initial**
1	*Original document created from CITS Specification v1.4*	*Sep-16*	*RPS*
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3	*Integration of this document with 000346 PDG Services Metering Guidelines*	*Oct-18*	*RPS*
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3	*Minor amendments to replacing references to new industry standard titles*	*Aug-19*	*KT*
3	*Inclusion of wording to allow departures from the existing guideline*	*Nov-19*	*RPS*
4	*Modification of consultant and contractor selection criteria*	*Feb-20*	*KT*
4	*Insertion of Documentation Deliverables Guidelines as a reference*	*Aug-20*	*RPS*

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1 INTRODUCTION

This document is updated regularly as standards change. Prior to using this document please confirm that it is the latest by contacting the Properties Infrastructure Manager – Network Cabling.

1.1 PURPOSE

This Project Delivery Guideline has been prepared for use by Curtin University personnel and for other organisations or parties that participate in provision and implementation of data communication cabling products and systems for the University. The document addresses information technology infrastructure cabling in new buildings but applies equally to existing areas that are planning significant upgrades and extensions to existing cabling infrastructure.

It provides guidance in the following areas:

- technical requirements for cabling systems
- product selection and dimensioning guidance
- design, installation and testing requirements
- cabling administration and documentation.

The Project Delivery Guidelines have been prepared in consultation with Curtin University subject matter experts and stakeholders. It is recognised that the subject matter of Guidelines will not always be suitable for all project elements and departures from the Guidelines may be required or desirable. Departures from Guidelines must be agreed upon in consultation with the relevant University Guideline subject matter expert. Departures must be recorded in a project register and recorded and reviewed in the Project Control Group meeting minutes under its own meeting agenda item "Project Delivery Guideline Departures". Where the University subject matter expert identifies that a departure adds ongoing value to the University, the subject matter expert will update the relevant Guideline.

1.2 SCOPE

This document addresses the following areas:

- cabling systems comprising balanced copper cabling and optical fibre cabling for use in University laboratories, teaching and office facilities
- cable pathways and equipment spaces
- communication rooms, including environmental and power requirements.

Guidelines are provided for capital works and for upgrades and minor works.

1.3 RELATED INFORMATION

Specific cabling requirements, particularly for capital works and major upgrades, will normally be set out in contract documents relevant to the particular works.

Additional guidance in relation to cabling and related matters for capital works will be provided by the Infrastructure Manager – Network Cabling.

Any questions or clarifications related to data communications or the contents of this document should be directed to the Infrastructure Manager – Network Cabling.

1.4 CURTIN UNIVERSITY REQUIREMENTS

1.4.1 DISABILITY AND ACCESS INCLUSION PLAN

Curtin University believes in creating equitable and inclusive access for people with a disability to its facilities, services, events and academic programs on all its Western Australian campuses.

The *Universal Design Guideline* has been developed to reflect a commitment to equity and inclusion for all by embedding Universal Design principles into project planning, design and delivery guidelines. Consultant architects, designers and engineers should make themselves familiar with the particular requirements of the *Universal Design Guideline* before responding to a project brief.

1.4.2 HEALTH AND SAFETY

Curtin University is committed to providing and maintaining high standards of health and safety in the workplace and will:

- ensure compliance with relevant legislation and the University's Health and Safety Management System
- promote an organisational culture that adopts health and safety as an integral component of its management philosophy
- ensure that health and safety is part of the business planning processes and that it is adequately resourced by all areas
- maintain an effective mechanism for consultation and communication of health and safety matters
- maintain an effective process for resolving health and safety issues and managing health and safety risks
- provide appropriate health and safety training
- regularly review health and safety performance to monitor the effectiveness of health and safety actions and ensure health and safety targets and objectives are met.

A copy of our Health and Safety Management Standards can be found at: https://healthandsafety.curtin.edu.au/local/docs/HSManagementStandards.pdf.

1.4.3 GREEN STAR – COMMUNITIES

It is Curtin University policy that all new or refurbishment projects on site should support its status as Australia's first university to achieve a 5-star Green Star — Communities rating from the Green Building Council of Australia (GBCA). Designers should understand and incorporate the Green Star criteria into designs and specifications in order to maintain and enhance Curtin's Green Star status.

Information on the criteria can be found in the *PDG Green Star – Communities Design Guidelines.*

1.4.4 SERVICES METERING NETWORK

A range of services reticulated throughout the Campus (e.g. potable water, gas, electrical power) are required to be metered at various points and the meters are to be networked via Curtin University's data communications infrastructure and connected into the iEnergy reporting software and the building management system (BMS).

The procedures for networking services meters and connecting them to the data infrastructure are described in *000346 PDG Services Metering Guidelines*, which can be found within the Project Delivery Guidelines listings on the Guidelines page of the Properties, Facilities & Development website at:

https://properties.curtin.edu.au/workingwithus/guidelines.cfm.

1.5 CONTRACTOR AND CONSULTANT SELECTION CRITERIA

1.5.1 CONTRACTORS

Contractors must demonstrate the following:

- Work will be undertaken by a Registered Telecommunications Cabler – Open Registration with relevant endorsements, such as:
  - Structured (data cable Cat 5/5e/6 etc.) (S)
  - Optical fibre cable (OF)
  - Coaxial cable (C)
  - Metallic Testing (MT)
  - Fibre Testing (FT)
  - Underground (U)
  - Aerial (A)
- Ability to provide a full Class EA test together with a DC resistance test for Power-over-Ethernet requirements with a level IV tester
- Provision of fibre equipment with up-to-date calibration certification for Fusion Splicer, Optical Time Domain Reflectometer (OTDR) and Light Source and Power Meter (LSPM) testing that aligns with national and international standards, Curtin University's Data Communications Cabling Requirements and best industry practice
- Evidence of Company and Technician Cable Vendor Endorsements and evidence of a previously applied installation warranty vendor certification to align with Curtin endorsed vendors.

1.5.2 CONSULTANTS

ICT infrastructure system design shall be carried out by ICT specialists with the following relevant qualifications, credentials and experience levels.

Consultants must demonstrate the following:

- experience (minimum of 5 years) in the design and implementation of ICT cabling infrastructure systems
- an understanding of the ACMA regulatory requirements and Australian/international performance standards
- capability to apply the Curtin Data Cabling Guidelines and Australian performance and regulatory requirements in the course of designing a fully compliant telecommunications infrastructure system.

Curtin University recognises the following industry credentials for ICT design expertise. Alternative credentials may be considered; however the applicant must demonstrate they are equivalent standards to those listed.

1. The BICSI Registered Communications Distribution Designer (RCDD) credential
2. An engineer possessing an IEng in telecommunications from the IET is also recognised as being knowledgeable and skilful in ICT infrastructure design.

Note: IEng engineers accredited in engineering disciplines other than telecommunications will **NOT** be considered sufficiently skilful to carry out the ICT designs.

2 DEFINITIONS AND ABBREVIATIONS

2.1 DEFINITIONS

- Alien crosstalk (AXT) – electromagnetic noise that can occur in a cable that runs alongside one or more other signal-carrying cables
- Building backbone cabling – cable that connects the building distributor to a floor distributor
- Cabinet/comms rack – see Enclosure
- Campus backbone cabling – cable that connects the campus distributor to the building distributor(s)
- Campus distributor – distributor from which the campus backbone cabling starts
- Carrier – this may, for the purposes of this document, mean the University's backbone network or a carrier under the Telecommunications Act such as Telstra, AMCOM, etc.
- Category 5 (Cat 5) – a performance standard for cable and equipment in AS/NZS11801.1
- Category 5e – any reference to Category 5e shall be interpreted as Category 5.
- Category 6 (Cat 6) – a performance standard for cable and equipment in AS/NZS11801.1
- Category 6a (Cat 6a) – a performance standard for cable and equipment in AS/NZS11801.1
- Channel – end-to-end transmission path connecting two pieces of application-specific equipment
- Communications earth system – a system of earthing using common elements to provide earthing facilities for electrical and communications equipment within a premises
- Consolidation Point – connection point in the horizontal cabling subsystem between a floor distributor and a telecommunications outlet
- Contractor – used within this document to indicate the party(s) responsible for the supply, installation, testing and warranty of cabling systems
- Consultant – used within this document to indicate the party(s) responsible for the documentation and design of cabling systems
- University – in this document shall mean Curtin University
- Distributor – the term used for a collection of components (such as patch panels, patch cords) used to connect cables
- Enclosure – a housing for accommodation of equipment and cabling that includes mounting rails and protective panels

- Horizontal cabling – cable connecting the floor distributor to the telecommunications outlets
- Main Distribution Frame – a distributor that provides, or is intended to provide, an electrical termination point for a carrier's lead-in cabling
- Permanent link – transmission path between the telecommunications outlet and the floor distributor
- Rack – see Enclosure
- Registered Jack 45 (RJ45) –In this document RJ45 shall mean a modular 8-pin connector wired according to T568A configuration in accordance with AS/NZS11801.1 Z.A.2
- Site – means a facility owned or occupied by the University and includes the buildings and grounds in which a cabling system would be installed
- Structured cabling system – set of cabling and connectivity products that are constructed according to standardised rules to facilitate integration of voice, data, video, and other signals
- Tenderer – means the entity requested to provide a quotation for the supply, installation, testing and warranty of cabling systems.

2.2 ACRONYMS AND ABBREVIATIONS

- 10GbE 10 Gigabit Ethernet
- ACA Australian Communications Authority
- BD Building Distributor
- CAD Computer Aided Design
- CD Campus Distributor
- CEC Communication external cabinets
- CET Communications Earth Terminal
- DTS Curtin IT Services
- comms communications
- CP Consolidation Point
- EMC Electromagnetic Compatibility
- FD Floor Distributor
- FOBOT Fibre Optic Break Out Terminal/tray
- GbE Gigabit Ethernet
- GPO General Purpose Outlet
- IDC Insulation Displacement Connection
- IP Internet Protocol
- LAN Local Area Network

- LASER Light Amplification by Stimulated Emission of Radiation
- LC A small form factor optical fibre connector
- MDF Main Distribution Frame
- mech mechanical cable connector
- MMOF Multi-mode Optical Fibre
- MPTL Modular Plug Terminated Link
- MT-RJ A small form factor optical fibre connector
- PDU Power Distribution Unit
- PoE Power over Ethernet
- PSE Power Sourcing Equipment
- RFI Radio Frequency Interference
- RJ45 Registered Jack 45 (USOC reference)
- RU Rack Units (1 RU = 44.5 mm)
- SCS Structured Cabling System
- SFF Small Form Factor (connector)
- SFP Small Form Factor Plug
- SMOF Single-mode Optical Fibre
- STP Shielded Twisted Pair
- TE Terminal Equipment
- TO Telecommunications Outlet
- UPS Uninterruptible Power Supply
- USOC Universal Service Ordering Code
- UTP Unshielded Twisted Pair
- F/UTP Foiled Unshielded Twisted Pair
- UV Ultraviolet
- VoIP Voice over Internet Protocol
- WAP Wireless Access Point
- WLAN Wireless Local Area Network.

3 REFERENCE DOCUMENTS

Cabling system works shall be carried out in accordance with the regulations, codes and standards listed below.

Where Australian and international standards are referenced in this document, the application of the standard shall be, unless specifically stated to the contrary, the latest edition and amendment available on the date 30 calendar days prior to the issue of any request for a quote, tender or proposal, within which this specification is included.

Where specifications or standards or any other references referred to in this document refer in turn to other specifications, standards or documents whether whole or in part, those consequential references shall apply to this specification as if they were completely contained in their entirety in the original reference.

AS/CA S009 defines mandatory work practices. Australian standards are advisory unless incorporated in legislation or agreed by contract.

3.1 STATUTORY CODES AND REGULATIONS

The work covered by the specification shall comply with the requirement of the following Acts and legislation:

- *Western Australian Environmental Protection Act 1986*
- *Western Australian Occupational Safety and Health Act 1984*
- *Western Australian Occupational Safety and Health Legislation Amendment Act 1995*
- *Western Australian Occupational Safety and Health Legislation Amendment Act 2002*
- Western Australian Electricity (Licensing) Regulations 1991
- ACA Radio communications (Electromagnetic Radiation – Human Exposure) Standard 2003.

3.2 AUSTRALIAN AND INTERNATIONAL STANDARDS

The work covered by the specification shall comply with the following Australian standards, specifications and technical bulletins.

Standard/Specification or Technical Bulletin Number	**Description**
ARPANSA Radiation Protection Series Publication No. 3	Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz
AS/NZS CISPR 22	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement

AS1269	Occupational noise management
AS1485	Safety and health in workrooms of educational institutions
AS2107	Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS2211.2	Laser safety – Safety of optical fibre communications systems
AS2834	Computer accommodation
AS/NZS2053	Conduits and Fittings for Electrical Installations
AS/NZS2648	Underground Marking Tape
AS/NZS3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS11801.1	Generic cabling for customer premises – part 1, to be read in conjunction with sub docs (parts 2-6) in series
AS/NZS3084:2017	Telecommunications Pathways and Spaces for Commercial Buildings
AS/NZS3085.1:2004	Telecommunications Installations Administration of Communication Cabling System – Part 1: Basic Requirements
AS/NZS3087.1:2003	Telecommunications Installations – Generic Cabling Systems – Specification for the testing of balanced communications cabling
AS/NZS3087.2:2003	Telecommunications installations – Generic cabling systems – Specification for the testing of patch cords in accordance with AS/NZS11801.1
AS3260	Safety of Information Technology Equipment including Electrical Business Equipment
AS3548	Electrical Interference – Limits and Methods of measurements of Information Technology Equipment
AS/NZS4117	Surge protection devices for telecommunication applications
AS/NZS4251.1	Electromagnetic compatibility (EMC) – Generic emission standard Part 1: Residential, commercial and light industry
HB 29:2000	Communications Cabling Manual, Module 2
IEC-60297 Part 1 and Part 2	Dimensions of mechanical structures of the 482.6 mm (19”) series

IEEE 802.3	Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications
IEEE 802.3af	Power over Ethernet standard. Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications – Amendment Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI)

3.3 ACA/ACIF TECHNICAL STANDARDS AND CODES

The work covered by the specification shall comply with the following AS/ACIF standards.

Standard/Specification or Technical Bulletin Number	Description
AS/CA S008:2010	Requirements for authorised cabling products
AS/CA S009:2013	Installation requirements for customer cabling (Wiring Rules)

3.4 CURTIN UNIVERSITY STANDARDS AND SPECIFICATIONS

Cabling system works shall be carried out in accordance with the Curtin guidelines, standards and specifications identified in tender or contract documents.

In the event of conflict between a Curtin standard or specification and other regulations, codes or standards, the order of precedence shall be as follows (unless Curtin specifications exceed the requirements):

1. statutory codes and regulations
2. mandatory codes and standards (e.g. AS/CA S009)
3. this standards document
4. specifications within the tender or contract
5. Referenced Australian and international standards.

Conflicts in requirements that are identified by Curtin personnel, consultants, tenderers or contractors shall be notified to the Infrastructure Manager – Network Cabling for resolution.

4 GENERAL CONDITIONS

4.1 CABLING SYSTEM WORKS

The scope of work for provision of cabling systems for the University shall include supply, installation, testing, commissioning, labelling and documentation. Warranty provisions shall include on-site repair for a period of one year following completion of commissioning with a minimum manufacturer's warranty of product including labour to replace/repair for 15 years. A warranty period of 20 years is preferred.

Installation shall be carried out by a communications cabling system installer who is accredited by the manufacturer of the cabling and connecting hardware as qualified to perform the cabling work relevant to the performance standard of the various elements of the particular cabling system. For further details on installer requirements see Section 17.

The installer's test results may be confirmed by random tests made by the cabling system manufacturer.

In addition, all installation works shall be 100 per cent site-supervised by personnel currently registered with the ACA or ACA-authorised registrar as holding a cabling provider open registration, together with additional accreditation indicating completion of endorsed courses in the areas of testing, commissioning, installation and correct work practices relevant to the performance standards of the various elements of the particular cabling system. Relevant trade and manufacturer accreditation certificates shall be provided by the contractor to the Infrastructure Manager – Network Cabling prior to work taking place as requested.

4.2 NEW EQUIPMENT

All cable, materials, components and equipment shall be new and unused, of current manufacture and first quality selected to ensure satisfactory operation under the environmental conditions present at the site.

Cables and equipment shall be delivered to site in its original packaging.

4.2.1 SAMPLES

The materials shall be approved by the Infrastructure Manager – Network Cabling where specific items have not been specified.

A register of approved items by manufacturer is kept by the Infrastructure Manager – Network Cabling.

PRIOR INSPECTION

Samples produced by the contractor or its supplier shall first be inspected for compliance with the documentation by the contractor prior to submission to the Infrastructure Manager – Network Cabling.

CATALOGUE IN LIEU OF SAMPLE

Samples shall be submitted by the contractor to the Infrastructure Manager – Network Cabling for all equipment, accessories and systems for inspection prior to installation. However, subject to the approval of the Infrastructure Manager – Network Cabling, where an item of equipment is a standard item, copies of the manufacturer's catalogue or brochure may be accepted in lieu of a sample, provided that all dimensions and relevant information are shown in the catalogue or brochure.

IDENTIFICATION LABELLING

Samples shall be labelled to identify their intended use and relation to these documents, e.g. 'telecommunications outlet'. The identified samples shall be submitted in sufficient time to permit modifications to be made without delaying the work if such are deemed necessary by the Infrastructure Manager – Network Cabling and to provide the Infrastructure Manager – Network Cabling with not less than seven working days to make his/her comments.

TECHNICAL DATA

Samples shall be accompanied by all manufacturer's relevant technical data.

PERMISSION TO USE

Once inspected, samples will be marked or notated by the Infrastructure Manager – Network Cabling giving permission to use and installation may then commence or, alternatively, samples will be marked or notated 'Resubmit', which will automatically require the sample to be amended as required and resubmitted.

RETURN OF SAMPLES

Samples given permission for use shall be held on site after inspection and used as a standard for acceptance or rejection of subsequent production units and then be returned to the contractor.

4.3 MINOR MATERIALS, FITTINGS AND CONSUMABLES

All materials and fittings or any work which is obviously necessary for the satisfactory and efficient functioning of the installation, or which is generally provided in accordance with accepted trade practices, shall be provided or carried out as part of the works, even though such material or work may not be explicitly mentioned in this specification or shown on the drawings.

Where a particular manufacturer has been adopted for fittings, accessories or equipment all such fittings shall be uniform.

4.4 CONTRACTOR REGISTRATION AND INDUCTION

All contractors/tenderers must go through the Curtin University registration program. More information can be found at:
http://properties.curtin.edu.au/workingforus/inductions.cfm. Also see Section 17.

4.5 ELECTRICAL INSTALLATION WORKS

All electrical work is to be undertaken by qualified electricians in accordance with the relevant Australian standards (AS3000).

4.6 SITE CONDITIONS

The cabling system provider shall undertake the necessary investigations to fully inform itself of the site conditions and other factors that could impact on execution of the works. This shall include but not be limited to the following:

- hazards that may be present at the site (such as asbestos and the like)
- heritage registration of buildings
- environmental conditions, including special precautions for protection of flora and fauna
- local site conditions including weather factors.

Prior to submitting quotations, the tenderer shall determine (in writing) with the University the presence at the site of any hazardous conditions or materials such as asbestos and the like. If there is any doubt regarding hazardous conditions or materials, the tenderer shall confirm the site conditions with the relevant Area Representative from the University.

Furthermore, the tenderer shall verify whether any of the buildings or other structures at the site have been included on the Heritage Register. Details of such registration can be verified using the Heritage Council database, accessible from http://www.heritage.wa.gov.au/. If a site is registered with the National Trust, approval is required from the Heritage Council prior to any works commencing.

4.7 SITE INSPECTIONS

Dimensions shall be checked on site. No claims will be allowed for errors due to scaling of drawings. Curtin University recommends that the contractor inspect the site prior to pricing to become familiar with the access, site conditions and the existing installations. Ignorance of the existing conditions or installations will not be accepted as justification for claims.

4.8 EQUIPMENT LOCATIONS

Equipment and cable pathways shall be installed in accordance with approved drawings and plans.

When deciding on a suitable location for equipment all factors as stated in Section 7.1 of this document in relation to health and safety should be considered.

Additions or modifications to installed plant shall not be made without the written approval of the Infrastructure Manager – Network Cabling. Such additions or modifications shall be detailed on drawings and plans.

4.9 SITE REINSTATEMENT

All sites shall be reinstated to their former condition, to the satisfaction of the University's representative. Site reinstatement must occur as soon as practicable after the works have been completed.

4.10 COORDINATION WITH OTHER WORKS

Where the cabling system works is dependent upon or carried out in conjunction with other works on the site such as building, electrical or mechanical works, the cabling system provider shall coordinate cabling activities with other works with respect to:

- use of the site and access facilities
- scheduling of the works and site construction resources and utilities
- maintaining mandatory segregation of services
- liaison as required for building management and security systems
- demolition
- reinstatement.

DEMOLITION

Return all network equipment, telephone handsets and cables back to the University at the commencement of demolition. Seek instruction from the Infrastructure Manager – Network Cabling.

5 UNIVERSITY STRUCTURED CABLING SYSTEM

5.1 BACKGROUND

The communications cabling system plays a critical role in telecommunications systems, providing the physical link between sources and destinations of information. Data, voice, video and control signals are transmitted over this infrastructure, linking devices across an office, throughout a building or across several buildings.

The cabling system may be quite small and simple, linking just a few nodes, or it may be massive, linking several buildings with hundreds of nodes, or a system somewhere in between.

Essentially the cabling system is the physical link between active network equipment such as routers, switches, and hubs, and terminal equipment such as network interface cards and telephones. Usually a structured cabling system (SCS) comprises unshielded/shielded twisted pair (UTP or F/UTP) cable or optical fibre cable or a combination of both.

To facilitate the day-to-day operations of a normal office environment, the cabling system must enable the user to make additions, moves and changes, wherever and whenever necessary. Furthermore, the SCS must also be flexible and provide the capability to carry a wide variety of applications, from high-speed local area network (LAN) applications to voice and low-speed data.

As data throughput and transmission speeds have continued to grow, greater demands are being placed on the UTP – F/UTP and optical fibre cabling plant. Network applications such as Gigabit Ethernet and 10 Gigabit Ethernet use 'parallel transmission schemes' where signals are transmitted simultaneously over multiple copper pairs instead of one pair.

Applications such as Gigabit Ethernet and 10 Gigabit Ethernet require increased performance from cabling plant. As a consequence, a number of existing Category 5-compliant cabling systems will fail to support these new applications.

Delivery of these new services requires increased performance from cabling plant.

Other factors to be considered in relation to cabling system design and performance include:

- convergence between data and voice applications including IP telephony
- video delivery using the Internet Protocol (IP)
- use of Wireless LAN technology.

5.1.1 STRUCTURED CABLING SYSTEM DESCRIPTION

A Structured Cabling System (SCS) is a set of cabling and connectivity products that are constructed according to standardised rules to facilitate integration of voice, data, video and other signals. Use of such a system provides benefits in terms of rationalisation of infrastructure costs and facilitation of predictable performance.

For the purpose of this document, an SCS is defined as the cabling, connecting hardware, terminations, patch cords and work area cords. Equipment enclosures and associated pathways and spaces are considered as ancillary items.

The cabling, connecting hardware, termination and interconnecting cords comprising the SCS for each building shall be a single matched solution from a vendor approved by the University on an individual building basis. The two major advantages to this approach are:

- manufacturer's warranty. Cabling equipment suppliers offer an automatic warranty of 15 to 20 years if the installation is a 'single brand solution' per building that is installed by a certified or accredited contractor, rather than the one to five years available for a cabling system constructed from mixed brand products.
- performance improvements. Independent testing has revealed that mixing cabling products from a number of manufacturers can have significant impact on the performance of the cabling system, thereby limiting the useful life of the installation.

In the case of cabling works undertaken to expand or upgrade existing cabling plant at existing buildings the following requirements are applied:

- The new equipment shall be specified to ensure all warranties and system performance is maintained.
- Existing equipment and installation should be matched as far as possible, unless such matching would conflict with occupational health and safety requirements or mandatory standards.
- The number of differing types of equipment installed throughout a site should be kept to a minimum.

In the case of cabling works undertaken for new buildings added to a site, the cabling system shall comply with the requirements of this document except where such compliance would create compatibility or performance issues. Such issues shall be brought to the attention of the Infrastructure Manager – Network Cabling prior to authorisation of any works.

5.1.2 DESIGN CONSIDERATIONS

ICT infrastructure refers to the cables and the supporting pathways installed in a building or linking buildings that is the transition medium for ICT transmissions and signals between active network equipment and electronic devices. Transmission protocols and signals include but are not limited to Ethernet, HD-BaseT, Analogue, Digital, PoE.

Over recent years advancements in technology and demand for higher and faster throughput have grown dramatically, placing higher demand and expectations on this infrastructure.

When designing ICT infrastructure consideration should be given to the needs for today but also the demands of tomorrow that will be placed on the ICT network. As such, the key requirements for consideration include the ability for future growth and flexibility of the network.

The ICT infrastructure shall be of a converged network architecture allowing the support and use of various transmission protocols and users. No individual cabling systems for single disciplines should be considered.

ICT infrastructure spaces and pathways must be designed in accordance with compliance, performance and client standards and environmental considerations, as well as provide room for future growth. Pathways and Consolidation Points (CPs) must be accessible for reconfiguration and manageability.

The cable considerations should cover the ability to support issues such as Multi-gig performance and Type 3 and 4 PoE. Future performance and lifecycle should also be considered when specifying a cable infrastructure, as it is expected the cabling infrastructure will remain in situ for at least two ICT hardware lifecycles (expected 10−12 years).

Advancements in low power devices that have the ability to be powered by PoE have impacted standards. Consideration for this should be considered and offered as options by the ICT consultant, explaining the benefits they could bring to the business.

Designs SHALL always be produced in consultation with the technical stakeholders.

Three things to be considered by any ICT design consultant:

1. Networks NEVER go slower.
2. Networks NEVER get smaller.
3. Networks NEVER stay the same.

5.2 LONG-TERM DEVELOPMENT OF CAMPUS FIBRE INFRASTRUCTURE

Consideration will be given to providing diverse infrastructure to all buildings on campus commensurate with the size and purpose of the building as part of the growth of the campus network. This diverse infrastructure will consist only of single-mode cables.

The existing OM1 multi-mode fibre network is regarded as fully developed and no expansion/replacement will be undertaken.

It is expected that in future all high-speed network links will be reticulated over the single-mode fibre network.

5.3 APPLICATIONS AND CABLING PERFORMANCE

The current University standard for new cabling installations is based on providing the capability to run 10 Gigabit Ethernet (10 GbE) over the backbone with 1000 BASE-T (1GbE) to the desktop.

IEEE standards have already been ratified for 10GbE and it is likely that cabling infrastructure will be required to support 10 Gigabit transmission on the backbone and Gigabit Ethernet to the desktop in the foreseeable future.

With the above in mind, Curtin University would like to ensure any new building installations from 01 January 2015 meet Class EA performance by using a minimum of Cat 6a cabling. The standard for this shall be foiled untwisted pair (F/UTP). Any

building that is being amended or added to must be completed with a minimum of Cat 6 (Class E).

The University cabling system shall be constructed to conform to AS/NZS11801.1 – Telecommunications installations – Generic cabling for commercial premises.

AS/NZS11801.1 specifies eight performance classes (A, B, C, D, E, EA, F and FA) for balanced cabling channels. Only E and EA performance classes are considered in this document.

Balanced cable channel performance is classified according to the maximum frequency at which performance is specified. Class E is specified to 250 MHz. Performance for class EA is specified to 500 MHz.

Gigabit Ethernet (1000 BASE-T) is supported by Class E (Class E system will support all Class D applications).

10 Gigabit Ethernet (10,000 BASE-T) is supported by Class EA (Class EA system will support all Class E and D applications).

The maximum channel length is 100 m for Classes E and EA.

The cable and components used within balanced cabling systems are classified according to Category. Category 6 components provide Class E performance.

Category 6a components provide Class EA performance.

AS/NZS11801.1 defines three operating ranges for optical fibre transmission using four types of optical fibre cable.

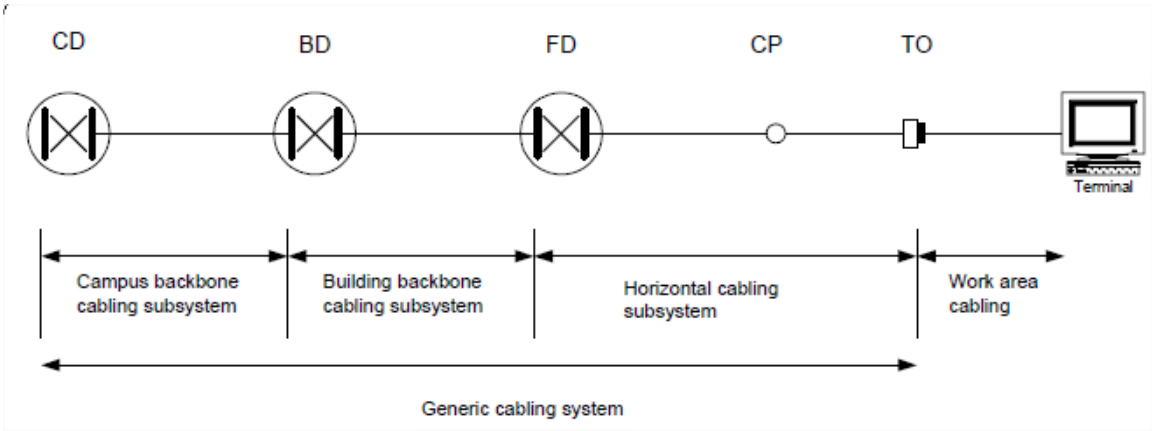
Operating ranges are specified for 300 m (OF-300), 500 m (OF-500) and 2,000 m (OF-2000). These distances are the minimum distances over which supported applications must operate.

The defined optical fibre types are OM1, OM2, OM3, OM4 and OS1 and OS2. The M signifies multi-mode while the S signifies single-mode. OM1 and OM2 may be 50/125µ or 62.5/125µ while OM3 is confined to 50/125µ cable. Only OS2 is to be used unless specifically exempted.

Any power sourcing equipment (PSE) must be 802.3af compliant e.g. switches, power injectors. For Gigabit Ethernet, PSE may only be of the end span type.

5.4 CABLING SYSTEM ARCHITECTURE

The conceptual arrangement of a generic cabling system (from AS/NZS11801.1) is illustrated in the figure below:



The distributors provide the means to construct different cabling system topologies such as bus, star and ring, or a combination of these. Furthermore, the distributor functions may be combined, and the consolidation point (CP) may or may not be included in the cabling between the telecommunications outlet (TO) and the distributor.

The Structured Cabling System within University facilities will often combine the building distributor (BD) and floor distributor (FD) functions. The lead-in cable providing the interface to carrier services will normally be located at the building that is closest to the carrier infrastructure.

5.4.1 BACKBONE CABLING

Backbone cabling includes both campus and building backbone cabling subsystems.

Campus backbone cabling runs between buildings. Building backbone cabling runs within buildings and provides the interconnection between the floor distributors and building distributors, or in some cases between a campus distributor and building/floor distributors.

The backbone cabling generally provides interconnection between active network equipment that may be within the same building or in separate buildings.

Campus backbone data communications cabling shall typically be optical fibre. In some unusual cases balanced copper cabling may be used for campus backbone cabling. This may be where the path is very short and the risk of damage due to voltage transients is very low (e.g. between closely spaced temporary buildings).

Use of balanced copper cabling for campus backbone cabling shall be approved by the Infrastructure Manager – Network Cabling on a case-by-case basis.

Building backbone data cabling shall be optical fibre only, unless otherwise approved.

Cabling for voice communications will vary according to the technology used for voice switching. For example, Internet Protocol (IP) telephony system voice signals will be transported together with data communication over common backbone cabling.

For conventional telephone systems the most practical solution will generally be to utilise balanced cabling in the backbone. In the majority of cases where optical fibre cabling is used for data communications, dedicated balanced cabling will be required in the backbone to support conventional voice communications.

All externally rated cabling must make a transition to internally rated cabling as close as practicable to the entry to the building. In no case must this transition exceed 15 m from the point of entrance. Indoor/outdoor-rated cables can be installed past the 15 m point from the entrance.

Any cable installed underground must meet the requirements of AS/CA S009 and S008.

5.4.2 HORIZONTAL CABLING

The horizontal cabling subsystem extends from the telecommunications outlet (TO) to the associated distributor. It includes consolidation points (CP) that may be in the path and distributor patch cords but does not include work area cords between the terminal equipment and the TO.

The horizontal cabling shall be of a star topology connecting each workplace telecommunications outlet to a patch point at a distributor, shown below in Figure 3.

No Cat 6/6a cabling shall be terminated within an old Cat 5 rack unless authorised by the Infrastructure Manager – Network Cabling.

CONSOLIDATION POINTS

Curtin University prefers the use of CPs within office environments for workstations, and is a mandatory requirement to include in any design unless it is cost-prohibitive to do so. However, for fixed items or areas that are in close proximity to the comms rooms, design discretion may be applied on the benefit/use of CPs.

CPs are to be designed/installed with the following in mind:

- Consolidation points (CP) must be used in office environments.
- All 24 circuits from a CP are to be wired back to the patch panel in the communications cabinet.
- Only 80 per cent fill rate of CPs on the field side is acceptable from initial installation.
- As CPs are mostly hidden, a standard mounting plate is to be installed on the ceiling or a T-bar close to the CP. The plate is to be engraved showing details of the CP. e.g. CP# 1 TO Bnnn – TO Bnnn.
- There is to be a minimum of 15 metres between the patch panel and the CP.

CPs for Cat 6a (F/UTP) must provide the following characteristics, in addition to the list above:

- the ability to maintain the cable's foil shield
- be mountable to either cable pathways or building fabric

- use adequate strain relief fixings for cables from the rack and field distribution
- an enclosed environment for the cable's interface
- adequate protection against the ingress of dust or debris to the enclosure.

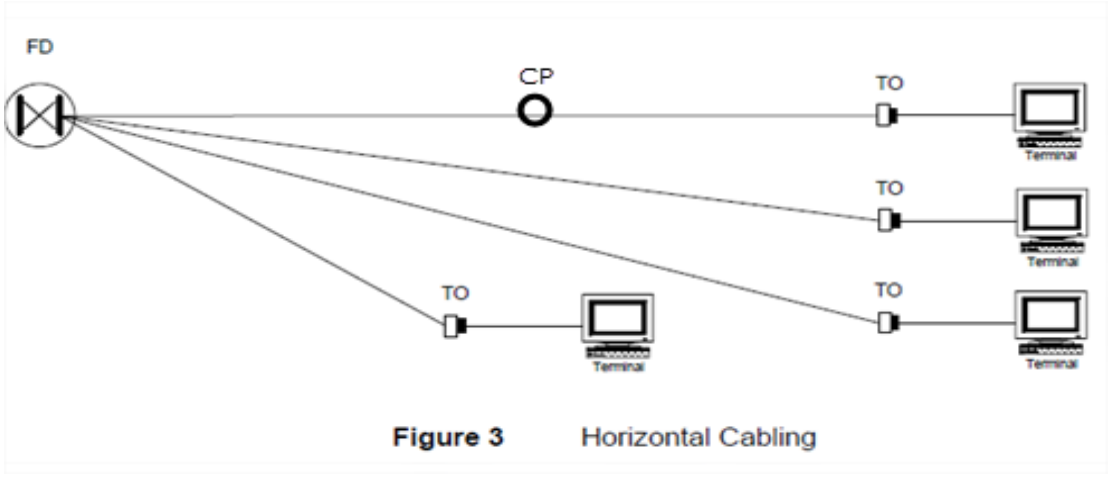


Figure 3 Horizontal Cabling

WIRELESS LAN INTERFACES

Use of wireless technology for data communications is increasing. A number of standards have been developed to extend the LAN using wireless.

Wireless LAN (WLAN) equipment conforming to the IEEE 802.11 standards is widely deployed. DTS – Networks should be approached for guidance regarding deployment of WLAN equipment.

WLANs provide an alternative to a wired LAN architecture but are usually deployed in conjunction with cabling infrastructure. The WLAN equipment is not considered to form part of the cabling system. However, horizontal cabling may be used to interconnect wireless access points to the network infrastructure and this aspect is briefly discussed below.

Wireless design and placement of wireless access points (WAPs) is the responsibility of DTS – Networks. Any changes to the placement of WAPs must be approved by DTS – Networks.

5.4.3 COPPER TERMINATIONS

The general method for termination of copper cabling shall be modular 8-pin sockets (commonly known as RJ45) and plugs using the T568A standard.

Interface connectors at the FD and TO shall be modular 8-pin sockets (RJ45). In the case of Cat 6 copper terminations the RJ45 must be green in colour. Horizontal balanced cables shall be terminated with corresponding modular 8-pin jacks.

Any Cat 6a when used must use blue mechs or a blue identifier.

Patch-by-exception systems are an alternative to RJ45 patching that is permitted by AS/NZS11801.1. A common arrangement is to use IDC blocks with semi-permanent connections established using jumpers. The jumpered connections may be interrupted by patch cords. Patch-by-exception systems provide higher density than patch panels

and are suited to systems where wiring changes are infrequent. Patch-by-exception systems are not described in this document but may be used within University cabling systems with the approval of the Infrastructure Manager – Network Cabling.

5.4.4 OPTICAL FIBRE TERMINATIONS

Optical fibre cable shall be terminated as per Section 10.3.4.

Network equipment that uses Small Form Factor (SFF) or Small Form Factor Pluggable (SFP) optical connectors shall be interfaced to the connectors at the patch panel using optical patch cords to provide adaptation between the patch panel and the particular SFF or SFP connector.

5.4.5 CARRIER INTERFACE

The carrier service interface varies according to location and function. For example:

- Campus sites are provided with service via an Ethernet connection.
- Regional sites are typically served by either a Telstra GWIP service or a managed fibre connection from Vocus.

Requirements for each site shall be determined in discussion with the Infrastructure Manager – Network Cabling.

5.4.6 BALANCED COPPER

Balanced cabling subsystems shall be constructed using Category 6 UTP or 6a F/UTP cable.

Shielded twisted pair (STP) cabling is intended for use in environments subject to high levels of electromagnetic interference or where low levels of electromagnetic radiation are required. The approval of the Infrastructure Manager – Network Cabling shall be obtained for use of STP cabling.

5.4.7 MAXIMUM CABLING CHANNEL LENGTHS

Maximum channel lengths specified by AS/NZS11801.1 (Table 1 Clause 5.7.1) are:

- 100 m for the horizontal cabling channel
- 2,000 m for the campus backbone + building backbone + horizontal cabling channel.

Maximum channel lengths specified for optical fibre cable are specified in the table below.

Application	Reference	Criterion	Fibre Type												Application Description
			Multimode								Singlemode				
			OM1		OM2		OM3		OM4		OS1		OS2		
		Wavelength (nm)	850	1300	850	1300	850	1300	850	1300	1310	1550	1310	1550	
Ethernet 10/100 BASE-SX	IEEE 802.3u	Distance (m)	300		300		300		300						2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 100Mb/s speed using 850nm short wavelength
		Channel Attenuation (dB)	4.00		4.00		4.00		4.00						
Ethernet 100 BASE-FX	IEEE 802.3u	Distance (m)		2000		2000		2000		2000					2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 100Mb/s speed using 1300nm long wavelength
		Channel Attenuation (dB)		11.00		11.00		11.00		11.00					
Ethernet 1000 BASE-SX	IEEE 802.3z	Distance (m)	275		550		1000		1040						2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 1Gb/s speed using 770-860nm short wavelength
		Channel Attenuation (dB)	2.60		3.60		4.50		4.80						
Ethernet 1000 BASE-LX	IEEE 802.3z	Distance (m)		550		550		600		600	5000		5000		2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 1Gb/s speed using 1270-1355nm long wavelength
		Channel Attenuation (dB)		2.30		2.30		2.30		2.30	4.50		4.50		
Ethernet 10G BASE-SR	IEEE 802.3ae	Distance (m)	33		82		300		550						2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 10Gb/s speed using 850nm short wavelength (VCSEL)
		Channel Attenuation (dB)	2.40		2.30		2.60		3.10						
Ethernet 10G BASE-LR	IEEE 802.3ae	Distance (m)									10000.00		10000.00		2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 10Gb/s speed using 1310nm long wavelength (Laser)
		Channel Attenuation (dB)									6.20		6.20		
Ethernet 10G BASE-LRM	IEEE 802.3ae	Distance (m)		220		220		220		220					2 cores of FO cable to provide 1 x Tx and 1 x Rx path. Provides up to 10Gb/s speed using 1310nm long wavelength (Laser)
		Channel Attenuation (dB)		1.90		1.90		1.90		1.90					
Ethernet 40G BASE-SR4	IEEE 802.3ba	Distance (m)					100		150						8 cores of FO cable to provide 4 x Tx and 4 x Rx path. Provides up to 40Gb/s speed using 850nm short wavelength (VCSEL)
		Channel Attenuation (dB)					1.90		1.50						
Ethernet 40G BASE-LR4	IEEE 802.3ba	Distance (m)									10000		10000		8 cores of FO cable to provide 4 x Tx and 4 x Rx path. Provides up to 40Gb/s speed using 1310nm long wavelength (Laser)
		Channel Attenuation (dB)									6.70		6.70		
Ethernet 100G BASE-SR10	IEEE 802.3ba	Distance (m)					100		150						20 cores of FO cable to provide 10 x Tx and 10 x Rx path. Provides up to 100Gb/s speed using 850nm short wavelength (VCSEL)
		Channel Attenuation (dB)					1.90		1.50						
Ethernet 100G BASE-LR4	IEEE 802.3ba	Distance (m)									10000		10000		20 cores of FO cable to provide 10 x Tx and 10 x Rx path. Provides up to 100Gb/s speed using 1310nm short wavelength (Laser)
		Channel Attenuation (dB)									6.30		6.30		

*** NOTES***

A) All values listed above referenced from IEEE 802.3xx standards unless specified

Operation at distances greater than those shown in the table is possible, but such distances are not defined by the relevant standards. For example, Gigabit Ethernet operation can be achieved over 70 km distances using higher power lasers and avalanche photodiode receivers, while operation can be extended to 100 km using dispersion shifted fibre or higher power lasers used for coarse wavelength division multiplexing (CWDM) systems.

5.5 CABLE UTILISATION GUIDELINES

5.5.1 INTRODUCTION

The optimum cable arrangement will depend on the circumstances of the particular installation. Factors that need to be considered in determining the composition of the SCS include:

- distances between distributors and outlets
- compatibility with existing cabling and equipment
- the equipment that will use the cabling system and constraints that such equipment may introduce with regard to supported interface modules
- environmental factors such as salty atmosphere and prevalence of lightning.

Guidelines for utilisation of the various cabling alternatives with respect to distance and locations are included in the following subsections.

5.5.2 GENERAL CABLE UTILISATION GUIDELINES

External (outdoor) cable routes shall utilise optical fibre cable, for the following reasons:

- increased bandwidth and resultant ability to support higher transmission rate application
- improved protection against damage due to voltage transients, electrical noise and lightning.

The approval of the Infrastructure Manager – Network Cabling must be obtained for the use of copper cable for external cable routes.

Single-mode optical fibre (SMOF OS2) is preferred for new works, rather than multi-mode optical fibre.

Emtelle Microduct is the preferred mechanism for distribution of single-mode optical fibre cables between the major distribution points and data centres on the Bentley Campus. These locations are:

- B309 room 112
- B402 room 221A
- B101 room 2104
- B500 room D103
- B206 room 208

- B100 room 125 and 126.

Underground pathways are preferred for external cable routes. However, above-ground routes may be used, subject to the Infrastructure Manager – Network Cabling approval, provided that:

- The pathway is fully covered and the cabling is installed within protective conduit or ducting for the entire external section of the cable route.
- Transient protection (where required) is provided at each termination point of the cable.

External cable routes utilising balanced copper cabling are subject to the following additional constraints:

- Transient voltage protection is provided at each termination point of the cable.

External cabling routes using catenary wire for support shall only be used in circumstances where alternative underground or above-ground pathways are impractical. Approval of the Infrastructure Manager – Network Cabling is required for external catenary wire cable pathways.

Category 6(a) cabling and components shall be used for the indoor components of balanced cabling subsystems of all new installations i.e. in new buildings or major refits.

Upgrade and expansion works to sites with existing Category 5 or earlier cabling shall be Category 6a. This shall be at the direction of the Infrastructure Manager – Network Cabling.

Upgrade and expansion works to sites with existing Category 6 cabling shall continue with Category 6.

Factory-terminated optical fibre cables in specific lengths are available from a number of suppliers. These may be appropriate as a low-cost alternative to terminating cores on site.

5.5.3 CABLE UTILISATION VERSUS LOCATION/DISTANCE

Guidelines for cabling selection for campus backbone, building backbone and horizontal cabling are included below.

CAMPUS BACKBONE CABLING (EXTERNAL INTER-BUILDING):

- OS2 loose tube 12-core single-mode optical fibre is preferred for new capital works and major upgrades.
- 7-tube minimum Emtelle Microduct to two locations (for diverse paths) for all core network buildings
  - within the blown tube OS2 12-core minimum to two locations via diverse cable paths.

BUILDING BACKBONE CABLING (INTERNAL INTRA-BUILDING):

- OS2 12-core single-mode optical fibre

- 2-tube minimum Emtelle Microduct between the core equipment room and major server/equipment rooms, rated accordingly.

HORIZONTAL CABLING:

- Category 6a for all new capital works, i.e. not upgrades to existing facilities or in buildings that have not commenced with a Cat 6 installation
- Category 6a for all building upgrades, additions.

5.6 LOCATION/PROGRAM-SPECIFIC REQUIREMENTS

5.6.1 CAPITAL WORKS PROGRAMS

Cabling systems for capital works shall utilise Category 6a (Class EA) balanced cabling.

5.6.2 EXPANSION AND UPGRADE TO EXISTING FACILITIES

Upgrade or expansion works are to maintain uniformity with the building's standard (i.e. minimum Cat 6 or OS2). Any variation must be justified to and approved by the Infrastructure Manager – Network Cabling.

5.6.3 TRANSPORTABLE BUILDINGS

Temporary buildings shall comply with the same standards as a normal Curtin building.

5.6.4 GENERAL DIMENSIONING REQUIREMENTS

General dimensioning requirements are as below:

Unless otherwise stated in a project tender brief, all TO provisions should have a minimum of a double faceplate (2 TOs) per workstation and single faceplate TOs (1 TO) for all other devices (limited to WAPs, security and plant devices).

5.7 MANDATED EQUIPMENT AND SERVICES

Tenderers and cabling system contractors shall confirm with the University the existence of any panel contracts or similar that may be in place that place constraints on the provision of services or materials or any exclusions. This can be done by contacting the Infrastructure Manager – Network Cabling.

6 EXCLUSIONS

6.1 BUILDING AND ELECTRICAL EARTHS

Building earth systems and electrical earth systems shall be provided as part of the building works.

Earthing and related works by the cabling system contractor shall be limited to the following:

- provision of a communications earth system (CES) and CET where specified as part of the works
- provision of a telecommunications reference conductor earthing system (TRC) where specified as part of the works
- bonding of the cabling system equipment, enclosures, components, pathways and the like to the relevant earthing system, including provision of earth bars, cabling and connections as required. Where an existing cabling system is present the earthing system should be checked and upgraded as necessary.

6.2 EXISTING CABLING

This document does not require the modification of existing cabling and related systems installed and completed prior to the commencement of any new works, except where necessary to achieve a successful merger of old cabling with new works on the same site.

Cabling that has been provided in accordance with earlier standards will generally be retained in service unless there is sufficient justification for replacement of the cabling such as re-cabling of the premises as part of an upgrade or redevelopment or if cabling performance is inadequate in relation to provision of new communications facilities.

Areas where safety in the existing installation has been compromised should be reported to the Infrastructure Manager – Network Cabling.

6.3 REDUNDANT CABLING

The Campus had an extensive network of University-owned telephone-type cabling, originally installed for operating remote terminals or computers. This network is gradually being removed but may still provide connectivity for some control equipment.

Opportunity should be taken to remove it and proposed activities likely to affect the operation of this cabling must be discussed with the Infrastructure Manager – Network Cabling.

Any other redundant cable and fittings shall be removed as part of the works.

6.4 OTHER CABLING OR SYSTEMS

Related cabling or systems that are outside the scope of this document include:

- network equipment (servers, switches and the like) that are connected to the SCS
- master antenna television (MATV) cabling and equipment
- security systems
- wireless LAN equipment patch-by-exception balance cable termination systems
- radio-based carrier interface system design.

7 SYSTEM DESIGN

Wall-mounted enclosures shall be located to avoid injury to persons. Requirements are specified in Section 11.3.1.

The layout and location of the cabling system and pathways shall ensure that equipment, access facilities or metallic components shall not be placed in a location where the earth potential rise (EPR) may exceed 430 V AC under power system fault conditions, in accordance with Clause 5.1.4 of AS/CA S009.

7.1.1 ACOUSTIC NOISE

For the purpose of design tasks associated with acoustic noise, particularly attenuation of noise, it shall be assumed that noise levels originating from a telecommunications closet shall be maintained within the limits specified by the National Standard for Occupational Noise – NOHSC: 1007(2000).

The national standard for exposure to noise in the occupational environment is an eight-hour equivalent continuous A-weighted sound pressure level (LAeq,8h) of 85dB(A). For peak noise, the national standard is a C-weighted peak sound pressure level (LC,peak) of 140dB(C).

The exposure to noise is taken to be that measured at the employee's ear position without taking into account any protection that may be afforded by personal hearing protectors.

Equipment enclosure locations shall be selected such that noise levels in work areas arising from servers and the like, when combined with other sources of work area noise, shall be maintained within the limits specified by AS/NZS2107. Recommended design sound levels are indicated in Table 1 of AS/NZS2107, from which the following design details are extracted.

Type of Occupancy/Activity	Design sound Level (LAeq dBA)		Reverberation Time (s)
	Satisfactory	Maximum	
Art/Craft Studio	40	45	0.6–0.8
Computer Room – Teaching	40	45	0.4–0.6
Duplicating Rooms/Stores	45	50	0.6–0.8
Library – General Area	40	50	0.4–0.6
Library – Reading Area	40	45	0.4–0.6
Teaching Areas – Primary	35	45	0.4–0.5
Teaching Areas – Secondary	35	45	0.5–0.6

In general this should be achieved by installing the equipment enclosure within a room that is segregated from work areas and that provides suitable attenuation of the noise transmission path between the equipment and the listeners.

Fire alarms and emergency warning information systems must be audible at the equipment racks.

7.1.2 ELECTROMAGNETIC RADIATION

The cabling systems specified within this document are passive and therefore will not radiate unless connected to active equipment.

Electromagnetic radiation needs to be considered in relation to compatibility with other equipment and potential harmful effects.

Electromagnetic compatibility aspects are addressed in Section 7.6.

The regulatory requirements in relation to human exposure to electromagnetic radiation (EMR) are undergoing review by the ACA and other bodies. The methodology and planned implementation is outlined in the ACA's EMR framework.

The Australian standard for human exposure to electromagnetic radiation (AS2772.2) expired in April, 1999 but remained the basis for ACA human exposure standards introduced in 1999 and 2001. In 2002, ARPANSA published the Radiation Protection Standard for Maximum Exposure to Radiofrequency Fields – 3 kHz to 300 GHz (2002).

The ARPANSA standard forms the basis for:

- ACA Radio communications (Electromagnetic Radiation – Human Exposure) Standard 2003, which commenced on 1 March, 2003 and imposes electromagnetic radiation (EMR) performance requirements on mobile and portable transmitters with integral antennas intended to be used in close proximity to the human body
- ACA Radio communications Licence Conditions (Apparatus Licence) Determination 2003 that imposes conditions on transmitters operating under apparatus licence conditions.

While human radiation exposure standards and legislation are not relevant to the passive cabling system components, the cabling system layout shall be developed with due consideration of outlets that are designated for interfacing with wireless LAN or other radio equipment. These outlets should be located such that antennas are installed with sufficient physical separation to satisfy human exposure criteria.

7.1.3 LASER RADIATION

Optical fibre systems shall meet the requirements of AS/NZS2211 – Laser safety – Safety of optical fibre communications systems. Connectors that are not in use shall have dust covers fitted to protect against potential laser exposure and dust ingress.

Laser-driven devices (such as SFP gigabit modules) should not be connected to the multi-mode network, as parts of this network do not comply with AS/NZS2211.1 – Laser safety.

7.2 COMMUNICATIONS ROOMS

Communication rooms shall meet the requirements of Section 8 and shall be designed with due consideration of the following:

- AS/NZS3084
- room for future expansion

- safety – the equipment layout shall not restrict escape routes
- acoustic noise requirements identified in Section 7.1.1
- suitable access to equipment for installation and maintenance as per AS/CA S009
- provision of space for carrier entry when required
- access to/from the equipment room to external parking for the transport of equipment
- equipment enclosures not to be installed in positions where exposure to moisture is likely e.g. enclosures should not be installed under air conditioning vents.
- Treatment & finishes should be light in colour to promote good lighting and the floor shall be composed of antistatic material (preference is vinyl).

7.3 SPARE CAPACITY

The cabling system at the time of installation shall be dimensioned to provide spare capacity as detailed below:

- Communication rooms shall allow for installation of an increase in the number of racks and enclosures by 25 per cent or one, whichever is the greater. For example, equipment rooms with one to four enclosures shall allow space for a further enclosure. An equipment room with five enclosures shall provide space for a further two enclosures.
- Enclosure and racks shall not be more than 60 per cent occupied.
- Pathways shall provide not less than 40 per cent spare capacity.
- Cable trays shall provide not less than 40 per cent spare capacity.
- Conduits shall not be filled to more than 40 per cent capacity.
- Balanced cabling backbone capacity (CD/BD – BD/FD) for voice communications shall have not less than 50 per cent spare capacity relative to the number of pairs allocated to voice services between the FD and connected TOs.

7.4 ENVIRONMENTAL FACTORS

The equipment comprising the cabling system shall be suitable for the environmental conditions at the particular site.

The cabling system layout, including equipment room and distributor locations, shall consider cabling and network equipment environmental performance specifications and manufacturers' recommendations.

7.4.1 LIGHTNING PROTECTION

Special consideration shall be given to earthing practices in areas prone to lightning activity.

Transient protection shall be provided for equipment connected to outdoor copper cabling.

Transient protection for cabling shall be compatible with the earthing system provided at the facility. Particular care needs to be taken where separate buildings' earths may not be bonded.

7.4.2 SALT

Particular care shall be taken for installations in coastal regions or near to salt pans/lakes to minimise exposure of equipment to salt.

Equipment enclosures and distributors shall not be installed in open areas. Equipment room vents shall be fitted with filters to minimise salt ingress.

7.4.3 CHEMICAL CORROSION

Communication rooms and distributors shall not be located near to corrosive atmospheric or environmental conditions.

Storage areas for cleaning solvents and other chemical products shall not be used to house cabling equipment and shall not be adjacent to equipment rooms or equipment room vents.

7.4.4 HEAT

Communication room design, including HVAC and venting, shall consider the heat load of active equipment likely to be fitted to enclosures and to maintain a comfortable working temperature in accordance with AS/NZS3084

Enclosures shall be equipped with vented panels to facilitate air flow for cooling of active equipment.

If further increased air flow is required, door vents and/or ceiling extraction fans should be used.

The duty cycle of any venting or HVAC provided shall be 24 hours/7 days. The provision for redundancy in plant should be considered as part of any design.

Note: side panels and doors should not be removed to improve ventilation. Instead, external environmental factors should be improved e.g. consider air conditioning.

Below is a table of device heat outputs to aid calculating air conditioning requirements.

Heat Loads – Design Table

Cisco WS-C3850-48P Stackable 48 10/100/1000 Ethernet PoE+ ports, with 1100W AC power supply

1100W Power Supply	Heat Output BTU/Hr	Total Watts	Suggested KW	Comments
1	3,793	1,111	1.1	1 BTU/h = 0.29307107 Watt 1,000 BTU = 293 Watts 115–240V AC, 50–60 Hz
2	7,586	2,222	2.2	
3	11,379	3,333	3.3	
4	15,172	4,444	4.4	
5	18,965	5,555	5.6	
6	22,758	6,666	6.7	
7	26,551	7,777	7.8	
8	30,344	8,888	8.9	

Cisco WS-C3850-48P Stackable 48 10/100/1000 Ethernet PoE+ ports, with 715W AC power supply

715W Power Supply	Heat Output BTU/Hr	Total Watts	Suggested KW	Comments
1	2,465	722	0.7	As above
2	4,930	1,445	1.4	
3	7,395	2,167	2.2	
4	9,860	2,890	2.9	
5	12,325	3,612	3.6	
6	14,790	4,335	4.3	
7	17,255	5,057	5.1	
8	19,720	5,779	5.8	
UPS 2100W Power Supply	**Heat Output BTU/Hr**	**Total Watts**	**Suggested KW**	**Comments**
1	7,171	2,100	2.1	As above
ATS 0 Watt Power Supply	**Heat Output BTU/Hr**	**Total Watts**	**Suggested KW**	**Comments**
Pass thru device	170	50	0.14	As above

7.5 RELIABILITY/SOFT WIRING

Floor-mounted boxes accommodating telecommunications outlets shall not be used in areas where water ingress is possible.

Floor-mounted telecommunications outlets shall not face upward.

Any soft wiring solutions must be approved by the Infrastructure Manager – Network Cabling prior to installation, as this is not an approved solution within Curtin University.

In an area where there are island-type workstations, a rigid power pole that is supported at ceiling and floor must be installed or a suitable floor box with a chased conduit pathway. Any alternative solution must be agreed by the Infrastructure Manager – Network Cabling prior to installation.

7.6 ELECTROMAGNETIC COMPATIBILITY

To address the problem of electromagnetic interference (EMI) the AS/CA and other regulators have established a framework to introduce technical limits for the electromagnetic compatibility (EMC) of devices and communications standards. This framework is known as the EMC framework.

Passive components including cables and connectors are presently excluded from the EMC framework.

In general, it is required that manufacturers of transmission equipment take full account of the contribution of the cabling to the overall EMC of the transmission system. In this case it is necessary to ensure that the performance of the installed cabling channel is within the limits specified by the transmission equipment.

Transmission equipment shall meet the requirements of AS/NZS CISPR 22. Complete systems are required to meet AS4251.1.

To facilitate satisfactory EMC performance of the overall SCS, the design of cable routes and pathways shall take due consideration of the recommendation included in AS/NZS11801.1 ZA.1 .3.3 and AS/NZS11801.1 ZA.3.2.

7.7 SECURITY

In general, it shall be necessary to pass at least two points of restriction to access equipment from outside the building. This shall generally be achieved using locked doors at the equipment room, communications cupboards/closets and equipment enclosures.

Core equipment rooms shall be placed on the University's Access Control system.

Pits and external plant shall be placed as unobtrusively as is practicable so as not to attract attention.

External cabling installed in overhead pathways shall be installed within protective conduits or ducts.

8 EQUIPMENT ROOMS AND SERVICE ENTRY

8.1 CARRIER SERVICE ENTRANCE

The service entrance for carrier services will generally be located within the building that is closest to the carrier infrastructure. These are:

- B105 Level 7 (Telstra, Optus, Vocus)
- B500 room D103 (Vocus)
- B206 room 208 (AARNET)
- B309 room 112 (AARNET).

Carrier service entry facilities should be planned in consultation with the carrier. The facility shall be easily accessible to the carrier.

The Infrastructure Manager – Network Cabling will clarify and advise these requirements on a project-by-project basis.

8.2 CORE EQUIPMENT ROOMS

This document does not require the modification of existing facilities to establish core equipment rooms as described below. In the case of existing facilities, the following are required features for an equipment room.

The core equipment room shall be used to accommodate the major items of communications equipment such as routers, switches and shall be the central point of the cabling system. Note that the interface to carrier services may not be located in the core equipment room.

Core equipment rooms shall meet AS3084 and the following requirements:

a) The minimum useable area of core equipment rooms shall not be less than 15 m^2, with a minimum width of 3 metres.

b) The clear height (i.e. without obstructions) shall not be less than 2.4 m.

c) In a multi-storey building, the preferred location is on the ground floor (Level 1). In all cases, seek direction from the Infrastructure Manager – Network Cabling as to location.

d) The door to the equipment room shall be a minimum of 900 mm wide and 2,000 mm high. The door shall be lockable via 'cardax' swipe with a comms key override but egress shall not require a key or tool.

e) The room shall house only telecommunications equipment and security control systems. A layout of the room shall be given to the Infrastructure Manager – Network Cabling for approval and shown on the drawings. The drawings shall indicate both current and future equipment locations.

f) The equipment room shall include an earth bar (CET) that is bonded to the building electrical earth system in accordance with AS/CA S009.

g) Equipment rooms shall not be located near to sources of electromagnetic interference (EMI) or radio-frequency interference (RFI) such as radio

transmitters, electric motors, transformers or arc welding equipment. The location shall be selected in accordance with AS/NZS3084 to meet the requirements of AS2834.

h) Access to the equipment room for authorised personnel shall be available on a 24-hour, 7-days-a-week basis apart from the core infrastructure buildings and data centres.

i) In some cases the carrier entry may be to the core equipment room. In these cases the room will be required to accommodate the building distributor (building MDF) cable frames and network interface devices.

j) Suitable pathways shall be provided to the building pathway(s), campus pathways and the carrier entrance facility (if separate to the campus pathways).

k) Floor loading shall meet the requirements of AS/NZS3084

l) No live water pipes, water sprinklers, or similar infrastructure are allowed in the room.

m) No air ducts, except for ducts that provide service to the equipment room, shall be installed in or routed through the equipment room.

n) There shall be no openings in the room except for the door, the ventilation/air conditioning ducts and cabling ducts. All windows, if any, must be shut and sealed. If necessary, window coverings and security grilles should be provided. Penetrations, openings and doors must adhere to suitable fire resistance levels where applicable. All external comms ducts must be suitably sealed in accordance with AS/CA: S009, preferred method TE TDux system.

o) The room shall not be located where it would be exposed to vibration due to vehicles or machinery.

p) Sufficient lighting shall be provided in the room in accordance with AS/NZS3084.

q) A dedicated electrical power supply should be provided to the room. The power supply shall be connected to an essential supply generator if provided.

r) Electrical power shall be distributed via a dedicated single-phase residual current device (RCD) circuit with a minimum current rating of 15 A.

s) The temperature and humidity shall be monitored and controlled to provide an operating range for the room between 18 °C and 24 °C with 30 to 55 per cent humidity as per AS/NZS3084.

t) Front and rear access to all enclosures and racks shall be provided.

u) There shall be a communications outlet in the room at one metre above the floor level. A wall phone will be supplied for this location by the University as part of the project.

Designs should consider the criticality of equipment housed in the room with respect to the need for independent or uninterruptible power supply.

8.3 COMMUNICATIONS ROOMS/CABINETS

Communications closets and cupboards are to be strategically located to restrict UTP and F/UTP cable runs to less than 90 metres and to minimise the number of cupboards/rooms required and are not to be used for core equipment. Locations shall be selected to meet equipment room environmental and access requirements as far as is practicable.

Communications rooms shall be designed as far as applicable to the requirements of Section 8.2 unless otherwise specified.

In buildings where communications rooms are provided, the doors shall be lockable and accessible only from the interior of the building.

There shall be at least one communications enclosure on each floor from which there shall be access by conduit or via the ceiling space to run cables along suitable pathways to all rooms on the floor.

Where there is more than one floor, communications rooms shall be located vertically one above the other.

Rooms shall be sealed from the roof space and located in cool dry areas of the building. Vents shall be provided in doors to provide an air flow that is clean and dry. Rooms shall not be located under gutters, water pipes and the like under any circumstances.

Floor-mounted racks with a minimum depth of 900 mm are required for installation in a comms room to allow installation of heavy equipment such as uninterruptible power supplies (UPSs). The minimum depth between the vertical rails shall be 450 mm. The standard width between mounting rails shall be 482.6 mm (19 inches). The recommended clearance forward of the front vertical rail is a minimum 230 mm.

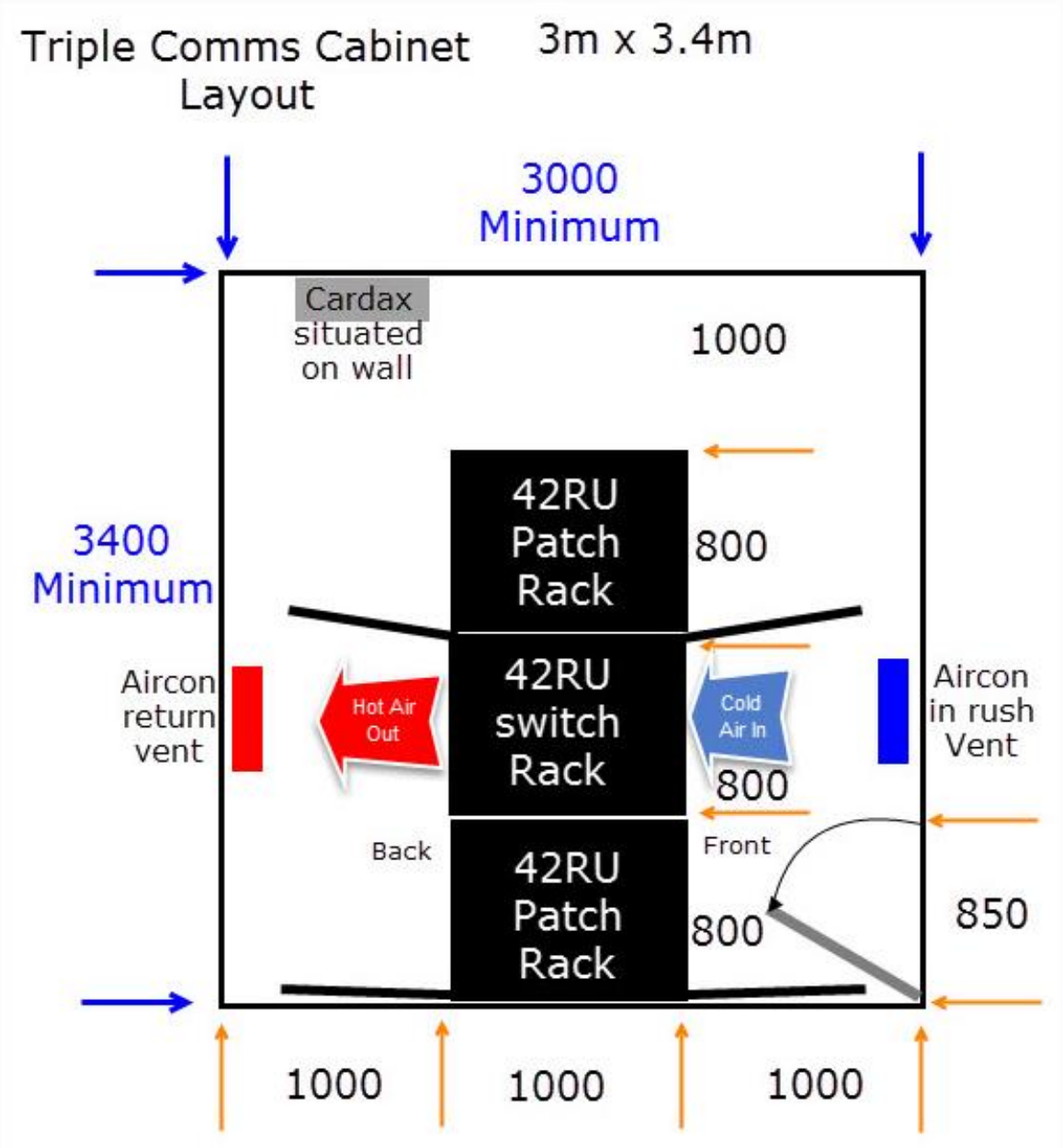
When designing new comms rooms, consideration must be given to the rooms also housing other service active equipment such as audiovisual, security etc., as these services also utilise the building's Structured Cabling System (SCS).

Where these rooms provide a shared space then the active network racks must be of a different brand to those of the passive and audiovisual racks, for security reasons.

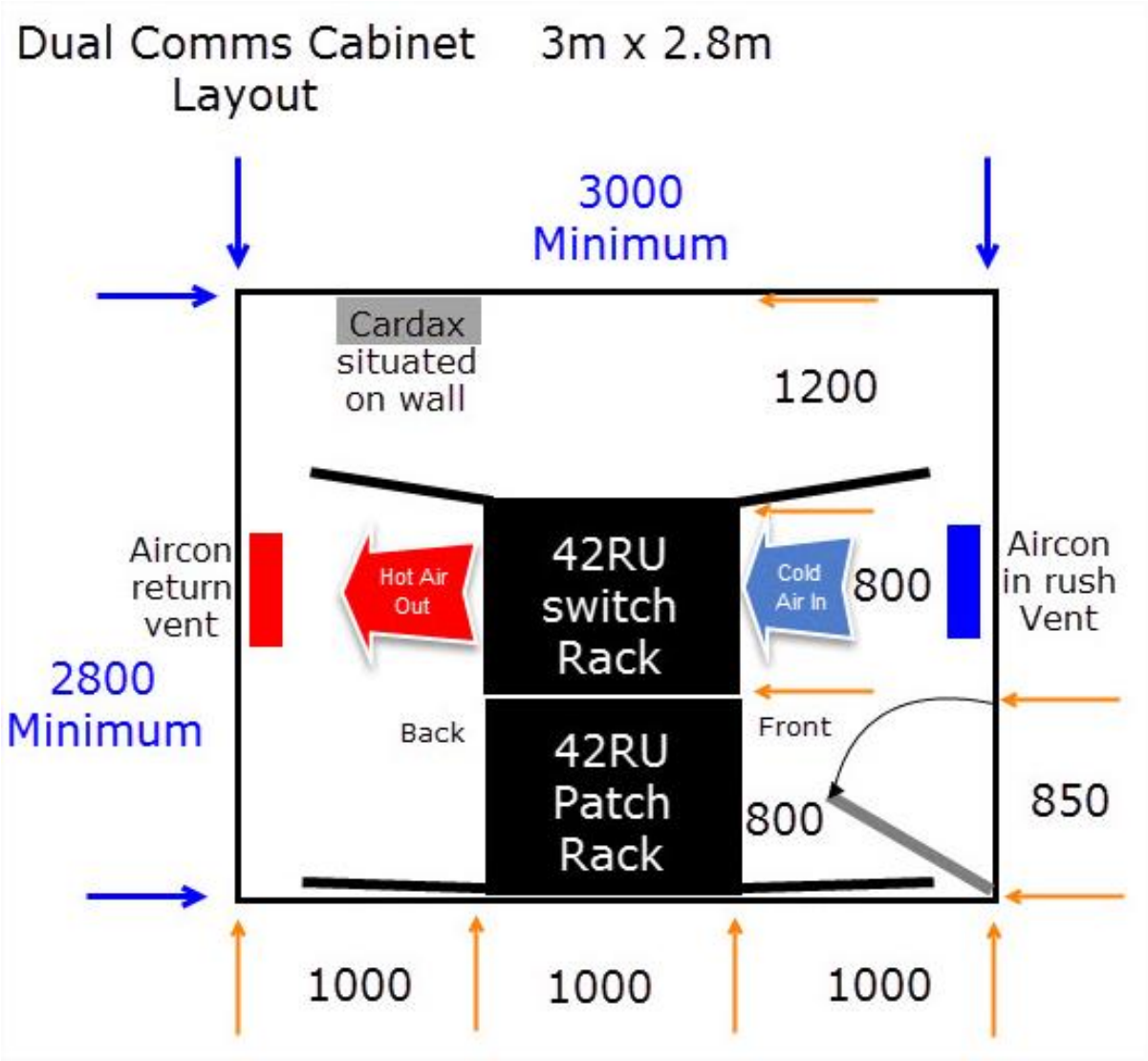
The preferred method is by utilising 'non-specific' branded racks for AV and passive racks and 'APC' branded racks for the active network equipment.

EXAMPLES OF COMMUNICATION ROOM LAYOUTS

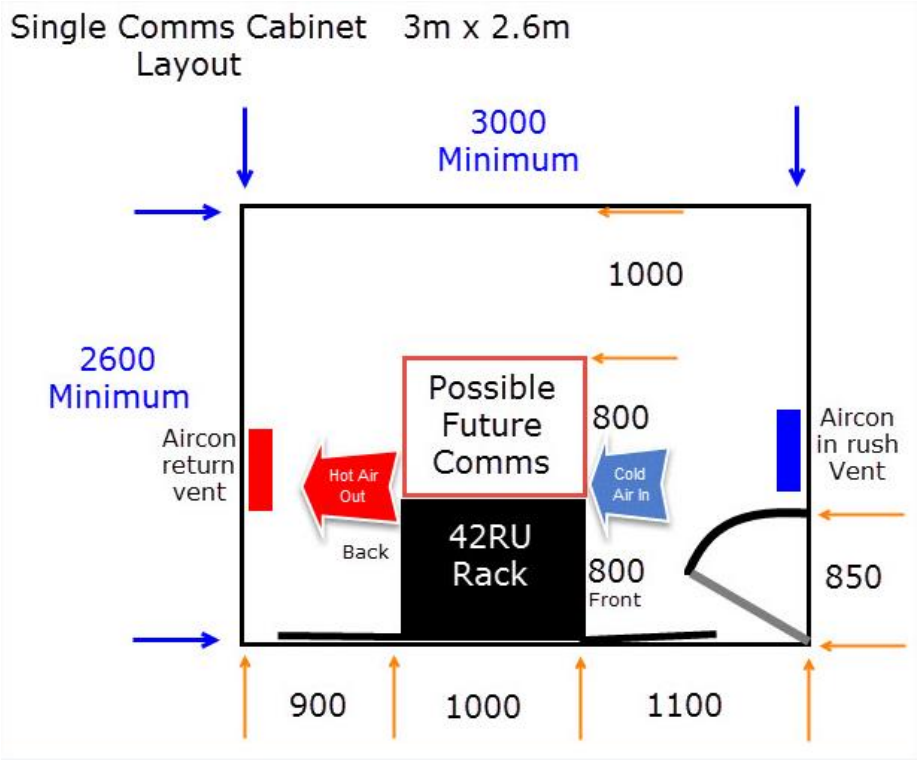
TRIPLE RACK LAYOUT



DOUBLE RACK LAYOUT

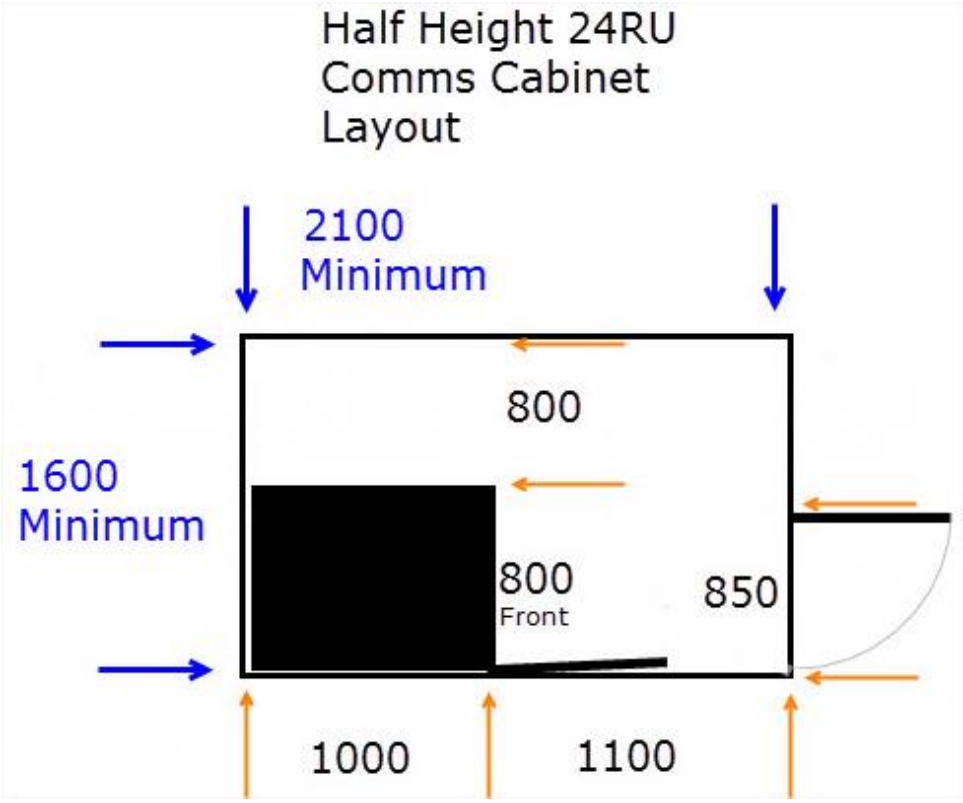


SINGLE RACK LAYOUT



HALF HEIGHT RACK LAYOUT

(Only to be used with prior approval)



9 CABLE PATHWAYS AND ENCLOSURES

9.1 GENERAL PATHWAY REQUIREMENTS

9.1.1 PATHWAY ROUTE

Cable pathways shall be selected and designed to:

a) maintain minimum segregation from other services, as mandated by AS/CA S009 and AS3000, in accordance with AS/NZS11801.1 ZA.3.1

b) minimise interference in accordance with AS/NZS11801.1 ZA3.2. Pathways and Spaces, and shall comply with AS/NZS3084.

9.1.2 BEND CONTROL ACCESSORIES

Bend control accessories are to be used to assist with cabling installation and they are not to be removed after the bend installation has been completed, i.e. all bend control accessories are to remain in situ.

9.1.3 REPLACEMENT DRAWSTRING

Where existing in situ drawstrings are utilised, they should be replaced with appropriate cord (see 9.3.1 Conduits) as a part of the pull. If the pathway is full, an additional pathway should be installed adjacent to the existing one.

9.2 INTRA-BUILDING PATHWAY VERTICAL RISERS

Where there is more than one floor, risers should be located vertically one above the other and shall be vertically interconnected by conduits or wiring access trays with the equivalent space of not less than three 150 mm conduits.

9.2.1 CABLE TRAY

Cable trays shall be ladder tray in style.

Minimum steel thickness for cable trays shall be:

- 1.0 mm for trays up to 150 mm wide
- 1.2 mm for trays up to 300 mm wide.

Trays shall have folded edges with a minimum height of 20 mm.

Trays shall be earthed to the CET provided at the comms room.

Electrical continuity shall be maintained along the full length of cable trays.

9.2.2 BASKET

Cable basket is preferred for Cat 6a installations, with 100 mm maximum between mesh wires.

9.2.3 DUCTING AND CONDUITS

For all non-exposed pathways, conduit is preferred. For exposed internal vertical use, ducting shall be used. For exposed external use, where the pathway is visible below the roof/ceiling line, ducting should be used.

When used, ducting shall be tamper-resistant, dual compartment, rectangular section, metal bodied. Clip-in covers shall not be used for exposed or accessible ducting. Horizontal/vertical ducting in office/class areas will be skirting-style metal dual channel 150 x 50 mm.

Ducting and conduit shall be selected to be aesthetically matched to the building as far as practicable and compliant with AS/CA S009 (colour to be black unless alternative approved by the Infrastructure Manager – Network Cabling).

Ducts and conduits shall have capacity for future expansion after the initial installation.

9.2.4 INTERNAL CATENARY

Catenary wires used for support of internal cablings shall be installed within ceiling spaces. Catenary wires shall have an insulating sheath.

The maximum bundle size of cables supported by a catenary wire shall be 24 4-pair cables for Category 6/6a.

The catenary wires shall be terminated, sized and supported to support the potential load of attached cables while meeting the maximum sag requirements of AS/NZS3084.

9.3 INTER-BUILDING PATHWAYS

Inter-building pathways shall be constructed to accommodate the cabling between buildings.

Underground pathways are preferred wherever practicable.

All new buildings and capital works must have a defined means of ingress for both voice and data cables created and a reserved ducted access to the core equipment room wherever it is located.

The crawl space under elevated buildings must be considered an external environment and proper consideration shall be given to the choice of components used in this space. Factors to be considered include dampness, flooding, UV radiation, vermin and future access.

9.3.1 UNDERGROUND PATHWAYS

Underground pathways shall be designed and constructed in accordance with AS/NZS3084. Pit provision and spacing shall be in accordance with Section 9.3.1 below.

The minimum conduit count and size for lead-in cables to any permanent building is two 100 mm conduits.

Minor campus pathways shall consist of a minimum of two 100 mm conduits.

Major campus pathways shall consist of a minimum of four 100 mm conduits.

Copper and fibre backbone cables shall follow the same routes. Copper and fibre shall be run in distinct conduits between pits and penetrations unless there is no other physical means of entering a building or structure or reaching the next pit.

TRENCHES

Trenches for communication cabling shall be constructed to provide the depth of cover and segregation specified in Clause 5.5.3 of AS/CA S009. Depth of cover in this case means the distance between the natural ground surface and the top surface of the communications conduit. In general, the depth of cover required shall be:

- 450 mm under public footways or roadways
- 300 mm in other areas, except where soil conditions preclude a trench depth to provide 300 mm cover, in which case the depth of cover shall be in accordance with AS/CA S009 Clause 5.5.3.5.2.

CONDUITS

The existing underground conduit system shall be utilised where possible and practical, without degrading the performance of the installation.

Underground conduits that are newly installed shall be sized to accommodate backbone cables such that conduit fill at the time of installation does not exceed 50 per cent of rated conduit capacity.

Conduits and accessories shall be white UPVC and shall conform to AS/ACIF S008 Clause 5.3.2 as outlined below:

Outdoor conduit/pipe shall meet the following minimum classifications in accordance with Clause 5 of AS/NZS2053:

- Clause 5.1. Any classification (PVC to be used in this application)
- Clause 5.2. Threadable or non-threadable
- Clause 5.3. Medium mechanical stresses (‘medium duty’)
- Clause 5.4. Rigid
- Clause 5.6. Flame propagating or non-flame propagating — the conduit/pipe should be marked ‘HF’ or ‘Halogen Free’, if applicable
- Clause 5.8.1. Rated to IP66
- Clause 5.8.2. Rated to IP66
- Clause 5.8.3.1. Medium protection outside/inside
- Clause 5.8.4. Medium protection against solar radiation
- Clause 5.8.5. Non-hygroscopic.

Sweeping bends shall be used to allow for cable bending radii and shall also be white communications-type PVC.

The University strongly recommends that a spare 100 mm diameter white PVC communications conduit shall be installed along the complete route of the underground inter-building pathway system for future installations.

All installed conduits shall be tested after all surrounding earth works are complete. Testing shall be by means of hauling through a brush and mandrel with a minimum diameter of at least 90 per cent of the conduit under test.

After testing all conduits shall be installed with a 3 mm nylon drawstring with a minimum break force of 90kg.

A test report for conduits shall be produced as part of the installation documentation.

Any section of conduit that may be exposed to direct sunlight shall be UV-stabilised. Conduits and accessories shall be provided in 50 mm or 100 mm sizes.

PITS

Pits shall be installed at suitable locations to facilitate installation and maintenance of cabling including:

- building entrances
- at distances not exceeding 50 m along underground cable pathways
- where a significant change of direction to the route occurs
- at road crossings or culverts.

The minimum pit dimensions shall be 600 mm x 1200 mm x 900 mm deep.

Pits shall be designed and installed according to the detail in this document and shall be provided with all required accessories including:

- trafficable covers and support bars for covers as required (minimum AS3996 Class C)
- covers permanently and appropriately labelled
- cable support bars
- PVC bushes for conduit entry
- gaskets and seals.

Where pits are installed in known high-traffic areas, the correct approved strengthening ring for the pit lip shall be used.

Shared service pits with other services (e.g. gas, power, water) shall not be used except under the limited circumstances described in AS/CA S009 and only with the express permission of the Infrastructure Manager – Network Cabling.

Pits shall include a drain point at the bottom of each pit to allow any accumulation of water to escape.

TUNNELS

This document does not address requirements for tunnels. In the event that tunnel pathways are required, suitably qualified personnel shall prepare design and appropriate specifications.

9.3.2 OVERHEAD PATHWAYS

Overhead pathways may be used where buildings are linked by covered walkways or gantries. Approval of the Infrastructure Manager – Network Cabling and Properties approval shall be obtained for the use of overhead pathways.

Overhead pathways shall be constructed of cable tray or cable ladder. Spare capacity of 50 per cent shall be provided.

Cables shall be installed within protective enclosures such as metal conduits or ducts for the length of the pathway.

9.3.3 AERIAL PATHWAYS

In cases where underground or overhead pathways are not practicable, aerial pathways utilising catenary suspension systems may be employed.

Aerial pathways shall meet the requirements of Clause 19.5 of AS/CA S009 and the following:

- Aerial pathways shall be selected to avoid crossing power lines.
- Where aerial pathways are indicated on the site plans, the SCS contractor shall install PVC-coated anaconda conduit between the respective buildings. The conduit shall be sized as to allow for only 50 per cent fill.
- The bearer or catenary wires shall be terminated and sized to support the load of the conduit with 80 per cent fill of cables under extreme weather conditions.
- Catenary wires shall be PVC-coated and in no circumstances shall be less than 4.0 mm diameter.
- Catenary wire shall be fixed to the buildings using eyelets and turnbuckles. The conduit shall be tied to the catenary with stainless steel cable ties.
- The anaconda conduit shall be earthed at both ends provided that such earthing does not conflict with Clause 5.5.4.5 of AS/CA S009 (Crossings with power lines). The bearer or catenary wire shall be bonded to the protective earth system.

9.4 ENCLOSURE/RACKS

Communication enclosures are used to house and restrict access to hubs, cabling, all active LAN components and other communications hardware. Enclosures may be freestanding or wall-mounted.

Enclosures and racks shall be designed for standard size (482.6 mm or 19”) equipment mounting.

The University’s preference is for fully enclosed cabinets/enclosures only to be used.

9.4.1 GENERAL

Cabinets and racks shall comply with the relevant requirements of IEC-60297.

The enclosure(s) within the core equipment/communication rooms containing core switching equipment shall provide 42 or 45 rack units (42 RU, 45 RU) equipment mounting space.

All enclosures at a site shall be fitted with keyed-alike doors.

Enclosures shall provide facilities for ventilation in the form of vented panels or the like.

Metal surfaces of the enclosure and accessories shall be powder-coated, painted or otherwise protected against corrosion. Black finish is preferred for enclosures/racks. Bare metal surfaces shall not be accepted.

Enclosures and racks shall be bonded to the protective earth system communications earth system (CES) using a minimum 6 mm^2 green/yellow conductor. Enclosures shall not be bonded to the Telecommunications Reference Conductor (TRC) if provided.

Power distribution will be provided by two dedicated 15 A GPOs presented with a captive socket which, where possible, shall be installed above the rack

All enclosures/racks shall be labelled to warn of the potential that hazardous laser radiation levels may be present.

9.4.2 ENCLOSURES (CABINETS)

Freestanding enclosures shall typically be provided as 42 RU or 45 RU. Curtin has specified either APC or equivalent non-branded cabinets (pending approval from Infrastructure Manager).

Enclosures shall be a minimum 900 mm deep when used as the core or server enclosure.

Enclosures shall be fitted with:

- front and rear 482.6 mm (19”) mounting rails
- horizontal and vertical cable tidy panels and/or loops
- vertical cable tray or cable management troughs fitted to both sides of the enclosure
- a minimum of two supporting shelves
- removable rear and side panels
- keyed, lockable, perforated steel front door
- keyed, lockable, perforated steel rear door or removable panel in cases where insufficient clearance is available to accommodate a door
- levelling adjustment
- horizontal earth bar as part of the Communications Earth System
- additional vertical earth bar for F/UTP installs.

9.4.3 WALL-MOUNTED SUB-ENCLOSURES (CABINETS)

Wall-mounted enclosures shall not be used without approval from the Infrastructure Manager – Network Cabling.

When approval is given, the wall cabinet shall meet the following criteria:

- 12 or 18 RU (capacity dependent)
- double section and dual-hinged
- minimum 600 mm deep
- internal front rail set back a minimum of 100 mm from rear of front door
- lockable front door and side panels
- installed at a minimum height of 1350 mm to the underside of the cabinet
- contain/supplied with a recessed PDU mounted on Us 1–3
- a dedicated 15 A GPO with captive socket mounted within the cabinet at the rear
- contain/supplied with internal earth bars as per Section 9.4.2
- contain/supplied with a fan kit.

An approved kit part number that complies with above requirements is available from APC, when ordering specify: APC-CWM13U.

The general layout of the cabinets is shown in Section 11.3.4.

9.4.4 OPEN FRAME RACKS

Open frame enclosures/racks shall not be used, unless approved by the Infrastructure Manager – Network Cabling.

9.4.5 EXTERNAL ENCLOSURES

9.4.5.1 Wall-mounted external enclosures

External enclosures can be used in locations such as bike pods, plant buildings, etc.

All equipment/products within the external enclosure shall be mounted on a DIN rail including the Curtin-supplied switches (Cisco 4000 industrial or 3560) or media converters.

The Cisco 4000 is capable of operating in temperatures up to 60 °C in a sealed enclosure. If location of the enclosure is likely to be in direct sunlight then a consideration for a dual-skinned enclosure must be given to reduce internal temperatures.

All external enclosures shall meet the following criteria:

- must be a minimum of IP55-rated, which is to be maintained through cable entry points
- secured with a key
- must have a minimum depth of 350 mm to allow sufficient bend radius for a DIN-mounted FOBOT
- must have a dedicated 15 A GPO
- must be earthed.

The general layout of the external enclosure is shown in Section 11.3.4.

9.4.5.2 Freestanding external enclosures

Communication external cabinets (CECs) are used to deploy devices and services that require IT connectivity and remote power.

CECs shall meet the following criteria:

- be built of marine grade aluminium 2.5mm thick minimum with double skin
- must be a minimum of IP55 rated
- must contain hinged front and rear lockable doors
- contain front and rear 482.6 mm (19") mounting rails
- be keyed to Curtin comms data key standard
- must be fed by 2 x 100 mm comms conduits and 1 x 50mm electrical conduit
- must have a suitably sized comms pit adjacent for cable deployment and management.

The following product shall be used when deploying services/fitting out the CECs:

- **K3M5DTHA4/4BK –** 4F SM (G652.d) LT FIBRE/ 4 PVC 36/0.32 ofcc NY/PE
- **PL-PWR-240-48 –** Din Rail Power Supply 240W, 48V DC output.

Suitable coverings shall be provided for the 240v AC connections to the power supplies and shall be in accordance with AS3000.

Product at the device end/multi-use poles:

- **FWE-2LCD-P-2154P –** 2LCD Splice pole box with 2 x POE++ media converter.

9.4.6 RACK/ENCLOSURE POWER (FLOOR-STANDING)

Two dedicated circuits providing dual 15 A power outlets on separate phases with locking rings (typically Clipsal 56C315) shall be provided for each rack/enclosure at each site. Allowance should be made to fit matching plugs per outlet.

Power outlets shall be mounted above the enclosure.

9.4.7 CABLE MANAGEMENT

All cable management shall be supplied by DTS – Networks. However designers should incorporate sufficient space requirements for vertical and horizontal management.

Installations with more than two adjacent enclosures/racks are to have cable ladder across the rack tops and vertical cable management installed between them.

9.4.8 RACK/ENCLOSURE MAXIMUM EQUIPMENT LOAD

Equipment enclosures shall be constructed to support the maximum equipment loads as detailed below.

a) 27 RU Enclosure Floor Mount

b) 32 RU Enclosure Floor Mount

c) 42 RU Enclosure Floor Mount

d) 45 RU Enclosure Floor Mount

e) 18 RU Cabinet Wall Mount – 45 kg

f) 12 RU Cabinet Wall Mount – 40 kg.

Consideration shall be given to load-bearing capacity of the floor when selecting or specifying floor-mounted enclosures.

10 CABLING SYSTEM TECHNICAL REQUIREMENTS

10.1 GENERAL

Cabling and components shall be selected to meet cabling system performance requirements with due consideration to compatibility and performance variation due to temperature.

Category 6(a) cable and components shall be independently verified for compliance with the Category 6(a) performance specifications of AS/NZS11801.1 by UL, ETL or other approved independent NATA laboratory verification system.

The cabling system contractor shall warrant that products will operate to the standards and specifications claimed by the manufacturer and that the product is free from any defects in materials or workmanship.

The supplier shall make technical and user documentation on the product available to the University.

Installation practices to be applied for cabling systems are described in Section 11.

10.1.1 OUTDOOR CABLING

Optical fibre cabling shall be generally used for campus backbone cabling. However, in the event that balanced cabling is used externally, the cable shall meet the following requirements:

a) For underground routes, the cables shall be moisture resistant in accordance with AS/CA S008.

b) Termite-resistant sacrificial sheath and jacket shall be utilised in areas prone to termites.

c) Transient protection equipment shall be provided for protection of equipment connected to the cables where such equipment can be provided without compromising transmission performance.

10.1.2 CATEGORY 6(A) URP, F/UTP CABLE AND CONNECTING HARDWARE

Category 6(a) cables used within horizontal or backbone cabling subsystems, or as work cords, shall comply with Clause 9 of AS/NZS11801.1. In the event that multiple signals share a cable, the additional performance requirements of AS/NZS11801.1 shall be met.

Category 6(a) connecting hardware used within horizontal or backbone cabling subsystems shall comply with Clause 10 of AS/NZS11801.1.

Category 6(a) horizontal cabling shall be terminated with modular 8-pin (RJ45) outlets using the T568A arrangement.

All new Category 6 (a) cabling must be of low smoke zero halogen (LS0H) make-up. The only exception will be when extending an already installed system that is of another make-up.

10.1.3 EXTERNAL CATEGORY 6/6A

For any external twisted pair requirements, externally rated F/STP, F/UTP shall be used and terminated/earthed as per the manufacturer's recommendations.

All F/STP, F/UTP external runs are to have approval from the Infrastructure Manager – Network Cabling prior to installation.

Category 6(a) backbone balanced cabling shall be generally terminated with modular 8-pin (RJ45) outlets using the T568A arrangement. However, insulation displacement (IDC) punch-down blocks may be used to terminate outdoor balanced cables used within the backbone.

10.1.4 UTP AND F/UTP MANUFACTURER REQUIREMENTS

All UTP, F/UTP components must be supplied from one of four Curtin University-approved manufacturers:

- Panduit
- Commscope (AMP Net-connect solution only)
- Molex
- Siemon.

Once a manufacturer has been selected for a building, it is the only manufacturer to be used in that building for future installations.

10.2 COPPER BACKBONE CABLING

10.2.1 CAPACITY PLANNING FOR ANALOGUE SERVICES

Any new building must cater for analogue services/technologies such as those in the table below. Also shown are service connection requirements:

Technology	Location	Service	Comments
Telephone	Bentley	IP telephony	connected via network switch in the building
	Remote campus	IP telephony	connected via network switch in the building
Fax	Bentley	IP with voice gateway	connected via network switch in the building
	Remote campus	IP with voice gateway	connected via network switch in the building

Lift phone	Bentley	copper service to B105 level 7	connected via network switch in B105 with extended uptime copper service to B105 level 7
	Remote campus	PSTN service	DTS-Telecommunications to organise with service provider
Emergency phones	Bentley	copper service to B105 level 7	connected via network switch in B105 with extended uptime copper service to B105 level 7
	Remote campus	PSTN service	DTS-Telecommunications to organise with service provider
EFTPOS	Bentley	PSTN service	DTS-Telecommunications to organise with service provider- connectivity is via B105 level 7
	Remote campus	PSTN service	DTS-Telecommunications to organise with service provider

A suitably sized copper backbone cable shall be allowed for, based on requirements from the table above.

Any requirement for fire panel connections/lines must be in line with Curtin PF & D guidelines.

10.2.2 INTER-BUILDING (CAMPUS) BACKBONE CABLING

All inter-building copper backbone cables shall be Austel/ACA/Telstra-approved and gel/grease-filled to prevent the ingress of moisture and impurities.

All inter-building (cross-site) cables shall be fed from one of the Campus's three PABX locations in buildings 100, 101 or 105.

The inter-building copper cables shall be of outdoor cable construction as in ACA TS 008, which in turn refers to AS1049-2003. Cables shall not be direct buried.

INTER-BUILDING TERMINATIONS

Cross-site (external grease-filled) copper cables must not terminate directly onto a copper patch panel, but must terminate on either 110-frame or Krone disconnect modules within a separate MDF or IDF.

10.2.3 INTRA-BUILDING BACKBONE CABLING

CABLE

The backbone cable shall be Austel /ACA-approved voice grade or Category 3 type UTP cable. The minimum wire diameter shall be 0.40 mm and 100-pair cables should be used where practical.

Backbone cabling shall be used to connect the CD/BD to all FDs where installed and the TPF in the PABX room. Backbone cables will also connect the distributor to the voice 110-frame within each rack.

INTRA-BUILDING TERMINATIONS

The backbone cable from the IDF/MDF to the comms racks will be of an internal grading and will be terminated on a 24-port copper Cat 5e patch panel (flat face) mounted within the building/level communications rack. The termination shall conform to all Austel /ACA regulations and the manufacturer's recommendations.

The backbone cable to the patch panel shall terminate sequentially. Outlets will be labelled according to Section 14.3.

All inter-building and intra-building backbone copper voice-grade cable shall be inspected for correct colour-coded termination with no split or transposed pairs. Tests should be conducted as per Section 13.

10.3 OPTICAL FIBRE CABLING

10.3.1 GENERAL

Optical fibre cabling shall meet the requirements of AS/ACIF S008 and shall meet or exceed the performance requirement of AS/NZS11801.1 Clause 9.4 for the relevant performance class.

Cable jackets shall incorporate clearly legible identification marking at distance intervals not exceeding one metre to indicate cable manufacturer, date of manufacture, batch number, cable type and capacity and length marker.

Cable Jacket	Optical Fibre
Aqua	50/125µ (OM3)
Blue or Black	9/125µ (OS2)

Table 10.3.1 Cable jacket colour requirements

The table above has been included to clearly identify indoor cabling requirements.

Optical fibre cables shall terminate at fibre patch panels located at distributors. Each cable shall be continuous from one patch panel to the destination patch panel without intermediate joins or connections. The cable strength member shall be securely fastened at the termination enclosure.

Emtelle Microduct shall terminate in a tube management box. A box shall be provided in each communications room and at each level the Microduct passes through in the case of a vertical riser. A two-tube duct shall be provided from the tube management

box to the fibre patch panel. Microduct shall be rated as per a normal cable for indoor or outdoor based on its use as per S008.

Optical fibre cable shall be terminated with fibre connectors as per Section 10.3.4. Enclosures shall be filled from left to right. Equipment that uses SFF optical connectors shall be interfaced to the connectors at the patch panel using optical patch cords to provide adaptation between the patch panel and the particular SFF connector.

While equipment-mounted optical connectors are outside the scope of this document it should be noted that the only SFF connector presently acceptable to the Infrastructure Manager – Network Cabling is the LC style.

10.3.2 OUTDOOR CABLING (SINGLE-MODE OPTICAL FIBRE CABLING)

The preference is to use loose tube construction suitable for drawing through underground conduits as required.

The cable core shall be filled with a suitable compound to prevent the ingress of water and/or other solutions and impurities.

Cables shall be capable of long-term water immersion without degradation of performance.

Termite-resistant sacrificial sheath and jacket shall be utilised in areas prone to termites.

10.3.3 INDOOR CABLING (SINGLE-MODE OPTICAL FIBRE CABLING)

Optical fibre cables for indoor cabling shall be non-metallic indoor tight-buffer fibre optic cable for riser applications.

Cable materials shall be flame retardant producing low levels of smoke and shall be halogen-free.

10.3.4 SINGLE-MODE OPTICAL FIBRE CABLING AND CONNECTING HARDWARE

OS2 optical fibre cables used within backbone cabling subsystems shall comply with Clause 9 of AS/NZS11801.1.

OS2 optical fibre connecting hardware used within backbone cabling subsystems shall comply with Clause 10 of AS/NZS11801.1.

All the fibre cores at both ends of each optical fibre cable run shall be terminated using LC-type fibre connectors conforming to the requirements of AS/NZS11801.1 and IEC 60874.

10.4 DISTRIBUTORS AND PATCH PANELS

10.4.1 GENERAL

Distributors and patch panels shall be designed for 482.6 mm (19”) rack mounting in accordance with IEC-60297.

10.4.2 BALANCED CABLING PATCH PANELS

Patch panels for balanced cabling shall be 24-way wedged/angled modular socket (RJ45) with a port density of 24 ports per 1 RU.

Note: Flat 24-way Cat 6 patch panels can be used only in small wall-mounted cabinets. These will be specified in the specific scope of work.

The connecting hardware of the patch panels shall be rated to the AS/NZS11801.1 performance Category 6(a) of the cabling system.

10.4.3 OPTICAL FIBRE PATCH PANELS

Optical fibre termination equipment shall provide cross-connect, interconnect or splicing capabilities.

Optical fibre patch panels shall be combination type 1 RU 12- or 24-port fitted with couplers (adaptors) and cover plate. Patch panels shall be equipped with cable management facilities including splice trays.

Terminated fibres shall be connected through couplers (adaptors) mounted on the faceplate of the optical fibre termination panels. Offset couplers shall be used to minimise potential eye hazards from optical sources.

The panels shall allow offset couplers to be angled to the left or right.

FIBRE PANEL MANUFACTURER REQUIREMENTS

Curtin's fibre panel standard is an AFC FOBOT as per part numbers below:

For campus backbone (such as blown tube/loose tube):

Part Number	Description
RC-1EH1DL-BA-1GG-JJ	1RU 12F SM LCD STATIC SLIDING ENCLOSURE WITH C-TRAY
RC-1EM1DL-BB-2GG-JJ	1RU 24F SM LCD STATIC SLIDING ENCLOSURE WITH C-TRAY
RC-1EM1EK-BB-2GG1LL-JJ	1RU 36F SM LCD STATIC SLIDING ENCLOSURE WITH C-TRAY
RC-1EM1EP-BB-4GG-JJ	1RU 48F SM LCD STATIC SLIDING ENCLOSURE WITH C-TRAY

For building backbone (such as tight buffer/riser):

Part Number	Description
RB-1EH1DL-BA-1GG-JJ	1RU 12F SM LCD SLIDING ENCLOSURE WITH C-TRAY
RB-1EM1DL-BB-2GG-JJ	1RU 24F SM LCD SLIDING ENCLOSURE WITH C-TRAY
RB-1EM1EK-BB-2GG1LL-JJ	1RU 36F SM LCD SLIDING ENCLOSURE WITH C-TRAY
RB-1EM1EP-BB-4GG-JJ	1RU 48F SM LCD SLIDING ENCLOSURE WITH C-TRAY

10.5 TELECOMMUNICATIONS OUTLETS

Each telecommunication outlet (TO) shall incorporate two or more modular RJ45 sockets.

The RJ45 sockets shall be matched to the AS/NZS11801.1 performance Category 6(a) of the cabling system.

Telecommunication outlets shall be equipped with unshuttered face plates. Where the TO is positioned on existing duct, modular-type mounting enclosures shall be used. Blanking plugs shall be fitted where the apertures of the mounting enclosure are not filled with an RJ45 jack.

All field Cat 6 mechs shall be green in colour, Any Cat 6a when used must use blue mechs or blue identifiers.

Faceplates shall match power outlets in appearance where possible.

Single TOs for wi-fi purposes shall be low profile and mounted on or below any false ceilings (where fitted) in accordance with design specifications in Section 5.3.2.

11 CABLING SYSTEM INSTALLATION PRACTICE

11.1 GENERAL

11.1.1 SAFETY

Cabling system installations shall be performed in a safe manner.

Personnel undertaking installation works shall be equipped with appropriate personal protection equipment, tools and mechanical aids.

Appropriate barriers and warning signs shall be used to restrict access and draw attention to potential hazards such as open trenches and the like.

Consult the Curtin University Contractor Safety guidelines available at http://healthandsafety.curtin.edu.au/index.cfm.

11.1.2 QUALIFICATIONS OF INSTALLER

The Structured Cabling System is to be installed only by organisations that are approved by the University and accredited by the manufacturer of the cabling system components, and by properly qualified personnel as specified in Section 17.

11.1.3 MANUFACTURER'S RECOMMENDATIONS

All equipment and cabling shall be installed and terminated in full accordance with manufacturer's recommendations and instructions.

11.1.4 CABLE LENGTHS

Cable lengths shall be kept to a minimum by taking the most direct and practical route. However, where possible, the horizontal cabling shall be no shorter than 15 m.

11.1.5 SEGREGATION

Cable pathways and cable installation shall be installed to achieve suitable segregation between communications cabling and other services.

Segregations shall comply with AS/CA S009 as an absolute minimum. However, additional segregation shall be provided where practicable in accordance with AS/NZS11801.1 ZA.3.

Areas where segregation has been compromised should be reported to the Infrastructure Manager – Network Cabling.

11.1.6 CONCEALMENT

All cables shall be concealed except where nominated otherwise, and shall be run in neat lines. Digital photographs should be taken of major pathways and representative examples before concealment.

11.1.7 EARTHING PROTECTION

All metallic conduit, boxes and enclosures shall be permanently and effectively grounded in accordance with the relevant Western Australian electrical codes.

Provision regarding earthing protection of cabling systems shall comply with Australian standards, including AS3000, AS/CA S009 and AS/NZS11801.1.

11.2 CABLE SUPPORT SYSTEMS AND PATHWAYS

11.2.1 GENERAL

Cable support systems and pathways shall meet the requirements of AS/CA S009 and AS/NZS3084.

11.2.2 HORIZONTAL PATHWAYS

No fixed horizontal cabling is to be visible to the eye within the workplace. All cabling shall be installed in conduits, in cable trays or in under-floor cavities. Approved cable fasteners shall be used at intervals as specified in AS/NZS3084.

It is preferred that cabling be concealed by location in roof, floor or wall spaces, however cabling may be surface-mounted within ducting in the following circumstances:

- between outlets within the one room in which case suitable neat ducting may be used
- where such location is considered expensive, disruptive or impracticable. All use of surface ducting shall be subject to approval by the University.

All cables shall be installed in a workmanlike manner, parallel to walls, floors and ceilings as far as is practicable.

All ducting shall be run in an inconspicuous manner. Excess cabling shall not be stored in the duct.

Where cable is run through a false (suspended) ceiling, it shall be supported by means of suspension from fixed non-movable structural features, purposely installed flat cable trays or by one or more catenary cables. Fixed, non-movable features exclude water pipes, sprinkler systems and trunked electrical power.

Any soft wiring solutions must be approved by the Infrastructure Manager – Network Cabling prior to installation, as this is not an approved solution within Curtin University.

In an area where there are island-type workstations a rigid power pole that is supported at ceiling and floor or a suitable floor box with a chased conduit pathway must be installed. Any alternative solution must be agreed by the Infrastructure Manager – Network Cabling prior to installation.

Any circumstance where horizontal cabling is planned to be installed outside building spaces shall be specified and the alternative described. Installation shall only proceed with the Infrastructure Manager – Network Cabling approval.

11.2.3 BACKBONE PATHWAYS

Intra-building pathways between communications rooms and closets shall consist of horizontally interconnected conduits or cable tray with the equivalent space of not less than two 100 mm conduits.

Inter-building pathways may consist of underground, buried and aerial pathways.

In multi-storey installations, cabling between floors must be routed via an approved communications cabling riser or duct.

Where cable is run in an exposed area, it shall be enclosed in PVC duct or conduit. External grade cable shall be used in accordance with AS/CA S009.

11.2.4 CABLE TRAYS/BASKET

Cable trays shall be installed in accordance with AS/NZS3084.

11.2.5 DUCTING/TRUNKING

Surface-mounted ducting shall be installed only where an alternative method for concealment of cables is not possible.

Ducting shall be screw-fixed to walls using suitable fixings (e.g. cavity fasteners for cavity walls and masonry anchors for concrete slabs, columns and the like) at approximately one metre intervals when run vertically and approximately 600 mm intervals when run horizontally. Fixings shall be of a type that does not cause undue distortion to the ducting when tightened.

11.2.6 FASTENERS FIXINGS/TIES

Generally fixings shall be of a type suitable to the situation in which they will be used. Where fixings are to be used externally or exposed to the weather, stainless steel or brass is preferred and plain steel will not be accepted. Where fixings are used internally, cadmium plated is acceptable. All fixings, fastenings and supports shall be of adequate strength and size and arranged to protect the installation against mechanical failure under normal conditions of use and wear and tear.

All surface-mounted conduits, duct, cable trays and support branches on masonry shall be fixed in position using plugs, masonry anchors or other approved means. Wooden plugs shall not be used.

Cadmium-plated ‘Loxins’, ‘Ramset’ or ‘Terrier’ masonry anchors shall be used for fixings in concrete, clay or concrete brickwork. Conduits may be saddled to walls and ceilings using ‘tappets’.

Where ‘Ezydrive’ or ‘nail-in’ type concrete fasteners are used these shall be the removable screw exit type, so as to avoid damage to wall and surrounds when removed.

Bolts or machine screws with nuts, washers and anti-vibration devices shall be used where necessary for fixings to masonry construction including plastered expanded metals. Such plugs shall be used only for minor shear loadings. Holes and inserts and PVC screw anchor plugs ‘Expandet’ branch or equivalent shall be correctly sized.

Cable bundling shall be tightened by hand without using tools and shall be tightened just sufficiently to hold cables together and to fix cables to supports. Care shall be taken to avoid tight twisting of the cable, tearing of the outer jacket, cutting or wearing through due to abrasion of the cable.

Only hook and loop cable ties e.g. Velcro-style, are to be used for F/UTP cables. Nylon/zip-style cable ties are not to be used. All cable ties shall be a minimum of 10 mm width with suitable length to allow adequate security of the tie. Cable ties used externally shall be UV-resistant.

11.2.7 INTERNAL CATENARIES AND ABOVE-CABLE TRAYS

Internal cabling supported by catenaries or above-cable trays shall be installed in accordance with AS/NZS3084 and the following:

- A main cable route shall be chosen such that the cable path is accessible and conforms to the segregation requirements of AS/CA S009.
- The catenary wire shall be anchored at a maximum of five-metre spans. Turnbuckles and steel eyelets shall be used to tighten the catenaries.
- A maximum of 24 x 4-pair F/UTP cables shall be tied to a single catenary. Cables shall generally leave the main cable route at 90 degrees to the final termination point.

11.2.8 TRENCHING

Trenches shall be constructed such that installed conduits shall maintain a minimum longitudinal grade of 1 in 150 at all times. A longitudinal grade of 1 in 100 is preferred where practicable in accordance with AS3084.

The conduit shall be supported firmly and evenly on all sides using suitable fines prior to commencement of backfill.

Backfilling shall be performed with due care to avoid compaction or distortion of the pit at the pit entry point.

11.2.9 UNDERGROUND CONDUITS

Conduits shall be laid into a trench at the depth specified in Section 9.3.1.0. The conduit shall extend into the pit for a distance of approximately 50 mm.

A suitable PVC bush shall be used for conduit entry. The conduit shall be glued in place within the bush while the bush shall be glued to the pit and sealed.

All external comms conduits/ducts must be suitably sealed at the building entry end and at the pit end in accordance with AS/CA: S009. The preferred method is the TE TDux system.

11.2.10 PITS

Conduits shall generally enter pits on the vertical centre-line of the pit end with a minimum clearance of 50 mm to the bottom of the pit.

Pits shall be located such that conduit entries shall be achieved using a straight section wherever practicable.

Pits shall be installed such that the pit covers are substantially flush with the ground level.

Pit locations shall be selected to be unobtrusive to reduce the potential for opportunistic vandalism or sabotage.

11.2.11 EXTERNAL CATENARIES/CONDUITS

External cabling supported by catenaries shall be installed in accordance with AS/CA S009 and the following:

- Cabling shall be installed within anaconda conduit that shall be sized in accordance with Section 9.3.3.
- Outdoor cabling shall be used in all cases, irrespective of the cable's enclosure within a conduit.

11.2.12 PENETRATIONS

Fire-rated elements and structural members are not to be penetrated without prior approval from the Building Architect and or the relevant Curtin fire authority.

Where ladders or trays pass through ceilings, walls and floors, neat, close-fitting apertures are required. At openings through fire-rated elements, terminate the ladders or trays both side of the opening and provide fire-stopped holes for the cables only. Fire stopping shall comply with the Building Code of Australia (BCA). Any product used for fire stopping or sealing shall be approved by Curtin University. A sample may be requested.

11.2.13 BUILDING ACCESS

Access from the underground conduit bends, adjacent to the building, to the ceiling space of the building where the conduit run cannot be continued, shall be achieved by installing a 100 mm perforated cable tray/ladder.

The cable tray shall be reverse-mounted from the conduit top at ground level, to an access hole at ceiling space level. The access hole at ceiling level shall be filled with a moisture- and fire-retardant material. The perforated tray and cabling shall be protected by a 150 mm x 150 mm steel top-hat section, painted to match other building fixtures such as downpipes and the like.

11.3 ENCLOSURES/CABINETS

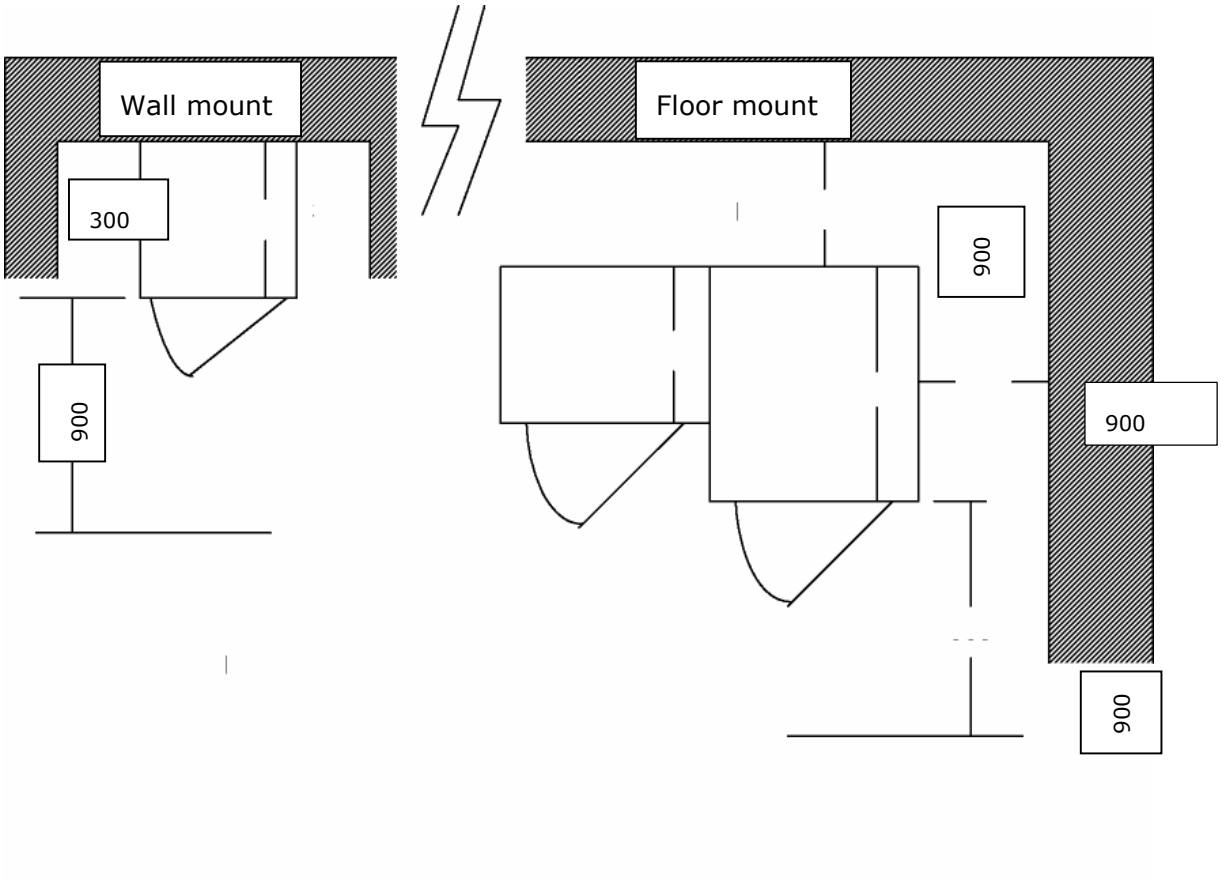
All enclosures, whether floor- or wall-mounted, shall be installed and mechanically supported to accommodate the load of the enclosure combined with the equipment load specified in Section 9.4.8.

Where space is limited for wall-mounted cabinets, they should be set to one side to allow adequate side access.

11.3.1 ENCLOSURE INSTALLATION

Communication enclosures shall be located to achieve maximum operator convenience. The space available for a communications cabinet is to be verified on site. The cabling contractor shall ensure that racks are arranged to permit installation of other equipment and enclosures with adequate access spaces for inspection, wire termination and patch field alterations.

Enclosures shall be provided with sufficient clearance for installation and maintenance activity. Minimum clearances for wall-mounted and freestanding enclosures are indicated in the figure below.



Enclosures shall be installed plumb and square without twists in the frames or variations in level between adjacent racks.

Enclosures shall be bonded to the communications earth terminal (CET).

Equipment mounting rails at the front of the enclosure shall be set back such that doors may be closed without contacting equipment or connectors or distorting cable bends.

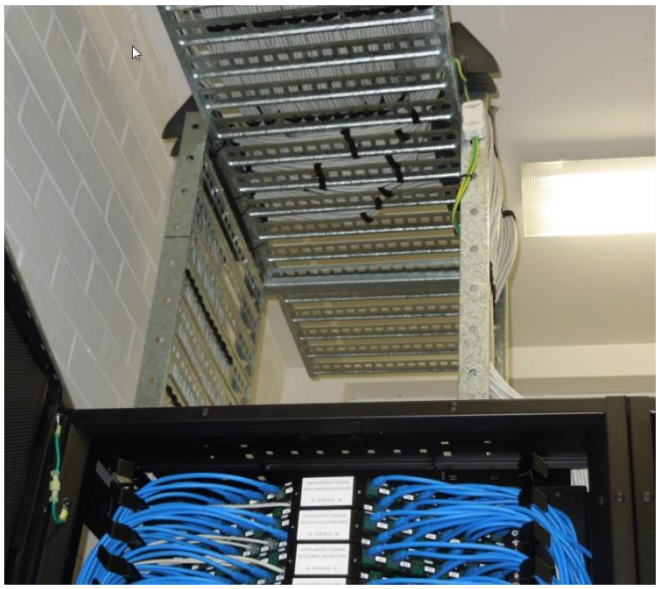
11.3.2 ENCLOSURE CABLE ENTRY

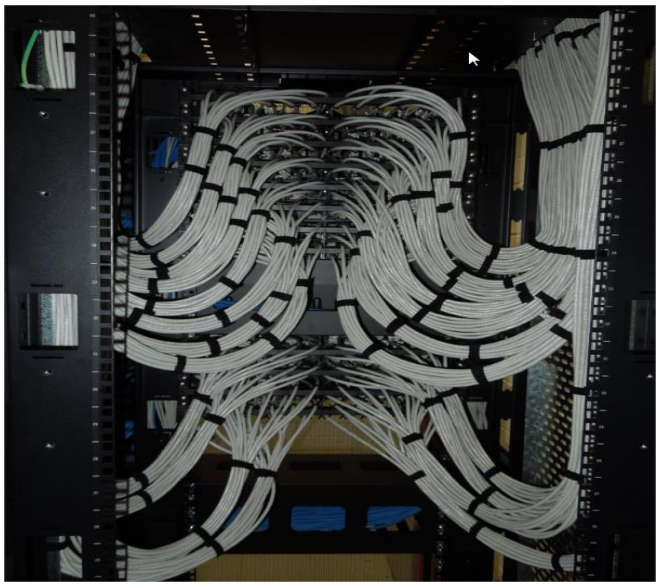
Cabling is to enter the racks from above and/or below to avoid obstructing access to the rear of the racks.

Cabling entering from the ceiling space to the enclosures shall be supported and concealed by a vertical cable support system and the cable bundles for each side of

the rack shall be fed via separate waterfalls. When feeding cables for a patch panel the quantity should be equally distributed (e.g. 12 from left and 12 from right). The exception to this rule is for racks that are up against a side wall and rear wall (generally reserved for half-height racks).

Below are images showing examples of enclosure entry trays and cable loops that Curtin University expect to see on all installations.





The vertical cable support system shall extend from the backbone/horizontal cable pathway to the base of the enclosure. In the case of raised floors, the vertical cable support system shall extend below the raised floor. In the case of above-ceiling pathways, the vertical cable system shall extend above the ceiling.

The vertical cable system shall have the same metal construction, colour and finish as the communications rack and be complete with two vertical cable trays (power and data/voice).

Note: No top hats are to be installed without the Infrastructure Manager – Network Cabling approval.

11.3.3 CABLING WITHIN ENCLOSURES

All cables shall terminate at the patch panels in the communications enclosures with 5 m of optical fibre cable and 2 m of other cables neatly placed out of sight prior to terminating.

Cables terminating at the enclosures shall be neatly loomed within the enclosure, utilising the cable management system specified in Section 9.4.7. Cables shall be loomed between the space on the outside of the mounting rails and the removable door. Cables loomed inside rack/cabinets shall be loomed in groups of a maximum of 12 on either side of the rack/cabinet, to allow enough space for mounting active network equipment.

INTER-RACK TIE CABLES

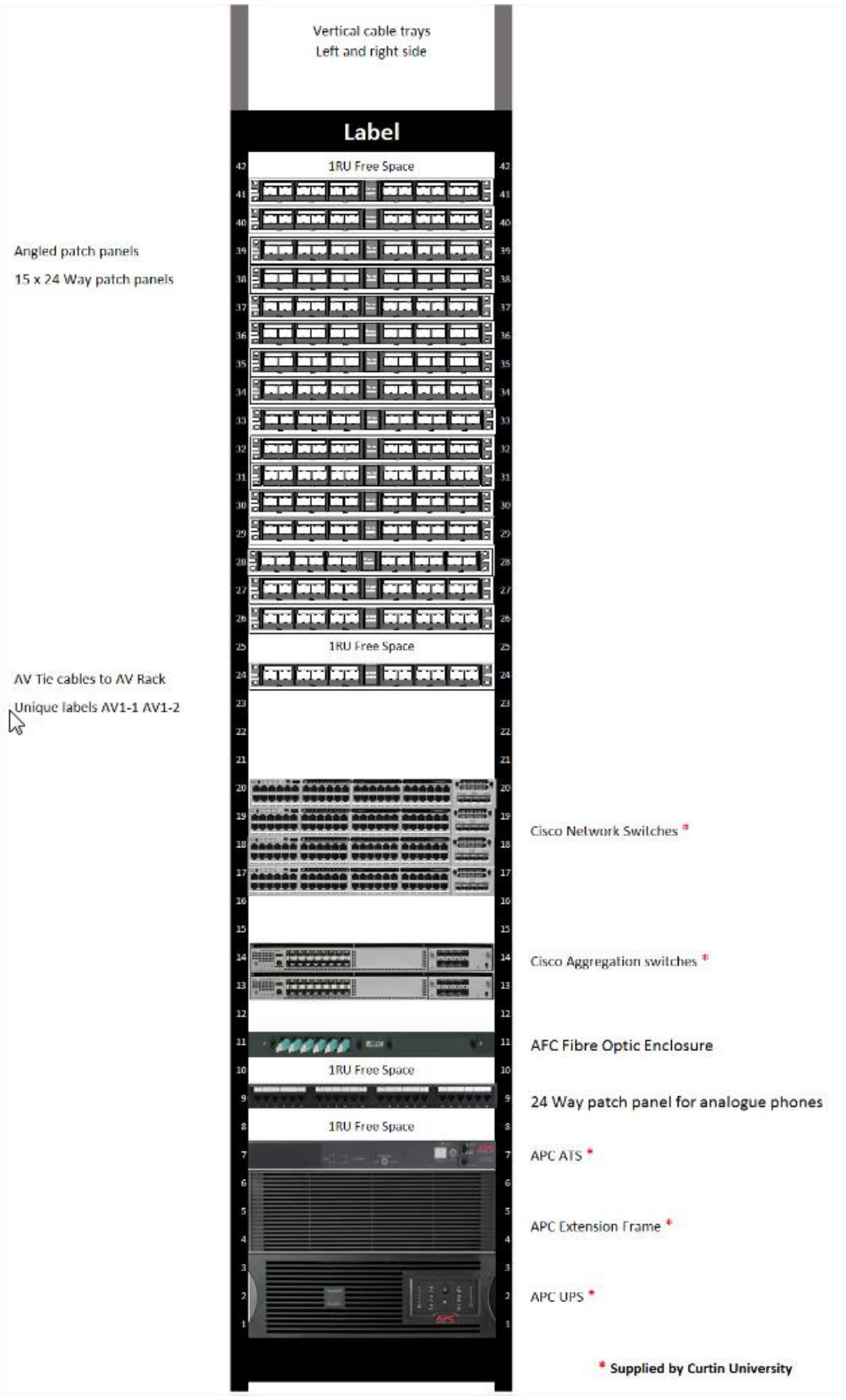
For any tie cable requirements between Curtin's network rack and other services/3rd party comms racks, these should be presented on separate patch panels.

The panels are to be identified as tie cables between the designated racks and not identified as general outlet numbers.

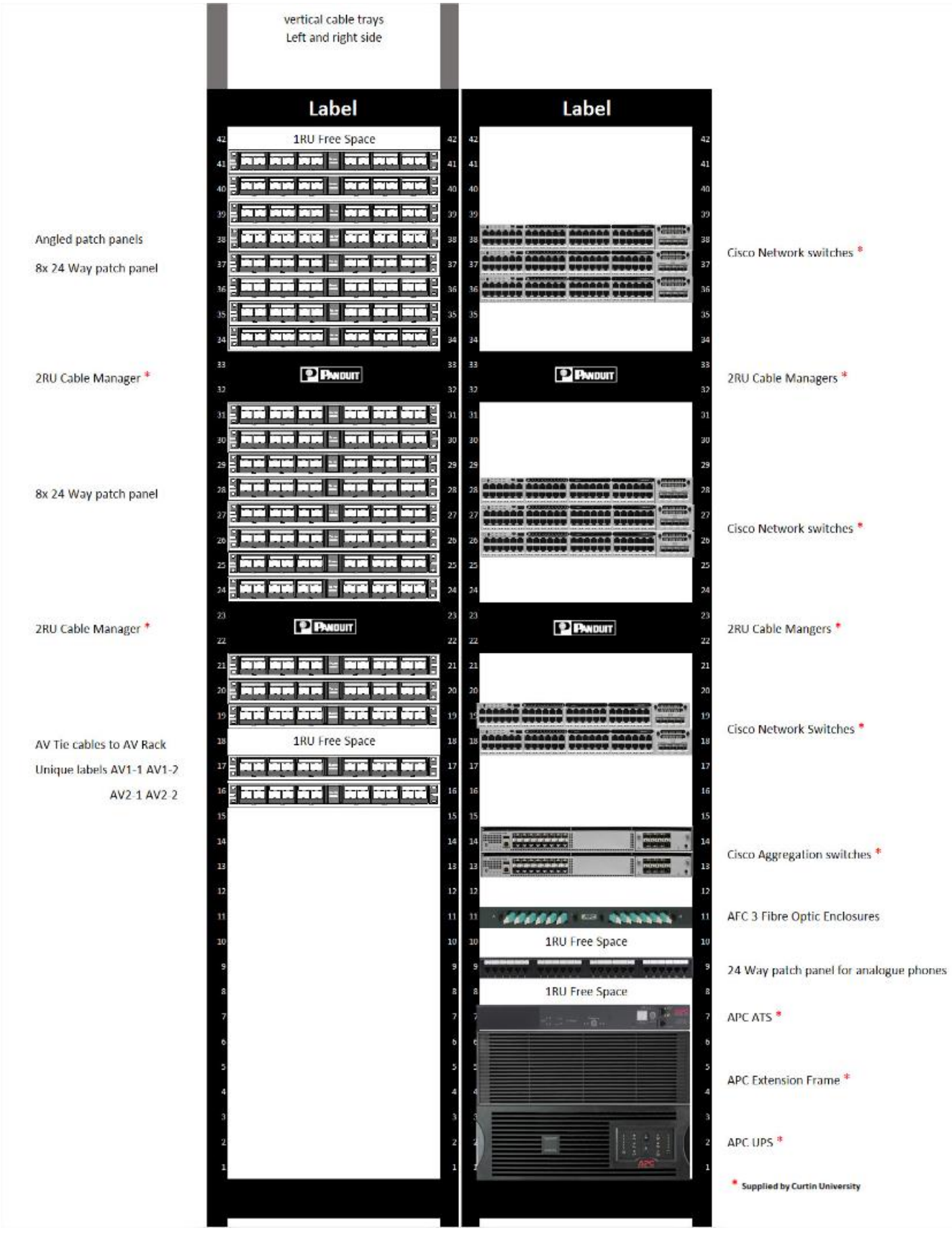
Tie cable panels should be located below the last row of the general floor distribution panels and maintain a 1 RU gap.

11.3.4 TYPICAL RACK LAYOUTS

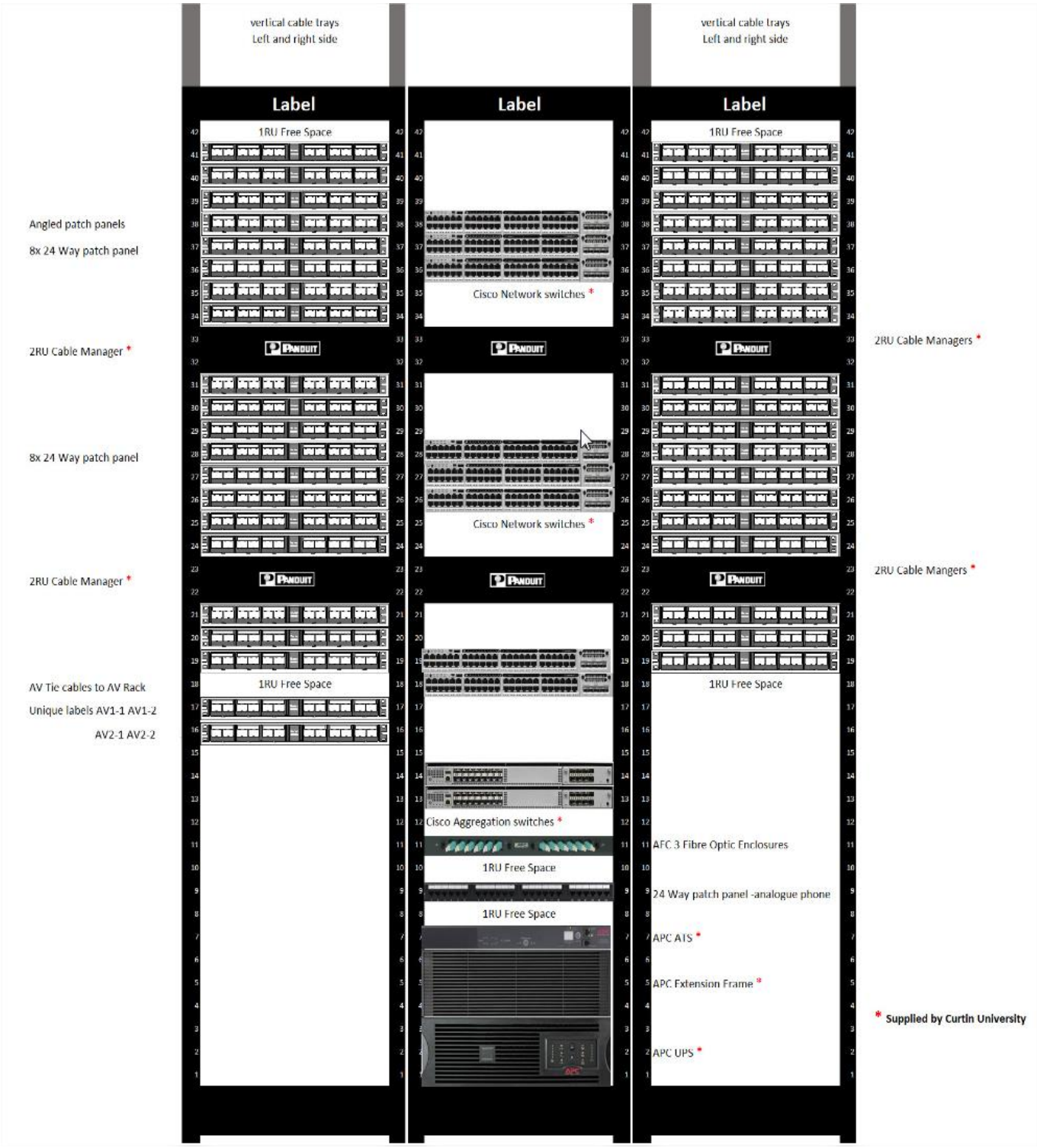
SINGLE RACK



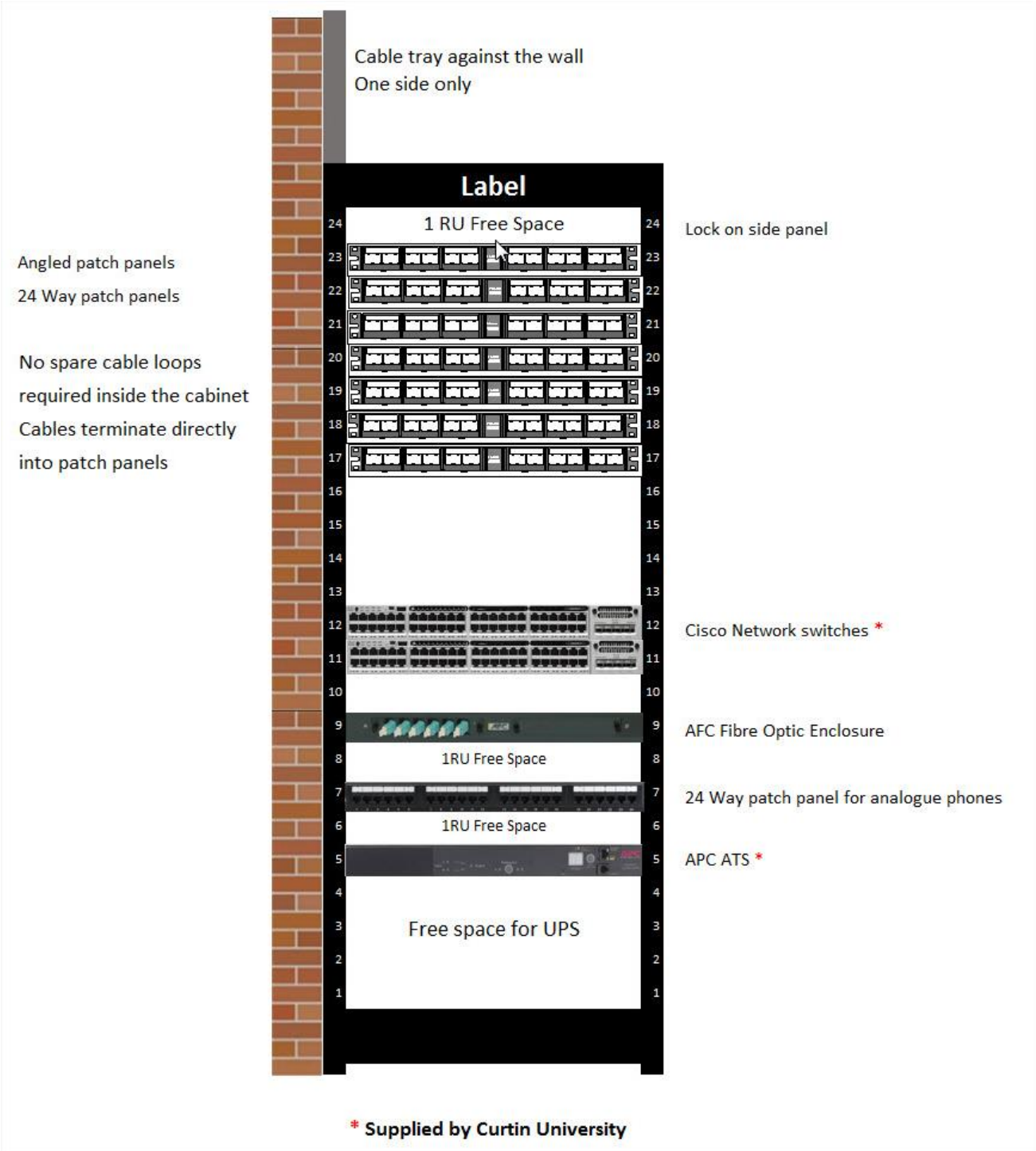
DUAL RACK


vertical cable trays
Left and right side
Label
Label
1RU Free Space
Angled patch panels
8x 24 Way patch panel
Cisco Network switches *
2RU Cable Manager *
2RU Cable Managers *
8x 24 Way patch panel
Cisco Network switches *
2RU Cable Manager *
2RU Cable Mangers *
AV Tie cables to AV Rack
Unique labels AV1-1 AV1-2
AV2-1 AV2-2
1RU Free Space
Cisco Network Switches *
Cisco Aggregation switches *
AFC 3 Fibre Optic Enclosures
1RU Free Space
24 Way patch panel for analogue phones
1RU Free Space
APC ATS *
APC Extension Frame *
APC UPS *
* Supplied by Curtin University

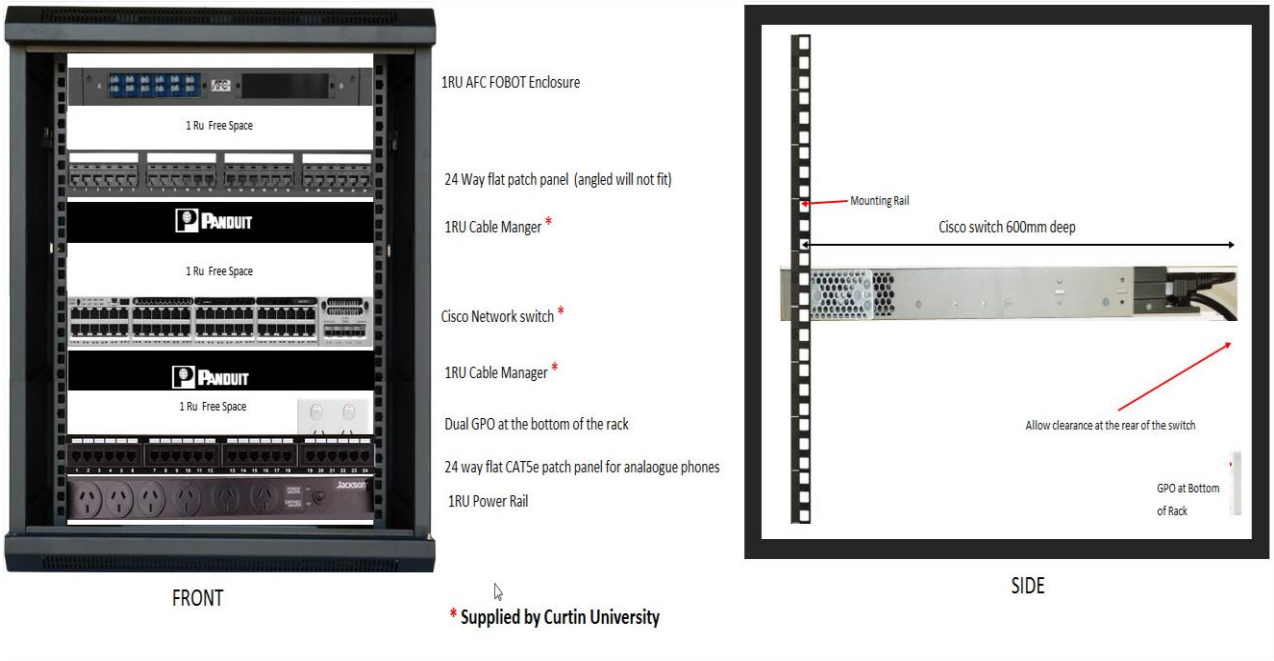
TRIPLE RACK


vertical cable trays
Left and right side
vertical cable trays
Left and right side
Label
Label
Label
1RU Free Space
1RU Free Space
Angled patch panels
8x 24 Way patch panel
Cisco Network switches *
2RU Cable Manager *
2RU Cable Managers *
8x 24 Way patch panel
Cisco Network switches *
2RU Cable Manager *
2RU Cable Mangers *
AV Tie cables to AV Rack
Unique labels AV1-1 AV1-2
AV2-1 AV2-2
1RU Free Space
1RU Free Space
Cisco Aggregation switches *
AFC 3 Fibre Optic Enclosures
1RU Free Space
24 Way patch panel -analogue phone
1RU Free Space
APC ATS *
APC Extension Frame *
APC UPS *
* Supplied by Curtin University

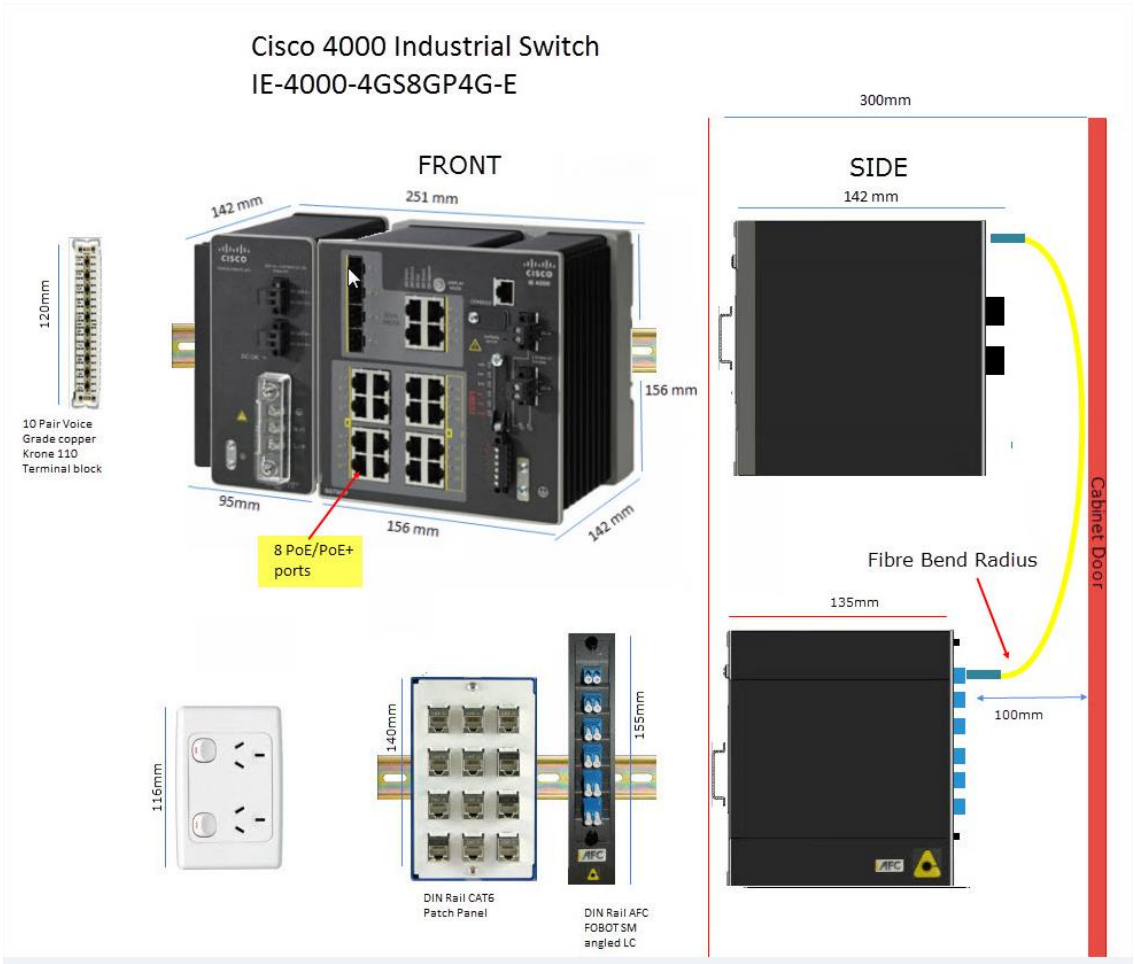
HALF HEIGHT RACK



WALL CABINET



EXTERNAL ENCLOSURE



11.4 CABLE INSTALLATION

11.4.1 GENERAL

All cabling shall be installed in full accordance with the manufacturer's recommendations.

Cables shall be installed with due skill and care such that:

- maximum permitted hauling tension is not exceeded
- minimum bending radius of the cable is not exceeded
- maximum permitted crush rating is not exceeded
- the cable is protected from damage.

Cable bundles shall not obstruct the installation and removal of equipment within equipment enclosures.

Wiring frames shall be wired such that jumper connect wires follow clear paths between sections and are not obstructing patch fields, and that lengths of jumper connect wires are minimised.

Equipment and patch cables shall be laid out such that patch cords follow clear paths and do not obstruct patch fields.

11.4.2 PRECAUTIONS DURING INSTALLATION OF CABLES

With Cat 6a (Class EA) cables, precautions shall be taken to not have excessive lengths of parallel cables, due to alien cross-talk. Cables need to be randomly laid, for basket pathways only and for areas of concealment i.e. above ceilings. Cables must be neatly loomed within the racks. Cables on trays shall be loosely bundled.

Precautions shall be taken to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles. Cables shall be run in a manner eliminating the possibility of strain on the cable itself or on the cable termination.

Care shall be taken not to distort the twists by excessive pulling or bending of cables.

Cable bundles shall not rub on or be unduly compressed against or by any cable tray, building or enclosure penetrations, equipment racking, or other cable support. Grommets or similar forms of protection shall be provided where cables pass metallic or other rigid edges.

Cables shall be kept a safe distance from items liable to become hot. The distance shall be consistent with the maximum temperature possible and cable type. Cables shall not at any point make direct contact with such items.

Cables shall not be embedded in plaster, concrete, mortar or other finishes unless they are in conduit and capable of being fully withdrawn and replaced after the building is finished without damages to finishes.

Adequate support shall be provided for vertically installed cabling ensuring that the weight of cables is sufficiently supported.

Category 6(a) cables shall be fixed to cable trays and catenary wires by loose bundling methods as referred to in Section 11.2.7.

Cables fixed to catenary wires or above-cable trays shall be supported at intervals according to AS/NZS3084. Cables that are supported by below-cable trays shall be tied at intervals not exceeding 1,200 mm. At no point shall the cabling rest on the topside of the false ceiling or light fittings or any other services.

Where cabling is run in cavity walls, surface-mounted ducting and similar enclosures, cables shall be installed in areas free from protrusion of screws and similar fasteners.

11.4.3 BALANCED CABLING INSTALLATION

The cable interconnecting distributors or between a telecommunication outlet and a horizontal distribution panel or patch panel shall be one continuous length with no intermediate joins, splices or taps. Mid-run joints of cables are not permitted except for the use of consolidation points as outlined in Section 5.3.2.

The maximum length of the various elements of the balanced cabling shall be in accordance with Section 5.3.7. Approval of the Infrastructure Manager – Network Cabling shall be sought for installation that does not comply with the specified maximum lengths and approval to proceed obtained in writing prior to commencing installation.

Where two or more cables share a pathway, the cables shall be tied together approximately every 600 mm to create a trunk effect.

When installing and terminating backbone cable runs, sufficient slack with minimum length of two metres shall be provided at a suitable location in the cable pathway. The preferred location is within the ceiling space or under raised floors.

All horizontal cabling shall be terminated within two metres of the intended location of the terminal equipment.

A figure-8 of cable shall be left in the cable trunking on the approach to each telecommunication outlet to facilitate re-termination of the cable in the future, should this be required. The preferred minimum length of this figure-8 is two metres, but the final determination as to the required length shall be made by the site representative.

The balanced copper cable bending radius shall not be less than eight times the cable diameter under no-load conditions and 16 times the cable diameter under load, i.e. when being pulled through conduits or as specified by the cabling manufacturer, whichever is greater. Cables shall be anchored immediately before the start and after the finish of the bend. Refer to Section 9.1.2 on the use of bend control accessories.

To preserve the electrical characteristics of the balanced cable, the outer insulation of the cable shall not be stripped back unnecessarily, and shall be left intact up to a point as close as possible to where the individual pairs are terminated to the IDC connector.

Sufficient cable slack shall be provided at telecommunications outlets to allow removal of faceplates and any associated RJ45 socket for servicing.

11.4.4 OPTICAL FIBRE CABLING

Optical fibre cable interconnecting distributors shall be one continuous length with no splices or joins except for pigtails used to terminate single-mode optical fibre cores or cable transitions.

The maximum length of optical fibre cable shall be in accordance with Section 5.2.7. The cable shall be handfed into conduits and cable trays.

Each optical fibre cable shall be installed with five m spare length in the communications enclosure at the respective distributors.

Optical fibre bending radius shall not be less than 10 times the cable diameter or as specified by the cabling manufacturer, whichever is greater, under no-load conditions and 20 times the cable diameter or as specified by the cabling manufacturer, whichever is greater, under load, i.e. when being pulled through conduits and the like.

11.5 TERMINATIONS

11.5.1 BALANCED CABLE TERMINATIONS

An RJ45 system shall be generally utilised at both the main communications centre and all remote cabinet locations.

Cable termination onto a horizontal distribution panel or patch panel should be undertaken in a manner permitting additional cables to be terminated without unduly disturbing previously installed cables.

Outlets from a common area should present themselves in adjacent locations on the patch panel.

The connecting hardware shall be installed to provide minimal signal impairment by preserving wire twists as close as possible to the point of mechanical termination, as per manufacturer's specifications.

The amount of untwisting in a pair as a result of termination to connecting hardware shall be reduced to a minimum.

The use of field terminating plugs maybe permitted for certain approved applications, these will need to be discussed with the Infrastructure Manager prior to installation. Any plugs used must be of an IDC type termination and match the branding of the cable used. If used the link must be tested using the MPTL test limit.

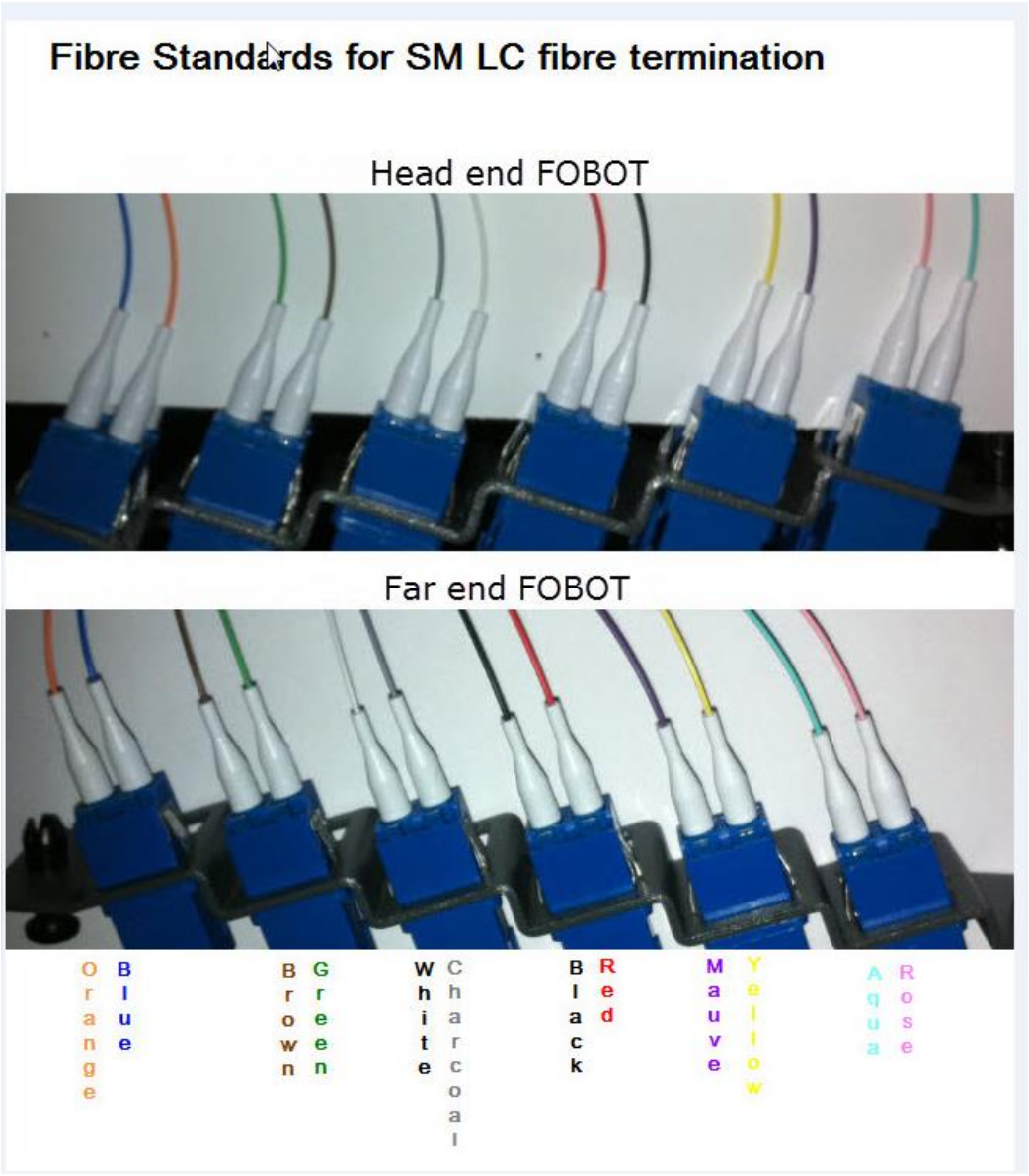
11.5.2 OPTICAL FIBRE CABLE TERMINATION

Optical fibre cabling shall be terminated as per Section 10.3.4.

OS2 single-mode optical fibre cores shall be fusion spliced with LC terminated pig-tails. Other termination methods shall be subject to approval by the Infrastructure Manager – Network Cabling.

The cables shall terminate in fully enclosed 1 RU 12-port or 24-port LC duplex patch panels in the communications cabinets. All fibre cores specified shall be terminated at each end.

Curtin University requires the fibres to be crossed as per the image below.



The patch panel shall meet the requirements of AS2211 for Class 2 lasers. Patch panels shall be angled, covered and be labelled with laser hazard warnings.

11.5.3 TELECOMMUNICATION OUTLETS

Outlets shall be installed above bench height in laboratory areas.

Locations of outlets shall be determined in advance of installation.

In the case of capital works, locations will be defined by the architect/consultant.

Outlet connectors are to be flush-mounted wherever practicable. Flush plates shall be mounted on skirting duct or floor boxes as required.

Mounting blocks, white in colour, shall be used where flush mounting of communications outlets is not practicable. All surface mount boxes are to be securely mounted on the skirting or wall adjacent to each required user connection point or as specified in the provided work plans.

Where possible the outlet shall be oriented to avoid contact of the work area lead with furniture, equipment or feet.

All telecommunication outlets shall have all cable pairs fully terminated and connected back to the distribution node.

Sufficient bend radius (1:8) shall be provided to avoid damage to the outlet or work area cords. Outlets shall be located to avoid being obscured by furniture and office equipment.

Unless indicated otherwise, outlets shall be located near to power outlets.

Balanced cables shall be terminated at the TO using the T568A pin assignments and colour codes in accordance with AS/NZS11801.1

Outlets designated for use by WLAN access points shall be located at the advice/design of DTS – Networks.

11.5.4 DC POWER SUPPLY CABLE TERMINATIONS

Where Communication enclosures accommodate the use of DC power supplies the supporting cables MUST be sized in accordance with relevant limits in mind. Connectors of DC cables shall use bootlace style terminations.

Where composite cable (powered fibre) is used the copper conductors of this cable shall also use be connected by using bootlace style terminations.

12 EARTHING AND TRANSIENT PROTECTION

12.1 EARTHING

All equipment racks, cable tray systems and the like shall be earthed in accordance with AS3000 to the building protective earth system.

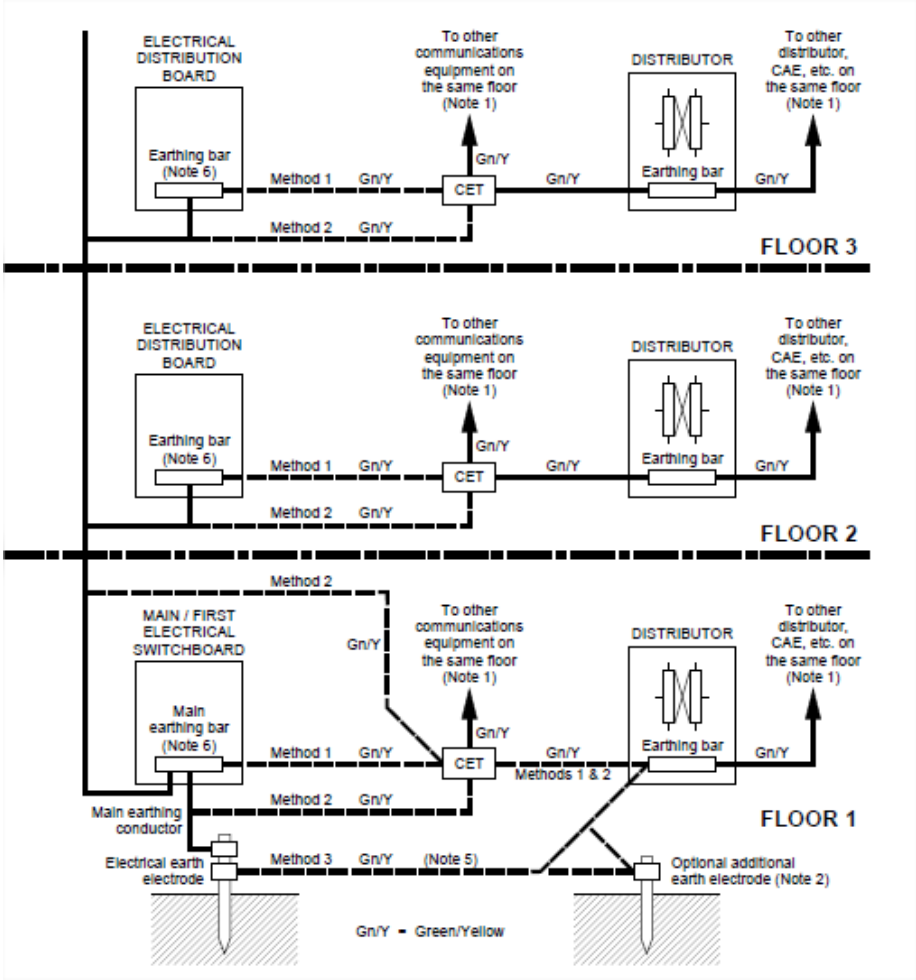
Earthing practices shall comply with the requirements of AS/CA S009.

A communications earth terminal (CET) shall be provided to all comms rooms, from either the nearest electrical distribution board or direct earth spike.

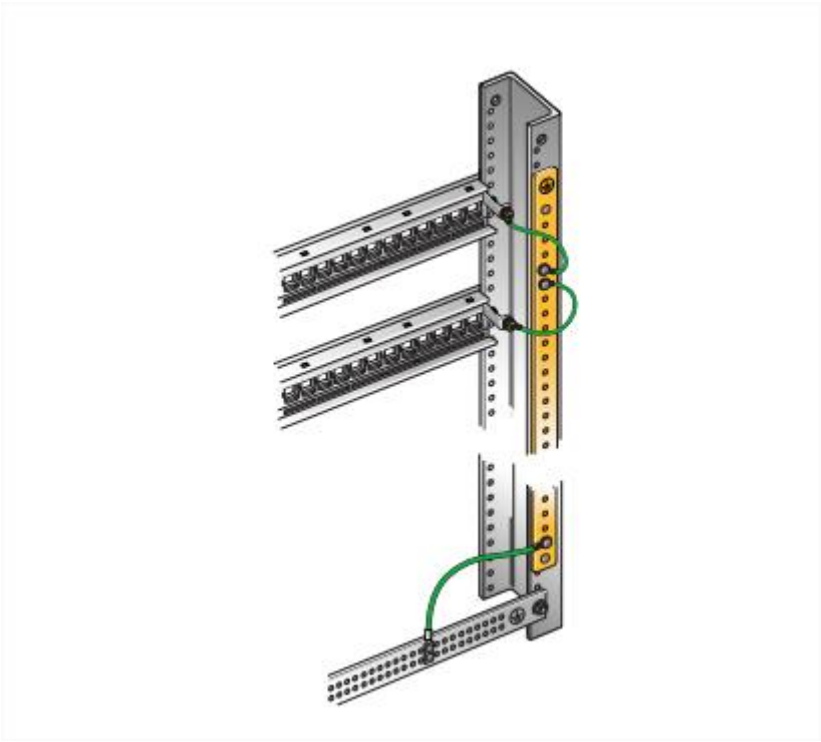
From the CET all racks and metallic pathways will be bonded.

Each rack/enclosure shall have fitted a proprietary earth bar kit (vertical and/or horizontal as required) connected to the comms room CET. All parts of the rack/enclosure, including doors, blank panels, trays and anything with an earth stud shall be bonded back to the rack's earth bar by green/yellow copper conductor flexible cable, minimum 4 mm^2 in cross section.

Below is an example layout from AS/CA S009-2013 on how the Infrastructure Manager – Network Cabling expect to see a comms earthing system installed to all comms rooms.



Curtin's preferred method of earthing for a shielded cable solution, provision of suitable earth bars as per 9.4.2 example below.



12.2 TRANSIENT PROTECTION

Transient protection equipment shall be provided by way of externally rated STP, F/UTP being used for any external run requirements. The STP, F/UTP will be terminated and earthed in line with manufacturer's recommendations. Any external runs must have the approval of the Infrastructure Manager – Network Cabling prior to installation/design.

13 INSPECTION, TESTING AND COMMISSIONING

13.1 GENERAL

The cabling system contractor shall supply all labour, materials and equipment required for fully commissioning and testing the installation.

Testing shall be performed at the permanent link level wherever practicable. Performance testing at other than permanent link level shall not be accepted without the approval of the Infrastructure Manager – Network Cabling.

Testing shall only be performed using calibrated test and simulation equipment. A Level IV tester shall be used for classes of testing.

The test results, for all cables, connectors and outlets shall be fully documented and tabulated, identifying each cable and each outlet or interface port by its label. Test results shall meet the requirements of AS3085.1 Section 9. Testing shall not proceed until all labelling and documentation is complete so that the test results accurately reflect the actual cables and connectors. All test results shall be included in the manuals and shall include tests for each of the cable types.

The contractor shall provide all necessary specification and compliance reports of the cables and connecting hardware used in the communications installation, and include such information in the manuals.

Prior to any large project/piece of work, the contractor shall issue a quality plan and have it agreed by the Infrastructure Manager – Network Cabling.

13.2 INSPECTION

The University may inspect the works from time to time to confirm accuracy and quality and that the cabling system installation conforms to specifications and construction drawings.

13.3 BALANCED CABLING AND CONNECTING HARDWARE

Test personnel and the test methodology shall comply with the requirements of AS/NZS3087.1 and AS/NZS3087.2. ISO 11801 PL … is the preferred test limit.

The acceptance testing and certification report section for balanced cabling shall include the test results for each outlet. The report shall include, as a minimum, the following details and tests results for each outlet:

- cable and outlet/port identification
- building and room numbers
- test equipment and test configuration details
- wire map testing
- DC resistance test (for PoE)
- cable length
- cabling performance parameters as specified in AS/NZS11801.1

- date and time of testing
- name of testing engineer.

Example of TO test result format for minor works (less than 5 TOs): BxxxRxxxTOxxx

The contractor shall fully test the cabling system for wire map (including pin assignment and colour coding), cable length and performance of all cable pairs.

The cable system shall be tested in accordance with Standards Australia HB27 and certified to Class E or EA (cable type dependent) permanent link performance in accordance with Clause 6 of AS/NZS11801.1.

Any cable run not meeting the required performance standards shall be replaced at the expense of the contractor.

The equipment supplier shall provide certification in writing indicating full compliance of the balanced cabling connecting hardware (telecommunication outlets and patch panels) with the relevant performance Category 6(a) of the cabling system. Certification shall include test results as recorded by the appropriate test laboratory.

The cabling system installer shall certify the performance of each channel (horizontal and backbone) to Class E(A) for all pairs. The overall responsibility for achieving and demonstrating this performance objective shall remain with the contractor.

For larger installations (5 or more TOs), the contractor can forego the need to identify the room and building number in the test result itself and instead provide an Excel spreadsheet with the following columns and the completed information.

COLUMN TITLES

- TO number
- Building Number
- Room Number.

13.3.1 OPTIC FIBRE BACKBONE CABLING AND RELATED HARDWARE

The acceptance testing and certification report for optical fibre cables shall include, as a minimum:

- cable identification
- test equipment and test configuration details including equipment settings
- OTDR trace (pulse width and time to be set according to cable length)
- length of fibre segment in metres
- loss over fibre segment in dB
- as-constructed scale site and building/floor location plans showing the location and size of pathways and the cables installed therein, cable routes, pit locations and enclosure/distributor locations. Scale drawings shall be to a reasonable accuracy in the event that CAD drawings of the site are not available. (See Figure C1 of AS/NZS3085.1.)
- date and time of testing

- name of testing engineer.

Cable length shall be determined for each core using an Optical Time Domain Reflectometer.

Optical loss testing shall be conducted on each core of all installed optical fibre cable runs by use of a light source and power meter. Actual throughput loss, in decibels (dB), of the fibre link at the wavelength of system operation shall be tabulated from both ends of each fibre link.

Testing for OS2 optical fibres shall be carried out at the optical wavelengths of:

- 1,310 nm
- 1,550 nm.

Testing shall be carried out using suitable launch & tail cables and clearly show loss at all splices and connectors.

14 LABELLING

14.1 GENERAL

All telecommunication outlets, patch panels, enclosures, cables and conduits shall be systematically and permanently labelled.

Labels may be computer-generated such as by the Brother Labelling system or equivalent, with the exception of telecommunications outlets. Use of felt-tipped pen and the like shall not be acceptable. Telecommunications outlets will be labelled with moulded removable plugs to fit flush plate apertures.

All labelling and designations shall be confirmed in writing with the Infrastructure Manager – Network Cabling at the earliest opportunity prior to installation.

14.2 ENCLOSURES

Each enclosure shall be labelled with a unique designation. The designation will be provided by the Infrastructure Manager – Network Cabling on a case-by-case basis.

14.3 BACKBONE CABLING

14.3.1 FIBRE

Each fibre installation shall be labelled with a unique designation. The designation will be verified by the Infrastructure Manager – Network Cabling on a case-by-case basis though the makeup will be following the template below:

Cable core count & type_building from~room# - building to~room# cable number

Example:

12SM_B100~125-B309~123_A

Each end of each cable jacket and at pit locations must be clearly identified.

Fibre optic cable must be clearly marked in all exposed areas. Exposed areas would be at a point the cable leaves ducting or cable trays, in cable pits and fibre termination points.

Marking is to consist of an optical fibre warning tag and is to include the designated number (provided by the Infrastructure Manager – Network Cabling) and the words "Curtin University".

Emtelle Microduct shall be labelled with source and destination. Individual tube joints (TBE) shall be treated as separate locations, with the blown fibre labelled accordingly at each end of the link.

14.3.2 LABELLING OF OUTLETS

This naming convention is to be used for all ICT TOs at Curtin University. The naming convention is always with reference to the location of the cabinet that the TO circuit terminates in. Within a communications cabinet, the numbers follow on in sequence from patch panel to patch panel. All TOs are within a building and each building has unique communications cabinets.

The standard format is: AnnnXE

A, X and E are alpha characters and nnn is numeric. There is no need to identify the term TO either at the patch panel or TO faceplate

The form is:

1. If there is only one cabinet in a building, there are no alpha characters.
2. The first alpha character is used to indicate the cabinet's location. It may be a building floor or location within a building e.g. in the Library building (B105), B100 is a circuit on level 2 and E055 is on level 5. In the Architecture building (B201), C060 is a circuit connected to a level 6 cabinet.
3. nnn is a unique number. There must only be one occurrence of a number unless it is with an alpha character.
4. The last alpha character is a direction within a building that determines the physical location of the communications cabinet on a floor.

   They can ONLY ever be N – north, S – south, E – east or W – west.
5. The 'X' denotes a service type. L – represents Laboratories and will only be used in special situations as directed. H – represents High Speed cable plant and will only be used in special situations as directed.

15 ADMINISTRATION AND DOCUMENTATION

15.1 HANDOVER DOCUMENTATION

Documentation shall be issued via electronic means, either via email or cloud service such as Dropbox or the like.

Emails shall be titled containing the relevant building number and project name and sent to the Infrastructure Manager – Network Cabling via any project consultants who will verify quality/format of the results.

This is for all projects including capital works; however the awarded consultant/builder will also have their own process to follow.

- copper test results
  - raw data
  - PDF copy
  - Calibration Certificate of device used for testing
  - all results shall have a summary page at top of PDF copy
- fibre results
  - OTDR trace (both wavelengths, both directions)
  - LSPM results (both wavelengths, both directions)
  - Calibration Certificate of device used for testing.
- as-constructed drawings (these will be either in PDF as mark-ups or in CAD, the Curtin Project Manager will advise on a job-by-job basis)
- manufacturer's warranty certificate for larger jobs. For smaller jobs/additions, where possible, an updated warranty certificate shall be provided.
- any requirement for CAD drawings – the contractor must ensure they have been drawn in the format required by Curtin Drawing Services, which comply with the requirements of the *Documentation Deliverables Guidelines* and can be obtained by contacting DrawingServices@curtin.edu.au.
- photos of the installations, which will be required for remote locations such as Kalgoorlie.

15.2 WARRANTY REQUIREMENTS/CLAUSES

The warranty requirements include:

- a minimum of 15 years manufacturer's warranty on parts and labour (20 years preferred)
- 12-month defects period on the workmanship of the installers
- work to be performed by certified installers.

When a fault is identified within 12 months of the initial installation, the installer shall rectify, within 48 hours of notification from Curtin University.

(Where the original installer cannot rectify within the required 48 hours then Curtin will engage its on-site comms technician to rectify and back-charge the original installer accordingly.)

For faults after the 12-month defects period, Curtin will require the original installer to attend and rectify within 48 hours of notification. Again, if this is not actioned then Curtin will have its on-site comms technician rectify. However, prior to back-charging the original installer, Curtin will advise on the cause of the fault as determined by its on-site comms technician and the Curtin Infrastructure Manager. Back charges will apply for faulty product but will not apply where the fault is the cause of 3rd party damage/user error.

16 TELEPHONES

16.1 MANAGEMENT

The management of the telephone system on campus is a devolved function.

The Infrastructure Manager – Network Cabling is responsible for the coordination and management of the physical cabling infrastructure of the University.

DTS – Telecommunications provides and operates telephone and switchboard services on behalf of the University.

16.2 PROVISION OF TELEPHONE SERVICES

Building telephone infrastructure may use Cat 3 twisted pair cable i.e. building MDF to IDF. Reticulation to the desktop shall only be made through a fully integrated Cat 6/6a structured cabling system. All references in these standards to Cat 3 non-integrated cabling system products are made for the express purpose of maintenance and limited expansion of existing cabling installations. The installation of new, or expansion of existing Cat 3 cabling systems shall be at the discretion of the Infrastructure Manager – Network Cabling.

16.3 SPECIFIC SERVICE CLASSES AND THEIR CONNECTION

Specific services shall be provided to University buildings as follows in line with the table in Section 10.2.1.

16.4 USE OF EXISTING INFRASTRUCTURE CABLING (INCLUDING EXPANSION)

In cases where the existing building telephone infrastructure is used (including MDFs and IDFs), DTS – Telecommunications will undertake to provide the following:

- telephone handsets (including plug in and test)
- analogue MDF jumpering.

Note: All costs for the above services are to be borne by the requesting department or project budget.

Large projects will be coordinated by the Infrastructure Manager – Network Cabling and the appropriate vendors and contractors.

16.5 REPLACEMENT/UPGRADE OF MDFS

In cases where the building MDF and/or IDFs are replaced/upgraded, the installing contractor shall provide the following:

- termination of the incoming cable/s on the 'A' side of the building MDF
- termination of the IDF feeder cables on the 'B' side of the building MDF

- jumpering between the 'A' and 'B' sides of the building MDF in order to restore pre-existing telephone services and any additional services as specified in the project.

Note: All costs for the above work are to be borne by the requesting department or project budget.

16.6 CABLING INSTALLATION AND ALTERATIONS

16.6.1 INSTALLERS AND STANDARDS

All cabling work on the University telephone network shall only be carried out by the Curtin-endorsed contractor and personnel with relevant open registration and endorsements. All such work shall meet the minimum requirements of S009. If such cabling installations are not being managed by the Infrastructure Manager – Network Cabling and their endorsed contractor, the approval of the Infrastructure Manager – Network Cabling shall be gained before the work commences.

16.6.2 SPLITTERS

The use of splitters is not supported.

16.7 TERMINATION FRAMES

MDFs shall be terminated in accordance with carrier regulations. IDFs and FDPs shall be specified as 110 Systems. All termination frames shall be located according to ACA height and working space requirements. Termination frames shall not be installed above doorways, in false ceilings or under-floor spaces.

16.7.1 JUMPERING AND PATCHING

All new jumpers shall be fed through fitted jumper rings along the jumper route, and installed in a neat and tidy manner. Diagonal paths and other shortcuts are not permitted. All redundant jumpers shall be removed from the terminating frame as part of the installation of new jumpers.

Jumpers installed on solder-tag type frames shall be soldered.

Where patch leads are required in an integrated voice and data installation (for example, a Jacques intercom), white patch leads shall be used. The length of the patch lead shall be chosen to minimise excessive slack and avoid the need for short cuts.

Note: All telephone patch leads will be supplied by DTS – Networks.

16.7.2 DOCUMENTATION

The installation contractor shall record all additions/alterations to the University telephone network in the appropriate record books in a clear, complete and legible manner. In the case of new installations, record books must be provided and secured by the installation contractor at each building MDF and floor IDF. All record books and FDP cards shall be filled in by the installation contractor (both ‘A’ and ‘B’ sides). The ‘A’ side detail shall include information on the trunk cabling and the ‘B’ side must

include the PABX extension number and room details. Building MDF record books must be located and secured on site. Tie cables installed between a building MDF/IDF and a fully integrated voice and data system enclosure shall be provided with a new record book at the patch panel location. The installation contractor shall provide the record book and shall fill in the 'A' side information. Contractors employed to install jumpers and/or patch leads in integrated and non-integrated cabling systems shall record the 'A' and 'B' side information in all record books for that system. This requirement shall include patch panel record books where relevant. If a record book cannot be found for a specific location, a replacement book shall be provided after consulting with the Infrastructure Manager – Network Cabling. All details of the current work shall be entered into the new book.

16.7.3 LIAISON

Specific inquiries are to be directed to the staff members as indicated below:

- New installations, moves and changes: DTS – Telecommunications.